Interventions in Acute Frailty

Dr Alexandra Jayne Burgess

MRCP, MBBCh, BSc (Hons)

Submitted to Swansea University in fulfilment of the requirements for the Degree of Medical and Health Care Studies, M.D

2025

Copyright: the author, Alexandra Jayne Burgess, 2025

PERSPECTIVE

When an older person presents to hospital, there are several additional variables that need to be considered with regards to whether inpatient admission is in that person's best interests (British Geriatric Society, 2014). Hospitalisation for frail older adults has been shown to result in multiple adverse consequences, some of which are a consequence of therapeutic interventions. Bed rest, polypharmacy, nosocomial infections, tethering devices (e.g. intravenous lines, urinary catheters, telemetry, restraints), sensory deprivation, disruption of usual sleep patterns, and lack of proper nutrition all contribute to functional, physical, and cognitive decline (Creditor, 1993).

This has greatly influenced my practice and during my training I have developed a clear interest in Front Door Frailty and Acute Geriatrics, working right at the interface between Primary and Secondary Care. This led me to go Out of Programme from training in order to commence a Fellowship in Acute Frailty with a MD in Swansea University which started in October 2022. I am constantly striving to improve the care of our older frailer patients. I have shown that when we work together as a multidisciplinary team, we can achieve the best care for our patients, often in difficult times. Predominantly my work has been in Acute Frailty and in Nursing Home residents, who remain one of the most vulnerable populations in our society with complex health and social care needs, including frailty, dementia and multiple comorbidities which all add together to create an elevated falls risk. I also collaborate very closely with colleagues in the ED and in other medical specialties, showing the benefit of teamwork and shared goals.

The predominant focus of this thesis has been analysing the work of the Older Persons Assessment Service (OPAS) based in Morriston Hospital, Swansea Bay University Heath Board (SBUHB). The current MD aims to examine the different approaches that are used with older, frailer adults and how they affect adverse patient outcomes and experiences.

SUMMARY

Frailty needs to be considered as part of a whole systems approach. A ‘one size fits all’ does not work as work, as frailty cannot occur in isolation. It must fit with a health care system’s strategic plan recognising the need to deliver a high-quality and sustainable system. During the admission-decision process, shared decision making, especially in frailer adults is essential. This MD proposal aimed to examine the different approaches and how they affect adverse patient outcomes and experiences.

To combat this, innovative models of service delivery are required to provide Comprehensive Geriatric Assessment (CGA) for older patients presenting to the emergency department (ED) with frailty syndromes. When a frailer, older adult presents to an urgent care setting, a multifactorial approach must be adopted to enable early shared decision-making with accurate risk stratification about whether hospital admission is in that person’s best interests. There is also a lack of evidence of who is best placed to deliver a CGA and whether a dedicated frailty team are best place to deliver this in a unit based or liaison-based model.

The aims of the proposed MD were:

I. To undertake a systematic literature review of published studies investigating clinical frailty interventions pre and in-hospital.
II. To determine the best approach for prehospital treatment of patients with frailty, focusing on Proactive Care by developing front door services in collaboration with the Acute GP Service and Advanced Practice Paramedics, plus virtual wards.
III. To determine the best approach for in-hospital treatment of patients with frailty, particularly focusing on pathway management and multidisciplinary team (MDT) input, improving reactive care.
IV. Chronic disease management e.g. Diabetes, Alcohol excess, and polypharmacy

It is only by working as a team, that front door, inpatient, and community services can be linked to provide the best, holistic care for frailer, older patients.

DECLARATIONS AND STATEMENTS

DECLARATION

This work has not previously been accepted in substance for any degree and is not being concurrently submitted in candidature for any degree.

Signed **(candidate) Date: 28/07/2025**

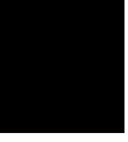
STATEMENT 1

This thesis is the result of my own investigations, except where otherwise stated. Where correction services have been used, the extent and nature of the correction is clearly marked in a footnote(s).

Other sources are acknowledged by footnotes giving explicit references. A bibliography is appended.

Signed **(candidate) Date: 28/07/2025**

I hereby give consent for my thesis, if accepted, to be available for electronic sharing.

Signed  **(candidate) Date: 28/07/2025**

The university ethical procedures have been followed and, where appropriate, that ethical approval has been granted This project is a service-based evaluation which took place at clinical sites across Swansea Bay University Health Board (SBUHB). Approvals were obtained from the appropriate clinical leads (Medicine, Care of the Elderly (COTE), Research & Development). The project was undertaken in collaboration with the COTE team in Swansea who have supported the design of this study. The COTE team is led by Dr Elizabeth Davies, a consultant geriatrician working at Morriston Hospital, who developed the Older Persons Assessment Unit in Morriston and has received recognition for this work. The approval from the Research and Development team is in Appendix 9.1 alongside a letter from the Clinical Director Dr Davies about the clinical quality importance of this work.

AUTHOR CONTRIBUTION STATEMENT

Conceptualisation:

I contributed to the design and development of new service initiatives within the Older Persons Assessment and Support (OPAS) team during my two-year Out of Programme Experience between August 2022 and August 2024. This included involvement in the conceptualisation of the CWTCH service and the Same Day Emergency Care (SDEC) scoring system, both aimed at improving the quality and continuity of care for older adults.

Methodology:

I developed methodological approaches for data collection, cleaning, and analysis across multiple datasets used in this thesis. I created data subsets (for example, those focusing on ambulance offload delays) and applied appropriate statistical methods to address the research questions posed in each chapter.

Investigation:

I undertook direct clinical work with patients as part of the OPAS team, contributing to the operational delivery of the service. I also participated in data collection through systematic data entry and clinical documentation to support service evaluation and research activity.

Data Curation:

I was responsible for the creation, management, and organisation of all databases used in this thesis. This included generating and maintaining datasets derived from the OPAS service, 999 call data, questionnaire data, and Welsh Ambulance Service (WAST) data. The general OPAS database demographic data was also maintained and updated by other staff.

Formal Analysis:

I performed all statistical analyses and data interpretation across the thesis. Specifically:

- Chapter 1: Conducted the literature review and all subsequent analyses.
- Chapter 2: Performed all data analysis and statistical testing of the OPAS database.
- Chapter 3: Created the ambulance offload delay subset, led the calculation of the Hospital Frailty Risk Score (HFRS) and Clinical Frailty Score (CFS), and completed all associated analyses.
- Chapter 4: Conducted manual calculation of various ambulatory care scores and completed all analyses.
- Chapter 5: Developed and evaluated the SDEC scoring system, performing all statistical analysis independently.
- Chapter 6: Created and analysed individual databases independently.

- Chapter 7: Analysed all 999-call data, questionnaire data, and WAST data, and contributed to the CWTCH initiative including teaching delivery in nursing homes. In addition, I performed all analysis and interpretation for the virtual wards data and presented this work across multiple forums.

Project Administration:

I coordinated aspects of data management and ensured consistency of analytical approaches across chapters. I consulted with the wider OPAS team to ensure accurate and timely data collection and integration into the research framework. I ensured that all the databases used as part of this thesis were complete and accurate.

Writing

I wrote the first drafts of all analytical sections within this thesis, including data presentation, figures, and statistical interpretation. I reviewed and refined the written material throughout the drafting process to ensure clarity, accuracy, and coherence across all chapters.

Supervision and Oversight:

While the overall service and project direction were overseen by the senior OPAS leadership team, I independently led the analytical and statistical aspects of the project under their general supervision.

CONTENTS

PERSPECTIVE	I
SUMMARY	II
DECLARATIONS AND STATEMENTS	IV
CONTENTS	VIII
LIST OF CHAPTERS AND SUBCHAPTERS	IX
LIST OF TABLES	XV
LIST OF FIGURES	XVII
LIST OF ABBREVIATIONS	XIX
PUBLICATIONS ASSOCIATED WITH THIS RESEARCH	XXIV
PRIZES WON DURING THIS THESIS	XXX
ACKNOWLEDGEMENTS	XXXI

LIST OF CHAPTERS AND SUBCHAPTERS

Chapter 1 – Introduction and systematic literature review		1
1.1	Background	2
1.2	Specific objectives of thesis	9
1.2.1	Overall objectives of thesis	9
1.2.2	Chapter 2 - Methods and the development of the older persons assessment service	10
1.2.3	Chapter 3 - Screening for frailty at the front door	11
1.2.4	Chapter 4 – Ambulatory care and same day emergency care	11
1.2.5	Chapter 5 - Developing a novel frailty specific same day emergency care score	12
1.2.6	Chapter 6 – Chronic disease in older adults who fall and de-prescribing	12
1.2.7	Chapter 7 - Providing community services	13
1.3	Criteria for including studies in the review	14
1.4	Search strategy	16
1.5	Methods of review	17
1.6	Results	17
1.6.1	The results of the search	17
1.6.2	Study range and characteristics	18
1.6.3	Effect of intervention on outcome	24
1.7	Discussion	33
1.8	Conclusions	37
Chapter 2 - Methods and the Older Persons Assessment Service		38
2.1	Introduction	39
2.2	Chapter aims	39
2.3	The Older persons assessment service	40
2.3.1	Older persons assessment service Liaison service: April 2018 to August 2018	42
2.3.2	Older persons assessment service unit based but reduced opening hours: June 2020 to January 2022	44

2.3.3 Unit based, increased opening hours and development of Frailty Short Stay ward. February 2022 to December 2022. 45
2.3.4 Acute Medical Services Redesign and expansion into Same Day Emergency Care: December 2022 to September 2024 51
2.3.5 Future directions and Frailty Specific Hub: September 2024 52
2.4 Data collection 53
2.5 Statistical analysis 54
2.6 Impact 55
2.7 Summary and Discussion 56

Chapter 3 - Screening for frailty at the front door 57
3.1 Introduction 58
3.2 Chapter aims 59
3.3 Aim 1 - Ambulance offload delays 59
3.3.1 Introduction 59
3.3.2 Methods 63
3.3.2.1 Study design 63
3.3.2.2 Statistical analysis 63
3.3.3 Results 63
3.3.4 Conclusion 66
3.4 Aim 2 - Hospital frailty risk score identification in the emergency department 68
3.4.1 Introduction 68
3.4.2 Methods 73
3.4.2.1 Study design 73
3.4.2.2 Statistical analysis 74
3.4.3 Results 74
3.4.4 Validating the hospital frailty risk score as a “Frailty Flag” in the emergency department 79
3.4.5 Conclusions 83
3.5 Overall conclusions 86
Chapter 4 – Ambulatory care and Same Day Emergency Care 87
4.1 Introduction 88

4.2	Aim	90
4.3	Methods	90
4.3.1	Study design	90
4.3.2	Statistical analysis	91
4.4	Results	91
4.5	Conclusions	99
4.6	Overall conclusions	101

Chapter 5 - Developing a novel frailty specific same day emergency care score 102

5.1	Aim	103
5.2	Methods	103
5.2.1	Study design	103
5.2.2	Statistical analysis	104
5.2.3	Defining the F. SDEC score	105
5.3	Results	106
5.3.1	Overall results	106
5.3.2	Results comparing patients from Same Day Emergency Care and Older Persons Assessment Service	109
5.3.3	Results of the Older Persons Assessment Service data only	112
5.3.4	Results of the Same Day Emergency Care data only	115
5.4	Conclusions	120
5.5	Overall conclusions	122

Chapter 6 – Chronic disease in older adults who fall and de-prescribing 123

6.1	Introduction	124
6.2	Chapter Aims	126
6.3	Aim 1 - Screening Tool of Older Persons Prescriptions in Frail adults with limited life expectancy	127
6.3.1	Introduction	127
6.3.2	Methods	129
6.3.2.1	Study design	129

6.3.2.2 Statistical analysis 129
6.3.3 Results 130
6.3.4 Conclusions 132
6.4 Aim 2 - Older people with Type 2 Diabetes Mellitus 133
6.4.1 Introduction 133
6.4.2 Methods 136
6.4.2.1 Study design 136
6.4.2.2 Statistical analysis 137
6.4.3 Results 137
6.4.4 Conclusions 141
6.5 Aim 3 - Alcohol excess in older adults who fall 144
6.5.1 Introduction 144
6.5.2 Methods 147
6.5.2.1 Study design 147
6.5.2.2 Statistical analysis 148
6.5.3 Results 148
6.5.4 Conclusions 148
6.6 Overall conclusions 151

Chapter 7 - Providing community services 156
7.1 Introduction 157
7.2 Aims 158
7.3 Aim 1 - Providing out-reach services into nursing homes 161
7.3.1 Introduction 161
7.3.2 Methods 163
7.3.2.1 Phase 1 of CWTCH intervention: January 2020 – February 2022 163
7.3.2.2 Phase 2 of CWTCH intervention: March 2022 to May 2022 164
7.3.2.3 Statistical analysis 166
7.3.3 Results 166
7.3.3.1 Phase 1 of CWTCH intervention: January 2020 – February 2022 166
7.3.3.2 Phase 2 of CWTCH intervention: March 2022 to May 2022 168
7.3.4 Conclusions 172

7.4	Aim 2 - To develop a virtual ward service, with a focus on reducing fractures by creating a fracture discharge pathway	174
7.4.1	Introduction	174
7.4.1.1	Virtual ward	174
7.4.1.2	Developing a fracture discharge pathway	178
7.4.2	Methods	180
7.4.2.1	Virtual ward	180
7.4.2.2	Developing a fracture discharge pathway	183
7.4.2.3	Statistical analysis	184
7.4.3	Results	184
7.4.3.1	Overall results	184
7.4.3.2	Patient reported outcome measures result for service users	185
7.4.3.3	Patient reported experience measures results for service users	187
7.4.3.4	Patient reported experience measures results for care givers	190
7.4.3.5	Results for the fracture discharge pathway	191
7.4.4	Conclusions	192
7.5	Overall Conclusions	195

Chapter 8 - Overall conclusions and discussions 197

8.1	Introduction	198
8.2	Specific chapter conclusions	198
8.2.1	Chapter 1 – Introduction and systematic literature review	198
8.2.2	Chapter 2 - Methods and the development of the older persons assessment service	199
8.2.3	Chapter 3 - Screening for frailty at the front door	199
8.2.4	Chapter 4 – Ambulatory care and same day emergency care	201
8.2.5	Chapter 5 - Developing a novel frailty specific same day emergency care score	201
8.2.6	Chapter 6 – Chronic disease in older adults who fall and de-prescribing	202
8.2.7	Chapter 7 - Providing community services	204
8.3	Overall Conclusions	206
8.4	Future Directions	210

Chapter 9 – Appendices 212

9.1 Approval 213

9.2 Older personals assessment service out of hours referral form 214

9.3 Hospital frailty risk score interface 215

9.4 Data collection form for hospital frailty risk score created on Microsoft forms 216

9.5 Ambulatory Score 218

9.6 Glasgow admission score 219

9.7 Sydney score 220

9.8 Novel frailty specific same day emergency care score 217

9.9 Screening Tool of Older Persons Prescriptions in Frail adults with limited life expectancy – Version 2 224

9.10 Potentially Serious Alcohol–Medication Interactions in Older adults criteria 229

9.11 Guideline The Management of Diabetes in the Older Adult published in Swansea Bay University Health Board 233

9.12 CWTCH intervention handout given to all staff. 241

Chapter 10 – Bibliography 242

LIST OF TABLES

Table 1.1: Studies included in systematic review 19

Table 1.2: Effects of emergency department based and unit-based specialist assessment primary patient outcomes 25

Table 2.1: Estimated older persons assessment service admission avoidance 2018 by Month during the pilot. Older persons assessment service was able to admission avoid over 50 patients a month 43

Table 3.1: Patient characteristics of those transported by ambulance to hospital 64

Table 3.2: Patient characteristics of those aged greater than 65 years old, who were offloaded into older persons assessment service compared to those who were offloaded to emergency department 65

Table 3.3: Patient characteristics of those transported by ambulance to hospital by gender. 66

Table 3.4: Patient characteristics of those admitted to the older persons assessment service unit divided by of hospital frailty risk score identification in the emergency department. 75

Table 3.5: Patient characteristics of those admitted to the older persons assessment service unit divided by clinical frailty score 77

Table 3.6: Patient characteristics of included in the validation sample divided by clinical frailty score 76

Table 3.7: Patient characteristics of included in the validation sample divided by hospital frailty risk score 80

Table 3.8: Patient characteristics of included in the validation sample divided by whether a frailty syndrome was the presenting complaint. 81

Table 4.1: Patient characteristics of those who presented to the older persons assessment service unit 92

Table 4.2: Comparison of the different scoring systems 95

Table 4.3: Comparing the screening ability of each score 98

Table 5.1: Patient characteristics of those who presented to the older persons assessment service and same day emergency care unit, divided by whether they were admitted or discharged 107

Table 5.2. The different scores to predict admission. Data for older persons assessment service and same day emergency care have been combined 109

Table 5.3: Patient characteristics of those who presented to the older persons assessment service and same day emergency care units 111
Table 5.4. Older persons assessment service and same day emergency care compared using admission scores 112
Table 5.5. Patient characteristics of those who presented to the older persons assessment service unit 114
Table 5.6. Older persons assessment service screening tools 115
Table 5.7: Patient characteristics of those who presented to the same day emergency care unit 117
Table 5.8. Same day emergency care screening tools 118
Table 5.9: Comparing the screening ability of each score 119
Table 6.1: Patient characteristics of those admitted to the older persons assessment service unit. 130
Table 6.2: Patient characteristics of those admitted to the older persons assessment service unit. 138
Table 6.3: Characteristics and outcomes of people with Type 2 diabetes taking hypoglycaemia-inducing agents or other diabetes medications. 139
Table 6.4: Characteristics of people with Type 2 diabetes admitted to older persons assessment service unit with a fall who had died or were alive at 12 months' follow-up. 140
Table 6.5: Patient characteristics of those admitted to the older persons assessment service unit 149
Table 6.6: Number of the Potentially Serious Alcohol–Medication Interactions in Older adults potentially inappropriate medications by category 150
Table 7.1: Patient characteristics of those aged greater than 65 years old, who were conveyed to hospital including those offloaded into older persons assessment service 167
Table 7.2. Conveyance data pre and post CWTCH intervention 170
Table 7.3. Patient reported outcome measures outcome data. 186
Table 7.4. Patient reported experience measures outcome data for service users. 188
Table 7.5. Patient reported experience measures outcome data for care givers 190

LIST OF FIGURES

Figure 1.1: Studies included in systematic review	18
Figure 2.1: Estimated older persons assessment service admission avoidance 2018	43
Figure 2.2: Average of patients seen and assessed per week by older persons assessment service. Extended multi-disciplinary team and opening hours started in February 2022	46
Figure 2.3: The age of patients admitted to Rapid Assessment Unit during each phase	47
Figure 2.4: Length of stay in Rapid Assessment Unit for all ages	48
Figure 2.5: Length of stay in Rapid Assessment Unit for those aged over 70 years old	48
Figure 2.6: Length of stay in Rapid Assessment Unit for those aged over 80 years old	49
Figure 2.7: Length of stay in Morriston Hospital	49
Figure 2.8: Length of stay in Morriston Hospital for those aged over 70 years old	50
Figure 2.9: Length of stay in Morriston Hospital for those aged over 80 years old	50
Figure 3.1: Comparing the clinical frailty score and hospital frailty risk score data distribution	76
Figure 3.2: Frailly by clinical frailty score and Welsh index of multiple deprivation decline	78
Figure 3.3: The ability of hospital frailty risk score as a screening tool for frailty identification.	79
Figure 3.4: The ability of the hospital frailty risk score flag as a screening tool for frailty identification.	83
Figure 4.1: Comparing the screening ability of each score	99
Figure 5.1: Comparing the screening ability of each score	119
Figure 6.1: Number of potentially inappropriate medications per Screening Tool of Older Persons Prescriptions in Frail adults with limited life expectancy	131
Figure 6.2: Number of Potentially Serious Alcohol–Medication Interactions in Older adults potentially inappropriate medications	150
Figure 7.I: Results of pre-intervention questionnaire.	168
Figure 7.2: Results of post-intervention questionnaire.	169
Figure 7.3: Conveyance data pre and post intervention.	171

Figure 7.4: Welsh Ambulance service data for 999 calls in Swansea Bay University Health Board from nursing homes were made, which resulted in an emergency vehicle attending the scene in a % of all calls. 172
Figure 7.5.: VW Clusters within Swansea Bay University Health Board from Swansea Bay University Health Board SharePoint 181
Figure 7.6: Word map for patient reported experience measures focusing on whether the service user felt like the virtual ward could have done anything differently or better 189
Figure 7.7: Word map for patient reported experience measures focusing on general comments the service user made about the virtual ward 189
Figure 7.8: Word map for patient reported experience measures focusing on whether the caregiver felt like the virtual ward could have done anything differently or better 191
Figure 7.9: Outcomes of fracture discharge service 192

LIST OF ABBREVIATIONS

4AT – 4 A’s test

ABMUCP - Abertawe Bro-Morgannwg Clinical Portal

ACE - Acute Care of the Elderly units,

ACP - Advanced Clinical Practitioner

ACT - Acute Clinical Teams

ADL - Activities of daily living

AEC - Anticholinergic Effect on Cognition Scale

AEU - Acute elderly unit

AMAU - Acute Medical Assessment Unit

AMB – Ambulatory Score

AMSR - Acute Medical Services Redesign

AMU - acute medical unit

AOD - Ambulance offload delays

AUC - Area under Curve

BGS – British Geriatric Society

CCI - Charlson comorbidity index

CFS - Clinical Frailty Scale

CGA - Comprehensive Geriatric Assessment

CNS - Clinical Nurse Specialist

CONSORT - Consolidated Standards of Reporting Trials

COTE - Care of the Elderly

COVID-19 - Coronavirus disease 2019

CP-CGA - Care Partner- Comprehensive Geriatric Assessment

CP-FI-CGA - Care Partner-derived Frailty Index based up on Comprehensive Geriatric Assessment)

CRP – C-Reactive protein

CWTCH - Can you move them, Will it harm them? - any new neck pain, back pain, anticoagulation, Treat them – pain relief, dressing wounds, Cup of Tea – In most cases can eat & drink, Help – when to call 999.

D/c 30 days - discharged from hospital in last 30 days

DOB - date of birth

ED - Emergency Department

EFI - electronic frailty index

EFS - Edmonton Frail Scale

EMIS - Education Management Information System

ENP - Emergency Nurse Practitioner

EuGMS - European Geriatric Medicine Society

F. SDEC score – Frailty specific same day emergency care score

FDS – Fracture discharge service

GAPS - Glasgow Admission Prediction Score

GEMU - Geriatric Evaluation and Management Units

GFI - Groningen Frailty Index

GIRFT - Getting it right first time

GP - General Practitioner

GPOOH - General practitioner out of hours service

HAH - Hospital at Home

Hba1C - glycated haemoglobin

HFRS - hospital frailty risk score

ICD-10 - International Statistical Classification of Diseases and Related Health Problems 10th Revision

ICHOM - International consortium for Health Outcome measurement

LT – Long Term

LOS -Length of stay

MDT- Multidisciplinary team

NEWS - National Early Warning Score,

NH – Nursing home

NHS – National Health Service

NOF – neck of femur

NPV -Negative Predictive value

OPAS - Older Person’s Assessment Service

OT - Occupational Therapy

PA - Physicians Associate

PICO - patient, intervention, comparison, outcome model

PIM - potentially inappropriate medications

POC - Package of care

POSAMINO - Potentially Serious Alcohol–Medication Interactions in Older adults

PPV - Positive Predictive Value

PREMs - Patient-reported experience measures

PRISMA - Preferred Reporting Items for Systematic reviews and Meta-Analyses

PROMs - Patient-reported outcome measures

PSAU - Physical Specialist Assessment Units

PT - Physiotherapist

RAU - Rapid assessment unit

RCP - Royal College of Physicians of London

RCT – Randomised controlled trial

RH – Residential home

SBUHB - Swansea Bay University Health Board

SDEC - Same Day Emergency Care

SOPAS - Surgical Older Persons Assessment Service

START - Sydney Triage to Admission Risk Tool

STOPPFRAIL - Screening Tool of Older Persons Prescriptions in Frail adults with limited life expectancy

T&O – Trauma and orthopaedics

T2D - Type 2 Diabetes Mellitus

TUG - Timed-Up and Go test

UK -United Kingdom

VW - Virtual Wards

WAST – Welsh ambulance service trust

WCP - Welsh Clinical Portal

WIMD - Welsh index of multiple deprivation

PUBLICATIONS ASSOCIATED WITH THIS RESEARCH

Burgess AJ, Clee D, Prichburg A, Burberry DJ, Keen L, Davies EA. CWTCH in the community: improving education to reduce adverse outcomes for patients who fall in nursing homes. Gerontol Geriatr Educ. 2023 Sep 4:1-9.

Burgess AJ, Williams DM, Collins K, Roberts R, Burberry DJ, Stephens JW, Davies EA. Diabetes management in older adults who fall: a study amongst older adults presenting to the emergency department. Eur Geriatr Med. 2023 Oct;14(5):1105-1110.

. McMillan M, Burgess AJ. Prescribe, Review, now! an assessment of adequate PRN analgesia and associated laxative prescribing using Hospital Electronic Prescribing and Medicines Administration (HEPMA). BMJ Open Quality 2023;12: e002090.

Burgess AJ, Davies EA, Burberry D, Beynon-Howells C, Quinn P, James L, Hopkins C, Mdhlongwa A, Davies D, Clee D. Older Persons Assessment Service (OPAS): delivering comprehensive geriatric assessment in the emergency department. Clin Med (Lond). 2022 Jul;22(Suppl 4):80-81.

Platform Presentations

National British Geriatric Society Spring Meeting, May 2024 - Virtual Wards Patient-reported outcome measures & patient-reported experience measures. Presenter, 1st Author.

Welsh British Geriatric Society Spring Meeting, April 2024 – - Patient-reported outcome measures & patient-reported experience measures. Presenter, 1st Author.

Welsh British Geriatric Society Spring Meeting, March 2023– Comparing same day emergency care scores. Presenter, 1st Author. 1st Prize

Welsh British Geriatric Society Spring Meeting, March 2023 – The Risk of Intracranial Haemorrhage in fallers. 3rd Author

Welsh Endocrine and Diabetes Conference – October 2022. Diabetes management in older adults who fall. 1st Author

Welsh British Geriatric Society Autumn Meeting, Oct 2022 – Hospital frailty risk score. Presenter & 1st Author

Welsh British Geriatric Society Autumn Meeting, Oct 2022– Diabetes management. Presenter & 2nd Author. 1st Prize

Welsh British Geriatric Society Autumn Meeting, Oct 2022 – Integrated care pathway development. 2nd Author

Welsh British Geriatric Society Autumn Meeting, Oct 2022 –Acute Frailty Unit at a Large Regional Centre. 5th Author

European Geriatric Medicine Society. Sept 2022 – Acute Frailty Unit at a Large Regional Centre. Presenter & 5th Author

European Geriatric Medicine Society, Sept 2022 – Screening Tool of Older Persons Prescriptions in Frail adults with limited life expectancy. Presenter & 2nd Author

European Geriatric Medicine Society, Sept 2022 – Integrated care pathway development. Presenter & 1st Author

European Geriatric Medicine Society Sept 2022 – Older persons assessment service. Presenter & 1st Author

Welsh British Geriatric Society Spring Meeting, March 2022 – CWTCH intervention. Presenter & 1st Author. 1st Prize

Welsh British Geriatric Society Spring Meeting, March 2022 – Older persons assessment service. Presenter & 1st Author.

Welsh British Geriatric Society Spring Meeting, March 2022 – Surgical older persons assessment service. 2nd Author.

Published Posters & Abstracts

National British Geriatric Society Spring Meeting, May 2024 – Developing a novel frailty specific same day emergency care score. Presenter, 1st Author

National British Geriatric Society Spring Meeting, May 2024 - Virtual wards patient-reported outcome measures & patient-reported experience measures. 1st Author

National British Geriatric Society Spring Meeting, May 2024 – Virtual wards Fracture discharge pathway. 3rd Author

National British Geriatric Society Autumn Meeting, November 2023 – Comparing same day emergency care scores. Presenter, 1st Author

National British Geriatric Society Spring Meeting, May 2023 – Diabetes Management in older adults. 1st Author

National British Geriatric Society Spring Meeting, May 2023 - Hospital frailty risk score in the emergency department. 1st Author

Diabetes UK April 2023 - Diabetes management in Fallers. 1st Author

National British Geriatric Society Autumn Meeting, November 2022 – CWTCH intervention. 1st Author

National British Geriatric Society Autumn Meeting, November 2022 – Frailty Scoring in Morriston. 3rd Author

European Geriatric Medicine Society, September 2022 – Developing a Rapid assessment unit. Platform Presenter, 5th Author

European Geriatric Medicine Society, September 2022 – Screening Tool of Older Persons Prescriptions in Frail adults with limited life expectancy. Platform Presenter, 2nd Author

European Geriatric Medicine Society, September 2022 – Integrated care pathway development. Platform Presenter, 1st Author

European Geriatric Medicine Society, September 2022 – Older persons assessment service. Platform Presenter, 1st Author

European Geriatric Medicine Society September 2022 - Diabetes management in Fallers. 1st Author

European Geriatric Medicine Society September 2022 - Ambulatory Care/ same day emergency care scores. 1st Author

European Geriatric Medicine Society September 2022 - Hospital frailty risk score in the emergency department. 1st Author

European Geriatric Medicine Society September 2022 - Ambulance Offloads. 1st Author

European Geriatric Medicine Society September 2022 – CWTCH intervention. 1st Author

European Geriatric Medicine Society September 2022 – Surgical Older Persons Assessment Service. 2nd Author

European Geriatric Medicine Society September 2022 – Frailty Scoring in MH. 3rd Author

National British Geriatric Society Spring Meeting, April 2022 - Older persons assessment service. 1st Author

Royal College of Physicians Medicine, Liverpool, March 2022 - Older persons assessment service. 1st Author

Presented Posters & Abstracts (not published)

Welsh Stroke Conference, June 2024 – Lipids. 2nd Author Winning Poster

Welsh British Geriatric Society Spring Meeting, April 2024 – Developing novel frailty specific same day emergency care score. 1st Author

Welsh British Geriatric Society Spring Meeting, April 2024 – Virtual wards Fracture discharge pathway. 3rd Author

Welsh British Geriatric Society Spring Meeting, March 2023 - Alcohol excess in older people who fall. 1st Author

Welsh British Geriatric Society Spring Meeting, March 2023 –Frailty and Delirium. 2nd Author

Welsh British Geriatric Society Spring Meeting, March 2023 – Referring to perioperative medicine. 3rd Author

Royal College of Physicians Medicine Update Cardiff, November 2022 - Prescribe, Review, Now. 1st Author

Welsh British Geriatric Society Autumn Meeting, October 2022 – Ambulance Offloads. 1st Author

Welsh British Geriatric Society Autumn Meeting, October 2022 – Screening Tool of Older Persons Prescriptions in Frail adults with limited life expectancy. 2nd Author

Bristol National Safety Conference, May 2022 – CWTCH in the Community intervention. Presenter & 1st Author

Bristol National Safety Conference, May 2022 – Prescribe, Review, Now. 2nd Author

Age and Anaesthesia, May 2022 – Surgical older persons assessment service. 2nd Author & Winning Poster

Acute and General Medicine, London, November 2021 - Older persons assessment service. Presenter & 1st Author. Highly Commended

Guidelines developed and implemented

Swansea Bay University Health Board Guidelines on Diabetes Management in Older, Frailer Adults – September 2022

PRIZES WON DURING THIS THESIS

British Geriatric Society Richard Dodds memorial prize for best research poster for Developing a novel frailty specific same day emergency care score Spring 2024

Best clinical quality platform presentation at British Geriatric Society Spring Meeting 2024 for Virtual wards patient-reported outcome measures & patient-reported experience measures

British Geriatric Society Rising Star Award for Clinical Quality 2023

Welsh British Geriatric Society Spring Meeting, March 2023 winning platform presentation for analysing different ambulatory care scores in older adults

John Brocklehurst Prize for best Clinical Quality poster at the National British Geriatric Society Autumn meeting 2022 for CWTCH in the community intervention

Welsh British Geriatric Society Autumn Meeting, October 2022 winning platform presentation for diabetes management in older adults who fall

Swansea Bay University Health Board 'Living our Values Awards' 2022 Winner – Speaking up with Compassion for CWTCH intervention project

Swansea Bay QI Awards, Summer 2022 Runner Up – CWTCH intervention. Presenter, 1st Author

Swansea Bay QI Awards, summer 2022 Winner– Prescribe review now Audit. 2nd Author.

Welsh British Geriatric Society Spring Meeting, March 2022 winning platform presentation for CWTCH in the community intervention

ACKNOWLEDGEMENTS

Firstly, I would like to thank all the patients who have attended the OPAS unit and have been a part of this thesis. The aim of this thesis was to find ways of providing improved care for older, frailer adults and it is for them that this work is essential.

Secondly, I would like to thank the following individuals:

Dr Elizabeth Davies, Dr David Burberry, and Dr Karina James who were my Clinical Supervisors whilst undertaking this project. You have all been incredibly helpful in providing ideas and without you, none of this would have been possible. A special thank you to Liz for always being there for expert guidance, advice, and motivational support. I have learnt so much and gained such valuable skills and for always accompanying me to various conferences to present this work.

I would also like to thank my primary Academic Supervisor Professor Jeff Stephens. You have been a constant wealth of knowledge and have helped this budding geriatrician achieve so much and develop a love of academia. You have always been willing to help with any queries big and small, and without you, none of this would have been achieved.

To Dr Thinzar Min, my secondary Academic Supervisor, thank you for your help and guidance.

To Dr Rhodri Edwards who has been my Educational Supervisor, thank you for supporting my out of programme time. I know it came as a bit of a surprise when I said I wanted to do research, but you have ensured that my CCT date has kept on track.

To the OPAS Team, you have all been a source of contact support and have been my cheerleaders, helping me with motivation when I am feeling overwhelmed and for all the hard work that the team do to improve care for older, frailer adults in SBUHB. This is extended to all the nursing staff, therapists, and other MDT members from the department of geriatric medicine, ED, and virtual wards. I would like to thank all the junior research fellows and administrative staff who have assisted with the data collection especially Dr Kyle Collins and Mrs Danielle Treseder, who were responsible for the maintenance and updating the OPAS database. I would also like to thank digital intelligence with their assistance in creating the “Frailty Flag” and the OPAS dashboard.

A personal huge thank you to my parents Gaynor and Doug and brother Chris. Thank you for always being there for me, in whatever I have done throughout my life. You have been my constant support, and I hope I have made you proud.

Finally, a big thank you to my husband Dr Brett Maddock. You have guided me throughout this process both personally and professionally and your advice and support have been a huge factor in all my successes, and you have accompanied me to various conferences to present this work. You have also encouraged me through the most difficult year of my career from 2024 to 2025, with commuting to Cardiff to complete my training and ST7, authoring this thesis and planning a wedding all at the same time, you are my rock.

Chapter 1 – Introduction and systematic literature review

1.1 Background

When an older person presents to hospital, there are several additional variables that need to be considered with regards to whether inpatient admission is in that person's best interests (British Geriatric Society, 2014). Hospitalisation for frail older adults has been shown to result in multiple adverse consequences, some of which are a consequence of therapeutic interventions. Bed rest, polypharmacy, nosocomial infections, tethering devices (e.g. intravenous lines, urinary catheters, telemetry, restraints), sensory deprivation, disruption of usual sleep patterns, and lack of proper nutrition all contribute to functional, physical, and cognitive decline (Creditor, 1993). This has led to the view that we need a significant cultural change for both pre-hospital and during hospital admissions.

Frailty is a multidimensional geriatric syndrome characterised by a progressive decline in physiological reserve and a diminished capacity to maintain homeostasis following stressors such as acute illness, surgery, or psychosocial disruption (Clegg et al., 2013). Unlike chronological ageing, frailty reflects biological age which is the cumulative deterioration across multiple systems that leads to vulnerability and increased risk of adverse outcomes including hospitalisation, institutionalisation, disability, and mortality (Dent et al., 2019). An international consensus group led by Morley et al (2013) described frailty as "a medical syndrome with multiple causes and contributors, characterised by reduced strength, endurance and physiological function that increases an individual's vulnerability for developing increased dependency and or death. Age UK (2019) describe frailty as "someone's overall resilience and how this relates to their chance to recover quickly following health problems.

The recognition of frailty as a distinct clinical entity has significant implications for healthcare systems facing demographic ageing. Estimates suggest that approximately 10–15% of community-dwelling adults aged over 65 years are frail, rising to more than 40% in those aged over 85 (Collard et al., 2012). Early identification is therefore a cornerstone of proactive geriatric care.

Two major conceptual frameworks underpin the understanding of frailty: The phenotypic Model (Fried et al., 2001) and the Deficit Accumulation Model (Rockwood and Mitnitski, 2007). Fried et al. (2001) proposed the frailty phenotype, defining the syndrome by the presence of three or more of the following criteria: unintentional weight loss (greater than 4.5 kg in the past year), self-reported exhaustion, weakness (grip strength), slow walking speed, and low physical activity. Individuals meeting one or two criteria are classified as pre-frail. This model emphasises the physical dimension of frailty and its manifestation as sarcopenia, weakness, and reduced mobility. Rockwood and Mitnitski (2007) conceptualised frailty as a state arising from the accumulation of various deficits including diseases, symptoms, disabilities, and laboratory abnormalities. The Frailty Index (FI) quantifies this burden as the ratio of observed deficits to the total considered, providing a continuous score between 0 and 1. This multidimensional model captures cognitive, psychological, and social domains, aligning more closely with the holistic nature of geriatric medicine. Both models are complementary: the phenotypic model offers simplicity and clinical utility, while the deficit model provides granularity and prognostic precision.

Frailty arises from complex, interrelated biological mechanisms rather than from a single cause. These mechanisms operate at molecular, cellular, and systemic levels: Chronic, low-grade inflammation often termed inflammageing is a central mechanism of frailty (Ferrucci et al., 2005). Elevated levels of inflammatory cytokines such as interleukin-6 (IL-6), C-reactive protein (CRP), and tumour necrosis factor-α (TNF-α) contribute to muscle catabolism, reduced appetite, and impaired tissue repair. With regards to endocrine and metabolic changes, age-related endocrine decline includes reduced anabolic hormones such as testosterone, dehydroepiandrosterone (DHEA), insulin-like growth factor-1 (IGF-1), and growth hormone (Morley et al., 2013). These changes impair protein synthesis and muscle regeneration, promoting sarcopenia which is a hallmark of frailty. Insulin resistance and altered glucose metabolism further exacerbate energy deficits. Ageing cells demonstrate mitochondrial dysfunction, leading to decreased adenosine triphosphate (ATP) production and increased reactive oxygen species (ROS) generation (Joseph et al., 2017). This oxidative stress

damages DNA, proteins, and lipids, accelerating cellular senescence and apoptosis. These processes cumulatively reduce organ resilience. Frailty is also influenced by neurocognitive decline, depression, and social isolation (Robertson et al., 2013). Cognitive impairment reduces executive function and physical performance, while loneliness and low mood contribute to physical inactivity and nutritional neglect. Thus, frailty reflects both biological and social vulnerability.

Early identification of frailty enables timely intervention. Several validated tools are used in clinical and research settings. Each tool varies in complexity, sensitivity, and domain coverage. Selection should depend on the clinical context, available resources, and purpose (screening versus comprehensive assessment). The common methods include: Fried Frailty Phenotype (FFP) which assesses five physical criteria (Fried et al., 2001), the Frailty Index (FI) based on cumulative deficits (Rockwood & Mitnitski, 2007), the Clinical Frailty Scale (CFS) comprising of a 9-point global scale ranging from “Very Fit” to “Terminally Ill,” widely adopted in hospital and critical care settings (Rockwood et al., 2005) and the Edmonton Frail Scale (EFS) consisting of a multidimensional tool assessing cognition, mood, social support, and medication use (Rolfson et al., 2006).

Frailty is a powerful predictor of adverse outcomes independent of chronological age (Clegg et al., 2013). In surgical populations, it predicts postoperative complications, prolonged hospital stays, and delayed recovery (Partridge et al., 2012). In community and acute care settings, it correlates with increased risk of falls, functional decline, and mortality (Dent et al., 2019). Recognition of frailty informs shared decision-making, helping clinicians weigh risks and benefits of interventions such as surgery, chemotherapy, or intensive care. It also supports personalised care planning and anticipatory care approaches.

Frailty is dynamic and potentially reversible, particularly in its early stages and it requires a multidisciplinary, multidimensional approach which can include:

- Exercise: Structured resistance and multicomponent exercise programmes (including balance and aerobic training) improve muscle strength, gait speed, and physical function (Theou et al., 2011).
- Nutrition: Adequate energy and protein intake (1.0–1.2 g/kg/day), along with supplementation of vitamin D and omega-3 fatty acids, supports muscle synthesis and reduces inflammation (Puts et al., 2017).
- Medication Review: Polypharmacy contributes to frailty through drug–drug interactions, side effects, and falls risk. Deprescribing inappropriate medications is a key strategy (Turner & Clegg, 2014).
- Comprehensive Geriatric Assessment (CGA): A multidimensional process assessing medical, functional, psychological, and social factors, CGA improves outcomes and maintains independence (Stuck et al., 2002).
- Social and Cognitive Engagement: Interventions targeting loneliness, depression, and cognitive stimulation can enhance wellbeing and resilience.
-

Frailty is a multifactorial, systemic syndrome representing the biological substrate of vulnerability in older adults. Its prevalence and clinical significance make it a core focus of modern geriatric medicine. Understanding its mechanisms from inflammation and endocrine dysregulation to social determinants enables more effective, person-centred care. With early identification and tailored interventions, frailty can often be slowed, stabilised, or partially reversed, ultimately improving quality of life and reducing healthcare burden.

Because frailty is complex and is underpinned by many mechanisms, it needs to be considered as part of a whole system's approach. During the admission-decision process, shared decision making, especially in frailer older adults is essential. Mortality is the ultimate adverse outcome, but patient factors such as lack of autonomy and dignity are important and less palatable outcomes (Rumley-Bass et al., 2016). Many still perceive hospital admission to be the best place for patient management, including

that of the frailest older adults (Kojima et al., 2018). The risk of discharge versus the risk of admission should always be considered as part of a shared care approach. When considering shared care, it is important to understand the burden of caring for frail patients with complex care needs in the community and in primary care and to move towards a proactive, rather than reactive approach (Lacas et al., 2012., NHS Improvement, NHS England, Ambulatory Emergency Care Network and Acute Frailty Network, 2019). Hospitalisation for frail older adults has been shown to result in multiple adverse consequences, which are a consequence of therapeutic interventions which all contribute to functional, physical, and cognitive decline (Creditor, 1993).

Admission to the emergency department (ED) is linked to adverse outcomes. By 2030, 25% of patients attending the ED are projected to be over 80 years old. Geriatric frailty syndromes can be difficult for triage systems to adequately assess in a timely fashion, and time is critical to the triage function. This is a factor that leads to older people being allocated lower priority status and their waits can be often prolonged with the chances of a 4-hour target breach being much higher in an elderly person verses an infant (Jones et al., 2022). Long waits in ED are associated with increased inpatient mortality, and standardised mortality rate starts to rise from 5 hours after the patient's time of arrival. In addition, there is one extra death for every 82 patients delayed for 6 to8 hours (Quinn et al., 2020). Delirium is also more common in patients who spend more time in ED, especially for those who remain in ED for longer than 10 hours (Bo et al., 2016). Since many ED departments have no windows and have artificial lighting, the lack of temporospatial ques increase delirium by increasing disorientation in space and time (Bauernfreund et al., 2018). An ED-stay associated with delirium increases the patient's risk of being hospitalised and extends their stay by approximately one week (Émond et al., 2017). Long waits in the ED, especially for elderly patients, are associated with an increase in hospital length of stay and nosocomial infection (Rutberg et al., 2014). This has had huge impact recently with the COVID-19 pandemic (Ponsford et al., 2021) which showed nosocomial-acquired cases had a median Clinical Frailty Scale (CFS) score of 5 compared with a CFS of 3 in community-acquired cases, this correlated with increased multi-morbidity in the nosocomial COVID-19 cases. It has been estimated that 16.4% of cases were hospital-acquired

with an in-patient mortality ranging from 38 to 42%, higher than mortality associated with community-acquired infection. Those with hospital-acquired infection were older and frailer (Ponsford et al., 2021). Similar data was shown in another study of patients with COVID-19 in hospital, it is estimated that 12.5% of COVID-19 cases were hospital-acquired, with an overall mortality of 27% in patients with nosocomial COVID. Increased mortality was associated with older age, increased frailty, renal failure, and increased CRP (Hewitt et al., 2020).

To combat this, innovative models of service delivery are required to provide Comprehensive Geriatric Assessment (CGA) for older patients presenting to the ED with frailty syndromes. When a frailer, older adult presents to an urgent care setting, a multifactorial approach must be adopted with an awareness of the “Geriatric Giants” which include presentations like Delirium, Falls, Immobility, Incontinence and social abandonment or unmet care needs, to enable early shared decision-making with accurate risk stratification about whether hospital admission is ultimately in that person’s best interests.

With regards to CGA in the ED unit, there is evidence that unit-based care on acute (first 72 hours) and general geriatric units achieve better results when applying CGA than liaison models (Hollinghurst et al.,2019 & Joseph-Williams et al., 2014), which is potentially due to having a specialist unit providing a controlled, functionally adapted environment with a multidisciplinary (MDT) based approach. CGA has been shown to be most effective with MDT assessment led by a consultant geriatrician at avoiding admission and readmission (Ballabio et al., 2008). Integrated care is also important as GCA has been shown to work best when able to link to an established, fully integrated system model within the hospital and in the community (Bird et al., 2007, & Caplan et al., 2004). When considering shared care, it is important to understand the burden of caring for frail patients with complex care needs in the community and in primary care and to move towards a proactive, rather than reactive approach. The main downside to a reactive approach is that this may require high health care expenditure, both in primary and secondary care, and the utilisation of multiple ‘out of hours’ visits. By

proactively identifying those most at risk from frailty syndromes, it may reduce unnecessary hospital admissions leading to increased quality of life (Lacas & Rookwood, 2012)

Quantitatively there is a lack of evidence relating to proactive strategies to reduce both admissions and adverse outcomes in older adults (Gwyther et al., 2018). Published studies focus on qualitative evidence of a proactive approach and these show either limited or no benefit on function, quality of life or adverse events (Bleijenberg et al., 2016). There is also a knowledge gap relating to what constitutes a good CGA, who is best to facilitate this and in what environment this should be performed and especially whether a liaison service or a dedicated inpatient unit have better outcomes. A meta-analysis of 29 randomised trials involving 14,000 participants found that those who received CGA were more likely to be living at home and were less likely to be admitted to a nursing home up to a year after hospital admission (Ellis et al., 2014).

There has been limited published research on CGA delivered in a unit alongside or within an ED. Some studies have examined the role of specialist nurses and consultant geriatricians show a reduction in admissions by offering CGA without any adverse outcomes, with an increase in appropriate specialty referrals and same-day discharge rates (Ellis et al, 2012). Another successful approach has utilised existing ED staff, with consultant geriatrician input, again showing that CGA in the ED was associated with a reduction in readmissions and an increase in discharges but with a caveat of an increase in LOS, for those who were admitted (Conroy et al., 2014). Others have used a wider MDT including a consultant physician with pharmacist, social worker, nurses showwed reduced admission rates but no change on discharges or reduced readmission rates (Keyes et al, 2014). With respect to the benefits of acute geriatric care units, there is no consensual opinion about what approach is best. United States (US) clinical practice includes Geriatric Evaluation and Management Units (GEMUs) and Acute Care of the Elderly (ACE) units, both of which are aimed to promote mobility and prepare for independence whilst providing acute care. GEMUs use an MDT approach and assume the care of the patient with a dedicated team of expert clinicians

including nurses and therapists. Published research demonstrates that care in ACE units is associated with greater independence in ADLs at discharge, less frequent discharge to a nursing home, shorter and less expensive hospital stays (Landefeld et al., 1995) and Flood et al., 2013) and reduced 30-day readmission rates, as well as higher satisfaction rates among patients, family members, clinicians, and nurses (Counsell et al., 2000). A similar model has not been studied in the UK in the same quantifiable way. In the US, a model has been developed to try and replicate ACE units, for patients managed on different hospital wards using the core values of CGA. A study comparing matched cohorts of patients whereby one received ACE-like MDT input showed lower rates of adverse events, shorter hospital stays, and better satisfaction (Hung et al., 2013) but compared to actual physical elderly care units they are not as effective. This may be due to a lack of specialist nursing and therapy staff.

1.2 Specific objective of Thesis

1.2.1. Overall objectives of thesis

The current MD thesis aims to examine the different approaches and how they affect adverse patient outcomes and experiences. The aim of this chapter is to undertake a systematic literature review of published studies investigating clinical frailty interventions. This will specifically focus on whether a physical specialist assessment unit based in the Emergency Department improved patient centred outcomes for those patients aged over 65 years old. This review aims to assess whether a liaison team in the ED or a unit-based CGA improves outcomes that matter most to older patients, including activities of daily living (ADL) improvement or maintenance, timely discharge shown by a reduced LOS, reduced readmissions, and reduced admission rate.

The aims of the proposed MD are:

I. To undertake a systematic literature review of published studies investigating clinical frailty interventions pre and in-hospital. This will specifically focus on whether a physical specialist assessment unit based in the Emergency Department improves patient centred outcomes.

II. To determine the best approach for prehospital treatment of patients with frailty, focusing on Proactive Care by developing front door services in collaboration with the Acute GP Service and Advanced Practice Paramedics, plus VW.
III. To determine the best approach for in-hospital treatment of patients with frailty, particularly focusing on pathway management and multidisciplinary team (MDT) input, improving reactive care.
IV. Chronic disease in the older adults is a frailty determinant, so I am collaborating with other colleagues at looking at chronic disease management e.g. Diabetes, Alcohol excess, and polypharmacy

1.2.2 Chapter 2 - Methods and the development of the Older Persons Assessment Service

The aim of this chapter is to describe what the OPAS is and how it was developed. The service will also be described in detail, and how the database was used for this MD thesis. An OPAS was developed, using adapted United States clinical practice. This includes Geriatric Evaluation and Management Units (GEMUs) and Acute Care of the Elderly (ACE) units, both of which are aimed to promote mobility and prepare for independence whilst providing acute care using an MDT approach and assume the care of the patient with a dedicated team of expert clinicians including nurses and therapists. Published research demonstrates that care in ACE units is associated with greater independence in Activities of Daily living (ADLs) at discharge, less frequent discharge to a nursing home, shorter and less expensive hospital stays (Landesfeld et al., 1995 & Flood et al., 2013) and reduced 30-day readmission rates, as well as higher satisfaction rates among patients, family members, clinicians, and nurses (Counsell et al., 2000). In the US, a model has been developed to try and replicate ACE units, for patients managed on different hospital wards using the core values of CGA which showed lower rates of adverse events, shorter hospital stays, and better satisfaction (Hung et al., 2013) but compared to actual physical elderly care units they are not as effective (Landesfeld et al., 1995). This may be due to lack of specialist nursing and therapy staff. There is also a lack of evidence of who is best placed to deliver CGA and whether a dedicated frailty team are best place to deliver this.

1.2.3 Chapter 3 - Screening for frailty at the front door

The aims of this chapter are to examine how frailty scoring, and the identification of frail patients can be used to improve outcomes at this crucial stage. Aim 1 is to analyse at ambulance offload delays (AOD) and how frailty influences this by examining whether AOD was associated with age, CFS, inpatient length of stay (LOS), ED re-attendance within 6 months and mortality at 6 months. A comparison of those over 65 years old with those who were directly admitted to the OPAS unit in Morriston Hospital. Aim 2 is to look at the hospital frailty risk score (HFRS) and how this can be applied to patients in the ED and how the CFS links with the HFRS. The HFRS and CFS both have their benefits and identifying older people at risk of adverse outcomes in hospital can allow a system to provide frailty-specific interventions throughout their stay. To aid triaging and in identifying who would benefit from the input of the OPAS in Morriston Hospital, ED, both scores have been analysed.

1.2.4 Chapter 4 – Ambulatory care and Same Day Emergency Care (SDEC)

The priority is to provide care in “The right place at the right time” and to provide an individualised approach balancing the traditional model of hospital admission with the ability to provide care closer to the place of residence. To assist clinicians to stratify who is best placed for SDEC, several patient selection scores have been developed to identify patients suitable for ambulatory care from triage in the ED and from the acute medical intake. These scores are designed to improve system efficiency, overcrowding and patient experience. The most frequently cited and tested scores are the Ambulatory Score (Amb) (Ala et al., 2012), the Glasgow Admission Prediction Score (GAPS) (Cameron et al., 2014) and Sydney Triage to Admission Risk Tool (START) (Dinh et al., 2016). The aim of this chapter was to retrospectively apply these scoring systems to service users who attended the OPAS to evaluate the applicability of patient selection scoring systems to identify older frail patients who were suitable for SDEC. This will identify people at risk of adverse outcomes in hospital to provide a system of frailty-specific interventions throughout their stay and to provide a way of stratifying who would be suitable for SDEC.

1.2.5 Chapter 5 - Developing a novel F. SDEC score

The aim of this section of work was to develop a novel SDEC score for older, frailer adults, called the F. SDEC score. Several scores have been developed to identify SDEC patients from ED triage and acute medical intakes. Scores are designed to improve system efficiency, overcrowding and patient experience but none have been developed for older adults. Previous work has shown that existing scores e.g. GAPS, START and Amb Score were not able to predict admission in our population (see Chapter 4).

1.2.6 Chapter 6 – Chronic disease in older adults who fall and de-prescribing

The aim was to examine whether people with specific chronic diseases such as type 2 diabetes mellitus (T2D) and alcohol excess admitted to hospital with a fall as these are not routinely part of a falls assessment, and whether were more likely to have greater frailty, co-morbidity burden, or risk factors for falls. The second aim is to examine prescribing practice and whether different de-prescribing tools can be used in the acute setting to improve patient outcomes and experience. Therefore, the aims of this chapter are to analyse various chronic diseases in older adults who present to the ED with falls. The chapter is divided into the specific chronic disease and analysed accordingly. The aims are:

1 – the aim of this study was to apply the STOPPFrail Version 2 (Screening Tool of Older Persons Prescriptions in Frail adults with limited life expectancy) criteria to identify potentially inappropriate medications (PIMs) in frail older adults with poor predicted one-year survival and to determine the proportion of older adults in which STOPPFrail criteria are applicable and to measure the prevalence of STOPPFrail PIMs and identify potential medication cost savings.

2 – To examine whether people with T2D admitted to hospital with a fall, were more likely to have greater frailty, co-morbidity burden, or risk factors for falls and use guidelines to assist with deprescribing

3 - To examine whether people admitted to hospital with a fall and had a history of alcohol excess, were more likely to have greater frailty, co-morbidity burden, or risk factors for falls. It was also examined whether people with a history or current alcohol abuse associated with poor clinical outcomes in a cohort of patients admitted to the ED with a fall. A second aim was to see whether the POSAMINO (Potentially Serious Alcohol–Medication Interaction's in Older adults) criteria could be used to identify PIMs to assist with deprescribing

1.2.7 Chapter 7 - Providing community services

The Welsh Government's Six Goals for Urgent Care Programme (Welsh Assembly Government, 2021), the GIRFT report on geriatrics (Jones et al., 2022) and the NHS England Right Care (NHS England, 2019) guidance concerning frailty, all clearly describe the requirement to provide an integrated system that includes secondary care, primary care, care homes, community services, ambulance services, local authorities and the voluntary sector and is centred on the needs of individual patients and focused on preventing inappropriate hospitalisation and progression of frailty. Older people living with frailty are more likely to have delayed transfers of care if they are admitted to hospital and are vulnerable to the potential adverse effects of hospital admission i.e. deconditioning, delirium and inpatient falls (Oliver et al., 2014 and Keeble et al., 2019). People living with frailty could often have their needs best met in settings outside of acute hospital care. Assessment in a person's own home is potentially less disruptive and more effective than acute admission to hospital. Many patients living with frailty are approaching the end of their life and it is important there is appropriate shared decision making, including advance care planning.

Therefore, the two main aims of this chapter are to: -

1. Provide outreach from hospital teams to intervene into nursing homes (NH) for older, frailer adults who fall by developing an education package provided to the NH staff around falls and the adverse effects associated.

2. To develop a virtual ward (VW) service, with a focus on reducing fractures by developing a fracture discharge pathway (FDS).

1.3 Criteria for including studies in the review

A systematic review of the literature was undertaken according to PRISMA (Preferred Reporting Items for Systematic reviews and Meta-Analyses) protocol, focusing on research related to clinical frailty interventions or assessments in the ED, including CGA. All the studies identified were observational in study design and included cohort, case control, and cross-sectional studies. Publications of case series or case reports were excluded. Cochrane reviews were also excluded but each paper included in the review articles were examined for relevance. I excluded any papers that are not in the English language, any papers where the full text is not available and any papers that do not relate to the specific outcomes listed above. In addition, exclusions were non-peer-reviewed articles (e.g., opinion pieces, editorials) and studies focused on interventions outside the scope of ED settings. I also excluded any studies that looked at specific conditions such as COVID-19, oncology, surgery, and trauma.

All people aged greater than 65 years of any gender were included in the review. The population was not restricted to the UK and examined global worldwide literature. The initial search question was derived from the PICO (patient, intervention, comparison, outcome) model: -

P – The population are older adults, aged greater than 65 years. Participant demographics studied involved extraction of participant characteristics from published manuscripts' methods or results sections, total sample size, age range or mean age, and gender distribution

I – The intervention was admission to hospital. I extracted specific details about the study setting from methods sections of manuscripts including type of healthcare facility (academic hospital, community hospital, etc.), specific department (the ED), geographic location (country, region), and Urban/rural setting.

C – Analysing a physical specialist assessment unit based in the ED or a liaison-based model providing a CGA in the ED. The principles of CGA outlined by Ellis et al (2014) were used to screen the papers for appropriateness for inclusion in the review. Ellis et al (2014) outline the following components: clinical leadership, structured assessment, multidisciplinary team meetings, goal setting, involving patients and carers in goal setting, outpatient follow-up, ward environment, adequate time, specialty knowledge, experience and competence, and tailoring treatment plans to the individual. I will therefore describe the specific intervention from methods section including the type of intervention (e.g., comprehensive geriatric assessment), who delivered the intervention (e.g., consultant geriatrician), specific components of the intervention, duration and frequency of intervention and any standardized tools or protocols used.

O – Key patient centred outcomes studied included mortality rates, changes in quality-of-life measures post-intervention, improvements in physical function and independence, assessment of interventions to reduce or extend hospital stay and admission rates to hospital. The primary outcome measures were extracted from methods and results sections of published manuscripts including the specific outcomes measured, measurement tools or methods, Numerical results with statistical significance including confidence intervals or p-values. I prioritised outcomes related to patient-centred outcomes in ED settings for frail older patients. In addition, numerical results, statistical significance, and confidence intervals if provided were documented. Any missing date will be noted. The variables I focused on are Hospital admission rates, Length of hospital stay, Readmission rates, Mortality rates, and Patient quality of life measures.

1.4 Search strategy

A search strategy for relevant citations between January 2012 and August 2024 was developed, using keywords including "Emergency Department”, “older adults”, “multidisciplinary assessment unit”, “patient-centred outcomes”, “frailty”, “functional decline”, “ACE” and “CGA”. MeSH search terms and ‘title, abstract’ searches were combined with Boolean operators to produce a search result. The search used the databases Cochrane, PubMed, and Web of Science. Articles identified were reviewed for relevance and appropriate studies will be included in the review. This was supported with assistance from the Morriston Hospital Library, which has considerable experience of supporting systematic reviews. I also performed hand searching of key journals such as Age and Aging as well as looking at references and citations for relevant articles.

1.5. Methods of review

The quality of the studies was evaluated using established criteria to ensure methodological rigor, such as the PRISMA checklist for systematic reviews or the CONSORT (Consolidated Standards of Reporting Trials) guidelines for randomised controlled trials. End Note software was used to maintain a record of the references and Microsoft excel will be used to keep a record of the PRISMA checklist. Data was extracted based on the types of interventions and outcomes measured. I considered all screening questions together and then judged to see whether the papers should be included individually.

1.6. Results

1.6.1 The results of the search

In total, 1261 papers were identified with 398 papers remaining after screening for review. The Cochrane library found 175 papers with 3 RCTs and 31 trials included for analysis with 141 removed on initial screening. PubMed search found 815 papers with

264 papers included with 551 removed on initial screening whilst Web of Science found 271 papers with 100 papers included with 171 removed on first screening. Once all the references were placed in End Note, 202 duplicates were removed. A further 54 abstracts were analysed identified by manual searching references and citations and systematic review articles. Two hundred and forty abstracts in total were assessed, with 203 excluded. In total, 37 full text articles were assessed with 17 excluded until I arrived at 20 papers in total included in the analysis. A total of 12 papers were excluded at the abstract review stage as they were not in the English language and translations were not able to be obtained. The studies identified are shown in Figure 1.1.

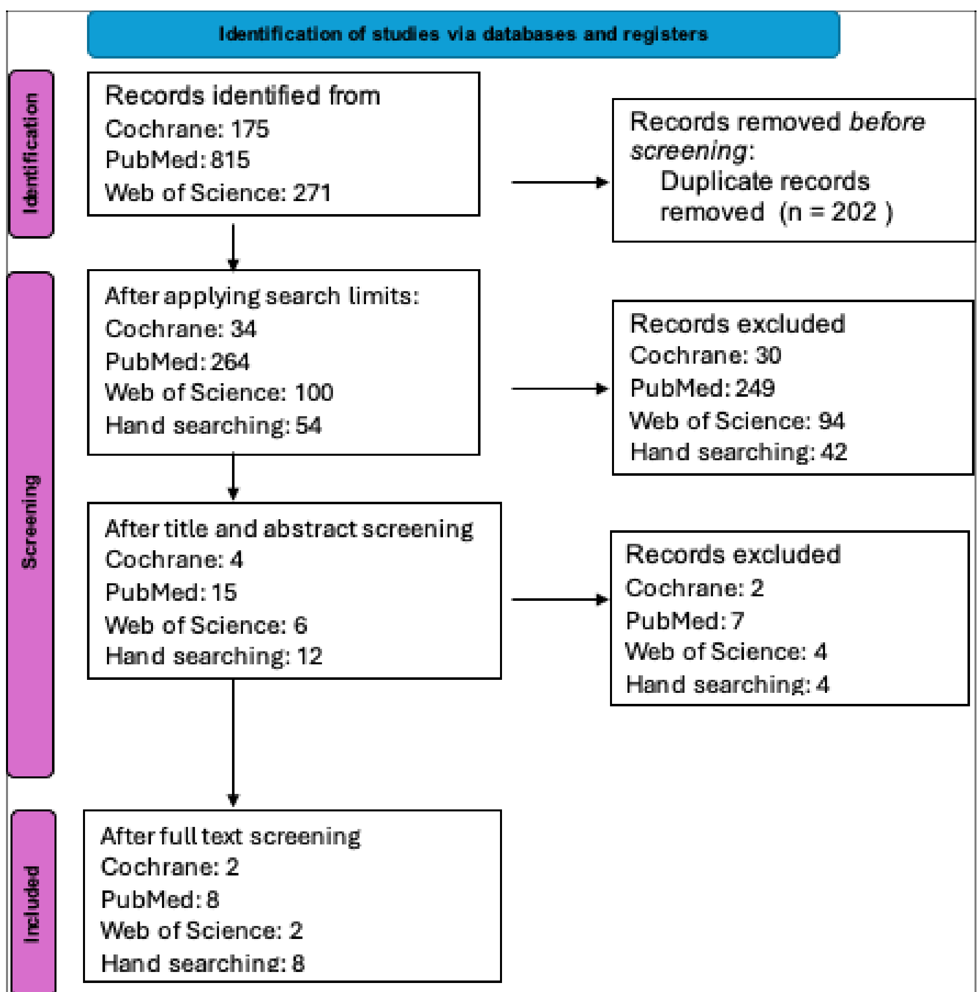


Figure 1.1: Studies included in systematic review

1.6.2 Study range and characteristics

There were 20 studies identified in this literature search post scoping review. When identifying whether the intervention was unit or team based, 9 of the studies included in this systematic review involved the creation of a unit-based model to provide a CGA (Barnes et al. 2012), Bornstein et al. (2016)., Conroy et al. (2013)., Ekerstad et al. (2018)., Leung et al. (2020)., Nathaniel and Amin. (2016)., Preston et al., (2018)., Wald et al., (2011) and Westgård et al., (2020), whilst 11 involved a MDT based in the ED to provide liaison comprising of a geriatrician plus many other healthcare professionals (Alakare et al., (2021)., Campmany et al., (2018)., Chong et al., (2021)., Chong et al., (2022)., Fox et al., (2016)., Huang et al., (2023)., Jay et al., (2016)., Lin et al., (2021)., Liu et al., (2021)., Silverster et al., (2014) and van den Broek et al., (2023).

Study	Study Design	Population Size	Intervention Type	Primary Outcomes
Alakare et al. (2021)	Randomized controlled trial, Single-centre study	432	Systematic geriatric assessment in ED	Cumulative hospital stays for 1 year follow up
Barnes et al. (2012)	Randomized controlled trial	1,632	Creation of an ACEU to offer enhanced care for older adults in specially designed hospital units.	Length-of-stay and cost, which were obtained from hospital financial records
Bornstein et al. (2016)	Cluster randomized controlled trial	1,384,	A redesigned unit-based workflow and trained interprofessional teams to create care plans for vulnerable older adults using principles of comprehensive geriatric assessment and team management.	Difference between observed and expected LOS.
Campmany et al. (2018)	Quasi experimental study; Single centre study	Not stated	ED geriatrisation, implementing MDT CGA performed by ED professionals (physician, nurses, social worker, pharmacist). Also, an elder-friendly area (EFA) inside the ED was built	Admission rate

Chong et al. (2021)	Quasi experimental study; Single centre study	100	Early geriatric specialist Interventions team in ED	Successful acute admission avoidance
Chong et al. (2022)	Quasi experimental study, Prospective study	140	Multicomponent frailty Intervention team in ED	Functional status (Modified Barthel Index and Lawton's instrumental Activities of Daily Living)
Conroy et al. (2013)	Observational study (cohort), Single centre study	Approx. 7,500 (Intervention cohort)	Unit based CGA	Admission avoidance from the ED
Ekerstad et al. (2018)	Clinical, prospective, controlled intervention trial	239	Unit based CGA	Patient satisfaction
Fox et al. (2016)	Feasibility study	168	Consultant Geriatrician based in ED	Length of stay and 30-day readmission rate

Huang et al. (2023)	Systematic review (scoping review)	Not applicable	Models of care for frail older people in ED	ED length of stay, hospital admission rates, cost savings, patient satisfaction
Jay et al. (2016)	Systematic review	28,434 (across included studies)	CGA team based in ED	Reduction in admission rates
Leung et al. (2020)	Retrospective cohort study	190	Frailty unit in ED	lengths of stay in acute and convalescent hospitals, transferral rate to a convalescent hospital and 28-day re-attendance rate.
Lin et al. (2021)	Prospective observational study (Before-after design)	358	CGA screening and follow-up Program based in ED	Revisits to ED, admissions, mortality within three months after discharge
Liu et al. (2021)	Observational pre-post study	2377 in the intervention period, and 2207 in the 2015 period	Interprofessional team of regular ED medical and nursing staff was dedicated to the geriatric module	Admission rate

Nathaniel and Amin. (2016)	Single case study	605 elderly patients in the AEU (Acute elderly unit) group a control group of 327 elderly patients who were seen by the general medical team (non- AEU group)	Elderly Receiving Unit (ERU)	admission avoidance, length of stay in hospital, and 30-day readmission rates
Preston et al. (2018)	Systematic mapping review	Not applicable	Changes to ED staffing, physical infrastructure Changes and MDT to provide CGA	Patient centred outcomes and health service outcomes
Silverster et al. (2014)	Prospective systems redesign study over 2 years.	98,702	MDT which included consultant geriatricians, junior doctors, nurses, pharmacists, therapists, and clerical staff based in ED	average bed occupancy, in-hospital mortality and the 28-day readmission rate,
van den Broek et al. (2023)	Systematic review	103 to 5930 (control/ preintervention),	Individual needs assessment team based in ED	ED revisit rates, hospital admission rates

		128 to 6230 (post intervention)		
Wald et al. (2011)	Quasi-randomized, controlled study	217	Hospitalist-ACE service was developed	The primary outcome was recognition of abnormal functional status by the primary medical team.
Westgård et al. (2020)	Two-armed design with participants randomized into the intervention or the control group in a university hospital.	155	Frail people aged 75 or older who required an unplanned hospital admission were randomized to either the CGA ward or to an acute medical ward	CGA had an impact on frail older people's activities of daily living (ADL)

Table 1.1: Studies included in systematic review

1.6.3 Effect of intervention on outcome

The main effects of ED-based and unit-based specialist assessment primary patient outcomes are shown below in Table 1.2. Each outcome will be addressed individually.

Study	Mortality Rates	Readmission Rates	Admission Rates	Functional Status	Length of Stay
Alakare et al. (2021)	No significant differences at 30 and 365 days	No significant difference (rate ratio 1.12, 95% CI 0.99-1.28, P = .08)	Lower in intervention group (62% vs 70%), not statistically significant (P = .10)	No significant difference in quality of life	No significant difference in cumulative hospital stays
Barnes et al. (2012)	No mention found	Three-month hospital readmission rates were similar	No mention found	There were no significant differences between the Acute Care for Elders and usual-care groups in patient functioning at discharge	Length-of-stay was significantly reduced in the Acute Care for Elders intervention group (6.7 days per patient) compared to the usual-care control group (7.3 days per patient)
Bornstein et al. (2016)	No difference OR - 0.69 (0.42-1.15) P= 0.160	Readmission within 30 days of discharge, did not differ significantly	No mention found	No mention found	Comparison group patients had longer observed LOS than intervention group patients (6.60 days vs. 5.40 days). The difference remained statistically significant with nonparametric testing (P= .005)
Campmany et al. (2018)	No mention found	No differences in ED attendance 3.6%	Decrease in the rate of re-admission (11.3%)	No mention found	No mention found

		pre and post intervention			
Chong et al. (2021)	No differences between groups	No differences in ED re-attendance	No mention found	No mention found	No mention found
Chong et al. (2022)	No mention found	Reduction in ED re- attendance. Rate ratio 0.35, 95% CI 0.13-0.90, P = 0.03	81.4% of intervention group avoided acute admission	Improved Modified Barthel Index (MBI) and Lawton's instrumental Activities of Daily Living (iADL) scores	No mention found
Conroy et al. (2013)	No mention found	Fell across all age groups; risk ratios of 0.77 (0.63-0.93) at 90 days for those aged 85+	Reduced from 69.6% to 61.2% for those aged 85+	No mention found	Increased for older people; no specific numerical results provided

Ekerstad et al. (2018)	No mention found	No mention found	No mention found	Decline in ADLs according to the ADL Staircase was less prevalent in the intervention group [24 (14.1%); n=170] than in the control group [98 (63.6%); n=154; P<0.0001	No mention found
Fox et al. (2016)	30-day mortality rate of 1.79%.	Seven-day and 30-day rates were 6.32% and 10.1% respectively	No mention found	No mention found	Overall average hospital length of stay was 6.5 days (0–55 days) with 53 (32%) patients discharged from ED directly.
Huang et al. (2023)	No mention found	No mention found	Lower hospital admission rates reported	No mention found	Shorter ED length of stay reported
Jay et al. (2016)	No mention found	Varied results, no specific data provided	Statistically significant reductions (Ranging between 2.6 and 19.7%)	No mention found	Varied results, no specific data provided

Leung et al. (2020)	No mention found	Reduced but not statistically significant (26.7% vs 15.0%, $p = 0.12589$).	No mention found	No mention found	Reduced LOS (2.38 vs 3.27 days, $p = 0.00018$).
Lin et al. (2021)	Significantly reduced from 10.7% to 3.0%	30.7% revisited the ED. No comparison	Significantly reduced from 50.8% to 23.1%	No mention found	No mention found
Liu et al. (2021)	No mention found	No mention found	Improved admission rate ($p < 0.01$).	No mention found	The median ED LOS was longer in the intervention period, 330 min (95% CI: 322 to 337) compared to 275 min (95% CI: 267 to 283) in the 2015 period
Nathaniel and Amin. (2016)	No mention found	No mention found	improved admissions avoidance (no specific results provided)	No mention found	Length of stay and admission prevention were higher in the AEU group than the non-AEU group

Preston et al. (2018)	No specific results provided	No specific results provided	No specific results provided	No mention found	No specific results provided
Silverster et al. (2014)	mortality fell by 2.25%	Remains unchanged	Decreased hospital admission rates reported	No mention found	Average bed occupancy fell by 20.4 beds (95% confidence interval (CI) −39.6 to −1.2, P = 0.037)
van den Broek et al. (2023)	No mention found	No mention found	Decreased hospital admission rates reported	No mention found	No specific results provided
Wald et al. (2011)	No mention found	No changes 30-day readmissions (12.3% vs 9.5%, P ¼ 0.51).	No mention found	fall rate for Hospitalist-ACE patients was not significantly different from the fall rate for usual care patients	No changes Hospitalist-ACE discharges and usual care discharges in mean length of stay (3.4 6 2.7 days vs 3.1 6 2.7 days, P= 0.52),

Westgård et al. (2020)	No mention found	No mention found	No mention found	There were no statistically significant differences between the two groups’	No mention found

Table 1.2: Effects of ED-based and unit-based specialist assessment primary patient outcomes. *ED* Emergency department

With respect to mortality, there was only a mention of mortality data for 7 out of the 20 studies identified as part of this review. Alakare et al. (2021), Chong et al. (2021), and Bornstein et al. (2016) all reported no significant differences between groups. Fox et al., (2016) and Preston et al., (2018) reported mortality data without providing specific results. Silverster et al., (2014) and Lin et al. (2021) reported significantly reduced mortality. There was no data on mortality found in 13 of the remaining full text articles (Barnes et al., (2012), Campmany et al., (2018), Chong et al. (2022), Conroy et al., (2013), Ekerstad et al., (2018), Huang et al., (2023), Jay et al., (2016), Leung et al., (2020), Liu et al. 2021., Nathaniel and Amin (2016), van den Broek et al., (2023), Wald et al., (2011) and Westgård et al., (2020)). Analysing the data to compare either Unit-based or liaison-based interventions, no significant differences in mortality was observed in 2 studies comprising of a liaison approach and 1 study looking at a unit. Only 2 of the studies in total showed a reduction in mortality and these were both team-based interventions.

There was a mention of readmission data for 12 out of the 20 studies. The results again varied with 7 reporting no significant difference between groups (Alakare et al., (2021), Barnes et al., (2012), Bornstein et al,. (2016), Campmany et al., (2018), Chong et al., (2021), Silverster et al., (2014) and Wald et al., (2011)). There was a reported reduced readmissions in 3 studies, Chong et al., (2022), Conroy et al., (2013) and Leung et al., (2020). Fox et al., (2016) and Lin et al., (2021) did not supply comparison data. There was no mention of readmission data in 8 studies (Ekerstad et al. (2018), Huang et al., (2023), Jay et al., (2016), Liu et al., (2021), Nathaniel and Amin (2016), Preston et al., (2018), van den Broek et al., (2023) and Westgård et al., (2020)). Further analysis of the data comparing unit and liaison interventions, 2 of the unit-based interventions showed reduced readmissions compared to 1 of the team-based interventions.

Admission rates were included for analysis in 12 of the 20 studies. Three studies reported significant reductions or improvements in admission rates (Jay et al., (2016), Lin et al., (2021) and Liu et al., (2021)). A majority of 9 studies reported improvement

in admission with lower or decreased rates without specifying significance (Alakare et al., (2021), Campmany et al., (2018), Chong et al., (2022), Conroy et al., (2013), Huang et al., (2023), Nathaniel and Amin, (2016), Preston et al., (2018), Silverster et al., (2014) and van den Broek et al., (2023)). Unfortunately, 8 of the studies did not include any data on admissions (Barnes et al., (2012), Bornstein et al., (2016), Chong et al., (2021), Ekerstad et al., (2018), Fox et al., (2016), Leung et al., (2020), Wald et al., (2011) and Westgård et al., (2020)). When comparing the 2 main interventions, all the studies who reported significant differences were team-based, with 3 of the unit-based models reporting lower rates, with no data supplied, compared to 6 of the team-based models.

Functional status was mentioned in only 6 of the studies analysed. Three studies reported improvements in ADLS (Chong et al., (2022), Ekerstad et al., (2018), and Wald et al., (2011)). Three studies reported no significant differences post intervention (Alakare et al., (2021), Barnes et al., (2012) and Westgård et al., (2020)). The remaining studies did not mention functional status or ADLs in their full texts (Bornstein et al., (2016), Campmany et al., (2018), Chong et al., (2021), Conroy et al., (2013), Fox et al., (2016), Huang et al., (2023), Jay et al., (2016), Leung et al., (2020), Lin et al., (2021), Liu et al., (2021), Nathaniel and Amin, (2016), Preston et al., (2018), Silverster et al., (2014) and van den Broek et al., (2023)). Two of the unit-based and one of the team-based models showed an improvement in ADLs.

There was a mention of Length of Stay (LOS) data in 13 of the studies, but this was very varied. Two of the studies reported no changes in LOS post intervention (Alakare et al., (2021) and Wald et al., (2011)). Six of the studies reported a decrease in LOS (Barnes et al., (2012), Bornstein et al., (2016), Huang et al., (2023), Leung et al., (2020), Preston et al., (2018) and Silverster et al., (2014)). Fox et al., (2016) reported LOS data but no comparison data whilst Jay et al., (2016) reported varied results and mentioned that there was no significant difference, increased LOS, and shorter LOS post intervention. There was an increased LOS post intervention in 3 of the studies (Conroy et al., (2013), Liu et al., (2021) and Nathaniel and Amin, (2016). There was

no LOS data reported in 7 of the studies (Campmany et al., (2018), Chong et al., (2021), Chong et al., (2022), Ekerstad et al., (2018), Lin et al., (2021), van den Broek et al., (2023) and Westgård et al., (2020)). Two of the team-based studies showed an improvement in LOS, compared to 4 of the unit-based interventions. This was again very variable as 2 of the unit-based interventions showed an increase in LOS.

Overall, the data had mixed results across these outcomes with readmission and admission rates being the most reported measures. There was inconsistent reporting across outcomes and there was no overwhelming difference between a unit-based and liaison-based model. There was more data provided for admission rates for a team-based model compared to liaison based.

1.7. Discussion

The interventions described across the studies share common elements but also demonstrate variability in their specific components and implementation strategies. A recurring theme is the use of CGA as a core component of the interventions. For example, Alakare et al., (2021) implemented a systematic geriatric assessment that included evaluation of functioning, cognitive status, delirium screening, and medication reviews. Similarly, Conroy et al., (2013) focused on CGA delivered by geriatricians in the ED. Other studies such as Wald et al., (2011) and Westgård et al., (2020) developed a unit primarily to provide a CGA.

Another common theme is the multidisciplinary nature of the interventions. Chong et al., (2021) described" early geriatric specialist interventions", while van den Broek et al., (2023) highlighted interventions involving various healthcare professionals such as care coordination teams, ED nurses, and patient navigators. Bornstein et al., (2016) redesigned a unit-based workflow and trained interprofessional teams on general medical/surgical units to create care plans for vulnerable older adults using principles of comprehensive geriatric assessment and team management. Others such as

Campmany et al., (2018), implementing multidisciplinary CGA performed by ED professionals (physician, nurses, social worker, pharmacist) and created an elder-friendly area (EFA) inside the ED. Conroy et al., (2013) described changes in ED unit configuration to support the implementation of CGA, while Preston et al. (2018) noted interventions involving changes to ED staffing and physical infrastructure. Conroy et al., (2013) described the addition of geriatricians to support medical care decisions in the ED, while Alakare et al., (2021) involved geriatricians in their systematic geriatric assessment. This integration of specialized geriatric knowledge into the ED setting appears to be a key factor in improving care for older patients.

The timing and duration of interventions varied across studies. Some, like Alakare et al., (2021), implemented the intervention during the ED visit, while others, such as Lin et al., (2021), included a follow-up program after the initial ED assessment. A key aspect of implementation that emerged from the studies was the adaptation of ED processes and structures to accommodate these interventions. However, there was no detailed information on implementation strategies, barriers, and facilitators in the reported studies. This lack of detail in the available full texts or abstracts makes it challenging to fully understand the contextual factors that may influence the success of these interventions in different settings.

The approaches to frailty assessment varied across the included studies, reflecting the lack of a universally accepted definition or a measurement tool for frailty in the ED setting. Some studies used specific frailty scales, while others relied on more general assessments of functional status or risk. Alakare et al., (2021) used the CFS to identify patients who were frail or at risk of frailty. Chong et al., (2022) also used the CFS, focusing on patients categorized as 4-6 on this scale. These standardized tools provide a more objective measure of frailty, potentially allowing for better comparison across studies. Other studies used broader criteria to identify vulnerable older adults. For instance, Lin et al., (2021) used the Fried frailty phenotype to classify patients as pre-frail or frail. This approach considers multiple dimensions of frailty, including physical function and physiological reserves. Some studies did not explicitly use frailty

assessments but instead focused on age and other risk factors. Conroy et al., (2013) targeted their intervention at patients aged 85 and older, while Chong et al., (2021) included ED patients aged 85 years and above. The variability in frailty assessment approaches highlights the diversity of methods used in the included studies. This diversity reflects the ongoing debate in the field about the most appropriate ways to assess frailty in the ED setting, which will be covered in more detail in this thesis.

Several studies described interventions that went beyond the traditional boundaries of ED care. For example, Chong et al., (2021) focused on identifying patients for safe discharge or transfer to low-acuity care settings, highlighting the importance of considering the entire care pathway. Similarly, van den Broek et al., (2023) described interventions involving discharge planning and coordination of services, emphasizing the need for continuity of care beyond the ED visit. This will be further explored in this thesis. Care coordination was often facilitated using standardized tools and protocols. Conroy et al., (2013) mentioned the use of a standardized integrated proforma and care pathways for frail older people, which can help ensure consistent and comprehensive care across different healthcare providers. However, we did not find detailed information on the specific mechanisms of service integration and care coordination in most of the studies.

There was data missing on who compromised of the MDT, whether this was unit or liaison based. It was difficult to draw conclusions as the different teams could not be compared. This was particularly apparent whether social workers, occupational therapists or physiotherapists were part of the team.

Overall, there were many limitations. A major limitation of this review is the substantial variability and inconsistency in outcome reporting across the included studies, which significantly constrains the ability to synthesise findings or identify clear patterns between unit-based, liaison-based, and team-based interventions. Mortality data, for

example, were available in only 7 of the 20 studies, and even within this subset several authors reported the presence of mortality data without providing actual comparative results, limiting interpretability. Similarly, readmission and admission rates, although more frequently reported were often presented without statistical significance or lacked adequate detail to determine the magnitude or direction of effect. Functional status was notably underreported, with only 6 studies addressing this outcome and half reporting no significant change, resulting in an insufficient evidence base to meaningfully assess the impact of different intervention models. Length of stay data were highly heterogeneous, with studies reporting decreases, increases, or mixed outcomes, and with several providing descriptive accounts without comparative analysis. Across all outcomes, the frequent absence of data in a large proportion of studies exacerbated these issues, preventing robust cross-study comparisons.

Additionally, the included studies varied widely in design, sample size, intervention structure, and outcome definitions, further limiting comparability. The imbalance in reporting across intervention types such as more admission-related data for team-based models compared to liaison-based services which introduces potential bias and makes it difficult to determine whether observed differences reflect true effects or simply disparities in documentation. In some cases, the lack of clarity regarding intervention components and fidelity makes it challenging to attribute outcomes directly to the model of care. Taken together, these limitations reduce the ability to draw strong or generalisable conclusions about the relative effectiveness of unit-based versus liaison-based services, and highlight the need for more standardised, comprehensive, and methodologically rigorous reporting in future research.

1.8 Conclusions

The overall review showed a shift towards holistic, patient-centred care models for frail older adults in the ED. It does not make a difference whether the approach is unit or liaison based but more that effective frailty management requires addressing medical, functional, and social needs in an integrated manner and considering care both during the ED visit and in transition to other settings. This is achieved by a CGA, by a team of trained professionals, rather than the actual physical setting. The best outcome for older, frailer adults is to have a geriatrician led, MDT team to provide a structured assessment with integration with community teams.

The limitations identified across the included studies highlight significant gaps in standardisation, reporting, and contextual detail. The variability in intervention design, frailty assessment methods, and multidisciplinary team composition, combined with incomplete descriptions of implementation strategies and care coordination mechanisms, restricts the ability to draw firm conclusions about effectiveness and scalability. These shortcomings underscore the need for future research to adopt consistent definitions, standardised assessment tools, and transparent reporting of implementation processes and resource requirements. Addressing these gaps will be essential to inform evidence-based strategies for integrating geriatric-focused interventions within emergency care settings. Further research is needed to look specifically at patient reported measures. This thesis will focus on different methods of identifying frailty and how patient specific outcome measures can be improved.

Chapter 2 – Methods and the development of the Older Persons Assessment Service

2.1 Introduction

As described in Chapter 1, hospital admission has adverse outcomes for older adults. To facilitate and combat this, innovative models of service delivery are required to provide CGA for older patients presenting to the ED with frailty syndromes. When a frailer, older adult presents to an urgent care setting, a multifactorial approach must be adopted with an awareness of the "Geriatric Giants" which include Delirium, Falls, Immobility, Incontinence, and social abandonment. Clinicians need to enable early shared decision-making with accurate risk stratification about whether hospital admission is in that person's best interests.

2.2 Chapter aims

The aim of this chapter is to describe the OPAS and how it was developed. The service will also be described in detail, and how the database was used for this MD thesis

This project is a service-based evaluation which took place at clinical sites across Swansea Bay University Health Board (SBUHB). Approvals were obtained from the appropriate clinical leads (Medicine, Care of the Elderly (COTE), Research & Development). The project was undertaken in collaboration with the COTE team in Swansea who have supported the design of this study. The COTE team is led by Dr Elizabeth Davies, a consultant geriatrician working at Morriston Hospital, who developed the Older Persons Assessment Unit in Morriston and has received recognition for this work. The approval from the Research and Development team is in Appendix 9.1 alongside a letter from the Clinical Director, Dr Davies, about the clinical quality importee of this work.

2.3 The OPAS service

An OPAS was developed, originally using adapted United States clinical practice. This includes Geriatric Evaluation and Management Units (GEMUs) and Acute Care of the Elderly (ACE) units, both of which are aimed to promote mobility and prepare for independence whilst providing acute care using an MDT approach and assume the care of the patient with a dedicated team of expert clinicians including nurses and therapists. Published research demonstrates that care in ACE units is associated with greater independence in ADLs at discharge, less frequent discharge to a nursing home, shorter and less expensive hospital stays (Landesfeld et al., 1995 & Flood et al., 2013) and reduced 30-day readmission rates, as well as higher satisfaction rates among patients, family members, clinicians, and nurses (Counsell et al., 2000). In the US, a model has been developed to try and replicate ACE units, for patients managed on different hospital wards using the core values of CGA which showed lower rates of adverse events, shorter hospital stays, and better satisfaction (Hung et al., 2013) but compared to actual physical elderly care units they are not as effective (Landesfeld et al., 1995). This may be due to lack of specialist nursing and therapy staff.

Morriston Hospital is a 750 bedded teaching hospital and tertiary referral centre which houses the major Accident and Emergency Department for Swansea and Neath Port Talbot which is additionally recognised as the Major Trauma Centre for Southwest Wales. SBUHB unified medical admissions at Morriston Hospital in December 2022 following an organisational change process. Morriston provides Acute General Medical services, Trauma and Orthopaedics service and General Surgical / Urological specialties for the people of Swansea, Neath, and Port Talbot. Specialist tertiary services provided at Morriston Hospital now include Renal Medicine, Neurology and Neurosciences, Oral and Maxillofacial Surgery, the Welsh Centre for Burns and Plastic Surgery, the bariatric surgery centre in Wales. Rheumatology and Palliative Medicine are also provided to a wide catchment area. Morriston Hospital is the regional cardiac and cardiothoracic centre and provides emergency PCI for Southwest Wales. These services are supported by critical care facilities, including a 26-bedded general intensive care unit and high dependency unit and a range of specialist beds.

Acute, intermediate, primary and community care and mental health services are integrated into the one Swansea Bay University Health Board. Services continue to be delivered across a network of primary care practices, community clinics, health centres, and community hospitals, supported by 3 main acute hospitals - Morriston, Neath Port Talbot and Singleton. The Swansea Bay University Health Board provides services to around 400,000 people, primarily serving the populations of Swansea, Neath, and Port Talbot. The Health Board holds a university title and works closely with Swansea University and its Medical School, along with other university and college partners in Wales.

In Morriston Hospital, out of 139,636 attendances to the ED in 2020-2021, 3906 of the attendees were older than 65 years and had presented with falls. In patients who are aged more than 80 years, 41.64% of these converted to admission, with readmission occurring in another 24% of patients within 2 weeks. Approximately 40% of the medical intake is made up of older patients presenting with frailty syndromes, such as delirium, falls, immobility, incontinence, and social abandonment. This is why a focus on Identifying frail patients who may benefit from a CGA is essential for individuals and overall system efficiency. The surgical liaison model had showed that a multi-disciplinary team led by a consultant geriatrician, supported by junior medical staff and using the existing team of surgical allied healthcare professionals supported the rehabilitation and discharge of patients under the surgical liaison service (Shipway et al., 2018). This was used as a blueprint to create a service within the ED to provide a CGA and facilitate early discharges. The OPAS has undergone several changes since the service was first developed. Each phase of service development is detailed below, with the changes to the MDT and referral process noted.

2.3.1 OPAS Liaison service: April 2018 to August 2018

From April to August 2018, the OPAS began a liaison service to the ED, taking referrals from the medical and ED teams for patients who presented with frailty syndromes (falls, cognitive impairment, care dependence, polypharmacy). The OPAS team consisted of a Physiotherapist (PT), Clinical Nurse Specialist (CNS), and Advanced Clinical Practitioner (ACP) with a background in medical nursing, linking with the existing ED Occupational Therapy (OT) service. This was with the support of a consultant Geriatrician. This was a redevelopment of a previous service which provided a liaison service to patients, both in the ED and on the Acute Medical Assessment Unit (AMAU). The service accepted referrals from 8 am to 4 pm Monday to Friday. There was no capacity to provide Outpatient services, and the service only provided advice as a liaison service because there was no capacity to admit patients directly.

During this period, the service saw 437 patients, with 76% of the patients discharged home following OPAS intervention. A further 90 patients received follow up in Community Hospital based ‘Falls Clinic’ and 25 being followed up in a Geriatric Day Unit. OPAS successfully transferred 29 patients to alternative inpatient healthcare providers directly from ED utilising Community hospitals, nursing/residential homes, or rehab facilities, rather than needing to admit to the acute hospital. Of the 60 patients who required admission, 51 were admitted to a non-geriatric ward. The service was able to show a sustained impact of reduction in admissions to medicine estimated to be in the range of 50-80 admissions a month, prompting OPAS to be commissioned as a permanent service. The readmission rate was consistently under 7% for patients who had been seen by OPAS, whilst the over 80s had a 30-day readmission rate of 15% from general medicine at that time. This was a service primarily targeted on fallers and ED discharged fallers had 14-day readmission rate of 25%, which is much higher than that from OPAS. It is apparent from analysis of hospital system data and local service data that the service is highly effective in facilitating alternative management pathways, avoiding hospital admission. Table 2.1 shows monthly admissions to general medicine beds between April 2017 and August 2018. It is evident in Figure 2.1 that the 2018 period (coinciding with the implementation of OPAS) is lower than its

comparative period the previous year. This reduction equates to 8.4% fewer admissions (418 patients). This data provides a crude indication of the positive impact of OPAS as this allows for a visual comparison of admissions during the April to August periods in 2017 and 2018 (circled in red).

Variable	April	May	June	July	August
Admissions 2017	842	871	887	892	836
Admissions 2018	788	817	784	786	835
Change (2017-2018)	-54	-54	-103	-106	-101
Admissions Avoided by OPAS	16	51	49	84	54

Table 2.1: Estimated OPAS admission avoidance 2018 by Month during the pilot. OPAS was able to admission avoid over 50 patients a month

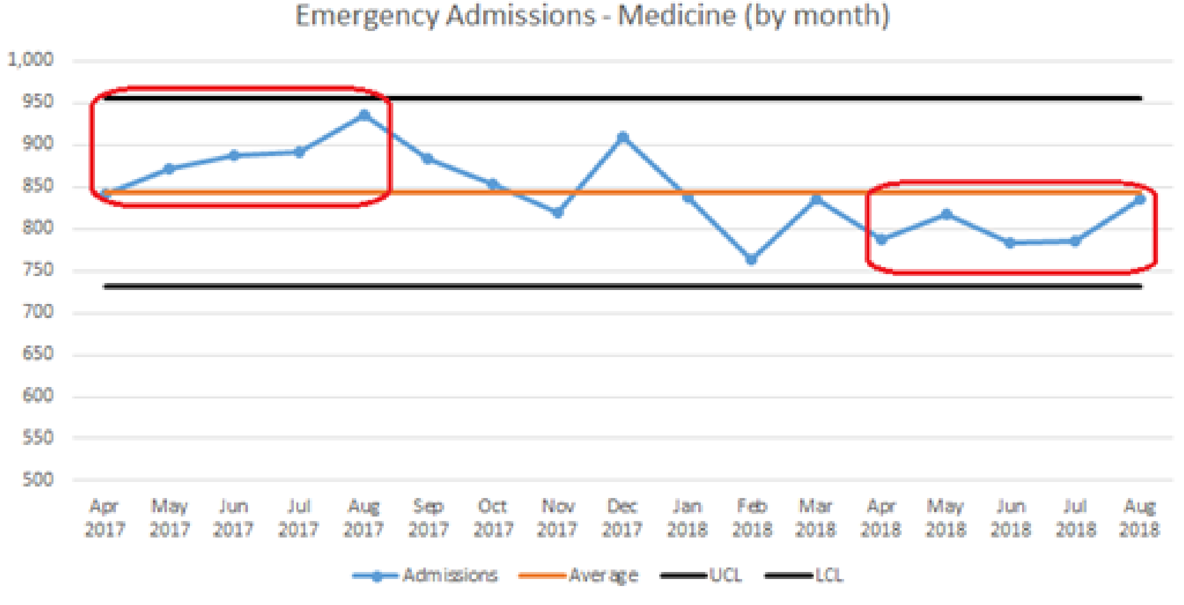


Figure 2.1: Estimated OPAS admission avoidance 2018. X axis: month of the year, Y axis: number of patients

2.3.2 OPAS self-contained unit based but reduced opening hours: June 2020 to January 2022

In June 2020, a dedicated unit within the ED was allocated to OPAS, enabling the acceptance of patients directly from either triage or the Welsh Ambulance Service (WAST). The COVID-19 Pandemic threatened the continuity of services for older people in primary and secondary care with Outpatient clinics and Rapid Access clinics closed to create space and workforce resource for additional inpatients and reduced theatre capacity due to the expansion of intensive care unit areas and subsequent redeployment of staff. There was also a shift towards denial of surgical procedures and admission to acute secondary care on rapidly formulated decision tools using frailty scoring. OPAS provided rapid access to specialist assessment, continued access to Elderly Care services, avoided exposure to coronavirus related admissions and the risks of nosocomial infection associated with admission. The service operated from 8am-4pm on weekdays. Again, this was MDT based, which had expanded with dedicated OT support and another ACP with a background in medical nursing, joining the existing team of PT, ACP, and CNS, with a consultant Geriatrician leading the service.

Between June 2020 and January 2022, the service saw 1396 new patients with 992 presenting with falls. 1167 patients (83.7%) were discharged off the acute site on the day of assessment. 69 (4.96%) patients were admitted to other facilities run by the Health Board (e.g. Inpatient Re-ablement). The average age of an OPAS patient was 83 years and had a CFS of greater than5. Readmission rate at 14 days was 5% (55). The OPAS service was an intervention designed to take patients directly from triage and later directly from WAST reducing waits and providing a clean admission stream. A patient who presents during working hours in ED waited an average of 55 minutes for assessment at OPAS from triage, which is influenced by factors out of OPAS control e.g. patients waiting overnight for assessment. From a COVID-19 perspective, 298 patients were admitted, 35 (12.3%) contracted nosocomial COVID-19 of which 11 died, underlining the importance of hospital as a potentially hazardous environment. OPAS offers a lot of ambulatory care but within the unit rather than at clinics because of the pressures on clinic space throughout the health board. Since 2021, the

conversion to admission via A&E has fallen to 37.68% (41.38% in 2017 pre-OPAS) and readmission rate is consistently below 10%, compared to 25% pre-OPAS. The service expansion was limited by staff shortages but still showed an improvement in length of stay, discharge rates off the acute site and were able to provide a clean admission stream, during the COVID-19 pandemic. OPAS was mentioned in the British Geriatric Society good practice guide "COVID-19: Preventing nosocomial infection in older people" (British Geriatrics Society and O'Mahony, 2021).

2.3.3 Unit based, increased opening hours and development of Frailty Short Stay ward (RAU). February 2022 to December 2022.

OPAS expanded again with increased opening from 7am-7pm on weekday, with associated recruitment of an additional ACP, with a background in trauma and orthopaedic nursing, an Emergency Nurse Practitioner (ENP), and 2 CNS to prioritise pathway management to pathway manage patient to geriatrician led acute units.

With an expanded MDT and opening hours, OPAS have seen double the patients, averaging 42 per week (19 previously) with an average of 37 being discharged (17 previously), (Figure 2.2). The average age of an OPAS patient remains at 82 years and had a CFS of greater than 5. OPAS demonstrates consistently improved triage time, maintaining an average of 55 minutes for assessment at OPAS from triage, with caveats mentioned previously and has expanded the type of patients seen, being able to see more patients who present with injuries sustained from falls, plus still maintaining core ethos of performing CGA in patients who present with frailty syndromes (falls, cognitive impairment, care dependence, polypharmacy).

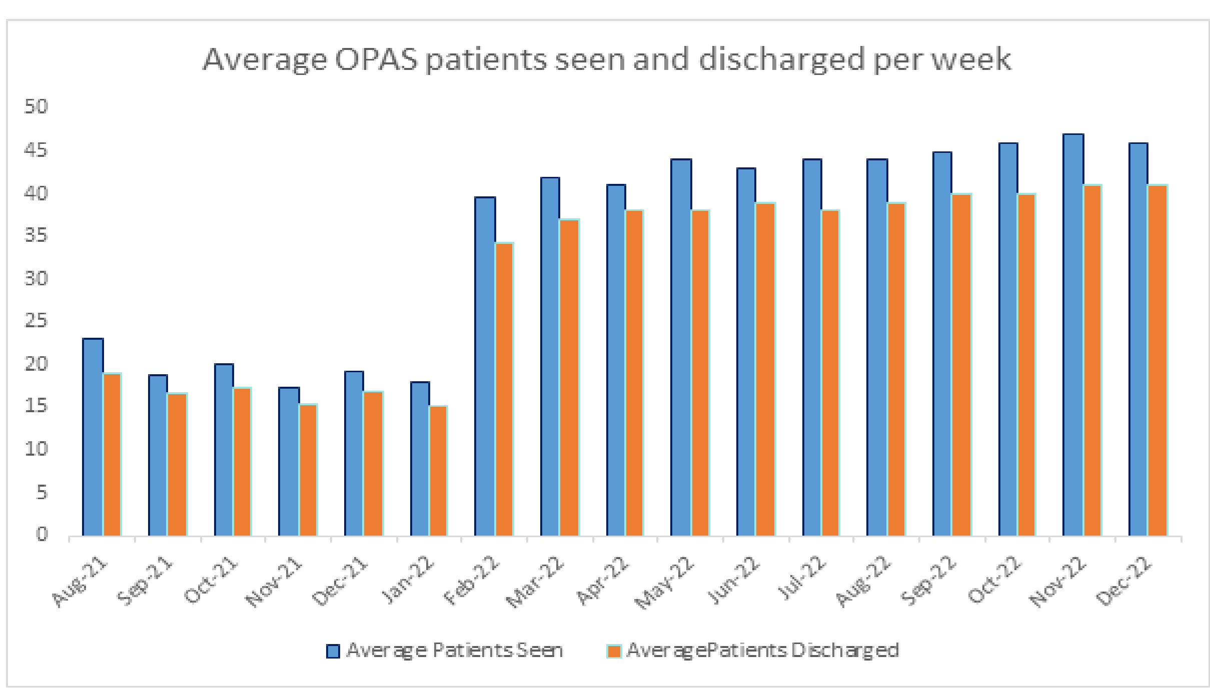


Figure 2.2: Average of patients seen and assessed per week by OPAS. Extended MDT and opening hours started in February 2022. X axis: month of the year, Y axis: number of patients

This service expansion within OPAS was coupled with developing a frailty Short Stay Unit, called RAU (Rapid assessment unit) which is geriatrician led. The patient flow to RAU is short-stay frailty with CNS pathway managers retrieving suitable patients from ED to RAU. This unit was developed as the medical intake at Morriston Hospital is accepted on two units; RAU and AMAU. Both were acute physician-led until July 2021 (Phase 1), when RAU became geriatrician-led (Phase 2). There was a change in practice with twice daily board rounds and a consistent junior doctor team. The unit has achieved a reduction in overall length of stay for the cohort of patients evaluated especially for those aged greater than >70 years (P=0.007) and acute geriatricians have delivered the 72-hour length of stay standard for assessment areas. This data supported a change in practice; RAU took a frailty specific intake from January 2022 until December 2022 (phase 3). The unit received patients on frailty criteria for CGA, with Clinical Nurse Specialists actively managing patients until discharge and following them from OPAS to RAU and then to extended stay Geriatrics Ward or local community hospitals. The ages of patients admitted to RAU is shown in Figure 2.3.

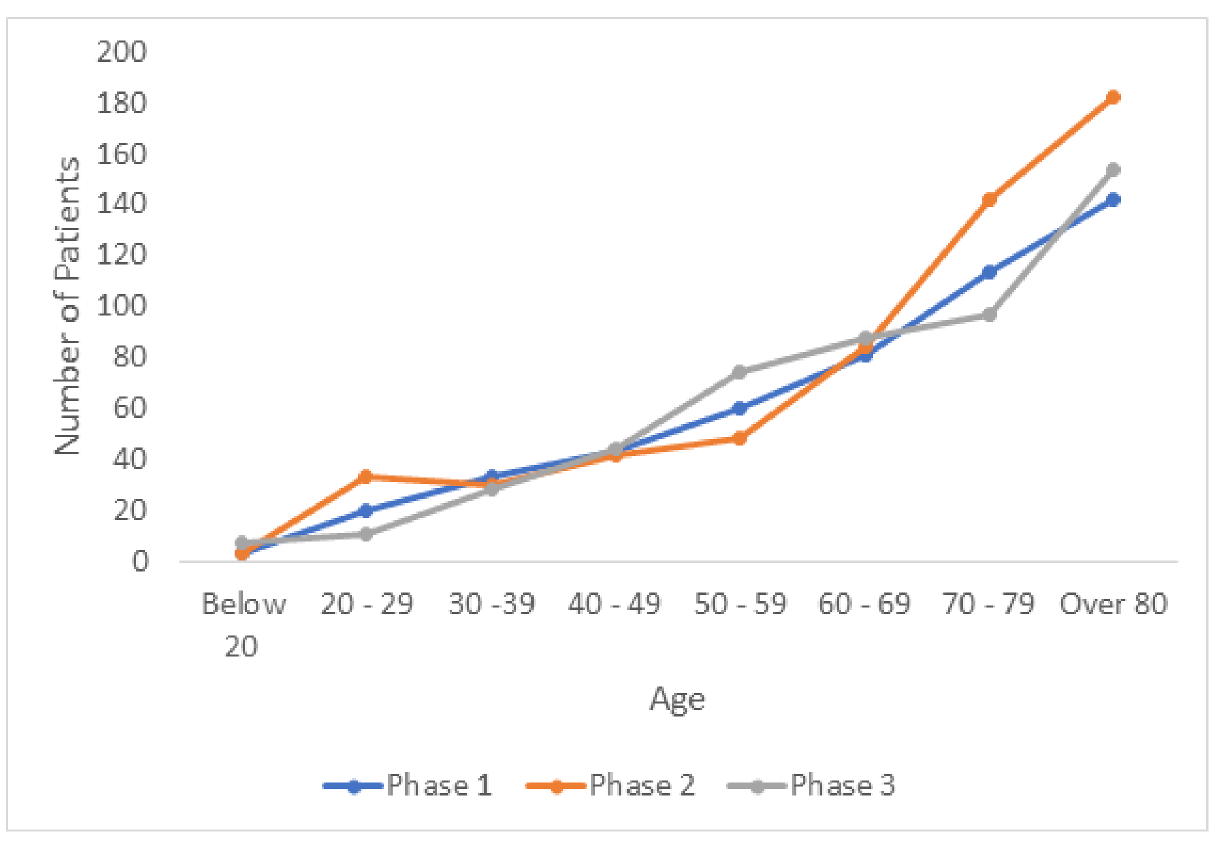


Figure 2.3: The age of patients admitted to RAU during each phase

There was a change in practice between 1 and 2, with Phase 2 having geriatrician input and a change in Phase 3 with a Frailty Specific intake. With the link with the Short-stay acute geriatrics unit, despite an increase in LOS on the unit, there was a significant reduction in LOS over patients' admission, which was particularly noticeable in those aged over 80's. Meanwhile, median overall hospital LOS showed a reduction from 7 to 5 days between phase 1 and phase 2 ($P<0.01$) and between phase 1 and 3 ($P<0.05$). For patients aged greater than 80 years old, the median LOS overall has reduced from 12 days in phase 1 to 7 days in phase 3 ($P<0.01$). Mean LOS within medicine at Morriston Hospital increased 1.5 days between Phase 1 and Phase 2. The unit has shown a LOS benefit for patients aged greater than 70 years, those aged greater than 80 years, experience a 5-day overall LOS reduction. Patient flow through assessment areas is dependent on the function of downstream medical wards and the ability to use community services. This is demonstrated in figures 2.4 to 2.9.

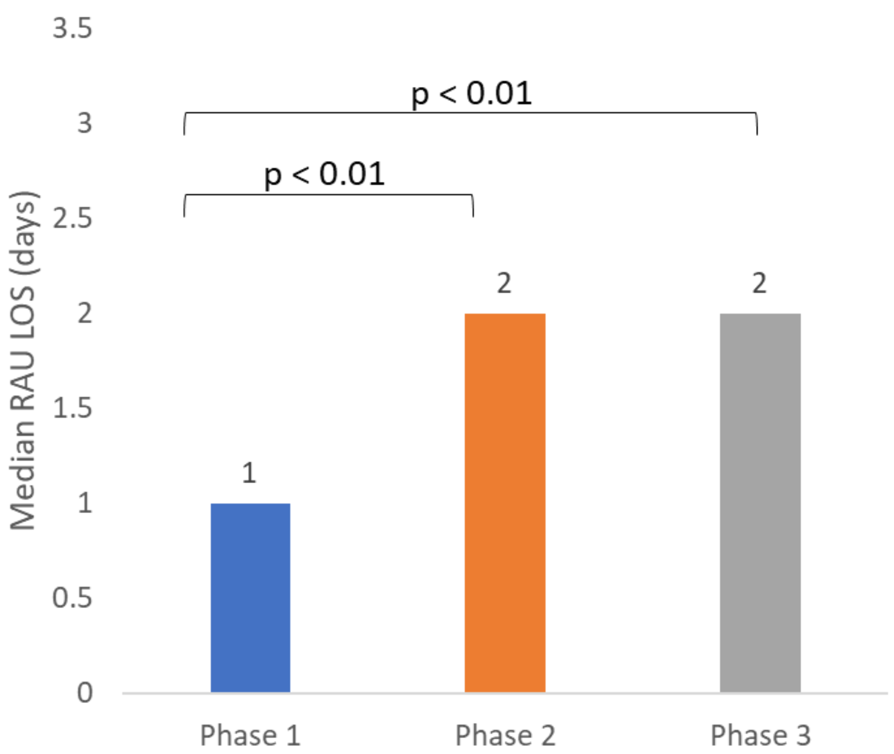


Figure 2.4: Length of Stay (LOS) in RAU for all ages

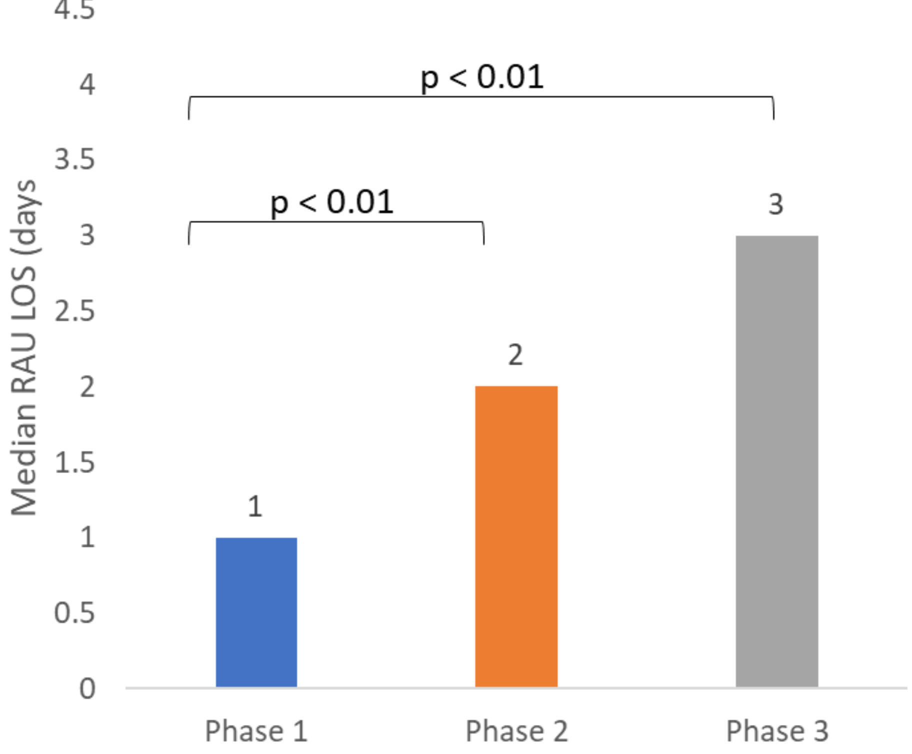


Figure 2.5: LOS in RAU for those aged over 70 years old

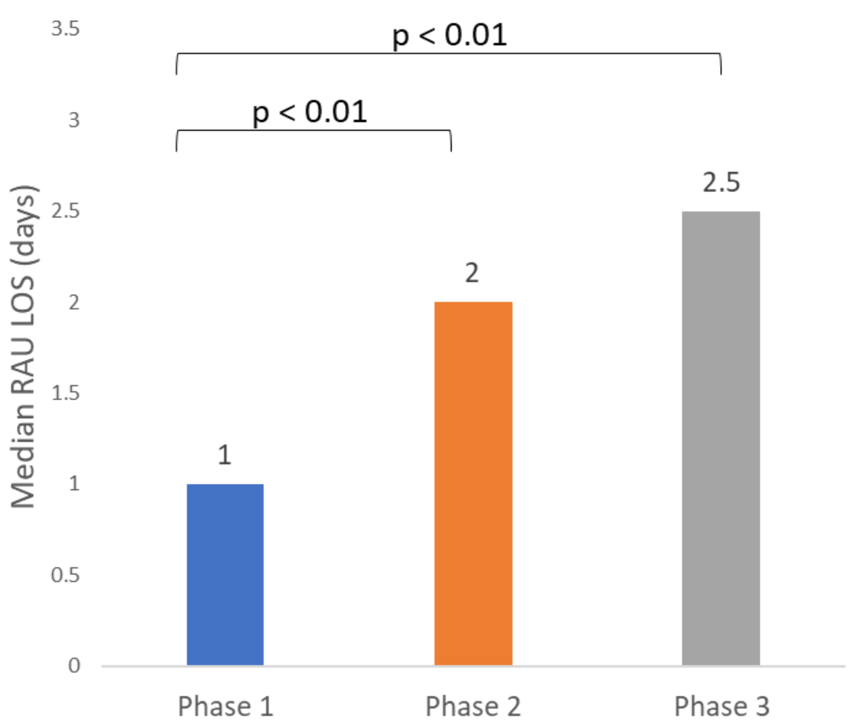


Figure 2.6: LOS in RAU for those aged over 80 years old

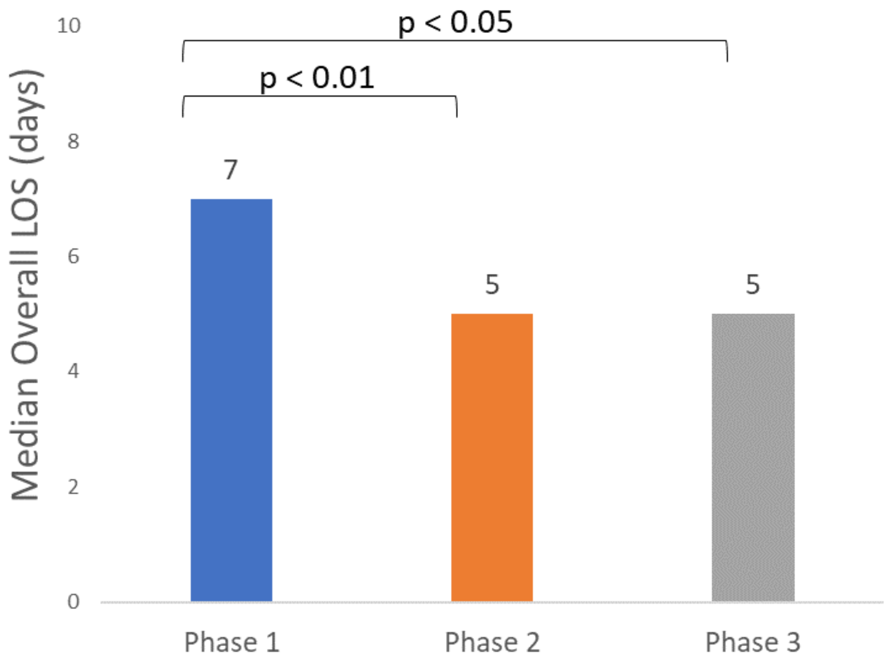


Figure 2.7. LOS in Morriston Hospital

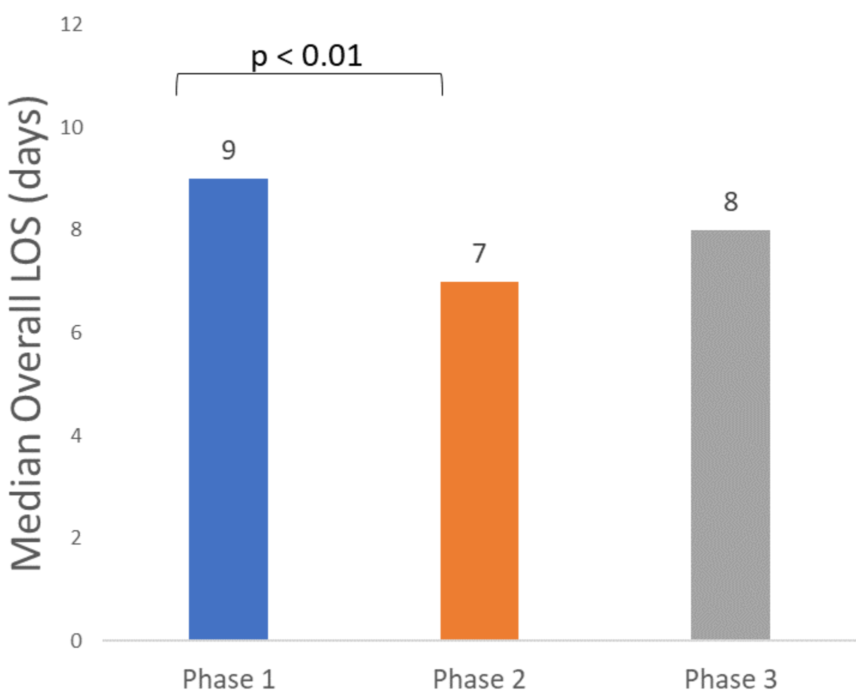


Figure 2.8. LOS in Morriston Hospital for those aged over 70 years old

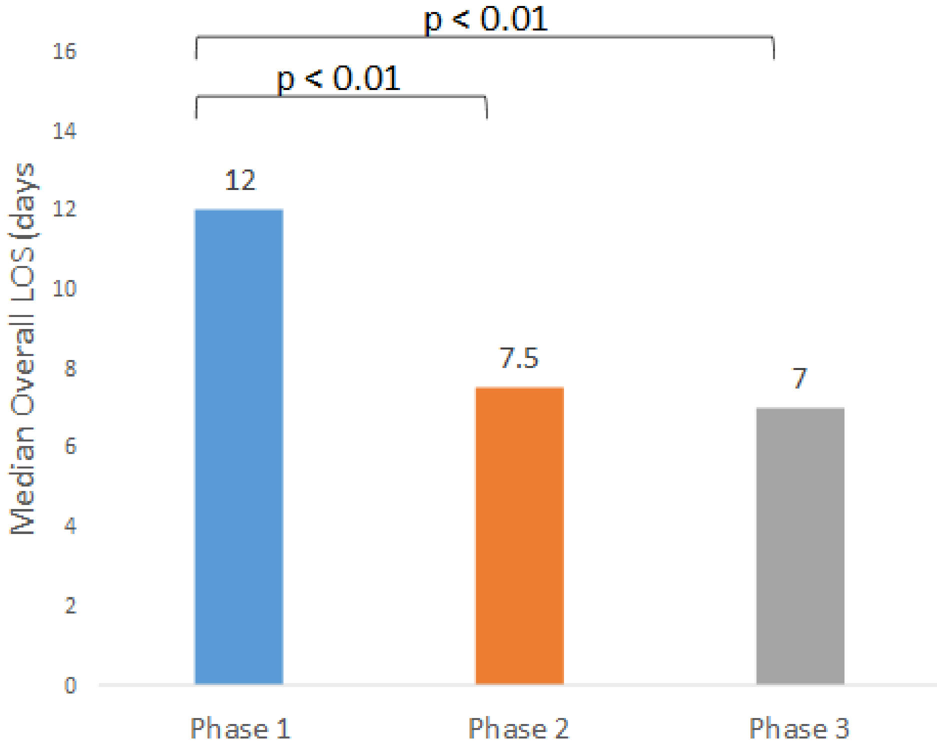


Figure 2.9 LOS in Morriston Hospital for those aged over 80 years old

2.3.4 Acute Medical Services Redesign (AMSR) and expansion into Same Day Emergency Care (SDEC): December 2022 to September 2024

Due to changes in the medical structuring during SBUHB, RAU moved to a specific area of the new AMU (acute medical unit) in December 2022, this enabled OPAS to also provide in-reach into SDEC and expand services. The OPAS team increased further with a Physicians Associate (PA) and ACP, who was previously an advanced practice paramedic. The increase in staffing allowed increased referrals, from Primary Care, ED, and AMU, with an Out of Hours referral form (see Appendix 9.2). This enabled patients to be seen quickly, normally within 48 hours as an outpatient, where they could receive a CGA including polypharmacy review, therapies assessment and be referred to community services such as VW. OPAS proactively work with the VW in the community to optimise their care in the community, avoid difficulties in transition to discharge in terms of medication reconciliation and follow up care and prevent readmission or admission in the first place.

Swansea Bay Health Board is covered by eight community clusters (240 virtual beds), each with their own VW and the VW governance structure includes the routine collection of person-centred metrics. SBUHB covers a population of 390,000 with an annual budget of around £1billion and the VW were set up in 2022 with a budget of just under £3million. There are 5 VW in Swansea (Bay, Penderi, City, Cwmtawe & Llwcher) and 3 in Neath and Port Talbot (Upper Valleys, Afan and Neath). The clusters range in size from the Upper Valleys which serves a population of 32,138 to Bay which serves a population of 75,221. The virtual wards exist to provide CGA, either to prevent hospital admission or deterioration in the community or step-down care to coordinate re-ablement, the transition to chronic disease specific services and ensure the discharge process and transition to primary care goes smoothly. Each Cluster based VW has a Clinical Manager (this is a band 7 nurse that oversees the VW), General Practitioner (GP), Geriatrician, Pharmacist, Occupational Therapist, Physiotherapist, Band 4 Assistant Practitioner, Specialist nurses such as Respiratory, Diabetes, and Heart Failure, Band 3 Health care support Administrator and a Dietician.

The change in practice allowed OPAS to see more medical patients, as opposed to older adults who fall, which was the core of OPAS ED referrals. During this 2023, OPAS team saw 1011 attendances, 414 (40.9%) Male, with a mean age 82.3 (± 8.4) years, CFS 5.3 (± 1.2) and Charlson Co-morbidity index (CCI) 8.0 (± 1.8), 701 (69.3%) discharged same-day and 629 (62.2%) fallers. The OPAS team within ED had 776 attendances, 306 (39.4%) Male, age 82.4 (± 8.7) years, CFS 5.3 (± 1.1) and CCI 7.9 (± 1.9), 540 (69.5%) discharged same-day, 557(71.8%) fallers. Whilst the OPAS team within SDEC saw 234 attendances, 108 (46.2%) Male, age 81.8 (± 8.0) years, CFS 5.2 (± 1.3) and CCI 8.2 (± 1.7), 162 (69.2%) discharged same-day, 72 (30.1%) fallers. There was significant difference between groups with NEWS ($P<0.02$), mortality ($P<0.001$) and presenting complaint ($P<0.001$). Despite the change in the population seen, the focus of OPAS remained to provide a CGA for older, frailer adults and still provided an equitable same day discharge rate across both sites. There is poor flow through the SDEC Unit and AMU, therefore onwards to the specialist wards. This leads to inappropriate patient moves and prolonged waiting times that contribute to overall deconditioning of frail, older adults who are inpatients. Currently in Morriston the assessment and admission pathway can result in a patient waiting up to 10 days to reach an elderly care ward by which time the deconditioning and general deterioration in physical health for the individual is so great, the discharge process, which was once simple, becomes complex and this further compounds the problem.

2.3.5 Future directions and Frailty Specific Hub: September 2024 onwards

The Health Board has several services for older people living with frailty that operate as the interface between community and acute services: the VW network, the Acute Clinical Teams (ACT), and the OPAS, as well as other Primary Care services such as GP’s, District Nurses, Long Term Care team, Community Resource team. By creating one integrated Frailty Service, it is hoped that it can improve care and access for patients and better align and integrate services and teams to provide one model of synergised care.

The integrated frailty service will have within it a dedicated Frailty Unit that is staffed by a multi-disciplinary team of geriatricians, nurses and therapists who will be able to provide the targeted care these vulnerable patients need, right from the offset. By giving them a comprehensive geriatrics assessment on arrival as well as having six ring fenced beds for patients with a confirmed fracture neck of femur and enabling specialty in reach and continuity of care across admitting areas and wards where the aim is to minimise the time spent in hospital and reduce unnecessary admissions.

2.4. Data collection

With regards to data collection, OPAS collects admission data for every patient who presents to the service. All patients receive a contemporaneous CFS following MDT assessment, and the service achieves same day discharge for greater than 75% of patients. Data collected for every patient who attends the OPAS service includes age, gender, and 4 'A's Test score (4AT), presenting complaint, post code, number of medications and whether the patient was admitted and to which hospital area this occurred in. The data is collected in a Microsoft Excel worksheet and is manually inputted each day, either directly into the spreadsheet or via a QR code linked to Microsoft forms. Additional information is gathered from the ED Zylab system which uploads all documentation including the CGA paperwork which incorporates an OT/PT functional assessment. Patient mortality prospectively at 12 months was analysed by reviewing electronic health records and evaluated postcode data to derive the Welsh index of multiple deprivation (WIMD). This dataset was then analysed in a variety of ways, depending on the specific outcome, which was being evaluated, which is detailed in each chapter. Further information e.g. to score a CCI or to calculate a SDEC score, was accessed using Welsh Clinical Portal (WCP) and Abertawe Bro-Morgannwg Clinical Portal (ABMUCP) where the ED Zylab information can be found.

Information is anonymised and gathered from existing clinical systems (WCP and patient notes. Data points are as advised by ICHOM (International consortium for Health Outcome measurement) for older person's health outcomes measurement. These include: -

(a) Demographics: NHS identification details, age, and date of birth (DOB), gender, current living arrangement, date of access to service, postcode, and deprivation score

(b) Clinical factors: CFS, inappropriate medication use (including the prescription of antipsychotics, benzodiazepines, tricyclic antidepressants, opioids, 1st generation antihistamines, vasodilators or antispasmodics have been prescribed in the previous 12 months); cognitive impairment; comorbidities, activities of daily living function (Barthel Index); total number of medications prescribed; AEC (Anticholinergic Effect on Cognition Scale) score; hearing or vision impairment; level of care received (Package of care (POC)/family/24h care); Charlston co-morbidity score.

(c) Disutility (harm) of care: Polypharmacy (total number of drugs prescribed and adverse drug events and if medications make patients unwell), falls (how many falls in last 12 months, how many result in fracture, need for any professional medical attention and hospitalisation); iatrogenic delirium.

(d) Clinical status: Admission to hospital; time spent in hospital; readmission rates, all-cause mortality (in hospital, and at 6 and 12 months); discharge destination.

(e) Ambulatory care scoring and Triage scoring: Glasgow score; AMB score; Sydney Triage score.

2.5 Statistical analysis

Analysis and management of the dataset was undertaken with support of the academic leads at Swansea University Medical School. As part of this I also undertook training courses in statistical methods and database management supervised by the academic supervisors. Detailed planning of this analysis will be ongoing. I ensured that the data was organised into a workable format. The significance of differences in

continuous variables from the planned perspective cross-sectional study will be undertaken using T-test. Nonparametric data was analysed with appropriate tests (Mann Whitney U test, Wilcoxon test) and differences in categorical variables using chi-squared analysis. Data is described with appropriate measures of central tendency (mean, median, standard deviation, quartile ranges) and represented graphically as necessary. Continuous variables are presented as the mean ± standard deviation, whilst categorical variables are presented as the number (%). Statistical significance was taken at $P<0.05$. Statistics will be described in more detail in each individual chapter. Logistic regression was performed using SPSS (Version 28) to evaluate associations when indicated.

2.6 Impact

Impact will be compared to standard care to measure improvement from services. Each approach will be evaluated by assessing:

(a) Admission rates and avoidance; adverse events (falls, delirium) and mortality at 6 months and 12 months.

(b) Cost of service.

(c) Savings from service (medication, admission avoidance, reduced length of hospital stays).

Proving or disproving an improvement in patient outcomes from the interventions and their cost effectiveness will inform national approaches to community or pre-hospital care for frail patient

2.7. Summary and Discussion

In summary, the evidence suggests that effective interventions for frail patients in ED include a MDT approach, with trained professionals with relevant experience and skills, led by a geriatrician and who can link to the rest of the system in terms of follow up and case management. There are some obvious gaps in the evidence as CGA is by its nature an intervention that is holistic and considers the person including their priorities, despite this, there are few studies that attempt to address patient reported outcomes, with most studies present service-based metrics. The design of intervention varies widely and as such it is difficult to appreciate the ideal intervention that should be put into place in ED, it is clear that multicentre studies are needed that can inform practice.

The OPAS database and OPAS service has provided a logical stepping stone for the remainder of this thesis to try a find a solution to the problems noted above. This will specifically focus on whether a physical specialist assessment unit based in the ED improves patient centred outcomes. As part of this, another aim is to determine the best approach for prehospital treatment of patients with frailty, focusing on Proactive Care and finally to determine the best approach for in-hospital treatment of patients with frailty, particularly focusing on pathway management and MDT input, improving reactive care. It is only by working as a team, that front door, inpatient, and community services can be linked to provide the best, holistic care for frailer, older patients.

Chapter 3 – Screening for frailty at the front door

3.1. Introduction

When an older person presents to hospital, there are several additional factors that need to be considered with regards to whether inpatient admission is ultimately in that person’s best interest (British Geriatric Society, 2014). These are wide ranging and the most extensively studied is that of frailty. Frailty is defined as “a condition characterised by loss of biological reserves, failure of physiological mechanisms and consequent increased risk of experiencing a range of adverse outcomes, including hospitalisation, longer length of inpatient stay, and delirium” (Clegg et al., 2013, Clegg et al., 2016, Gilbert et al., 2018).

Frailty needs to be considered as part of a whole system's approach. Pre-hospital frailty assessment has encountered significant historical barriers (Hung et al., 2013) but it is important as identifying frail patients who may benefit from comprehensive geriatric assessment (CGA) is essential for individuals and overall system efficiency. However, patient selection is difficult to achieve through the usual bed management processes and there is a growing need to develop alternative pathways which tend to focus on Ambulatory or Same Day Emergency Care (SDEC). This is a focus of British Geriatric Society’s principles of frailty (British Geriatric Society, 2021), Royal College of Physicians (RCP) toolkit (Royal College of Physicians of London, 2014) and the Welsh Assembly Governments 6 goals (Welsh Assembly Government, 2021).

The priority is to provide care in “the right place at the right time” and to provide an individualised approach balancing the traditional model of hospital admission with the ability to provide care closer to the place of residence. As part of this ‘Getting it right first time (GIRFT)’ focus, it is important that we enable our paramedic colleagues to be able to identify frailty (Charlton et al., 2022) as early identification is crucial.

3.2 Aims

The aims of this chapter are to examine how frailty scoring, and the identification of frail patients can be used to improve outcomes at this crucial stage. Aim 1 is to examine AOD and how frailty influences this. Aim 2 is to examine the HFRS and how this can be applied to patients in the ED and how the CFS links with the HFRS.

3.3 Aim 1 - ambulance offload delays

The aim of this section is to examine AOD in the ED and how this influences patient centred outcomes.

3.3.1 Introduction on ambulance offload delays

Within the UK and developed western countries the proportion of older adults is increasing to 23% of the entire population in the UK by 2035 (Office for National statistics, 2012), 29% in Europe by 2050 (European Commission, 2020) and 20% of the USA by 2030 (Centers for Disease Control and Prevention, 2013). In addition, older frailer adults tend to attend hospital more frequently and have increased stay length, leading to increased demands on the system. (Boone & Schuerer, 2013., Newekk et al., 2009, Staudenmayer et al., 2013).

Older adults use ambulances more frequently than younger adults (Goldstein et al., 2015), so paramedics and other pre-hospital staff need to be able to accurately triage, develop appropriate management plans and be able to signpost to alternate services effectively. This is more difficult in older patients who tend to have multiple co-morbidities and are already living with frailty, making it more difficult to be able to use current triage and management guidelines in prehospital care (Alshibani et al., 2021A). This is particularly observed in older adults who fall and sustain significant trauma with high injury severity, who were not accurately identified in specific triage trauma criteria to identify who required trauma centre care (Alshibani et al., 2021B). This is because traditional triage strategies rely on physiological variables (Alshibani et al., 2021C)

which are not accurate in older adults due to the natural process of aging. Older adults also tend to be on more medications and have significant co-morbidities which traditional triage pathways do not consider.

Offload delays with ambulances at the ED are associated with adverse outcomes. By 2030, 25% patients attending the ED are projected to be over 80 years of age (Creditor, 1993). Older people are likely to present with falls, delirium, immobility, pain or trauma and these geriatric frailty syndromes can be difficult for triage systems to assess, leading to older people being allocated lower priority status and a higher chance of a 4-hour breach compared to younger patients (Creditor, 1993). Older people also have a higher risk of longer waits which result in inferior outcomes (Jones et al., 2022) and standardised mortality rate starts to rise from 5 hours after the patient’s time of arrival at the ED and there is one extra death for every 82 patients delayed for 6-8 hours (Jones et al., 2022).

Once the older patient has been offloaded into the ED, this remains a hazardous environment. Patients who remain in ED for longer than 10 hours are at a significant risk of developing delirium (Bo et al., 2016) and an ED-stay associated delirium increases the patient’s chance of being hospitalised and an extended stay of approximately 1 week (Emond et al., 2017). Admission to the ED is associated with adverse outcomes. Geriatric frailty syndromes can be difficult for triage systems to adequately assess in a timely fashion, and time is critical to the triage function. This is a factor that leads to older people being allocated lower priority status and their waits can be often prolonged with the chances of a 4-hour target breach being much higher in an elderly person verses an infant (Bo et al., 2016). Long waits in ED are linked to increased inpatient mortality (Emond et al., 2017) and standardised mortality rate starts to rise from 5 hours after the patient’s time of arrival and there is 1 extra death for every 82 patients delayed for 6-8 hours. Delirium is also more common in patients who spend more time in ED, especially for patients with a wait longer than 10 hours (Rutberg et al., 2014). As many ED departments have no windows and have artificial lighting, the lack of temporospatial queues increase delirium by increasing

disorientation in space and time (Rutberg et al., 2014). An ED stay associated delirium increases the patient's chance of being hospitalised and extended their stay by approximately 1 week (Hewitt et al., 2020). All these adverse outcomes are magnified in older, frailer adults.

Long waits in the ED, especially for elderly patients, are correlated with an increase in subsequent hospital length of stay which increases nosocomial infection (British Geriatrics Society and O'Mahony, 2021), which we have seen a huge impact recently with the COVID-19 pandemic (Hewitt et al., 2020) which showed nosocomial-acquired cases had a median CFS score of 5 compared with a CFS of 3 in community-acquired cases which correlated with increased multi-morbidity in the nosocomial COVID-19 cases. It was estimated 16.4% of cases were probably hospital-acquired with an inpatient mortality for nosocomial infection ranging from 38 to 42%, higher than mortality in those with community-acquired infection. Those with hospital-acquired infection were older and frailer (Ponsford et al., 2021). In patients with COVID-19 in hospital, it is estimated that 12.5% of COVID-19 cases were hospital-acquired, with an overall mortality of 27% in patients with nosocomial COVID. Increased mortality was associated with older age, increased frailty, renal failure, and increased CRP (Ponsford et al., 2021). Similar adverse effects can also be seen in other nosocomial infections such as Influenza (Ponsford et al., 2021).

With respect to AOD specifically, there is a little consensus about what constitutes a long delay with some studies describing over 30 minutes and others over 60 minutes (Stewart et al., 2019, Li et al., 2019). Those who experience longer AOD tend to be older, female and live in dependent living situations but there has been no association shown between AOD with mortality or increased LOS (Stewart et al., 2019). This was not replicated in other studies which have showed that increased AOD were associated with increased mortality, with women and those aged greater than 65 years waiting longer (Dawson et al., 2022). There is also research suggesting that increased AOD is associated with increased LOS in the ED, which is not a favourable environment for older adults (Crilly et al., 2015). The Nuffield Trust published guidance

which states that “patients arriving at an emergency department by ambulance must be handed over to the care of A&E staff within 15 minutes” (Nuffield Trust, 2024). There was a 27% increase in AOD in the winter 2023-24 and a clinical review in 2023 by the Association of Ambulance Chief Executives showed that of patients who experienced a handover delay of over an hour, 30,000 potentially experienced additional harm and 3,000 potentially experienced severe harm because of the delay (Association of ambulances, 2024).

All the adverse effects noted above, highlight the importance of identifying frailty, as early as possible, by a trained professional. When paramedics were asked about frailty, they felt that a frailty assessment in a prehospital setting was feasible and important (Green et al., 2018, Harris et al., 2018) and that paramedics should be aware of it (Green et al., 2018, Harris et al., 2018). Paramedics recognise the significance of frailty and how many older adults are living with frailty (Alshibani et al., 2023). There have been many frailty scores used and assessed by paramedics and other pre-hospital professionals (Goldsteom et al., 2014) and there is a need for a simple, clear frailty measure to facilitate a clear handover. There are barriers as some pre-hospital staff feel like they are not the best placed professionals to conduct a frailty assessment (Harris et al., 2018). The six frailty scores which have been used in pre-hospital care are: 1) Care Partner-Comprehensive Geriatric Assessment (CP-CGA), 2) Care Partner-derived Frailty Index based up on Comprehensive Geriatric Assessment (CP-FI-CGA), 3) Edmonton Frail Scale (EFS), 4) Groningen Frailty Index (GFI), 5) CFS, and 6) Timed-Up and Go (TUG) test (Harris et al., 2018). Some are based on comprehensive geriatric assessment (see Chapter 1) and others are based on functional assessment (CFS, TUG and EFS).

The aim of this chapter was to examine whether AOD was associated with age, CFS, inpatient length of stay (LOS), ED re-attendance within 6 months and mortality at 6 months. A comparison of those over 65 years old with those who were directly admitted to the OPAS in Morriston Hospital.

3.3.2 Methods on ambulance offload delays

3.3.2.1 Study design

This was a retrospective analysis examining adult ambulance offload data to Morriston Hospital, Swansea during consecutive months February to June 2022 focussing on age, CFS, inpatient LOS, ED re-attendance within 6 months and mortality at 6 months. This was service based delivery and development as part of improving clinical quality. Those over 65 years old were compared with those who were directly admitted to the OPAS and those who remained in the ED. Further information was accessed using WCP and ABMUCP where the ED Zylab information can be found.

3.3.2.2 Statistical analysis

Continuous variables are presented as the mean ± standard deviation, whilst categorical variables are presented as the number (%). Statistical significance for continuous variables was determined using student's t-test and categorical variables using Chi-squared test. Statistical significance was taken at $P<0.05$.

3.3.3 Results on ambulance offload delays

A consecutive sample of 1,000 people transported by ambulance to Morriston Hospital ED from February to June 2022, with a mean age 66.7 ± 20.9 years and 492 (49.2%) males. The mean CFS was 5.4 ± 1.5 and AOD was 322.5 ± 1451.1 minutes with a mean LOS of 9 ± 17.3 days. At 6 months follow-up, 836 (83.6%) patients were alive and 320 (32%) had represented to the ED. Of patients included, 378 (37.8%) people were aged below 65 years old and 622 (62.2%) were older than 65 years. Compared to people less than 65 years old, those older than 65 were more likely to experience AOD (403.0 ± 1825.3 minutes' vs 189.3 ± 251.2 minutes, $P=0.02$) and have a longer LOS (11.0 ± 19.6 days' vs 5.0 ± 11.5 days, $P<0.001$). Moreover, greater mortality was observed at 6 months' follow-up in those aged greater than 65 compared to those aged less than 65 (22.1% vs 0.1%, $P<0.001$). These data are presented in Table 3.1.

Variable	All n=1,000	<65 years old n=378	≥ 65 years old n=622	P value
Age (years)	66.7 (± 20.9)	43.8 (± 13.8)	80.6 (± 8.8)	P<0.001
Male (n/%)	492 (49.2%)	200 (52.9%)	292 (46.9%)	P=0.07
Female (n/%)	508 (50.8%)	178 (47.1%)	330 (53.1%)	
CFS	5.4 (± 1.5)	N/A	5.4 (± 1.5)	N/A
Offload (minutes)	322.5 (± 1451.1)	189.3 (± 251.2)	403.0 (± 1825.3)	P<0.02
LOS (days)	9.0 (± 17.3)	5.0 (± 11.5)	11.0 (± 19.6)	P<0.001
Readmitted	320 (32.0%)	116 (30.7%)	204 (32.8%)	P=0.49
Alive (n/%)	836 (83.6%)	352 (93.1%)	484 (77.8%)	P<0.001
Dead (n/%)	164 (16.4%)	26 (0.1%)	138 (22.1%)	

Table 3.1: Patient characteristics of those transported by ambulance to hospital *CFS* clinical frailty score, *LOS* Length of Stay in days. Continuous variables are presented as the mean (± standard deviation), whilst categorical variables are presented as the number (%).

When performing a comparison of those over 65 years old admitted to ED with those who were directly admitted to the OPAS, 622 patients were included. Of patients included in the analysis, 33 (0.05%) people were offloaded directly into the OPAS area. Compared to people offloaded into the OPAS area, people offloaded into the ED were younger (80.2 (± 8.8) years old vs 86.9 (± 13.8), P<0.001), had increased AOD (406.0 ± 1873.7 minutes' vs 104.0 ± 110.8 minutes, P=0.05) and a longer LOS (12.0 ± 20.0 days' vs 5.1 ± 8.6 days, P=0.05). Those offloaded into OPAS were frailer as per CFS (5.9 ± 1.3 vs 5.4 ± 1.5, P=0.03). Moreover, greater mortality was observed at 6 months' follow-up in those offloaded into the ED compared to those into the OPAS area (23.6% vs 9.1%, P=0.05). These data are presented in Table 3.2.

Variable	≥ 65 years old n=622	OPAS n=33	ED n=589	P value
Age (years)	80.6 (± 8.8)	86.9 (± 13.8)	80.2 (± 8.8)	P<0.001
Male (n/%)	292 (46.9%)	15 (45.5%)	277 (47.0%)	P=0.86
Female (n/%)	330 (53.1%)	18 (54.5%)	312 (53.0%)	
CFS	5.4 (± 1.5)	5.9 (± 1.3)	5.4 (± 1.5)	P<0.03
Offload (minutes)	403.0 (± 1825.3)	104.0 (± 110.8)	406.0 (± 1873.7)	P<0.05
LOS (days)	11.0 (± 19.6)	5.1 (± 8.6)	12.0 (± 20.0)	P<0.05
Readmitted	204 (32.8%)	11 (33.3%)	193 (32.7%)	P=0.94
Alive (n/%)	484 (77.8%)	30 (90.9%)	450 (76.4%)	P<0.05
Dead (n/%)	138 (22.1%)	3 (9.1%)	139 (23.6%)	

Table 3.2: Patient characteristics of those aged greater than 65 years old, who were offloaded into OPAS compared to those who were offloaded to ED *CFS* clinical frailty score, *LOS* Length of Stay in days. Continuous variables are presented as the mean (± standard deviation), whilst categorical variables are presented as the number (%).

With respect to gender, males were younger (65.0 ± 20.4 vs 68.3 ± 21.4 years old, P=0.01) and had a lower CFS (5.2 ± 1.6 vs 5.5 ± 1.4, P<0.009). There was no difference in AOD (302.7 ± 1484.5 minutes' vs 341.6 ± 1419.1 minutes, P=0.67) and LOS (8.2 ± 15.5 days' vs 9.8 ± 18.8 days, P=0.15) and no difference in mortality (17.1% vs 15.7%, P=0.57) or readmission rates (30.5% vs 33.5%, P=0.31). Even when excluding those aged less than 65 years, Males were younger (79.3 ± 8.3 vs 81.7 ± 9.3 years, P<0.001) but there was no difference in mortality, LOS, AOD or readmission rates. This data is presented in Table 3.3.

Variable	All n=1,000	Male n=492	Female n=508	P value
Age (years)	66.7 (± 20.9)	65.0 (± 20.4)	68.3 (± 21.4)	P=0.01
CFS	5.4 (± 1.5)	5.2(± 1.6)	5.5 (± 1.4)	P<0.009
Offload (minutes)	322.5 (± 1451.1)	302.7 (± 1484.5)	341.6 (± 1419.1)	P=0.67
LOS (days)	9.0 (± 17.3)	8.2 (± 15.5)	9.8 (± 18.8)	P=0.15
Readmitted	320 (32.0%)	165 (33.5%)	155 (30.5%)	P=0.31
Alive (n/%)	836 (83.6%)	408 (82.9%)	428 (84.3%)	P=0.57
Dead (n/%)	164 (16.4%)	84 (17.1%)	80 (15.7%)	

Table 3.3: Patient characteristics of those transported by ambulance to hospital by Gender. *CFS* clinical frailty score, *LOS* Length of Stay in days. Continuous variables are presented as the mean (± standard deviation), whilst categorical variables are presented as the number (%).

3.3.4 Conclusion on ambulance offload delays

Longer AOD times are associated with greater 6-month mortality and re-attendance for older, frailer people in ED. Those directly offloaded to OPAS had decreased LOS (5.1 days) and offload time (110.8 minutes') despite a mean CFS 5.9, indicating a need to increase OPAS capacity including direct offloads and referrals into OPAS. As each call-out has a huge cost per hour there are significant potential cost savings plus improved patient experience and outcomes. With respect to gender, there was no difference in mortality and AOD between females and males, but males tended to be younger and less frail which may account for this. Previous studies did not look at frailty specifically.

This study has some important limitations. Firstly, it is a retrospective study which is prone to usual biases associated with this type of study. To minimise this, patients with missing data were excluded from the analysis. There are multiple external factors that may lead to increased AOD, which we have not controlled for in this study. These include ED crowding, staffing levels, and ambulance availability. These uncontrolled variables introduce potential confounding effects, making it difficult to attribute observed changes solely to the intervention. Second, the number of patients offloaded directly to the OPAS area represented only a small proportion of the total sample aged over 65 years, limiting the statistical power and generalisability of findings related to OPAS-specific outcomes. This small subset may not adequately reflect the broader population of older adults attending the ED. This was demonstrated in the large confidence intervals which it is difficult to determine clinical significance and to make meaningful conclusions about AOD as a benefit for OPAS expansion. Consequently, further data collection focusing on the OPAS cohort is warranted to enable more robust analysis and to determine whether observed trends persist in a larger sample.

There is little consensus on what tools should be used to assess frailty prior to hospital admission by the paramedics and ambulance service and at the front door when the patient has been admitted to hospital, there is. The importance of frailty assessment early is paramount as it supports clinical decision making and enables patients to be placed on the right pathways earlier and avoidance of hospital admission and convenance entirely, therefore causing less AOD. This is a focus of BGS's principles of frailty (British Geriatric Society, 2021), RCP (Royal College of Physicians of London, 2014), and the Welsh Assembly Governments 6 goals (Welsh Assembly Government, 2021). The priority is to provide care in "The right place at the right time" and to provide an individualised approach balancing the traditional model of hospital admission with the ability to provide care closer to the place of residence. As part of this 'Getting it right first time' focus, it is important that we enable our paramedic colleagues to be able to identify frailty (Green et al., 2018, Harris et al., 2018) as early identification is crucial and the CFS maybe the easiest way. By being able to share data across settings such as hospital frailty risk score (Gilbert et al., 2018) in secondary care or electronic frailty index (Clegg et al., 2016) in primary care would benefit paramedics.

In conclusion, those with increased AOD have increased 6-month mortality and increased hospital LOS, and this is especially prevalent in those aged over 65 years old. We have shown that with a frailty specific area which specialist staff who can perform a comprehensive geriatric assessment for these patients can significantly improve patient outcomes and experience. This is why it is important that we identify frailty at the front door, even prior to hospital admission.

3.4 Aims of hospital frailty risk score (HFRS) identification in the ED

The aim of this section is to look at frailty in the ED, and whether CFS is the best way of identifying frailty or whether the HFRS could be used.

3.4.1 Introduction of HFRS identification in the ED

While there is growing interest in assessing frailty in older people needing NHS specialised services, there is no standardised approach, making case-mix comparisons difficult. The electronic Frailty Index (Clegg et al., 2016) is used in primary care but has not been validated for its predictive utility in secondary care or specialised services. As described, identifying frailty at the earliest opportunity is crucial and is a focus of British Geriatric Society's principles of frailty (British Geriatric Society, 2021), RCP toolkit (Royal College of Physicians of London, 2014), and the Welsh Assembly Governments 6 goals (Welsh Assembly Government, 2021). There are numerous different tools that can be used to identify frailty in both primary and secondary care and there is little consensus about which tools are best.

The ability to identify frailty early in a patient's journey is especially important and in Wales, the Welsh Ambulance Service NHS Trust (WAST) collect CFS data on every patient they have seen as part of their assessment documentation. This is manually inputted by the Paramedic themselves, rather than being calculated automatically. The CFS is used by paramedics in the UK but not routinely internationally (Green et al.,

2018, Robson et al., 2019) but there are some perceived barriers to it being used. Paramedics, when questioned, were unsure of the use of the CFS and were worried that it could be used as a way of limiting the care patients receive, rather than providing a way of triaging who would benefit most from being transferred to an alternative pathway of care. The CFS documented by paramedics was lower than that collected by geriatricians or after assessment with a CGA, showing a limitation of the CFS ability to be used prehospital prior to a CGA being performed (Robson et al., 2019). The Welsh Assembly Government want to embed CFS scoring into every ED in Wales. This has happened in multiple departments in the UK (Elliott et al., 2017, Elliott et al., 2021, Kaeppeli et al., 2020, Serina, et al., 2021, Shrier et al., 2021., Wallis et al., 2015). This is normally calculated at triage as frailty can predict adverse outcomes (Elliott et al., 2021).

At the front door of the hospital, the CFS has been studied in the ED and is the most common tool used in this setting in the UK (Elliott et al., 2021, Kaeppeli et al., 2020, Serina, et al., 2021., Lewis et al., 2019). The CFS has been used both as a triage method and as a way of identifying patients who would benefit from COTE input. This is either for COTE as a liaison service or to identify patients to move to frailty specific units. The CFS has been used internationally (UK, Australia USA, and Switzerland) in the ED and is linked to predicted LOS and mortality (Elliott et al., 2021, Kaeppeli et al., 2020, Serina, et al., 2021., Lewis et al., 2019). The CFS has been studied in "Silver Trauma" as part of a falls assessment where the CFS has been found to predict increased LOS, mortality, increased inpatient delirium risk and increased care support needed at discharge (Rickard et al., 2021). The advantage of the CFS being used in ED is that the CFS is quick and easy to use as it is designed to be picture based with a concise description of a person's functional ability (Rookwood et al., 2020). It is also available as an app for mobile devices. It has been evaluated in the ED for reliability and has been validated in the ED (Fehlmann et al., 2022, Horlin et al., 2022). It takes approximately one minute to calculate a CFS and due to its speed and ease, has been recommended in the ED (Preston et al., 2018., Elliott et al., 2017., Horlin et al.,2022, Fehlmann et al., 2022).

There are some issues around the use of the CFS in the ED. ED departments are remarkably busy and the CFS is not calculated routinely, with completion rates ranging from 50% to 98.9% (Knight et al., 2022., McGrath et al., 2019, Jarman et al., 2021, Checa-Lopez et al., 2023). Also, staff felt that the CFS was easy to use on practice cases, whilst patients are more complex, and this decreased their confidence in using the CFS (McGrath et al., 2019). The CFS cannot be calculated automatically, and this is a barrier towards its use. The CFS does require minimal training but is perceived to be “it is someone else’s role” or that “it is not a priority” (Jarman et al., 2021, Checa-Lopez et al., 2023). The Acute Frailty Network (NHS Acute Frailty Network, 2021) state that “The CFS can be undertaken by any appropriately trained healthcare professional (doctor, nurse, health care assistant, therapist etc.) with training and support” showing that this can be calculated without needing to be a practitioner specialising in older adults and that any medical professional with minimal training is competent to perform a CFS in any clinical encounter.

The CFS as a scoring system does have issues. The Acute Frailty (NHS Acute Frailty Network, 2021) state that “Ask the patient or their carer/next of kin/paramedics/care home staff what their capability was TWO weeks ago”. The CFS has only been validated in older people i.e. those over 65 years old and it is not validated in those with dementia or learning disability and in younger populations (below 65 years of age). In some studies, agreement between ED CFS and inpatient CFS was found to be weak and the CFS calculated in ED, could not predict outcomes such as mortality and length of stay (Shrier et al., 2021). Studies have shown that the CFS is used primarily within medicine, in subspecialities such as geriatrics, ED, ITU, cardiology and renal medicine (Church et al., 2020).

There have been issues with the ethics surrounding the CFS as during the COVID-19 pandemic there were numerous examples of the CFS being used as way of limiting care that patients received. As the CFS is easy to calculate and rapid, NICE and the BGS suggested that the CFS was used to assist with critical care decision making (National Institute for Clinical Excellence, 2020, British Geriatrics Society and O'Mahony, 2021). The CFS was used inappropriately as those patietns with a CFS cut off of greater than 5 being identified as frail and therefore not for intervention rather than as a way of identifying those would benefit most from a CGA. This is thought to be influenced by the CFS being a test of one's functional ability therefore giving it an "ableist bias" (Atkins et al., 2021). This had particularly emotive effects in those with stable disabilities and the perceived value that society places on these individualises lives due to the elevated levels of support and care needs they had prior to be diagnosed with COVID-19 (Baker, 2020).

To create a score that was calculated automatically, the HFRS was created. The HFRS was developed using Hospital Episode Statistics and validated on over one million older people using hospitals in 2014/15. The HFRS uses International Classification of Disease 10 (ICD-10) codes that look at range of presentations from elective to nonelective hospital admissions to generate a frailty risk score (Gilbert et al., 2018). When assessed in clinical practice, the score was able to identify a relatively small proportion of people over 75 years old in hospitals who were at the greatest risk of harms of prolonged or inappropriate admission such as increased LOS, mortality, and readmission (Gilbert et al., 2018). The initial validation was in over 1 million patients and those with elevated risk on the HFRS was associated with increased LOS, mortality, and readmission rates. There was also fair to moderate correlation with Fried and Rookwood frailty scales (Gilbert et al., 2018).

Importantly the HFRS can be calculated automatically, which removes the burden and potential errors associated with manual scoring systems such as the CFS (Gilbert et al., 2018). this is because the HFRS uses administrative hospital data collected routinely and is based on 109 broad ICD-10 codes with specific weighting applied to each variable. This removes the need for manual assessment of frailty, removing the biases that the CFS can be prone to (Baker, 2020). This reduces the time and effort needed to calculate the CFS and there are no inter-operator reliability issues. When calculating the HFRS, all 20 diagnostic fields in all episodes are searched for the ICD-10 codes and added together to create the final score. Three risk categories can be created using cut-points which discriminated between individuals with different risks of adverse outcomes. These are Low-risk of frailty (HFRS less than 5), Intermediate-risk of frailty (HFRS 5–15) and High-risk of frailty (HFRS greater than 15). By using ICD-10 codes, the HFRS is closer to the electronic frailty index (EFI) used in primary care which is based on Read codes used in most UK general practices (Clegg et al., 2016).

The HFRS has been used in specialist services Cardiac Surgery, Stroke, Hip fractures and has even been validated in France, Australia but never calculated automatically in an ED population (Nghiem et al., 2021, Meyer et al., 2021, Imman et al., 2021). One study of comparing both the CFS and HFRS in the ED showed that both scores predicted adverse outcomes, but these scores were calculated using retrospective CFS data and then the HFRS was calculated only for those admitted. (Alshibani et al., 2022). There was low/slight agreement between the scores indicating that the scores look at different aspects of frailty.

The HFRS and CFS both have their benefits and identifying older people at risk of adverse outcomes in hospital can allow a system to provide frailty-specific interventions throughout their stay. To aid triaging and in identifying who would benefit from the input of the OPAS in Morriston Hospital, ED, both scores have been analysed.

3.4.2 Methods of HFRS identification in the ED

3.4.2.1 Study design

This was a retrospective analysis of patients admitted to the OPAS at Morriston Hospital in Swansea. The HFRS was used to categorise patients in High/Intermediate and Low Frailty Risk. Low was classified as less than 5 and High/Intermediate as greater than 5. We considered age, CFS, length of stay (LOS), 12-month mortality and evaluated postcode data to derive the WIMD to compare these measures in people classed as high/intermediate or low frail per HFRS. Further information was accessed using WCP and Abertawe Bro-Morgannwg Clinical Portal (ABMUCP) where the ED Zylab information can be found. All the information was placed in a subset of the OPAS database in Microsoft excel.

To enable a HFRS to be calculated, digital workforce developed a system to automatically work out the HFRS and then this allowed the implementation of a “Frailty Flag” to appear on the ED clinical portal system, which showed those patients who were High/Intermediate frailty as per HFRS. Implementation of the “Frailty Flag” which considered the set of rules derived by Lightfoot’s analysis along with the Frailty algorithm. This flag is calculated based on a set of rules derived by the analysis conducted by Lightfoot along with the Frailty score, which provides a scoring to identify patients with Low (0 – less than5), Intermediate (5 - 15) and High risk (greater than15) of adverse clinical outcomes in older people admitted to a hospital. The patients’ characteristics that were used to create the Frailty score are bed days, hospital costs, and a set of 109 ICD-10 codes for diagnosis identified a priori as signs of frailty. Hospital admissions related with mental health are excluded and the calculation of the Frailty score is based on the entire history of hospital admissions. This then enabled an automatic frailty flag for those patients aged over 50 years old with a LOS of over 14 days in the preceding 2 years or patients aged over 50 years old with a HFRS of over 5.

3.4.2.2 Statistical analysis

Continuous variables are presented as the mean ± standard deviation, whilst categorical variables are presented as the number (%). Statistical significance for continuous variables was determined using student's t-test and categorical variables were determined using Chi-squared test. Statistical significance was taken at $P<0.05$.

3.4.3 Results of HFRS identification in the ED

A total of 1,581 patients were included for analysis from consecutive admissions from January 2021 to August 2022, using HFRS to divide into High/Intermediate and Low frailty as per HFRS. The initial sample was 1694 patients but 113 were excluded from analysis (10 High/Intermediate and 103 Low) as they were aged below 65 years and this would not allow comparison with CFS, as this is only validated in those aged greater than 65 years. Of the entire cohort, the mean age 83.5 ± 7.6 years and 634 (40.1%) were male. The mean CFS of the total cohort was 5.2 ± 1.3 and at 12 months' follow-up, 1114 (70.5%) patients were alive and 467 (29.5%) had died. The mean WIMD decile of the total cohort was 5.6 ± 2.9. These data are presented in Table 3.4.

Variable	All n=1581	HFRS High/ Intermediate n=668	HFRS Low n=913	P value
Age (years)	83.5 (± 7.6)	84.0 (± 7.3)	83.2 (± 7.8)	P=0.03
Male (n/%)	634 (40.1%)	286 (42.8%)	348 (38.1%)	P=0.05
Female (n/%)	947 (59.9%)	380 (58.2%)	565 (61.9%)	
CFS	5.2 (± 1.3)	5.9 (± 1.2)	4.4 (± 1.4)	P<0.001
Alive (n/%)	1114 (70.5%)	428 (64.1%)	686 (75.1%)	P<0.001
Dead (n/%)	467 (29.5%)	240 (35.9%)	227 (24.9%)	
Deprivation decile	5.6 (± 2.9)	5.5 (± 3.0)	5.7 (± 3.0)	P=0.23

Table 3.4: Patient characteristics of those admitted to the OPAS unit divided by of HFRS identification in the ED. *CFS* clinical frailty score, *HFRS* hospital frailty risk score Continuous variables are presented as the mean (± standard deviation), categorical variables are presented as the number (%).

Of patients included in the analysis, 668 (42.3%) people were identified as High/Intermediate using the HFRS and 913 (57.7%) people classed as Low frailty. Compared to people classed as low frailty, people with High/Intermediate frailty were more likely to be male (42.8% vs 38.1%, P=0.05), be older (84.0 ± 7.3 years vs 83.2 ± 7.8 years, P=0.03), and have greater CFS (5.9 ± 1.2 vs 4.4 ± 1.4, P<0.001). Moreover, greater mortality was observed at 12 months' follow-up in people with High/Intermediate compared to those with Low frailty (35.4% vs 24.5%, P<0.001). The mean WIMD decile of those with High/Intermediate frailty was 5.5 ± 3.0 compared to those with low frailty 5.7 ± 3.0. (P=0.23). These data are presented in Table 3.4. The distribution of HFRS and CFS is shown in Figure 3.1.

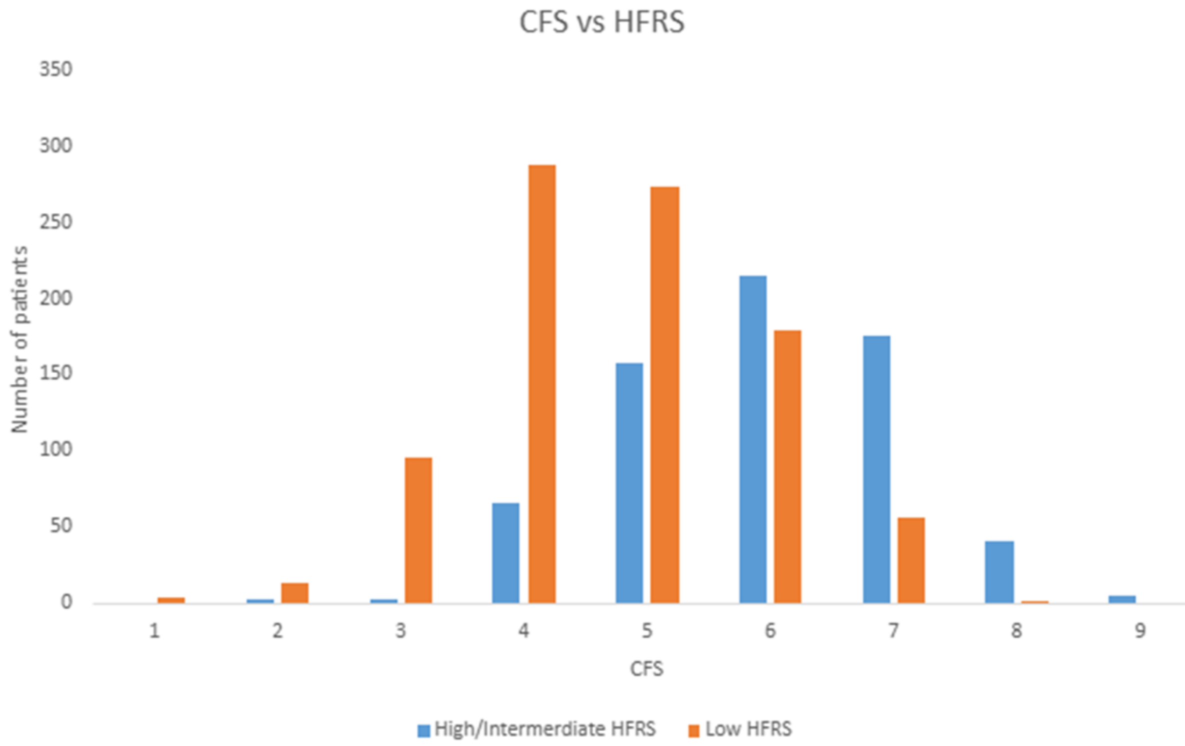


Figure 3.1: Comparing the CFS and HFRS data distribution *CFS* clinical frailty score*, HFRS* hospital frailty risk score

When comparing CFS, 474 (29.9%) had a CFS of less than 5 with a mean CFS of 3.7(± 0.6) and 1107 had a CFS greater than or equal than 5, with a mean CFS of 5.9 (± 0.9). Compared to people with CFS less than 5, those with CFS greater than or equal than were move likely to be older (84.6 ± 7.2 years vs 80.9 ± 8.0 years, P<0.001) and be classed as High/Intermediate frailty (596 (53.8%) vs 72 (15.2%), P<0.001). There was no difference in gender, with males (42.4% vs 39.1%, P=0.22) across the CFS. Moreover, greater mortality was observed at 12 months' follow-up in people with CFS greater than or equal than 5 compared to those with CFS less than5 (64.1% vs 10.0%, P<0.001). The mean WIMD decile of those CFS greater than or equal than 5 was 5.5 ± 2.9 compared to those with CFS less than 5 5.8 ± 3.0. (P=0.07). These data are presented in Table 3.5.

Variable	All n=1581	CFS < 5 n=474	CFS >/ 5 n=1107	P value
Age (years)	83.5 (± 7.6)	80.9 (± 8.0)	84.6 (± 7.2)	P<0.001
Male (n/%)	634 (40.1%)	201 (42.4%)	433 (39.1%)	P=0.22
Female (n/%)	947 (59.9%)	273 (57.6%)	674 (60.9%)	
CFS	5.2 (± 1.3)	3.7(± 0.6)	5.9 (± 0.9)	P<0.001
HFRS low	913 (57.7%)	402 (84.8%)	511(46.2%)	P<0.001
HFRS high/intermediate	668 (42.3%)	72 (15.2%)	596 (53.8%)	
Alive (n/%)	1114 (70.5%)	428 (90.0%)	394 (35.9%)	P<0.001
Dead (n/%)	467 (29.5%)	46 (10.0%)	713 (64.1%)	
Deprivation decile	5.6 (± 2.9)	5.8 (± 3.0)	5.5 (± 2.9)	P=0.07

Table 3.5: Patient characteristics of those admitted to the OPAS unit divided by CFS. *CFS* clinical frailty score, *HFRS* hospital frailty risk score Continuous variables are presented as the mean (± standard deviation), whilst categorical variables are presented as the number (%).

When looking at the mean WIMD decile, this was not significant by either CFS or HFRS but there was a trend by CFS as seen in Figure 3.2.

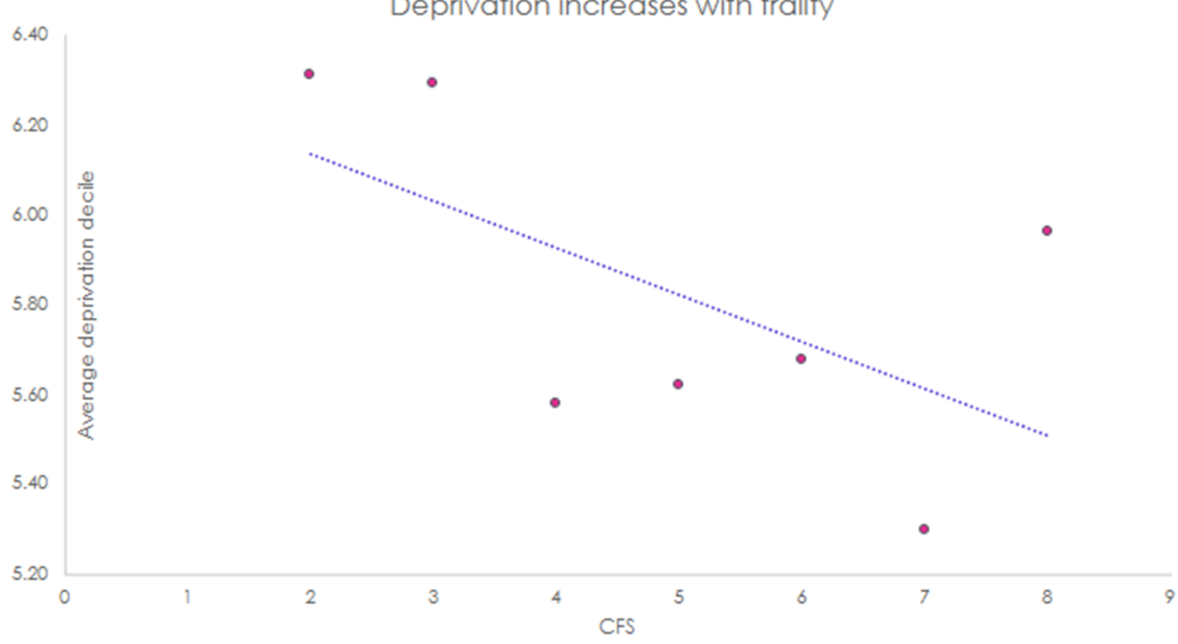


Figure 3.2: Frailly by CFS and WIMD decline *CFS* clinical frailty score*,* Welsh index of multiple deprivation (WIMD)

With respect to HFRS as a screening tool in our sample when comparing those with High/Intermediate and Low frailty, Sensitivity: 0.54, Specificity: 0.85, Positive Predictive Value: 0.89, Negative Predictive value: 0.44, Area Under Curve: 0.29. This is seen in Figure 3.3.

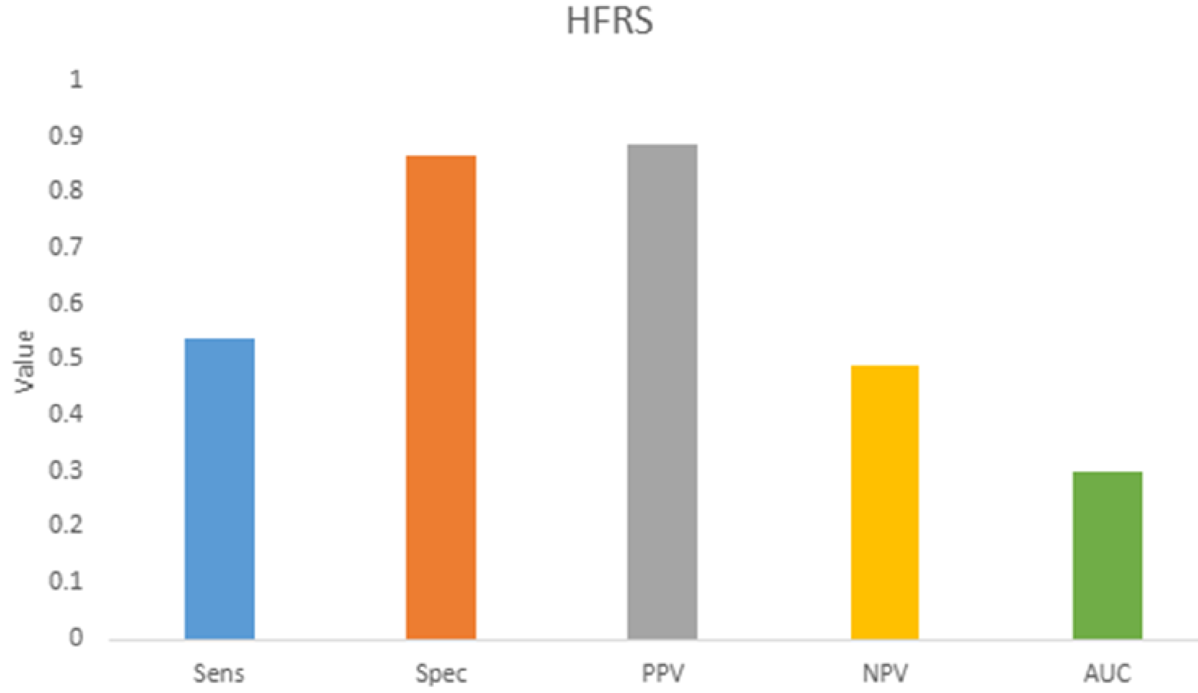


Figure 3.3: The ability of HFRS as a screening tool for frailty identification. *Sens* Sensitivity, *Spec* Specificity, *Positive Predictive Value* (PPV), *Negative Predictive value* (NPV), *Area under Curve* (AUC).

3.4.4 Validating the HFRS as a "Frailty Flag" in ED

The validity of the HFRS as a tool to identify patients in Morriston Hospital ED was prospectively assessed over a 10-day period in October 2022. All patients admitted to the ED on these days were included for analysis, who were aged over 65. A CFS was calculated for all the patients, and then the HFRS footprint was checked to see if the patients were "flagged" on the system. There has been a development of electronic, automated Frailty Flag that operates in real-time to signpost appropriate patients who would benefit from CGA which we have evaluated in clinical practice. The flag was already present on the ED interface (see Appendix 9.3 for example live view). The presenting complaint of the patient was also noted, and whether this was a frailty syndrome. Frailty syndromes were previously known as geriatric giants and one of these five frailty syndromes can indicate that the patient is frail (British Geriatric Society, 2014). These include falls, immobility, delirium, incontinence, and increased

susceptibility to side effects of medication. The CFS was calculated by the same person (AJB), and the data was collected by a group of resident doctors supervised by (AJB). Microsoft forms were used as a way of collecting the data (appendix 9.4).

In total, 522 patients aged over 65 years were prospectively analysed. A CFS was generated and compared to who "flagged" on our system. Those with a CFS <5 was younger (mean age of 73.4 (± 7.0) vs 82.4 (± 7.6), P< 0.001) compared to those with a CFS ≥5. Patients with a CFS <5 were less likely to be flagged on HFRS (52 (44.1%) vs 324 (79.6%), P< 0.001) compared to those with a higher CFS. Gender was not significantly different across groups. This data is presented in Table 3.6.

Variable	**All** **n=522**	**CFS <5** **n=118**	**CFS ≥5** **n=404**	**P value**
Age (years)	80.8 (± 8.0)	75.4 (± 7.0)	82.4 (± 7.6)	P<0.001
Male (n/%)	179 (34.3%)	49 (41.5%)	130 (32.0%)	P=0.06
Female (n/%)	343 (65.7%)	69 (58.5%)	274 (68.0%)	
CFS	5.6 (± 1.4)	3.6 (± 0.6)	4.4 (± 1.4)	P<0.001
HFRS Flag Y	371 (71.1%)	52 (44.1%)	324 (79.6%)	P<0.001
HFRS Flag N	146 (29.9%)	66 (55.9%)	80 (20.4%)	
Frailty Syndrome	327 (62.6%)	47 (39.8%)	283 (69.5%)	P<0.001

Table 3.6: Patient characteristics of included in the validation sample divided by CFS. CFS clinical frailty score, HFRS Hospital frailty risk score. Continuous variables are presented as the mean (± standard deviation), whilst categorical variables are presented as the number (%).

The HFRS flagged up 376 patients in total, these had a mean age of 82.8 (± 7.5) vs 75.8 (± 7.5), P< 0.001 compared to those not flagged and had a higher CFS (mean CFS of 5.8 (± 1.2) vs 5.0 (± 1.6), P< 0.001). Gender was not significantly different across groups. This data is presented in Table 3.7.

Variable	All n=522	HFRS No n=146	HFRS Yes n=376	P value
Age	80.8 (± 8.0)	75.8 (± 7.2)	82.8 (± 7.5)	P<0.001
Male	179 (34.3%)	53 (36.3%)	126 (33.5%)	P=0.55
Female	343 (65.7%)	93 (63.7%)	250 (66.5%)	
CFS	5.6 (± 1.4)	5.0 (± 1.6)	5.8 (± 1.2)	P<0.001
Frailty Syndrome	327 (62.6%)	65 (44.5%)	265 (70.5%)	P<0.001

Table 3.7: Patient characteristics of included in the validation sample divided by HFRS. CFS clinical frailty score, HFRS Hospital frailty risk score. Continuous variables are presented as the mean (± standard deviation), whilst categorical variables are presented as the number (%).

With respect to presenting complaint, those with frailty syndromes such as Falls, Immobility, Delirium, Incontinence, and increased susceptibility to side effects of medication were identified. In total, there were 330 patients presented with frailty syndromes. Again, those who presented with frailty syndromes were older with a mean age of 82.0 (± 7.8) vs 78.7 (± 8.2), P<0.001 compared to those not flagged and had a higher CFS (mean CFS of 5.8 (± 1.2) vs 5.2 (± 1.5), P<0.001). Gender was not significantly different across groups. This data is presented in Table 3.8.

Variable	All n=522	Frailty flag No n=192	Frailty flag Yes n=330	P value
Age (years)	80.8 (± 8.0)	78.7 (± 8.2)	82.0 (± 7.8)	P<0.001
Male (n/%)	179 (34.3%)	64 (33.3%)	115 (34.8%)	P=0.72
Female (n/%)	343 (65.7%)	128 (66.7%)	215 (65.2%)	
CFS	5.6 (± 1.4)	5.2 (± 1.5)	5.8 (± 1.2)	P<0.001
HFRS Flag Y	371 (71.1%)	111 (57.8%)	265 (80.3%)	P<0.001
HFRS Flag N	146 (29.9%)	81 (42.2%)	65 (19.7%)	

Table 3.8: Patient characteristics of included in the validation sample divided by whether a frailty syndrome was the presenting complaint. CFS clinical frailty score, HFRS Hospital frailty risk score. Continuous variables are presented as the mean (± standard deviation), categorical variables are presented as the number (%).

Examining the HFRS flag as a screening tool to be able to identify those with frailty in the prospective validation sample, the Sensitivity is 0.93, Specificity 0.48, Positive Predictive Value 0.86, Negative Predictive value: 0.68 and AUC: 0.27. This is shown in Figure 3.4.

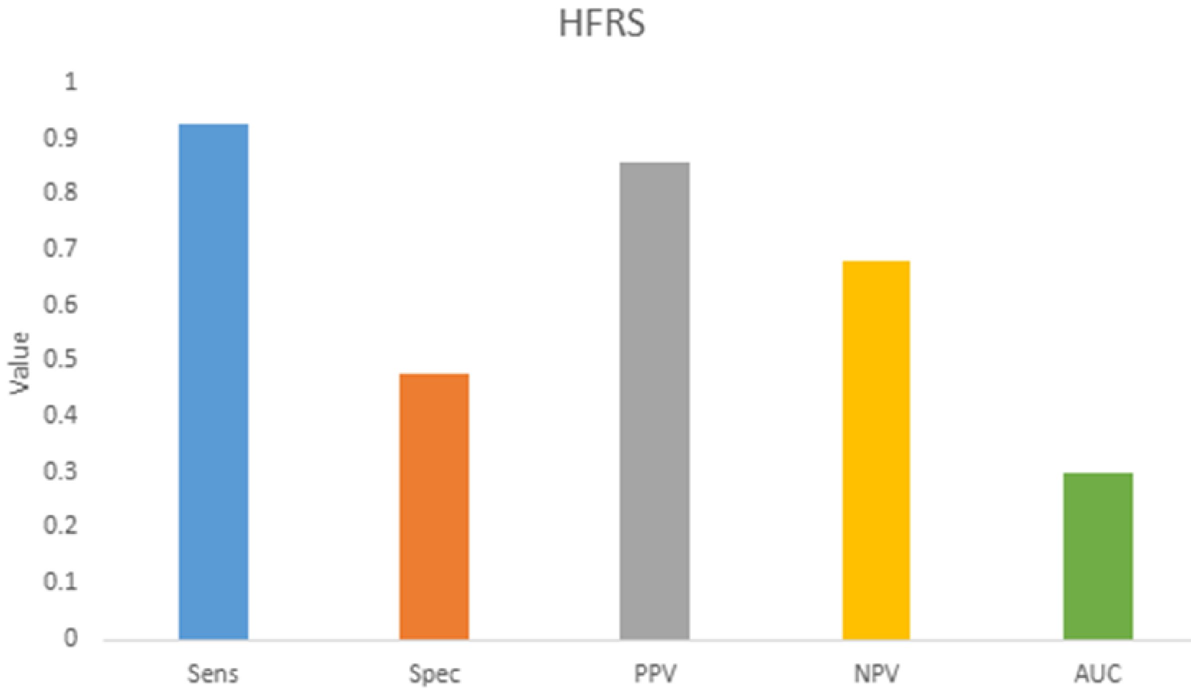


Figure 3.4: The ability of the HFRS flag as a screening tool for frailty identification. *Sens* Sensitivity, *Spec* Specificity, *Positive Predictive Value* (PPV), *Negative Predictive value* (NPV), *Area under Curve* (AUC)

3.4.5 Conclusion of HFRS identification in the ED

The HFRS was significantly associated with CFS and age in our ED population. Those classified as High/Intermediate frailty were also more likely to be male. Of those admitted, High/Intermediate Frail per HFRS had median LOS of 28.11 days vs 21.26 days for not frail, with 30-day mortality 10.12% vs 8.90%; potentially suggesting the HFRS can identify a subpopulation of high-risk frail patients. On a prospective analysis of those admitted to the ED, looked to see whether they were “flagged” and did a prospective CFS. those who were flagged were older and had a higher CFS (P<0.001) indicating that the flag is working

We found socio-economic status and coding had no relationship to the screening efficacy of HFRS. The only caveat to this was patients who were out of the Swansea Bay geographical area, who due to the parameters of the HFRS coding algorithm these patients were not flagged correctly. As this was an exceedingly small sample, this did not alter the results significantly, we acknowledge that the HFRS can only be generated after an initial admission, so risk stratification information would not be possible at first presentation. These patients may be from nursing homes or may be under the Virtual Ward in SBUHB and therefore maybe very frail but have been a success of admission avoidance schemes. We also found no link between postcode and the WIMD with frailty assessed by the HFRS but there was a trend with CFS, further research on a larger scale e.g. using the SAIL database would be useful to look for a statistically significant link.

This study has some important limitations. Firstly, it is a retrospective study which is prone to usual biases associated with this type of study. To minimise this, patients with missing data were excluded from the analysis. Due to some patients being recently added to the databank, these do not have mortality outcomes at 12 months currently. Frailty is a dynamic measure which is not fixed, and there can be a major bias in calculating the CFS especially when external factors such as cognitive impairment can limit someone's functional ability (Rookwood et al., 2020). This was mediated by all the CFS scores being checked by the same person (AJB), who was able to access everyone's CGA including physiotherapy and occupational therapy assessments.

The limitations of the CFS have been covered in 3.7 of this chapter. The main problems are that the CFS has only been validated in older people i.e. those over 65 years old and that the CFS is prone to bias especially in those with chronic health conditions and learning difficulties. The CFS cannot be calculated automatically, and this is a barrier towards its use. The CFS should also be used as a means of identifying would benefit most from a CGA, which is thought to be those who have a CFS greater than 5. There has been evidence that a CGA is also beneficial in those who have a CFS of 4. In our sample, the majority of those with CFS less than 5 and flagged as

High/Intermediate HFRS, had a CFS of 4 (66 of 72 patients) and these “Pre-frail” patients would also benefit from a CGA. This has important consequences as those classed as “Low” frailty per HFRS still had an average CFS of 4.4 and would also benefit from a CGA. The CFS also requires health care professionals to have training, albeit minimal, and ask certain questions on functional ability whilst the HFRS uses routinely collected data.

The HFRS as a tool also has its limitations. The HFRS is a frailty risk score, rather than a purely frailty score such as CFS and may not be as useful at an individual patient level. It also is more arbitrary and does not have the levels like CFS, making it harder to track the progression of frailty. A full frailty assessment should include a CGA with a multidimensional approach to assess frailty with an overview of environmental and social factors, leading to reduced physiological reserve which negatively affect all organ systems. The HFRS is based on the number of comorbidities calculated by available ICD-10 codes assigned to patients from current and previous hospital admissions. This is prone to error as these codes could be incorrect, incomplete and do not reflect disease severity (Alshibani et al., 2023). The ICD 10 codes used do not include crucial elements of frailty such as sarcopenia, polypharmacy, and need for support in ADLs. Most of the ICD-10 codes are associated with acute medical conditions such as delirium, aspiration pneumonia, and acute renal failure. Others are more closely aligned with frailty syndromes such as dementia, hypotension, dizziness, and giddiness but these are not frailty specific. Some of the codes could reflect some elements of frailty such as swallowing problems and increased vulnerability to hospital acquired and nosocomial infections but are not specific. There was no link with the quality of coding and HFRS in our sample. This was also shown as the HFRS was predictive of poor outcomes even in hospitals with less robust coding (Gilbert et al, 2018) but that when coding was better, more patients were classed as frail.

Overall, the HFRS was significantly associated with CFS and age in our ED population. The frailty flag that was developed using the HFRS data has been amended as the HFRS identified 57% of the retrospective OPAS cohort, and with the addition of greater than 80 years of age, the modified score identifies greater than 85% of service users. In our sample, the majority of those with CFS <5 and flagged as High/Intermediate HFRS, had a CFS of 4 (66 of 72 patients) and these “Pre-frail” patients would also benefit from a CGA. This has important consequences as those classed as “Low” frailty per HFRS still had an average CFS of 4.4 and would also benefit from a CGA. This shows the importance of frailty assessment as a means of identifying those who need a CGA.

3.5 Overall conclusions

Frailty assessment, whether that is pre-hospital or in the ED is important. The AOD data has shown that those with increased AOD have increased 6-months mortality and increased hospital LOS which is especially prevalent in those aged greater than 65 years old. We have shown that with a frailty specific area which specialist staff who can perform a comprehensive geriatric assessment for these patients can significantly improve patient outcomes and experience.

It is paramount for this to be a success that the correct patients are identified, and the data has shown the HFRS was significantly associated with CFS and age in our ED population. The HFRS can be used to identify patients in the ED and can be used to measure frailty-specific intervention system efficiency. The HFRS is also used to monitor impacts of interventions within hospitals on frail patients, if successful, this modified tool could be used to monitor impacts on community populations that have or are at risk of developing frailty syndromes. It is important that frailty is identified whether that is by CFS or HFRS or by another means such as clinical judgement. Identify frailty by assigning a number by whatever means is likely to be erroneous and older people need individualised assessment by trained people The heterogeneity of the patient group we serve is what makes the medicine we practice so rewarding.

Chapter 4 – Ambulatory care and Same Day Emergency Care (SDEC)

4.1 Introduction

To assist clinicians to stratify who is best placed for SDEC, several patient selection scores have been developed to identify patients suitable for ambulatory care from triage in the ED and the acute medical intake. These scores are designed to improve system efficiency, overcrowding and patient experience. The most frequently cited and tested scores are the Ambulatory Score (Amb) (Ala et al., 2012), the Glasgow Admission Prediction Score (GAPS) (Cameron et al., 2014) and Sydney Triage to Admission Risk Tool (START) (Dinh et al., 2016) (Appendices 9.4, 9.5 and 9.6).

With respect to the scoring systems, they all score for slightly different parameters. The Amb score (Ala et al., 2012), was developed in South Wales in a small semi-rural district general hospital and is recommended by the RCP Acute care toolkit 10 (Royal College of Physicians of London, 2014). The average age used to develop the score was 67 years old for males and 63 for females and used 282 subjects to develop the score, with typically 50% discharged same day [(Ala et al., 2012). A score cut-off between 4 and 5 gave the most favourable sensitivity (96%) and specificity (65%) so patients receiving a score <5 are considered likely to be admitted. This score also assigns points to age, gender and whether the patient is acutely confused.

Comparing this to the GAPS (Cameron et al., 2014) which was developed in 2014 after assessing admissions over 6 different sites in North Glasgow including 3 ED, 2 acute medical admission units and 1 minor injury units in a predominantly urban setting. No data was provided on average age, and 215,231 presentations were used to develop the score, with 107.615 patients included for validation. This score looks at data which is readily available at triage including Manchester Triage Score and uses probabilities to group patients into low and high groups with a ‘high probability’ score of >25 identified in over one-third of admissions immediately; a score of <8 would identify over half of all discharges at triage. When used as a binary predictor, the optimum cut-off of ≥15 points indicate admission with a sensitivity of 78% and a specificity of 81.7%.

Another commonly used score is the START (Dinh et al., 2016) developed in 2016, using 1,721,294 presentations from 23 units in New South Wales, Australia, with 49.38% males and the mean age was 49.9 years. This uses deciles of risk scores with corresponding mean predicted probabilities of admission. Therefore, patients scoring ≥14 are considered to have a high probability of being admitted. The score examines information gathered at triage but also includes time of arrival and presenting complaint. An extended START (START+) has since been developed (Ebker-White et al., 2018) with more emphasis on frailty, with frailty itself now scoring along with multiple or major comorbidities now contributing to the START. Frailty was defined "as a clinical state of age-related vulnerability, severe weakness, reduced mobility and decreased physical function that impacts on daily living" (DInh et al., 2016) rather than using a specific scoring system.

There have been multiple studies have been conducted that compare the ability of these scoring systems but none specifically in frail older adults. A study of 1500 patients in Glasgow and Sheffield (Cameron et al., 2018) showed GAPS to be a better discriminator of ED disposition and need for inpatient care compared to the Amb score and flagged that an important limitation of the Amb score in that it also requires additional questions to be asked that are not part of routine triage. The Amb score has been tested in Taunton (Thompson et al, 2015) and did not predict which patients would be discharged within 12 hours, which probably reflects population and demographic differences as Taunton has one of the fastest growing older adult populations, and 38% patients were aged over 80 years. When comparing the Amb score and GAPS in 7365 admissions in Birmingham (Atkin et al., 2022), both had poor discriminatory ability and 30% of the participants were aged greater than 70 years old. A study in Milan comparing the three scores in 1710 patients with a median age of 54 years, showed that each score provided moderate accuracy in predicting patient admission (Salvato et al, 2022). However, all the scores were significantly worse than the clinical judgement of the triage nurses who completed the prospective triage scoring. When looking at a frailty specific population of 318 patients with a median age 80 years the Amb score did not validate well in this patient group and therefore has limited applicability (Elias et al, 2017).

4.2 Aim

The aim of this chapter was to retrospectively apply these scoring systems to service users who attended the OPAS to assess the applicability of patient selection scoring systems to identify older frail patients who were suitable for SDEC. This will identify people at risk of adverse outcomes in hospital to provide a system of frailty-specific interventions throughout their stay and to provide a way of stratifying who would be suitable for SDEC.

4.3 Methods

4.3.1 Study design

This was a retrospective analysis of patients admitted to the OPAS at Morriston Hospital in Swansea (see Chapter 2). Associations between clinical outcomes with age, CCI and CFS were evaluated alongside a comparison of each ambulatory score, all scored retrospectively by the me. Each score was calculated using the original papers. Re-presentation at 14 days, 1 month and 6 months plus 12-month mortality were also analysed. ED documentation was used to gain triage data and other information required by the scores. Further information was accessed using WCP and ABMUCP where the ED Zylab information can be found. All the information was placed in a subset of the OPAS database in Microsoft excel. Microsoft forms were used to develop a data collection sheet. This was then used to quickly calculate the Amb score, GAPS score and START score plus CMI as none of this data was routinely collected by OPAS. The data was collected from June 2020 to December 2021.

4.3.2. Statistical analysis

Continuous variables are presented as the mean ± standard deviation, whilst categorical variables are presented as the number (%). Statistical significance for continuous variables was determined using student's t-test and categorical variables were determined using Chi-squared test. Statistical significance was taken at $P<0.05$.

4.4 Results

A total of 748 patients were included for analysis from consecutive admissions from June 2020 to December 2021. Of the entire cohort, the mean age 82.8 ± 8.5 years and 274 (36.6%) were male. The initial presentation in 79.0% of patients was falls. The mean CFS of the sample was 5.2 ± 1.4 with a mean CCI of 6.7 (± 2.6) with 584 (78.1%) discharged the same day. With respect to individual scoring systems, the mean Amb score was 4.2 (± 1.7), mean GAPS of 21.4 (± 5.8) and mean START was 23.5 (± 4.7). All these scores are in the admission, not the discharge range. At 12 months' follow-up, 530 (70.9%) patients were alive and 218 (29.1%) had died. With respect to re-presentation rates, 86 (11.5%) represented within 2 weeks, 162 (21.7%) represented within 1 month and 351 (46.7%) represented within 6 months. These data are presented in Table 4.1.

Of patients included in the analysis, 584 (78.1%) were discharged the same day and 164 (21.9%) were admitted to hospital. There was a significant difference in CFS between those discharged and admitted (5.1 ± 1.4 vs 5.5 ± 1.2, P<0.001) but no difference in CCI (6.6 ± 2.6 vs 6.9 ± 2.5, P=0.27). There was no difference in gender (34.9% male vs 42.7%, P=0.07) or age (82.7 ± 8.6 years vs 83.4 ± 8.8 years, P=0.28) or representation rates. There was a significant difference in the Amb score between those discharged and admitted (4.3 ± 1.7 vs 3.6 ± 1.7, P<0.001) and the START (23.3 ± 4.9 vs 24.2 ± 3.9, P=0.03) but no difference in the GAPS (21.3 ± 5.8 vs 21.9 ± 5.6, P=0.17). The mean of each scoring system for the discharged patients was in the admission range per score. Moreover, greater mortality was observed at 12 months follow-up in those admitted compared to those discharged (37.2% vs 26.9%, P=0.01). These data are presented in Table 4.1.

Variable	All n=748	Discharged n=584	Admitted n=164	P value
Age (years)	82.8 (± 8.5)	82.7 (± 8.63	83.4 (± 8.8)	P=0.28
Male (n, %)	274 (36.6%	204 (34.9%)	70 (42.7%)	P=0.07
Female (n, %)	474 (63.4%)	380 (65.1%)	94 (57.3%)	
Fallers (n, %)	591 (79.0%)	467 (80.0%)	124 (75.6%)	P=0.23
CFS	5.2 (± 1.4)	5.1 (± 1.4)	5.5 (± 1.2)	**P<0.001**
ACB	1.6 (± 1.8)	1.6 (± 1.8)	1.6 (± 1.7)	P=0.95
AMT	3.2 (± 1.2)	3.3 (± 1.3)	3.2 (± 1.1)	P=0.54
CCI	6.7 (± 2.6)	6.6 (± 2.6)	6.9 (± 2.5)	P=0.27
Amb	4.2 (± 1.7)	4.3 (± 1.7)	3.6 (± 1.7)	**P<0.001**
GAPS	21.4 (± 5.8)	21.3 (± 5.8)	21.9 (± 5.6)	P=0.17
START	23.5 (± 4.7)	23.3 (± 4.9)	24.2 (± 3.9)	**P=0.03**
Representation (n, %)				
2 weeks	86 (11.5%)	65 (11.1%)	21 (12.8%)	P=0.55
1 month	162 (21.7%)	125 (21.4%)	37 (22.6%)	P=0.75
6 months	351 (46.7%)	279 (47.8%)	72 (43.9%)	P=0.38
Alive (n, %)	530 (70.9%)	427 (73.1%)	103 (62.8%)	**P=0.01**
Dead (n, %)	218 (29.1%)	157 (26.9%)	61 (37.2%)	

Table 4.1: Patient characteristics of those who presented to the OPAS unit CFS clinical frailty score, *ACB* Anti-cholinergic burden score, *AMT* Abbreviated mental test score, *CCI* Charlson comorbidity index, *Amb* Ambulatory Score, *GAPS* Glasgow Admission Prediction Score, *START* Sydney Triage to Admission Risk Tool. Continuous variables are presented as the mean (± standard deviation), whilst categorical variables are presented as the number and percentage (n, %).

When each scoring system was examined in more detail, the Amb score, 475 (63.5%) scored less than 5, which is considered admission range whilst 273 (36.5%) scored greater than or equal to 5 which is considered discharge range. There was a significant difference in age (84.4 ± 7.5 years vs 80.0 ± 9.3 years, P<0.001) despite this being adjusted for in the Amb score. There was a significant difference in admissions (25.9% vs 15%, P<0.001) between groups and in CFS (5.4 ± 1.3 vs 4.7 ± 1.4, P<0.001) and CCI (7.0 ± 2.6 vs 5.9 ± 2.2, P<0.001). Greater mortality was observed at 12 months' follow-up in people who scored less than 5 (34.9% vs 19%), P<0.001). There was a significant difference in GAPS and START, but the mean for each score for the patients discharged was in the admission range per score. There was no difference in gender (38.7% male vs 33.0%, P=0.11) but this is adjusted for in the Amb score. These data are presented in Table 4.2.

With respect to the GAPS, 79 (10.6%) scored less than 15, which is considered to be in the discharge range whilst 669 (89.4%) scored greater than or equal to 15 which is considered admission range. GAPS was assessed as a binary outcome using a cut-off of 15 to indicate higher likelihood of discharge within 12 hours, although adjusting the cut-off to maximise performance within each centre is advised by the authors. There was a significant difference in age (80.5 ± 9.0 years vs 83.1 ± 8.4 years, P<0.01) despite this being adjusted for in the GAPS. There was a no significant difference in admissions (15.2% vs 22.4%, P=0.12) between groups and in 12-month mortality (20.2% vs 30.2%, P=0.07). There was a significant difference in CFS (4.4 ± 1.8 vs 5.3 ± 1.3, P<0.001) and CCI (5.6 ± 2.2 vs 6.8 ± 2.6, P<0.001). There was a significant difference in START and the Amb score. There was significant difference in gender (49.4% Male vs 35.1%, P=0.01) but this is not adjusted for in the GAPS. These data are presented in Table 4.2.

Finally with respect to START, only 27 patients (3.6%) in our sample made the discharge cut off of less than 14, whereas 721 (96.4%) were in the admission range of greater than or equal to 14 making comparisons difficult. There was no significant difference in age (74.9 ± 9.3 years vs 83.1 ± 8.3 years, P=0.17) which is adjusted for

in the START and gender (40.7% Male vs 36.5%, P=0.65) which is not adjusted for in the score. There was a significant difference in Admissions (3.7% vs 22.6%, P=0.02) between groups and in 12-month mortality (0% vs 30.2%, P<0.001). There was a significant difference in CFS (3.1 ± 1.4 vs 5.2 ± 1.3, P<0.001) and CCI (4.9 ± 1.8 vs 6.7 ± 2.6, P<0.001). There was a significant difference in GAPS and the Amb score. These data are presented in Table 4.2.

Variable	All n=748	Amb <5 n=475	Amb ≥ 5 n=273	P value	GAPS <15 n=79	GAPS ≥ 15 n=669	P value	START <14 n=27	START ≥ 14 n=721	P value
Age (years)	82.8 (± 8.5)	84.4 (± 7.5)	80.0 (± 9.3)	**P<0.001**	80.5 (± 9.0)	83.1 (± 8.4)	**P<0.01**	74.9 (± 9.3)	83.1 (± 8.3)	P=0.17
Male (n, %)	274 (36.6%)	184 (38.7%)	90 (33.0%)	P=0.11	39 (49.4%)	235 (35.1%)	**P=0.01**	11 (40.7%)	263 (36.5%)	P=0.65
Female (n, %)	474 (63.4%)	291 (61.3%)	183 (67.0%)		40 (51.6%)	434 (64.9%)		16 (59.3%)	458 (63.5%)	
Admitted (n, %)	164 (21.9%)	123 (25.9%)	41 (15.0%)	**P<0.001**	12 (15.2%)	152 (22.7%)	P=0.12	1 (3.7%)	163 (22.6%)	**P=0.02**
CFS	5.2 (± 1.4)	5.4 (± 1.3)	4.7 (± 1.4)	**P<0.001**	4.4 (± 1.8)	5.3 (± 1.3)	**P<0.001**	3.1 (± 1.4)	5.2 (± 1.3)	**P<0.001**
ACB	1.6 (± 1.8)	1.6 (± 1.7)	16 (± 1.8)	P=0.98	1.3 (± 1.6)	1.7 (± 1.8)	P=0.07	0.7 (± 1.6)	1.7 (± 1.8)	**P=0.02**

AMT	3.2 (± 1.2)	3.0 (± 1.3)	3.6 (± 0.9)	**P<0.001**	3.4 (± 1.1)	3.2 (± 1.2)	P=0.22	3.5 (± 1.1)	3.2 (± 1.2)	P=0.29
CCI	6.7 (± 2.6)	7.0 (± 2.6)	5.9 (± 2.2)	**P<0.001**	5.6 (± 2.2)	6.8 (± 2.6)	**P<0.001**	4.9 (± 1.8)	6.7 (± 2.6)	**P<0.001**
GAPS	21.4 (± 5.8)	22. 8 (± 4.9)	19.0 (± 5.1)	**P<0.001**	5.9 (± 1.8)	4.0 (± 1.6)	**P<0.001**	6.8 (± 1.)	4.1 (± 1.6)	**P<0.001**
START	23.5 (± 4.7)	24.8 (± 4.0)	21.3 (± 5.0)	**P<0.001**	17.2 (± 3.9)	22.5 (± 4.5)	**P<0.001**	14.0 (± 5.7)	21.7 (± 5.2)	**P<0.001**
Representation (n, %)										
2 weeks	86 (11.5%)	65 (13.7%)	21 (7.6%)	**P=0.01**	4 (5.1%)	82 (12.3%)	P=0.06	0 (0.0%)	86 (11.9%)	P=0.06
1 month	162 (21.7%)	114 (24.0%)	48 (17.6%)	**P=0.04**	7 (8.8%)	155 (23.3%)	**P=0.04**	1 (3.7%)	161 (22.3%)	**P=0.02**
6 months	351 (46.7%)	234 (49.2%)	117 (42.3%)	P=0.09	22 (27.8%)	395 (59.0%)	**P<0.001**	8 (29.6%)	343 (47.6%)	P=0.07

Alive (n, %)	530 (70.9%)	309 (65.1%)	221 (80.0%)	**P<0.001**	63 (79.7%)	467 (70.1%)	P=0.07	27 (100%)	503 (69.8%)	**P<0.001**
Dead (n, %)	218 (29.1%)	166 (34.9%)	52 (19.0%)		16 (20.2%)	202 (30.2%)		0 (0.0%)	218 (30.2%)	

Table 4.2: Comparison of the different scoring systems **CFS** clinical frailty score, *ACB* Anti-cholinergic burden score, *AMT* Abbreviated mental test score, *CCI* Charlson comorbidity index, *Amb* Ambulatory Score, *GAPS* Glasgow Admission Prediction Score, *START* Sydney Triage to Admission Risk Tool, *Repres* Representation to Hospital. Continuous variables are presented as the mean (± standard deviation), whilst categorical variables are presented as the number (%).

Each score was examined as a screening tool to compare admission and discharges with the cut offs previously described for the original validation scores. All the scores had low positive predictive value (PPV) with equivocal sensitivity, specificity, negative predictive value (NPV), and area under the curve (AUC) when used as a screening tool. The Amb score actually had the lowest sensitivity and specificity in our sample when used as a screening, despite having the biggest significance between groups when examining at individual variables. The CFS had truly little usability as a screening tool. These data are presented in Figure 4.1 and Table 4.3.

Variable	Sensitivity	Specificity	PPV	NPV	AUC
Amb	0.75	0.60	0.26	0.85	0.69
GAPS	0.93	0.89	0.23	0.75	0.62
START	0.99	0.97	0.23	0.95	0.65
CFS	0.20	0.26	0.17	0.24	0.53

Table 4.3: Comparing the screening ability of each score *CFS* clinical frailty score*, Amb* Ambulatory Score, *GAPS* Glasgow Admission Prediction Score, *START* Sydney Triage to Admission Risk Tool, *Positive Predictive Value* (PPV), *Negative Predictive value* (NPV), *Area under Curve* (AUC).

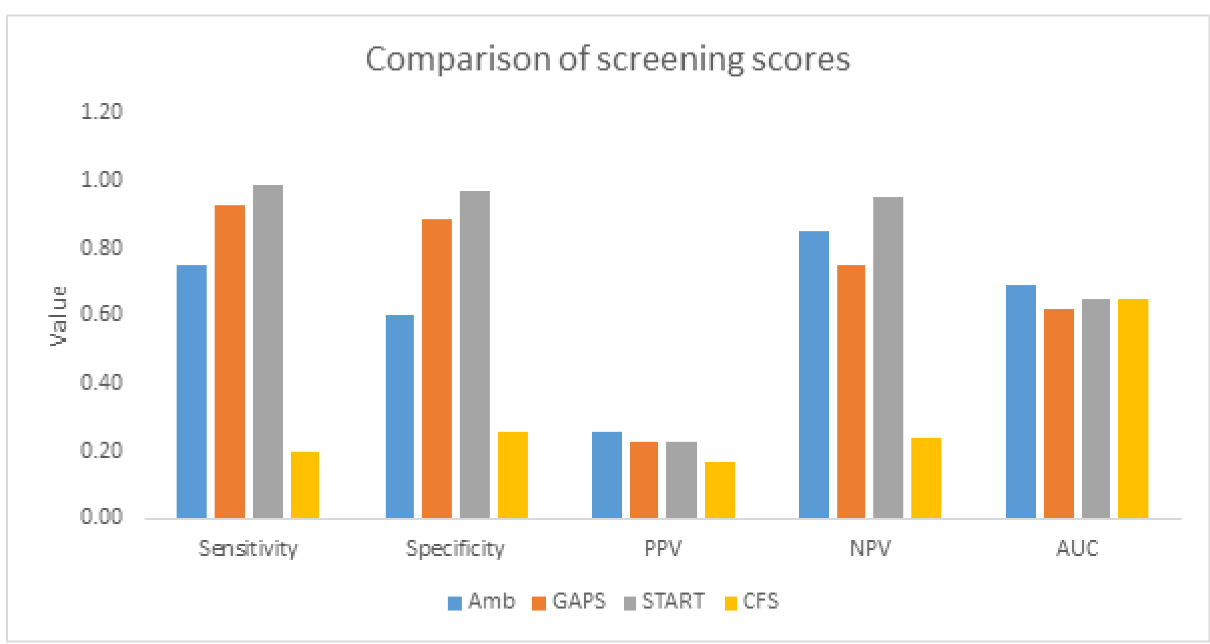


Figure 4.1: Comparing the screening ability of each score

CFS clinical frailty score*, Amb* Ambulatory Score, *GAPS* Glasgow Admission Prediction Score, *START* Sydney Triage to Admission Risk Tool, *Positive Predictive Value* (PPV), *Negative Predictive value* (NPV), *Area under Curve* (AUC).

4.5 Conclusions

Frailty is an important determinant in identifying whether ambulatory care is appropriate. No score could be reliably used as a screen for suitable patients for same day emergency care services although the Amb score was the most accurate when assessing each individual variable despite having limited validity as a screening tool.

This study has important limitations. Firstly, it is a retrospective study which is prone to usual biases associated with this type of study. To minimise this, patients with missing data were excluded from the analysis. Due to some patients being recently added to the databank, these do not have mortality outcomes at 12 months currently. When examining mortality data, this was in the peak of the COVID-19 pandemic. Long waits in the ED, especially for older adult patients, are correlated with an increase in subsequent hospital length of stay which increases nosocomial infection (Rutberg et

al., 2014), which we have seen a huge impact recently with the COVID-19 pandemic (Ponsford et al., 2021) which showed nosocomial-acquired cases had a median CFS score of 5 compared with a CFS of 3 in community-acquired cases which correlated with increased multi-morbidity in the nosocomial COVID-19 cases. It was estimated 16.4% cases were probably hospital-acquired with an in-patient mortality for nosocomial infection ranging from 38 to 42%, higher than mortality in those with community-acquired infection. Those with hospital-acquired infection were older and frailer (Ponsford et al., 2021). In patients with COVID-19 in hospital, increased mortality was associated with older age, increased frailty, renal failure, and increased serum c-reactive protein (Hewitt et al., 2014). In our sample, of the 164 patients who were admitted to an inpatient setting, 12.3% contracted nosocomial COVID-19. When looking at population demographics, our population was most similar to that used in the development of the Amb score. In addition, the sample was predominantly from a semi-rural area with historical areas of high deprivation. This is also a single centre study which is prone to the usual bias. Also, as a lot of the data needed was not routinely collected by OPAS so Zylab data via ED and WCP had to be reviewed to calculate the Amb score, GAPS score and START score plus CMI. This was done between December 2022 and February 2023. This required a separate data collection sheet to be developed and was prone to retrospective bias.

Frailty is a dynamic measure which is not fixed, and there can be a major bias in calculating the CFS especially when external factors such as cognitive impairment can limit someone's functional ability (British Geriatrics Society, 2021). This bias was reduced by all the CFS scores being checked by the same person (AJB), who was able to access everyone's CGA including physiotherapy and occupational therapy assessments. Identifying frailty by assigning a number, by any means is likely to be erroneous and it is clear that older people need individualised assessment by trained people. With respect to each scoring system, discriminators such as age range being greater than 80 years is going to have a limited value when the mean age is over 80 years old. Other discriminates such as ambulance arrival also have limited value as only 6% of the patients in the sample presented using their own transport. The Manchester Triage score also had limited value as 75.8% of patients had triage

category 3. The Amb score also had a score for acute confusion and there is a huge impact of delirium especially in the ED. Delirium is also more common in patients who spend more time in ED, with patients who remain in ED for longer than 10 hours are at a significant risk (Bo et al., 2016). In this sample the incidence of delirium or acute confusion was 67% in the discharged group and 66% in the admission group so had no impact. Considering the Modified START+ (Ebker-White et al., 2018) as nearly all the patients sampled would have scored for frailty and for multiple comorbidities, illustrated by the CCI, so this would not have made a difference to the ability of the STRAT score to discriminate who was suitable for SDEC in our population.

4.6 Overall conclusions

This analysis is the first comparing all three scores in the United Kingdom and in a specific frailer, older population. In our centre, the same day discharge was 78% for patients, despite having high incidences of delirium, high CFS and CCI, therefore, perhaps a more useful principle for promoting ambulatory care is to assume that all patients are suitable for ambulatory care until proved otherwise. This is in line with the principles of British Geriatric Society's principles of frailty (British Geriatric Society, 2021), RCP toolkit (Royal College of Physicians of London, 2014), and the Welsh Assembly Governments 6 goals (Welsh Assembly Government, 2021). There is evidence that early senior review can significantly reduce admission rates and inappropriate discharges (Cameron et al., 2014) and our service has consistent consultant geriatrician input with close links to our community teams and virtual wards, which certainly can aid to signpost patients most effectively. Further research is needed to delve into what factors can assist signposting who is suitable for SDEC in this unique population. The next chapter looks at how a frailty specific SDEC score was developed.

Chapter 5 - Developing a novel F. SDEC score for older, frailer adults

5.1 Aim

The aim of this section of work was to develop a novel SDEC score for older, frailer adults, called the F. SDEC score. Several scores have been developed to identify SDEC patients from ED triage and acute medical intakes. Scores are designed to improve system efficiency, overcrowding and patient experience but none have been developed for older adults. Previous work has shown that existing scores e.g. GAPS, START and Amb Score were not able to predict admission in our population (see Chapter 4).

5.2 Methods

5.2.1 Study design

The patients admitted to the OPAS and the medical SDEC at Morriston Hospital in Swansea has already been described in Chapter 2 of this thesis. Retrospective analysis was used to determine the parameters needed for the F. SDEC score

As described, OPAS is an ED service which accepts patients on frailty criteria such as patients aged over 70 years or who present with geriatric syndromes such as falls, delirium and unmet care needs. Associations between clinical outcomes with age, CCI and CFS were evaluated alongside a comparison of each ambulatory score, all scored retrospectively by me. Each score was calculated using the original papers. Re-presentation at 14 days, 1 month and 6 months plus 12-month mortality were also analysed. ED documentation was used to gain triage data and other information required by the scores. Further information was accessed using Welsh Clinical Portal (WCP) and Abertawe Bro-Morgannwg Clinical Portal (ABMUCP) where the ED Zylab information can be found. All the information was placed in a subset of the OPAS database in Microsoft excel. Microsoft forms were used to develop a data collection sheet. This was then used to quickly calculate the Amb score, GAPS score and START score plus CMI as none of this data was routinely collected by OPAS.

The same data was then collected for patients who presented to our medical SDEC. This was using the same ACP and consultant geriatrician workforce but using the OT and PT teams based in the Acute Medical Unit (AMU) in Morriston Hospital, Swansea. The opening of the AMU coincided with extended OPAS staffing and the acute medical service redesign process within Morriston Hospital (see Chapter 2.7.4), allowing the service to provide in reach into SDEC and AMU. There was a slight change in the type of patients seen, with less patients being seen with Falls, which is the core service of the ED OPAS team, whereas the same team saw more patients with Geriatric Syndromes. We were also able to provide an outpatient service via an Out of Hours referral form. This enabled patients to be seen quickly within 48 hours as an outpatient, where they could receive a CGA including polypharmacy review, therapies assessment and be referred to community services such as VW. OPAS proactively work with the VW in the community to optimise their care in the community, avoid difficulties in transition to discharge in terms of medication reconciliation and follow up care and prevent readmission or admission in the first place.

5.2.2. Statistical analysis

Continuous variables are presented as the mean ± standard deviation, whilst categorical variables are presented as the number (%). Statistical significance for continuous variables was determined using student's t-test and categorical variables were determined using Chi-squared test. Statistical significance was taken at $P<0.05$.

When validating the score, each variables weighting was determined by doing serial t-tests and chi-squared tests, in addition to using existing scores. Clinical expertise and decision making was also important, as each consultant had important insight into what should be part of the score.

5.2.3 Defining the F. SDEC score

Extensive analysis and discussion with consultant geriatricians provided the parameters to develop the F. SDEC score. It was important the score was able to capture medically unwell older adults (NEWS score / presenting complaint), delirium (4AT), frailty (CFS, CCI, age) and those with unmet care needs (questions around ability to cope) as these are the fundamentals of geriatrics. In the initial analysis described in section 4.4, the CFS was useful but was significant as a discriminatory variable. By further analysis of existing scores (GAPS, START, Amb), variables that appeared in all the scores were used as the basis for the F. SDEC score including age, gender, discharged within last 30 days and NEWS score. As independent variables they were not able to discriminate in the initial cohort.

Logistic regression was used to identify independent variables, and the adjusted odds ratios are quoted, with a $P<0.05$ as statistically significant. Ten independent factors were then used to formulate a frailty, focused SDEC score, termed here as the F. SDEC score. The weighting of each parameter was chosen to reflect the odds ratio (OR) of being discharged within 12 hours from the derivation data, such that those with an OR in favour of early discharge were given a higher value. Due to this being a F-SDEC score, negatively weighed values in the Amb score such as being waged over 80 years, were broken down in deciles in the F. SDEC score. When the score was applied to the derivation data, a score of 6.5 or above corresponded to an increased likelihood of being admitted for more than 24 hours (OR 0.3).

Bivariate analysis comparing each of the n9 F. SDEC score parameters in the 2 groups showed a high level of statistical significance, confirming the discriminatory ability of these variables, apart from whether the patient lived in a NH or RH. The initial validation score used whether the patient has a Package of Care (POC), was living with no formal support or was a resident in a care facility, either Nursing Home (NH) or Residential Home (RH). This was not able to accurately determine admission so this was changed to 2 questions, one on living situation which subdivided patients into

four categories: Alone with No POC/ Social support, Alone with POC/ Social support, Spouse/ Family or NH/ RH/ Other Long term (LT) care facility and another question on whether the patient or their family stated that they were coping at home or not coping at home. My initial analysis used AMT to assess cognition, but this was changed to the 4 A's Test for Delirium Screening (4AT), which is a better tool for discriminating between Dementia and Delirium (Anand et al., 2022). The presenting complaint was spilt into falls and other, as the majority of the patients we see are those who fall and they tend to be discharged same day after a CGA with community follow up. When bivariate analysis comparing each of the now ten F. SDEC score parameters in the two groups showed a high level of statistical significance, confirming the discriminatory ability of these variables. A cut-off points between a F. SDEC score of 6.5 was chosen as this gave the most favourable sensitivity of 73% whilst maintaining the 70% specificity. The specificity reflects the proportion of patients that the score had correctly predicted would be admitted for ≥24 hours. It is lower than the sensitivity because some of these patients were discharged within 12 hours. The F. SDEC score is in Appendix 9.8.

5.3.1 Results

5.3.1. Overall results

A total of 1011 patients were included for analysis from consecutive admissions from December 2022 to August 2023 with a mean age 82.3 ± 8.4 years and 414 (40.9%) were male. This total cohort comprised of patients admitted to OPAS via ED and SDEC via AMU. With respect to the presenting complaint, 629 (62.2%) of patients presented with falls. The mean CFS of the total cohort was CFS 5.3 (± 1.2) with a mean CCI of 8.0 (± 1.8) and 702 (69.3%) discharged same day. At 12 months' follow-up, 830 (82.1%) patients were alive and 181 (17.9%) had died. These data are presented in Table 5.1.

Variable	All n=1011	Discharged n=702	Admitted n=309	P value
Age (years)	82.3 (± 8.4)	82.2 (± 8.3)	82.3 (± 8.5)	P=0.91
Male (n, %)	414 (40.9%)	286 (40.7%)	128 (41.4%)	P=0.84
Female (n, %)	597 (59.1%)	416 (59.3%)	181 (58.6%)	
Fallers (n, %)	629 (62.2%)	459 (65.4%)	170 (55.0%)	**P<0.002**
NEWS	1.2 (± 1.7)	0.9 (± 1.3)	2.0 (± 2.1)	**P<0.001**
CFS	5.3 (± 1.2)	5.2 (± 1.2)	5.5 (± 0.9)	**P<0.001**
4AT	0.9 (± 1.6)	0.7 (± 1.4)	1.3 (± 1.9)	**P<0.001**
CCI	8.0 (± 1.8)	7.9 (± 1.8)	8.2 (± 1.7)	**P<0.05**
D/c 30 days (n, %)	215 (21.3%)	144 (20.5%)	71 (23.0%)	P=0.38
NH/ RH / LT care (n, %)	160 (15.8%)	107 (15.2%)	53 (17.1%)	**P<0.001**
Alone – POC (n, %)	88 (8.7%)	34 (4.9%)	54 (17.5%)	
Alone – no support (n, %)	214 (21.2%)	140 (19.9%)	74 (24.5%)	
Lives with someone (n, %)	549 (54.3%)	421 (59.9%)	128 (42.4%)	
Not coping at Home (n, %)	100 (9.9%)	19 (11.2%)	81 (5.6%)	**P<0.001**
Representation (n, %)				
2 weeks	118 (11.7%)	96 (13.7%)	22 (7.1%)	**P<0.003**
1 month	204 (20.2%)	158 (22.5%)	46 (14.9%)	**P<0.05**
6 months	314 (31.1%)	226 (32.2%)	88 (28.5%)	P=0.25
Alive (n, %)	830 (82.1%)	599 (83.3%)	231 (74.8%)	**P<0.001**
Dead (n, %)	181 (17.9%)	103 (14.7%)	78 (25.2%)	

Table 5.1: Patient characteristics of those who presented to the OPAS and SDEC unit, divided by whether they were admitted or discharged. *CFS* clinical frailty score, *NEWS* National Early Warning Score, *4AT* 4 'A's Test score, *CCI* Charlson comorbidity index, *D/c 30 days* discharged from hospital in last 30 days. Continuous variables are presented as the mean (± standard deviation), whilst categorical variables are presented as the number (%).

Of patients included in the analysis, 702 (69.3%) were discharged same and 309 (30.7%) were admitted to hospital. There was a significant difference in CFS between

those discharged and admitted (5.2 ± 1.2 vs 5.5 ± 0.9, P<0.001) and a difference in CCI (7.9 ± 1.8 vs 8.2 ± 1.7, P<0.05). There was a difference in presenting complaint, whether that was with falls or general medicine problems (459 fallers (65.4%) vs 170 fallers (55.0%), P<0.002). There was no difference in gender (40.7% male vs 41.4%, P=0.84) or age (82.2 ± 8.3 years vs 82.3 ± 8.5 years, P=0.91). Those who were discharged were more likely to represent to hospital at 2 weeks (96 (13.7%) vs 22 (7.1%), P<0.003) and 1 month (158 (22.5%) vs 46 (14.9%), P<0.05) but not 6 months (226 (32.2%) vs 88 (28.5%), P=0.25). There was a significant difference in the NEWS score between those discharged and admitted (0.9 ± 1.3 vs 2.0 ± 2.1, P<0.001) and the 4AT (0.7 ± 1.4 vs 1.3 ± 1.9, P<0.001) but no difference in whether the patient had been discharged 30 days prior (144 (20.5%) vs 71 (23.0%), P=0.38). Moreover, greater mortality was observed at 12 months follow-up in people who were admitted compared to those discharged (14.7% vs 78%, P<0.001). Self-reported or family reported not coping at home was significantly greater in those who were admitted (19 (11.2%) vs 81 (5.6%), P<0.001) and place of residence and who the patient lived with was also significant (P<0.001). These data are presented in Table 5.1.

When analysing the ability of different screening scores in relation to admission and discharge, only the F. SDEC score was significantly different between groups (P<0.001) and was able to predict admission. Of note, CFS, 4AT and CCI, were significantly different between groups and all are individual components of the F. SDEC score. None of the pre-existing validated scores: Amb, GAPS and START were able to significantly predict admission. We used a cut-off F. SDEC score >6.5 indicating admission (P<0.0001). Each individual variables score was determined using T-tests and Chi-squared analysis. This is shown in table 5.2.

Variable	All n=1011	Discharged n=702	Admitted n=309	P value
F. SDEC score	5.8 (± 2.1)	5.4 (± 1.8)	7.1 (± 2.5)	**P<0.001**
Amb	4.1 (± 1.7)	4.2 (± 1.7)	3.9 (± 1.8)	P=0.06
GAPS	22.3 (± 5.8)	22.2 (± 5.5)	22.5 (± 6.2)	P=0.39
START	23.6 (± 4.6)	23.5 (± 4.5)	23.7 (± 4.8)	P=0.47
CFS	5.3 (± 1.2)	5.2 (± 1.2)	5.5 (± 0.9)	**P<0.001**
4AT	0.9 (± 1.6)	0.7 (± 1.4)	1.3 (± 1.9)	**P<0.001**
CCI	8.0 (± 1.8)	7.9 (± 1.8)	8.2 (± 1.7)	**P<0.05**

Table 5.2. The different scores to predict admission. Data for OPAS and SDEC have been combined *F. SDEC Novel* Frailty score developed by A Burgess, *Amb* Ambulatory Score, *GAPS* Glasgow Admission Prediction Score, *START* Sydney Triage to Admission Risk Tool, *CFS* clinical frailty score, *4AT* 4 'A's Test score, *CCI* Charlson comorbidity index.

5.3.2 Results comparing patients from SDEC and OPAS

When comparing the two admissions streams SDEC and OPAS, there were significant differences between the patient characteristics who presented to each area. Of patients included in the analysis, OPAS had 777 attendances while SDEC had 234 over the period from December 2022 to August 2023. There was no difference in gender between OPAS and SDEC (39.4% Male vs 46.2%, P=0.06), whether the patient was admitted or discharged (30.5% vs 30.7%, P=0.93) or age (82.4 ± 8.5 years vs 81.8 ± 8.0 years, P=0.29). There was a no significant difference in CFS (5.3 ± 1.1 vs 5.2 ± 1.3, P=0.34), 4AT (0.9 ± 1.7 vs 0.8 ± 1.5, P=0.34) and CCI (8.0 ± 1.9 vs 8.2 ± 1.7, P=0.09). There was a difference in presenting complaint, whether that was with falls or general medicine (557 fallers (71.7%) vs 126 fallers (53.8%), P<0.001). There was a significant difference in the NEWS score between those who attended OPAS and SDEC (1.2 ± 1.6 vs 1.5 ± 1.7, P<0.02) but no difference in whether the patient had been discharged 30 days prior (157 (20.2%) vs 58 (24.8%), P=0.38). Moreover, greater mortality was observed at 12 months' follow-up in people who presented to

OPAS compared to those who presented to SDEC (21.1% vs 7.3%, $P<0.001$). Patients were also more likely to say they were not coping at home if they presented to OPAS [87 (11.2%) vs 13 (5.6%), $P<0.02$)]. Self-reported or family reported not coping at home was significantly greater in those who were seen in OPAS (87 (11.2%) vs 13 (5.6%), $P<0.02$) and place of residence and who the patient lived with was not significant between OPAS and SDEC ($P=0.07$). These data are presented in Table 5.3.

Variable	All n=1011	OPAS n=777	SDEC n=234	P value
Age (years)	82.3 (± 8.4)	82.4 (± 8.5)	81.8 (± 8.0)	P=0.29
Admitted (n, %)	309 (30.6%)	237 (30.5%)	72 (30.7%)	P=0.93
Male (n, %)	414 (40.9%)	306 (39.4%)	108 (46.2%)	P=0.06
Female (n, %)	597 (59.1%)	471 (60.6%)	126 (53.8%)	
Fallers (n, %)	629 (62.2%)	557 (71.7%)	72 (30.8%)	**P<0.001**
NEWS	1.2 (± 1.7)	1.2 (± 1.6)	1.5 (± 1.7)	**P<0.02**
CFS	5.3 (± 1.2)	5.3 (± 1.1)	5.2 (± 1.3)	P=0.34
4AT	0.9 (± 1.6)	0.9 (± 1.7)	0.8 (± 1.5)	P=0.34
CCI	8.0 (± 1.8)	8.0 (± 1.9)	8.2 (± 1.7)	P=0.09
D/c 30 days (n, %)	215 (21.3%)	157 (20.2%)	58 (24.8%)	P=0.13
NH/ RH / LT care (n, %)	160 (15.8%)	136 (17.5%)	24 (10.3%)	P=0.07
Alone – POC (n, %)	88 (8.7%)	67 (8.8%)	21 (8.5%)	
Alone – no support (n, %)	214 (21.2%)	160 (20.6%)	54 (23.1%)	
Lives with someone (n, %)	549 (54.3%)	414 (53.3%)	135 (57.7%)	
Not coping at H (n, %)	100 (9.9%)	87 (11.2%)	13 (5.6%)	**P<0.02**
Representation (n, %)				
2 weeks	118 (11.5%)	92 (11.8%)	26 (11.1%)	P=0.76
1 month	204 (21.7%)	171 (22.0%)	33 (14.1%)	**P<0.008**
6 months	314 (46.7%)	281 (36.2%)	33 (14.1%)	**P<0.001**
Alive (n, %)	830 (70.9%)	613 (78.9%)	217 (92.7%)	**P<0.001**
Dead (n, %)	181 (29.1%)	164 (21.1%)	17 (7.3%)	

Table 5.3: Patient characteristics of those who presented to the OPAS and SDEC units. *CFS* clinical frailty score, *NEWS* National Early Warning Score, *4AT* 4 'A's Test score, *CCI* Charlson comorbidity index, *D/c 30 days* discharged from hospital in last 30 days, *NH* being resident in a Nursing Home/ Other care facility, *POC* having a POC, *No support* No formal care support. Continuous variables are presented as the mean (± standard deviation), whilst categorical variables are presented as the number (%). This table compares the two admission streams.

When analysing the efficacy of different screening scores, when comparing OPAS and SDEC, only the GAPS score was significantly different between groups (P<0.001). This is shown in table 5.4.

Variable	All n=1011	OPAS n=777	SDEC n=234	P value
F. SDEC score	5.8 (± 2.1)	5.5(± 2.1)	6.2 (± 2.1)	P=012
Amb	4.1 (± 1.7)	4.2 (± 1.7)	4.0 (± 1.7)	P=0.17
GAPS	22.3 (± 5.8)	21.4 (± 5.8)	25.9 (± 5.3)	**P<0.001**
START	23.6 (± 4.6)	23.5 (± 4.7)	23.9 (± 4.0)	P=0.27
CFS	5.3 (± 1.2)	5.3 (± 1.1)	5.2 (± 1.3)	P=0.34
4AT	0.9 (± 1.6)	0.9 (± 1.7)	0.8 (± 1.5)	P=0.34
CCI	8.0 (± 1.8)	8.0 (± 1.9)	8.2 (± 1.7)	P=0.09

Table 5.4. SDEC vs OPAS using admission scores. *F. SDEC Novel* Frailty score developed by A Burgess, *Amb* Ambulatory Score, *GAPS* Glasgow Admission Prediction Score, *START* Sydney Triage to Admission Risk Tool, *CFS* clinical frailty score, *4AT* 4 'A's Test score, *CCI* Charlson comorbidity index.

5.3.3 Results of the OPAS data only

When only OPAS data was analysed, 541 (69.6%) were discharged same day whilst 236 (30.4%) were admitted to hospital. There was a significant difference in CFS between those discharged and admitted (5.3 ± 1.2 vs 5.5 ± 01.0, P<0.001) but no difference in CCI (7.9 (± 1.9) vs 8.1 (± 1.8), P=0.18). There was a difference in presenting complaint, whether that was with falls or general medicine (407 (75.2%) vs 151 (63.7%), P<0.001). There was no difference in gender (38.8% male vs 40.5%, P=0.67) or age (82.4 ± 8.4 years vs 82.4 ± 8.6 years, P=0.92). There was a significant difference in the NEWS score between those discharged and admitted (0.8 ± 1.2 vs 1.9 ± 2.1, P<0.001) and the 4AT (0.8 ± 1.5 vs 1.2 ± 1.9, P<0.001) but no difference in whether the patient had been discharged 30 days prior (109 (20.1% vs 48 (20.1%),

P=0.97). Moreover, greater mortality was observed at 12 months' follow-up in people who were admitted compared to those discharged (17.4% vs 29.7%, P<0.001). Self-reported or family reported not coping at home was significantly greater in those who were admitted (15 (2.8%) vs 72 (31.7%), P<0.001) and place of residence and who the patient lived with was also significant (P<0.003). These data are presented in Table 5.5.

Variable	All n=777	Discharged n=541	Admitted n=236	P value
Age (years)	82.4 (± 8.5)	82.4 (± 8.4)	82.4 (± 8.6)	P=0.92
Male (n, %)	306 (39.4%)	210 (38.8%)	96 (40.5%)	P=0.67
Female (n, %)	471 (60.6%)	331 (61.2%)	141 (59.5%)	
Fallers (n, %)	557 (71.7%)	407 (75.2%)	151 (63.7%)	**P<0.001**
NEWS	5.2 (± 1.4)	5.3 (± 1.2)	5.5 (± 1.0)	**P<0.02**
CFS	0.9 (± 1.7)	0.8 (± 1.5)	1.2 (± 1.9)	**P<0.001**
4AT	1.2 (± 1.6)	0.8 (± 1.2)	1.9 (± 2.1)	**P<0.001**
CCI	7.9 (± 1.8)	7.9 (± 1.9)	8.1 (± 1.8)	P=0.18
D/c 30 days (n, %)	136 (17.5%)	91 (16.8%)	45 (18.9%)	
NH/ RH / LT care (n, %)	67 (8.8%)	34 (5.7%)	33 (14.0%)	
Alone, POC (n, %)	160 (20.6%)	116 (21.4%)	44 (18.6%)	**P<0.003**
Alone, no support (n, %)	414 (53.3%)	300 (55.4%)	114 (48.3%)	
with someone (n, %)	87 (11.2%)	15 (2.8%)	72 (31.7%)	**P<0.001**
Not coping at home (n, %)	157 (20.2%)	109 (20.1%)	48 (20.1%)	P=0.97
Representation (n, %)				
2 weeks	92 (11.8%)	75 (13.9%)	17 (7.2%)	**P<0.008**
1 month	171 (22.0%)	131 (21.4%)	40 (16.9%)	**P<0.03**
6 months	281 (36.2%)	199 (36.8%)	82 (34.7%)	P=0.58
Alive (n, %)	613 (78.9%)	447 (82.6%)	167 (71.3%)	**P<0.001**
Dead (n, %)	164 (21.1%)	94 (17.4%)	70 (29.7%)	

Table 5.5: Patient characteristics of those who presented to the OPAS unit. *CFS* clinical frailty score, *NEWS* National Early Warning Score, *4AT* 4 'A's Test score, *CCI* Charlson comorbidity index, *D/c 30 days* discharged from hospital in last 30 days. Continuous variables are presented as the mean (± standard deviation), whilst categorical variables are presented as the number (%). This table focuses on whether the patient was admitted or discharged.

For the screening scores in OPAS, all scores apart from GAPS and CCI were significant at predicting admission, see table 5.6.

Variable	All n=777	Discharged n=541	Admitted n=236	P value
F. SDEC score	5.7 (± 2.1)	4.9(± 1.8)	6.8 (± 2.5)	**P<0.001**
Amb	4.2 (± 1.7)	4.3 (± 1.7)	3.6 (± 1.7)	**P<0.001**
GAPS	21.4 (± 5.8)	21.3 (± 5.8)	21.9 (± 5.6)	P=0.17
START	23.5 (± 4.7)	23.3 (± 4.9)	24.2 (± 3.9)	**P=0.03**
CFS	5.2 (± 1.4)	5.3 (± 1.2)	5.5 (± 1.0)	**P<0.02**
4AT	0.9 (± 1.7)	0.8 (± 1.5)	1.2 (± 1.9)	**P<0.001**
CCI	7.9 (± 1.8)	7.9 (± 1.9)	8.1 (± 1.8)	P=0.18

Table 5.6: OPAS screening tools. *F. SDEC Novel* Frailty score developed by A Burgess, *Amb* Ambulatory Score, *GAPS* Glasgow Admission Prediction Score, *START* Sydney Triage to Admission Risk Tool, *CFS* clinical frailty score, *4AT* 4 'A's Test score, *CCI* Charlson comorbidity index.

5.3.4 Results of the SDEC data only

When only SDEC data was analysed, 162 (69.2%) were discharged same day whilst 72 (30.8%) were admitted to hospital. There was a significant difference in CFS between those discharged and admitted (5.0 ± 1.3 vs 5.8 ± 0.8, P<0.001) but no difference in CCI (8.1 (± 1.8) vs 8.5 (± 1.3), P=0.09). There was no difference in presenting complaint, whether that was with falls or general medicine (53 (32.7%) vs 19 (26.4%), P=0.33). There was no difference in gender (46.9% male vs 44.4%, P=0.72) or age (82.4 ± 8.4 years vs 82.1 ± 8.1 years, po=0.68). There was a significant difference in the NEWS score between those discharged and admitted 1.1 (± 1.3) vs 2.3 (± 2.2), p <0.001) and the 4AT (0.6 (± 1.3) vs 1.4 (± 1.8), P<0.001) and no difference in discharged 30 days prior]35 (21.6%) vs 23 (31.9%), P=0.09]. Moreover, there was no increased mortality was observed at 12 months' follow-up in people who were admitted compared to those discharged (5.6% vs 11.1% P=0.13).

Self-reported or family reported not coping at home was significantly greater in those who were admitted (4 (2.5%) vs 9 (12.5%), $P<0.001$) and place of residence and who the patient lived with was also significant ($P<0.001$). These data are presented in Table 5.7.

Variable	All n=234	Discharged n=162	Admitted n=72	P value
Age (years)	81.8 (± 8.0)	82.4 (± 8.4)	82.1 (± 8.1)	P=0.68
Male (n, %)	108 (46.6%)	76 (46.9%)	32 (44.4%)	P=0.72
Female (n, %)	126 (53.4%)	86 (53.1%)	40 (55.6%)	
Fallers (n, %)	72 (30.8%)	53 (32.7%)	19 (26.4%)	P=0.33
NEWS	5.2 (± 1.3)	5.0 (± 1.3)	5.8 (± 0.8)	**P<0.001**
CFS	0.8 (± 1.7)	0.6 (± 1.3)	1.4 (± 1.8)	**P<0.001**
4AT	1.5 (± 1.7)	1.1 (± 1.3)	2.3 (± 2.2)	**P<0.001**
CCI	8.2 (± 1.7)	8.1 (± 1.8)	8.5 (± 1.3)	P=0.09
D/c 30 days (n, %)	24 (10.3%)	16 (9.9%)	8 (11.1%)	
NH/ RH / LT care (n, %)	20 (8.5%)	0 (0%)	20 (27.8%)	
Alone – POC (n, %)	54 (23.1%)	20 (12.5%)	34 (48.1%)	**P<0.001**
Alone – no support (n, %)	135 (57.7%)	125 (77.2%)	10 (13.8%)	
Lives with someone (n, %)	13 (5.6%)	4 (2.5%)	9 (12.5%)	**P<0.001**
Not coping at H (n, %)	58 (24.8%)	35 (21.6%)	23 (31.9%)	P=0.09
Representation (n, %)				
2 weeks	26 (11.1%)	21 (12.9%)	5 (6.9%)	P=0.17
1 month	33 (14.1%)	27 (16.7%)	6 (8.3%)	P=0.09
6 months	33 (14.1%)	27 (16.7%)	6(8.3%)	P=0.09
Alive (n, %)	217 (92.7%)	153 (94.4%)	64 (88.9%)	P=0.13
Dead (n, %)	17 (7.3%)	9 (5.6%)	8 (11.1%)	

Table 5.7: Patient characteristics of those who presented to the SDEC unit. *CFS* clinical frailty score, *NEWS* National Early Warning Score, *4AT* 4 'A's Test score, *CCI* Charlson comorbidity index, *D/c 30 days* discharged from hospital in last 30 days. Continuous variables are presented as the mean (± standard deviation), whilst categorical variables are presented as the number (%). This table focuses on whether the patient was admitted or discharged.

With respect to screening scores in SDEC all scores apart from CCI were significant at predicting admission, see table 5.8.

Variable	All n=234	Discharged n=162	Admitted n=72	P value
F. SDEC score	6.2 (± 2.1)	5.5(± 1.7)	7.2 (± 2.3)	**P<0.001**
Amb	4.0 (± 1.7)	4.4 (± 1.6)	2.9 (± 1.6)	**P<0.001**
GAPS	25.9 (± 5.3)	25.2 (± 4.8)	27.8 (± 5.9)	**P<0.002**
START	23.9 (± 4.0)	23.5 (± 3.9)	24.9 (± 4.1)	**P<0.03**
CFS	5.2 (± 1.3)	5.0 (± 1.3)	5.8 (± 0.8)	**P<0.001**
4AT	0.8 (± 1.7)	0.6 (± 1.3)	1.4 (± 1.8)	**P<0.001**
CCI	8.2 (± 1.7)	8.1 (± 1.8)	8.5 (± 1.3)	P=0.09

Table 5.8. SDEC screening tools *F. SDEC Novel* Frailty score developed by A Burgess, *Amb* Ambulatory Score, *GAPS* Glasgow Admission Prediction Score, *START* Sydney Triage to Admission Risk Tool, *CFS* clinical frailty score, *4AT* 4 'A's Test score, *CCI* Charlson comorbidity index.

As a screening tool in our sample in relation to admission and discharges in relation to the cut offs mentioned previously from the original validation scores, all the scores had a low positive predictive value (PPV) with equivocal sensitivity, specificity, negative predictive value (NPV) and area under the curve (AUC). The Amb score actually had the lowest Sensitivity and Specificity, despite having the greatest significance between groups when looking at individual variables. The CFS had truly little usability as a screening tool. The F. SDEC score was equivalent to previously tested scores. These data are presented in Figure 5.1 and Table 5.9.

Variable	Sensitivity	Specificity	PPV	NPV	AUC
F. SDEC	0.75	0.73	0.65	0.67	0.65
Amb	0.75	0.60	0.26	0.85	0.69
GAPS	0.93	0.89	0.23	0.75	0.62
START	0.99	0.97	0.23	0.95	0.65
CFS	0.20	0.26	0.17	0.24	0.53

Table 5.9: Comparing the screening ability of each score *F. SDEC Novel* Frailty score developed by A Burgess, *CFS* clinical frailty score, *Amb* Ambulatory Score, *GAPS* Glasgow Admission Prediction Score, *START* Sydney Triage to Admission Risk Tool, *Positive Predictive Value* (PPV), *Negative Predictive value* (NPV), *Area under Curve* (AUC).

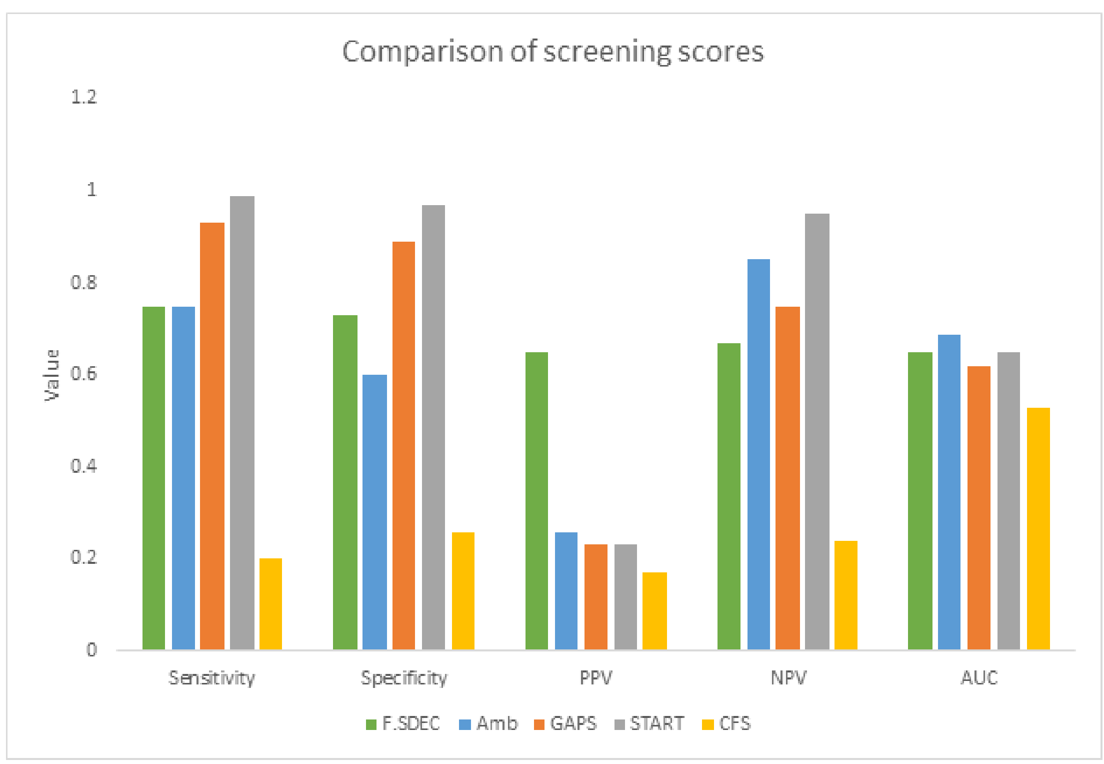


Figure 5.1: Comparing the screening ability of each score *F. SDEC Novel* Frailty score developed by A Burgess *CFS* clinical frailty score, *Amb* Ambulatory Score, *GAPS* Glasgow Admission Prediction Score, *START* Sydney Triage to Admission Risk Tool, *Positive Predictive Value* (PPV), *Negative Predictive value* (NPV), *Area under Curve* (AUC).

5.4 Conclusions

Frailty is an important determinant in identifying whether ambulatory care is appropriate. Within this chapter, data is presented to show that the F. SDEC score was comparable to existing scores such as Amb, GAPS and START.

Frailty is a dynamic measure and therefore can be a major bias in calculating the CFS especially when external factors such as cognitive impairment can limit someone's functional ability. This bias was reduced by all the CFS scores being checked by the same person (AJB), who was able to access each individual's CGA including physiotherapy and occupational therapy assessments. The CFS can be undertaken by any appropriately trained healthcare professional with training and support and is validated for people aged over 65. It is primarily a functional assessment focusing on a person's ability to undertake ADLs rather than a medical assessment. It is prone to bias especially in younger patients (Romero-Ortuno et al., 2016). The CFS should be based on how the person's function was two weeks prior to deterioration. This requires understanding of their global function and cognition which requires communication with the patient, their family members, and their careers as appropriate, which was done in this analysis. The BGS recommends frailty as a part of a global assessment (British Geriatric Society, 2014) and states that is inappropriate to use the (Rockwood) CFS as a method of identifying frailty without a formal clinical assessment. This is because the CFS is not validated for measuring improvement in individuals after an event such as an acute illness showing acute deterioration and should only be used after a CGA, which is how it was used here.

Assessing frailty in urgent care such as in the ED is complicated. Frailty syndromes themselves can mask medical conditions e.g. delirium as a result of COVID-19 infection and it is important to look at a whole systems approach. Frailty syndrome such as falls should always be considered as a route for a CGA (British Geriatric Society, 2014). The BGS comment that this should be assessment with a multi systems approach with shared care and goals (British Geriatric Society, 2014). An

assessment should include "assess clinical condition: measure vital signs and consider if any red flags are present which suggest the patient needs acute hospital care - such as hypoxia, significant tachycardia or hypotension," this is assessed by using the NEWS score as part of the F. SDEC score. The BGS also recommend a functional assessment, this is calculated using the CFS in the F. SDEC score which is calculated after a CGA which comprises of an OT and PT assessment. This should also include the identification of frailty syndromes such as falls and delirium, which the F. SDEC score assess for using the 4-AT for delirium and asks about falls specifically.

When looking at delirium specifically, we know the coexistence of frailty and delirium significantly increased the risk of a prolonged hospital stay. Patients who remain in ED for longer than 10 hours were at a significant risk of developing delirium (Bo et al., 2016) and an ED-stay associated delirium increases the patient's chance of being hospitalized and extended their stay by approximately a week (Émond et al., 2017). The BGS recommends that delirium is assessed at emergency presentation of the frailer, older person (British Geriatric Society, 2014) and the 4-AT is used here as part of a medical review looking at other causes such as infection. 4-AT can be used as an independent predictor of 30-day mortality, hospital length of stay and time at home in the year following the admission (Anand et al., 2022). As part of the F. SDEC score, 4-AT was significantly different between those admitted and discharged in OPAS and SDEC populations and overall. This shows the importance of delirium as part of a CGA and should be part of any assessment of the older person.

This methodology has some important limitations. Firstly, it is a retrospective study which is prone to usual biases associated with this type of study. To minimise this, patients with missing data were excluded from the analysis. Due to some patients being recently added to the databank, these do not have mortality outcomes at 12 months currently. When looking at comparing our SDEC and OPAS populations, despite having similar demographic data and CFS scores, there was significant differences in the GAPS score only. This is likely due to the NEWS score as this is part

of the GAPS score only and was significantly different between groups. Interestingly when the SDEC and OPAS populations were analysed separately, Amb and START were also significantly different in those who were admitted and discharged with GAPS also being significant in SDEC. When looking at the whole sample, only F. SDEC was significant, alongside CFS, CCI and 4AT which the F. SDEC score incorporates. The F. SDEC incorporates elements of all the other scores, and the smaller sample size is likely to have a factor into why the other scores were significant.

5.5 Overall Conclusions

The efficacy of the F. SDEC score is comparable to the results derived in validation cohorts of existing and recommended scores. The F. SDEC score is currently being prospectively evaluated in our new integrated frailty hub which comprising of patients from all streams within the hospital and community. This includes direct from the ambulance service, from nursing homes, escalations from the ACT in the community, SDEC, ED and the AMU. Frailty is a dynamic measure which is not fixed, and there can be a major bias in calculating the CFS especially when external factors such as cognitive impairment can limit someone’s functional ability. Evidence shows that clinical judgement, alongside an MDT providing a CGA is gold standard care, which is difficult to provide using traditional methods.

The F. SDEC score can hopefully be used to streamline this process and help identify patients who are suitable to be discharged on the right pathway early on, making sure they get care in the right place and reducing length of stay. The earlier we can transfer care to a VW or community service such as ACT will be better for patient care and flow and LOS. This is the first frailty specific ambulatory score developed and multi-centred tested is needed to further prove its efficacy.

Chapter 6 – Chronic disease in fallers and de-prescribing

6.1 Introduction

NICE define a fall as ‘an unintentional event that results in a person coming to rest on the ground or another lower level, not as a result of a major intrinsic event (such as stroke or epilepsy) or overwhelming hazard (such as being pushed),’ (NICE, 2013). ‘A simple fall is defined as one resulting from a chronic impairment of cognition, vision, balance, or mobility. It is distinguished from a collapse caused by an acute medical problem, such as an acute arrhythmia, transient ischaemic attack, or vertigo.’ Falls are the leading cause of fatal and non-fatal injuries for those who are aged greater than 65 years old. Falls are responsible for over 36,000 deaths in older adults each year in the UK. In addition, falls are a huge burden on emergency services with around 1,200 admissions per day of older adults who falls, which is around 435,000 people a year. The cost to the NHS from falls by seniors exceeds £2.3 billion per year and is projected to surpass £3.6 billion by 2030 (Caring for Care, 2024)

Falls are often multifactorial in origin (Rapp et al., 2014) and are more common in nursing home residents and those with frailty (Robertson et al., 2012). In addition, falls are the leading cause of death due to unintentional injury in people aged over 65 years (Shumway-Cook et al., 2009) in the USA and are the second cause of unintentional injury deaths worldwide (Tinetti et al., 1988). In England between 2020 to 2021, there were more than 2023 per 100,000 ED hospital admissions related to falls in patients aged over 65 years, with 5174 per 100,000 in patients aged ≥80 years (Centres for Disease Control and Prevention, 2016). Of note, recurrent falls are responsible for significant morbidity and mortality in older adults. In addition to physical injury, recurrent falls may result in “post-fall syndrome,” where an older person refuses to move for fear of recurrent falls and further injury. It is estimated that one-third of these individual’s experience one or more falls per year, while 10% experience multiple falls annually (Just et al., 2020 and Deandrea, 2010). The risk of falls is higher in octogenarians and nonagenarians, with an annual incidence of 50% (Aging Collaborators, 2022, World Health Organisation, 2021, Office for Health Improvement & Disparities, 2021 and Public Health England, 2022).

Frailty is a complex intermingling of physical, social, and psychological factors that all lead to a reduction in reserve and an ability to maintain homeostasis leading to an increased risk of disability from external stressors (Rodríguez-Mañas et al., 2013). This is different to multimorbidity which is universality defined as the “concurrent occurrence of two or more chronic diseases” (Chew-Graham et al., 2019). This is different to frailty as frailty comprises of subclinical losses of reserve across multiple systems, which can run in parallel with multi-morbidity (Weiss, 2011). Both frailty and multi-morbidly are associated with adverse outcomes such as increased hospital attendance and length of stay (Weiss, 2011). When considering frailty or multi-morbidity it is important to be aware that most frail individuals present with multi-morbidity, however fewer multi-morbid individuals present with frailty (Weiss, 2011). Many chronic diseases such as diabetes and heart failure may coincide and give an overall picture of frailty being the dominant symptom (Bhattarai et al., 2024).

In relation to the complexities of falls, many chronic conditions increase risk (Immonen et al., 2020), and are more prevalent in older, frailer adults. These include dementia and cognitive impairment (Tinetti et al., 1988), Parkinsons disease (Stolze et al., 2004) and diabetes (Yang et al., 2016). Age alongside multi-morbidity and chronic disease leads to an increased number of falls (Teixeira et al., 2019 and SIbley et al., 2014). There is disparity between measuring the number of chronic conditions that are associated with a higher risk of falling and whether these conditions form part of a falls assessment (Immonen et al., 2020). The CCI, is an assessment tool designed specifically to predict long-term mortality associated with the accumulation of comorbidities and has been validated in multiple populations (Charlson et al., 2022). The addition of frailty data to assess the physiological effects of an acute illness can guide mortality prediction (Hollinghurst et al., 2019).

6.2 Chapter Aims

The aim was to examine whether people with specific chronic diseases such as type 2 diabetes mellitus (T2D) and alcohol excess who were admitted to hospital with a fall and to assess whether those who presented with aT2D or alcohol excess history were more likely to have greater frailty, co-morbidity burden, or risk factors for falls. This is because taking an alcohol history or checking for diabetes are not routinely part of a falls assessment. The second aim is to examine prescribing practice and whether different de-prescribing tools can be used in the acute setting to improve patient outcomes and experience. Therefore, the aims of this chapter are to analyse various chronic diseases in older adults who present to the ED with falls. The chapter is divided into the specific chronic disease and analysed accordingly.

The aims are:

1 – The aim of this study was to apply the STOPPFrail (Screening Tool of Older Persons Prescriptions in Frail adults with limited life expectancy) Version 2 criteria to identify potentially inappropriate medications (PIMs) in frail older adults with poor predicted 1-year survival and to determine the proportion of older adults in which STOPPFrail criteria are applicable and to measure the prevalence of STOPPFrail PIMs and identify potential medication cost savings.

2 – To examine whether people with T2D admitted to hospital with a fall, were more likely to have greater frailty, co-morbidity burden, or risk factors for falls and use guidelines to assist with deprescribing

3 - To examine whether people admitted to hospital with a fall and had a history of alcohol excess, were more likely to have greater frailty, co-morbidity burden, or risk factors for falls. It was also examined whether people with a history or current alcohol abuse associated with poor clinical outcomes in a cohort of patients admitted to the ED with a fall. A second aim was to see whether the POSAMINO criteria could be used to identify PIMs to assist with deprescribing

6.3. Aim 1 - STOPPFrail

The aim of this study was to apply the STOPPFrail (Screening Tool of Older Persons Prescriptions in Frail adults with limited life expectancy) Version 2 criteria to identify potentially inappropriate medications (PIMs) in frail older adults with poor predicted 1-year survival and to determine the proportion of older adults in which STOPPFrail criteria are applicable and to measure the prevalence of STOPPFrail PIMs and identify potential medication cost savings.

6.3.1 Introduction

As people live with increasing frailty, it is important that shared decision making occurs around prescribing and polypharmacy especially when the person is in the last 6 months of life. This would include medications such as those used to manage hypertension, hyperlipidaemia, and cognitive impairment (Lavan et al, 2019).

Those who live in NH and other care facilities, despite being frail with multiple co-morbidities tend to have several medications prescribed. The rate of polypharmacy (5–9 drugs) is 48.7% and excessive polypharmacy (≥10 drugs) is 24.3%, in nursing home residents (Onder et al., 2012). NH residents tend to be older (Ribbe et al., 1997) with 25% of adults aged over 85 years living in NH and this is likely to increase as the population demographic changes. Due to frailty and multi-morbidity, within 1 year of NH admission, 65% of residents have died (Kelly et al., 2010), hence it is important to prioritise quality of life rather than medications that have negatable long-term benefit. Over 50% of NH residents (Kojima 2015) compared to 17% of community dwelling older adults are considered frail (Santos-Eggimann, et al., 2009). Older adults are more likely to experience Inappropriate prescribing (IP), which is where medications are overprescribed, under prescribed or mis prescribed medications especially in the presence of other chronic disease as the focus lacks a holistic approach looking at other medications, co-morbidities, functional and cognitive status as well as treatment goals and life expectancy (Tija et al., 2014).

There are some tools to aid deprescribing in older adults and to help identify PIMs (Potentially Inappropriate Medications). These tools include STOPP/START (STOPP (Screening Tool of Older Persons' potentially inappropriate Prescriptions) and START (Screening Tool to Alert to Right Treatment) (O'Mahony et al., 2015), FORTA (Fit for the aged) criteria (Kuhn-Thiel, Weiss and Wehling, 2014) and Beer's criteria (ABCUE, 2015). These tools are designed to aid clinicians in identifying PIMS in older adults, not specific to frailer adults with a limited life expectancy. There is also the NORGEP-NH (The Norwegian General Practice--Nursing Home criteria) (Nyborg et al., 2015) which is designed for use in NH only. The STOPPFrail was designed to fill this gap (Lavan et al., 2017). This gives 27 PIMs in frail, older adults with a limited life expectancy and should be used in parallel with clinical judgement to enable clinicians to make informed decisions around medication reviews and treatment aims. Clinicians who have expertise in recognising frailty and those older adults who are nearing the end of their lives are who the tool was designed to be used by (Curtin et al., 2021). STOPPFrail has some similarity in format to STOPP/START as the medications are listed by physiological system. A second version of STOPPFrail was developed (Curtin et al., 2021) as it was thought that the original version was too rigid and did not allow shared decision making with patients and their families and some common medications were not included in the original version.

There have been limited studies using the STOPPFrail in clinical practice. When the criteria were used by physicians from many different specialties, there was significant inter-rater reliability with a kappa coefficient of 0.76 (Hae et al., 2022). The tool also guided clinicians to make decisions that were like traditional' geriatrician-led deprescribing (Hae et al., 2022). STOPPFrail has also shown that for each additional medication that an older adult is prescribed, there is an increased chance of identifying a PIM of 58% (Lavan et al., 2019). The STOPPFrail criteria can be applied to most NH residents with at least 65% being eligible and 90% are prescribed more than 1 PIM (Lavan et al., 2019).

Therefore, the aim of this study was to apply the STOPPFrail (Version 2) criteria to identify potentially inappropriate medications (PIMs) in frail older adults with poor predicted one-year survival. This study aimed to determine the proportion of older adults in which STOPPFrail criteria are applicable and to measure the prevalence of STOPPFrail PIMs and identify potential medication cost savings. This is the first of its kind to apply the STOPPFrail in an ED setting with a comprehensive geriatric assessment.

6.3.2 Methods

6.3.2.1 Study design

This was a retrospective analysis of patients admitted to the OPAS at Morriston Hospital in Swansea, as described in Chapter 2. The OPAS databank was retrospectively analysed for people with frailty admitted with a fall between June 2020 and December 2022 and examined age, medication usage, CCI and CFS and applied STOPPFrail (Version 2) in patients who fulfilled STOPPFrail criteria after a geriatrician-led multidisciplinary assessment. Medication costs were identified using the Medoptimise medication review software. This work was undertaken as part of a service evaluation of the function of OPAS within the ED. The STOPPFrail (Version 2) criteria is in Appendix 9.9.

6.3.2.2 Statistical analysis

Continuous variables are presented as the mean ± standard deviation, whilst categorical variables are presented as the number (%). Statistical significance for continuous variables was determined using student's t-test and categorical variables were determined using Chi-squared test. Statistical significance was taken at $P<0.05$.

6.3.3 Results

In total 279 patients were prospectively assessed over 12-week period between June-August 2022 with a mean age 84.4 ± 6.7 years and 106 (38.0%) were male. The mean CFS of the total cohort was 5.4 ± 1.1 and CCI was 6.1 ± 1.2 and the mean number of medications used was 8.3 ± 3.7 per patient. At 12 months' follow-up, 187 (67.0%) patients were alive and 92 (33.0%) had died. This data is presented in Table. 6.1.

Variable	All n=279	STOPPFrail n=47	Not STOPPFrail n=232	P value
Age	84.4 (± 6.7)	87.7 (± 6.7)	83.8 (± 6.6)	P<0.001
Male	106 (38.0%)	17 (36.2%)	89 (38.4%)	P=0.76
Female	172 (62.0%)	30 (63.8%)	(142 (61.6%)	
CFS	5.4 (± 1.1)	7.2 (± 1.1)	5.1 (± 0.7)	P<0.001
Fall	88 (31.5%)	28 (59.6%)	60 (25.9%)	P<0.001
CCI	6.1 (± 1.1)	6.7 (± 1.8)	5.6 (± 1.3)	P<0.001
Alive	187 (67.0%)	17 (36.2%)	170 (74.4%)	P<0.001
Dead	92(33.0%)	30 (63.8%)	62 (25.6%)	

Table 6.1: Patient characteristics of those admitted to the OPAS unit. *CFS* clinical frailty score, *CCI* Charlson comorbidity index. Continuous variables are presented as the mean (± standard deviation), whilst categorical variables are presented as the number (%).

When analysing STOPPFrail, 47 patients (16.8%) met STOPPFrail eligibility criteria, see appendix 9.9, with a mean age 87.7 ± 6.7 years and 17 (36.2%) were male. The mean CFS of this cohort was 7.2 ± 1.1 and CCI was 6.7 ± 1.8. Compared to people who were not STOPPFrail eligible, people who were STOPPFrail eligible were more

likely to be frail as per CFS (7.2 (± 1.1) vs 5.1 (± 0.7), P<0.001), present with a fall (28 (59.6%) vs 60 (25.9%), P<0.001) and have greater CCI (6.7 ± 1.8 vs 5.6 ± 1.3, P<0.001). Moreover, greater mortality was observed at 12 months' follow-up in people who were STOPPFrail eligible (63.8% vs 25.6%, P<0.001). There was no difference in gender between groups (P=0.76). This data is presented in Table. 6.1.

The mean number of medications in the STOPPFrail group was 8.4 (± 3.2). Those STOPPFrail eligible were prescribed 397 medications, of which 104 were PIMs. At least 1 PIM was identified in 42 eligible patients (89.3%) with the mean number of PIMs per person was 2.2 (± 1.3). Most common PIMs were antihypertensives in patients with a recorded systolic blood pressure lower than 130mmHg (23 pts; 22% identified PIMs), statins in 21 patients (20% PIMs) and calcium supplements 11 pts (10.5% PIMs) and vitamin D/calcium 15 pts (14.4% PIMs). When using the MedOptimise software, £12,589.39 of medication cost savings were identified using the STOPPFrail criteria. This is shown in Figure 6.1.

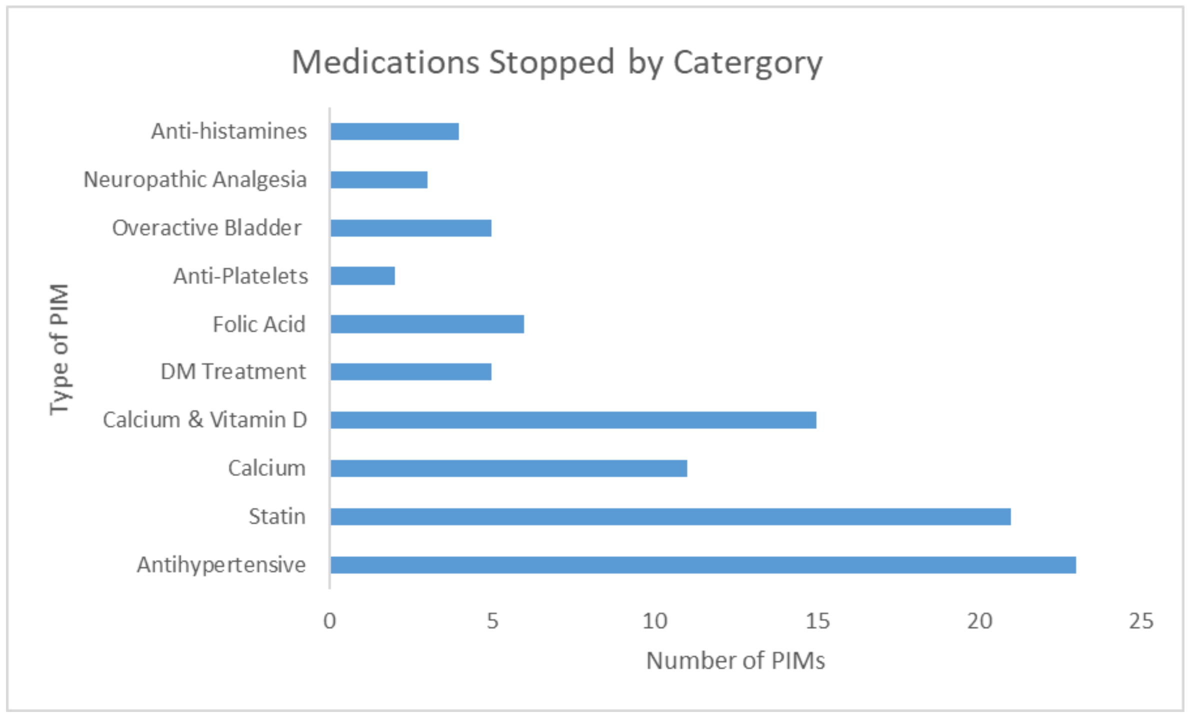


Figure 6.1: Number of PIMs per STOPPFrail. *PIM* potentially inappropriate medications

6.3.4 Conclusions

This study has shown the benefit of the STOPPFrail criteria to identify potentially inappropriate prescriptions and medication cost savings, however the ability of the criteria to prevent adverse events for patients is unknown. Even though not all patients fulfilled STOPPFrail criteria, 16.8% of screened patients were STOPPFrail eligible with PIMs identified in 89.3%. The number of PIMs was indicative of the number of chronic diseases and frailty that is shown in this population. Every patient is an individual and it is important that shared decision making occurs especially as everyone has a choice about whether to continue a PIM, even once it has been explained that the risks outweigh the benefits (Lavan et al., 2019). Most older patients, once the medications have been explained, would be happy to discontinue multiple medications (Lavan et al., 2019).

With respect to the STOPPFrail tool, those who were identified were frailer as per CFS and did have more co-morbidities as per CCI, so the tool was able to identify the correct patient population. The downside of using any tool is that they do not capture all patients and is important that this is used as part of a CGA, by trained professionals rather than in isolation. Previous research showed the rate of STOPPFrail-PIM decreased significantly at discharge after the geriatric multidisciplinary team care (Lavan et al., 2017).

In conclusion, STOPPFrail was able to identify several PIMs in a front door setting and when used as part of a CGA, can help clinicians deprescribe. Those who were identified as being eligible also had increased mortality, frailty, and multi-morbidity. STOPPFrail has been incorporated into the routine structured medication review process within the local services. This was the first study of its kind applying the STOPPFrail criteria in an ED population.

6.4. Aim 2 - Older people with Type 2 Diabetes Mellitus (T2D)

To examine whether people with T2D admitted to hospital with a fall, were more likely to have greater frailty, co-morbidity burden, or risk factors for falls and use guidelines to assist with deprescribing

6.4.1 Introduction

Many chronic diseases such as diabetes and liver disease may coincide and give an overall picture of frailty being the dominant symptom (Bhattarai et al., 2024). There is a complex intermingling of frailty and chronic disease, a consequence of both is falls. Falls are associated with several different chronic diseases including T2D (Immonen et al., 2020). Many complications seen in T2D are associated with frailty such as cognitive impairment, reduced physical reserve, and limited physical activity plus linked to other co-morbidities (Strain et al., 2021).

An individualised approach should be used when treating older adults with frailty and T2D. Recently, the Joint British Diabetes Societies for Inpatient Care (Joint British Diabetes Societies for Inpatient Care, 2019), Association of British Clinical Diabetologists (Association of British Clinical Diabetologists, 2019) and National Institute for Health and Care Excellence (NICE, 2018) have released updated guidance on the management of diabetes in people with significant frailty, usually defined as a CFS of 5 or more. One in six hospital beds are occupied by a person with diabetes and most of these are older adults. These patients have a greater length of hospital stay, morbidity and mortality than those without diabetes [(National Diabetes Inpatient Audit England, 2019). Careful consideration of medications used to treat type T2D whilst avoiding clinical harm associated with some classes of diabetes medication are needed for this group. For example, medications such as gliclazide or insulin are associated with hypoglycaemia, whilst sodium-glucose co-transporter 2 (SGLT-2) inhibitors may be associated with diabetic ketoacidosis and urogenital infections (Tavener et al., 2022) as older patients with diabetes particularly those with catheters should be regularly reviewed for urinary infections.

People with diabetes aged over 65 years should receive a risk factor evaluation for conditions and factors associated with risk of hospital admissions including suboptimal-controlled diabetes, history of hypoglycaemia, poor nutritional intake, cardiovascular risk factors, co-morbidities including recent disabling stroke or fracture, polypharmacy with potential drug interactions, unmet care needs and activities of daily living, risk of hyperglycaemic emergencies such as diabetic ketoacidosis (DKA) or hyperosmolar hyperglycaemic state (HHS) and risk of falls (Strain et al., 2021).

Due to the complex interaction between frailty and multi-morbidity, individualised care plans detailing co-morbidities, presence of frailty or functional loss (including cognition), individualised agreed goals of treatment, medications, frequency of monitoring, target capillary blood glucose and HbA1c, blood pressure and serum lipid levels are helpful alongside an assessment of the older person’s ability, capacity and preference for self-management of diabetes (including blood-glucose testing and injection administration). For those who rely on community support from nursing teams to administer medications such as insulin, there should be robust care planning and routines around the timing of medications with meals and blood glucose testing are managed to reduce risk of hyper or hypoglycaemia (Strain et al., 2021). The discharge process should ensure that the older person, their carers and primary or community diabetes teams fully understand the care plan and any post-discharge medicines adjustments that may be.

As with any person with diabetes, the target HbA1c should be individualised based on co-morbidities, frailty and patient wishes. Whilst NICE (NICE 2018) recommend a target HbA1c 48-58mmol/mol (6.5%-7.5%) in most people with diabetes, some people benefit from a less stringent glycaemic target (e.g. those with frailty, falls or reduced life expectancy). This is because tighter HbA1c targets are typically associated with polypharmacy and an increased falls and hypoglycaemia risk, resulting in a risk of harm. The JBDS-IP (Joint British Diabetes Societies for Inpatient Care. 2019)

recommend relaxing the target HbA1c up to 70mmol/mol (8.5%) and random blood glucose targets 6.7-11.1 mmol/L in people with significant frailty (CFS ≥ 5). Often, the goal of treatment in people with diabetes and frailty is to achieve a good quality of life rather than tight glycaemic control. In practice this means avoiding diabetes-related emergencies such as hypoglycaemia, DKA and HHS using the least number of medications possible with the safest side-effect profile.

With respect to the association between T2D and falls risk in the frail or older person, there is some published literature. One meta-analysis observed that older adults with T2D are associated with excessive falls risk compared to people without T2D, with greater risk in insulin-treated patients (Yu Yang et al., 2016). Hypoglycaemia induced by intensive glycaemic control or chronic complications such as peripheral neuropathy and retinopathy may also increase the risk of falls. The mechanisms responsible for the falls risk in older patients are multifactorial and possible contributing factors include peripheral neuropathy, visual impairment, vestibular dysfunction, cognitive impairment, musculoskeletal/neuromuscular complications, or hypoglycaemia associated with insulin use (Crews et al., 2013). Insulin treatment has previously been associated with excessive risk of falls, which may be related to longstanding diabetes complications, impaired hypoglycaemic awareness, and the presence of other co-morbidities such as heart disease and chronic kidney disease (Crews et al., 2013).

The aim was to examine whether people with T2D admitted to hospital with a fall, were more likely to have greater frailty, co-morbidity burden, or risk factors for falls. It was also examined whether people with T2D had a worse outcome, including mortality, following admission and whether the use of insulin or gliclazide was associated with poor clinical outcome in a cohort of patients admitted to the ED with a fall.

6.4.2 Methods

6.4.2.1 Study design

This was a cross-sectional study examining patients admitted to the OPAS at Morriston Hospital in Swansea. The OPAS databank was analysed for people with T2D admitted with a fall between June 2020 and September 2022. Age was compared alongside medication usage, CCI and CFS (Hollinghurst et al., 2019) in people with or without T2D. We also explored biochemical parameters such as HbA1c, and data related to hypoglycaemia on admission. Patient mortality was checked prospectively at 12 months by reviewing electronic health records and evaluated postcode data to derive the WIMD to compare these measures in people with or without T2D. This work was undertaken as part of a service evaluation of the function of OPAS within the ED.

6.4.2.2 Statistical analysis

Continuous variables are presented as the mean ± standard deviation, whilst categorical variables are presented as the number (%). Statistical significance for continuous variables was determined using student's t-test and categorical variables using Chi-squared test. Statistical significance was taken at $P<0.05$. Logistic regression was performed using SPSS (Version 28) to evaluate associations between T2D and its treatment with one-year mortality.

6.4.3 Results

A total of 1,081 patients were included for analysis, with a mean age 84.0 ± 7.9 years and 436 (40.3%) were male. The mean CFS of the total cohort was 5.3 ± 1.3 and CCI was 6.2 ± 2.2, and the mean number of medications used was 8.3 ± 3.7 per patient. At 12 months' follow-up, 831 (76.9%) patients were alive and 250 (23.1%) had died. The mean WIMD decile of the total cohort was 5.4 ± 3.0.

Of patients included in the analysis, 294 (27.2%) had T2D and 787 (72.8%) people did not have T2D. People with T2D had a mean HbA1c 53.9 ± 15.8 mmol/mol [7.1%]. Of those with T2D, 175 (59.5%) and 240 (81.6%) had a HbA1c ≤53 mmol/mol [7.0%] and ≤64 mmol/mol [8.0%], respectively. In total, 48 (16.3%) people with T2D admitted with a fall were identified to have a capillary blood glucose below 4.0 mmol/L on admission. Compared to people without T2D, people with T2D were more likely to be male (53.1% vs 35.5%, $P<0.001$), take a greater number of medications (9.1 ± 3.6 vs 8.0 ± 3.7, $P<0.001$) and have greater CCI (7.0 ± 2.2 vs 5.9 ± 2.1, $P<0.001$). Moreover, greater mortality was observed at 12 months' follow-up in people with T2D compared to those without T2D (27.2% vs 21.6%, $P<0.05$). Logistic regression was performed using mortality as the observed variable, with confounding variables of age, sex, CFS and T2D diagnosis. This observed that older age ($P<0.001$), male sex ($P<0.001$), greater CFS ($P<0.001$), and a diagnosis of T2D ($P<0.05$) significantly predicted 1-year mortality in the total cohort. The mean WIMD decile of those with T2D was 5.3 ± 2.9 compared to those without T2D 5.5 ± 3.0. ($P=0.30$). These data are presented in Table 6.2.

Variable	With diabetes n=294	Without diabetes n=787	P value
Age	83.5 (± 7.6)	84.2 (± 8.1)	P=0.18
Male	156 (53.1%)	280 (35.6%)	P<0.001
Female	138 (46.9%)	507 (64.4%)	
CFS	5.3 (± 1.2)	5.3 (± 1.3)	P=077
Number of medications	9.1 (± 3.6)	8.0 (± 3.7)	P<0.001
CCI	7.0 (± 2.2)	5.9 (± 2.1)	P<0.001
Alive	214 (72.8%)	617 (78.4%)	P<0.05
Dead	80 (27.2%)	170 (21.6%)	
Deprivation decile	5.3 (± 2.9)	5.5 (± 3.0)	P=0.30

Table 6.2: Patient characteristics of those admitted to the OPAS unit. *CFS* clinical frailty score, *CCI* Charlson comorbidity index. Continuous variables are presented as the mean (± standard deviation), whilst categorical variables are presented as the number (%).

In people with T2D, 82 (27.9%) were prescribed insulin and/or gliclazide, with the remainder prescribed oral agents or treated with dietary measures alone. At 12 months follow-up, people with T2D prescribed insulin and/or gliclazide had significantly greater mortality (36.6% vs 23.6%, P<0.05). People with T2D prescribed insulin and/or gliclazide had a significantly higher HbA1c than those treated with dietary measures or oral agents (65.5 ± 17.2 mmol/mol [8.2] vs 48.9 ± 12.1 mmol/mol [6.6%]) but had a significantly greater frequency of hypoglycaemia observed on admission to hospital (35.4% vs 11.8%, P<0.001). The mean WIMD decile of those with T2D prescribed insulin and/or gliclazide was 5.2 ± 2.6 compared to those without T2D 5.3 ± 3.1. (P=0.85). These data are presented in Table 6.3. After excluding those prescribed

insulins, the significant difference in greater HbA1c (61.5 ± 14.5 mmol/mol vs 49.1 ± 12.1 mmol/mol, P<0.001) and frequency of hypoglycaemia on admission to hospital (21.4% vs 8.9%, P<0.001) remained, though the greater mortality previously observed was no longer statistically significant (35.7% vs 25.0%, P=0.15). Moreover, people with T2D prescribed insulin had a greater HbA1c (69.4 ± 18.1 mmol/mol vs 61.5 ± 14.5 mmol/mol, P<0.05) and frequency of hypoglycaemia (55.6% vs 21.4%, P<0.05) than those prescribed gliclazide, though the greater 12-month mortality in those prescribed insulins was not statistically significant (44.4% vs 35.7%, P=0.47).

Variable	Gliclazide/Insulin n=82	Other n=212	P value
Age	82.5 (± 7.9)	83.9 (± 7.4)	P=0.18
Male	33 (40.2%)	105 (49.5%)	P=0.25
Female	49 (59.8%)	107 (50.5%)	
CFS	5.3 (± 1.3)	5.3 (± 1.2)	P=0.96
Number of medications	9.8 (± 3.8)	8.8 (± 3.5)	P=0.07
Alive	52 (63.4%)	162 (76.4%)	P=0.02
Dead	30 (36.6%)	50 (23.6%)	
HbA1c	65.5 (± 17.2)	48.9 (± 12.1)	P<0.001
Hypoglycaemia on admission	29 (35.4%)	25 (11.8%)	P<0.001
CCI	7.2 (± 3.6)	6.9 (± 2.1)	P=0.36
Deprivation decile	5.2 (± 2.6)	5.3 (± 3.1)	P=0.85

Table 6.3: Characteristics and outcomes of people with T2D taking hypoglycaemia-inducing agents or other diabetes medications. *CFS* clinical frailty score, *CCI* Charlson comorbidity index, *HbA1c* glycated haemoglobin. Continuous variables are presented as the mean (± standard deviation), whilst categorical variables are presented as the number (%).

People with T2D who were deceased at 12 months' were more likely to be male (58.8% vs 42.5%, P=0.01), have greater CFS (5.8 ± 1.2 vs 5.1 ± 1.2, P<0.001) or CCI (7.6 ± 2.5 vs 6.8 ± 2.1, P=0.01) and prescribed a greater number of medications (9.8 ± 3.8 vs 8.8 ± 3.5, P=0.03) than people who were alive at 12 months' follow-up. In people with T2D, a logistic regression was performed using mortality as the observed variable, with confounding variables of age, sex, CFS, Hba1c and T2D treatment prescribed. This analysis observed that 1-year mortality was associated with male sex (P<0.01), greater CFS (P<0.001) and a lower HbA1c (P<0.05) but not with the use of diabetes medications associated with hypoglycaemia (P=0.62). The mean WIMD decile of those with T2D deceased was 4.9 ± 2.9 compared to those alive 5.4 ± 2.9. (P=0.25). There was a trend to greater age (85.4 ± 7.4 vs 82.9 ± 7.6 years, P=0.07) and lower HbA1c (50.3 ± 15.5 mmol/mol [6.7%] vs 55.2 ± 16.1 mmol/mol [7.2%], P=0.07) in people who had died compared to those who were alive at 12 months' follow-up which did not meet statistical significance. These data are shown in Table 6.4.

Variable	Deceased n=80	Alive n=214	P value
Age	85.4 (± 7.1)	82.8 (± 7.6)	P=0.07
Male	47 (58.8%)	91 (42.5%)	P=0.01
Female	33 (41.3%)	123 (57.5%)	
CFS	5.8 (± 1.2)	5.1 (± 1.2)	P<0.001
Number of medications	9.8 (± 3.8)	8.8 (± 3.5)	P=0.03
Hba1c	50.3 (± 15.5)	55.2 (± 16.1)	P=0.07
CCI	7.6 (± 2.5)	6.8 (± 2.1)	P=0.01
Deprivation decile	4.9 (± 2.9)	5.4 (± 2.9)	P=0.25

Table 6.4: Characteristics of people with T2D admitted to OPAS unit with a fall who had died or were alive at 12 months' follow-up. *CFS* clinical frailty score, *CCI* Charlson comorbidity index, *HbA1c* glycated haemoglobin. Continuous variables are presented as the mean (± standard deviation), whilst categorical variables are presented as the number (%).

6.4.4 Conclusions

A high proportion of the sample studied with T2D were admitted to hospital with a hypoglycaemic event (16.3%). Previous observational data have observed that more than 70% of hypoglycaemia-related admissions occur in those aged 60 years and older, with gross numbers increasing (Zaccardi et al., 2016). Hypoglycaemic events are well known to be associated with falls especially in those who are aged greater than 65 years (Cheng et al., 2022) and with more intensive HbA1c control compared to those with a HbA1c between 53-58 mmol/mol [7.0–7.4%] who have a lower risk of recurrent falls. It was observed that those with T2D had a higher number of medications, which might be expected given the additional disease burden, but nevertheless polypharmacy is an independent risk factor for recurrent falls (Dhalwani et al., 2017), which should prompt clinicians to perform a structured medication review. In addition, those with T2D had a higher CCI, which might be expected given that diabetes is scored in this clinical tool (Charlson et al., 2022). There was a significantly higher proportion of men in our cohort with T2D, again unsurprising, given that men are more likely to have T2D (Gale et al., 2001). There was increased mortality in those with T2D, consistent with data from the United States (Alain et al., 2002). This may be a consequence of associated complications observed in people with T2D, therapeutic inertia with respect to medication de-escalation, or the management of T2D may be overlooked by many clinicians with a reluctance to change diabetes medications. We found no difference with respect to social deprivation between those with and without T2D.

When analysing the characteristics and outcomes of people with T2D prescribed insulin and/or gliclazide compared with other agents, there was not a greater mortality associated with insulin and/or gliclazide compared with other agents for treatment of T2D, and their use was not associated with a lower HbA1c. Though, the use of insulin and/or gliclazide was associated with an increased risk of hypoglycaemia on hospital admission. Indeed, people with T2D prescribed insulin and/or gliclazide had a significantly higher HbA1c, and therefore the use of these drugs may better reflect these patients' greater clinical need, with more significant or longer suboptimal glucose control in this group. However, hypoglycaemic events are known to be associated with

falls and poor outcomes especially in those aged greater than 65 years. Therefore, clinicians should consider the use of non-hypoglycaemia-inducing medications in the first instance in such a cohort of people with T2D, unless felt clinically necessary.

Importantly, these remain essential medications for older adults with poorly controlled T2D to prevent hyperglycaemic emergencies and should not be de-prescribed routinely or avoided through fear of causing patient harm. Indeed, these data demonstrate a lack of association between insulin and/or gliclazide use and 1-year mortality outcomes. This requires the clinician to balance the risk and benefits of such a treatment strategy in the individual person with T2D, and to provide support for their use such as with community nursing care, frequently with secondary care diabetes team input. People prescribed insulin were most likely to have a hypoglycaemia-related fall during admission to hospital compared to those prescribed other agents including gliclazide. This is an established complication associated with insulin use, but an imperative take-home message. Nevertheless, gliclazide was also independently associated with increased hypoglycaemia-related admissions compared to other agents, showing that clinician selection of medications is important. This observation is less well described in people admitted with falls compared with insulin use (Cheng et al., 2022) and is another important clinical reminder of the impact of hypoglycaemia associated with the use of gliclazide in this at-risk cohort.

Logistic regression confirmed diagnosis of T2D was associated with 1-year mortality, but this was not significantly associated with hypoglycaemic-inducing agents. The increased mortality in those with T2D was associated with male sex (Gale et al., 2001), greater frailty (Alain et al., 2002) and polypharmacy (Dhalwani et al., 2017). This observation highlights the need for an individualised diabetes treatment plan and glycaemic targets for the older person with T2D. There was no difference with respect to social deprivation between those with T2D and mortality related to the use of hypoglycaemia inducing medications.

This study has some important limitations. Firstly, it is a cross-sectional with prospective follow-up in relation to mortality study, which is prone to usual biases associated with this type of study. To minimise this, patients with missing data and in this case these subjects were excluded from the analysis. In addition, limited information was available with respect to hospital readmission with often-incomplete routinely available electronic health records. Due to some patients being recently added to the databank, these do not have mortality outcomes at 12 months. There is a need for more robust prospective studies to adjust for such variables associated with mortality to infer causation between variables such as HbA1c, hypoglycaemia, medication use and polypharmacy in the cohort. Frailty is a dynamic measure and there can be a major bias in calculating the CFS especially when external factors such as cognitive impairment can limit someone's functional ability (Hollinghurst et al., 2019). This was mediated by all the CFS scores being checked by the same person (AJB), who was able to access everyone's CGA. The databank only focused on patients admitted with a fall, rather than other medical conditions or frailty syndromes. This limited comparison with people who did not fall to establish whether the mortality observed in this group was related to T2D or the underlying frailty syndrome itself. This could be expanded to look at frail, older adults in the community who have not fallen with T2D but are at a major increased risk of falls (Vinik et al., 2017). Further studies focusing on whether de-prescription affects the rate of falls or mortality would enable a more robust conclusion and would be of major clinical interest.

In conclusion, falls are a significant burden, and hypoglycaemia-inducing agents may contribute to the greater mortality observed in people with T2D. People with T2D had a similar CFS, were more likely to be male and be prescribed more concomitant medicines. Clinician awareness can support de-prescribing for frail patients with HbA1c less than 64mmol/mol. There should be increased awareness of the impact of hypoglycaemia, especially in those using insulin or gliclazide. Individualised care plans detailing co-morbidities, presence of frailty or functional loss (including cognition), individualised agreed goals of treatment, medications, frequency of monitoring, target capillary blood glucose and HbA1c, blood pressure and serum lipid levels are helpful. Other modifiable risk factors such as alcohol excess should be studied

6.5. Aim 3 - Alcohol excess in older adults who fall

To examine whether people admitted to hospital with a fall and had a history of alcohol excess, were more likely to have greater frailty, co-morbidity burden, or risk factors for falls. It was also examined whether people with a history or current alcohol abuse associated with poor clinical outcomes in a cohort of patients admitted to the ED with a fall. A second aim was to see whether the POSAMINO criteria could be used to identify PIMs to assist with deprescribing.

6.5.1 Introduction

The number of older people within our population is increasing, as is the number of older people who drink alcohol excessively. It is important to establish this relationship in older patients, who are at a greater risk of falling, to allow for appropriate risk management. Some evidence suggests that mortality rates linked to alcohol use are higher in older people (Royal College of Psychiatrists, 2011). Alcohol has been identified as a potential risk factor for falls in older people. 'At risk' drinking was present in 11% of older patients presenting to an ED with falls in one study (Bell et al., 2000).

In a previous review on alcohol and falls which included 21 studies that described alcohol related falls and injuries in adults, alcohol was present acutely in 21% to 77% of fatal falls and 17% to 53% of nonfatal falls and concluded that alcohol increased the risk of falling (Hingson and Howland, 1987). This review, however, was written without a focus on older people as a population or their risk of falls in relation to alcohol intake. The relationship between alcohol intake and falls in older people is unclear. There are several published studies with contradictory findings, some have reported no association between alcohol intake and falls risk, some have suggested a protective effect of alcohol on falls, and some have found that alcohol intake is linked to an increased risk of falls. These findings are unhelpful for clinician who wishes to give patients evidence-based advice regarding their alcohol intake and the likelihood of its impact on their falls risk.

Alcohol consumption could increase an individual's risk of falls through several mechanisms. Alcohol intake can impair balance, there is some evidence that this is especially true in older adults (Vogel-Sprott and Barrett, 1984 and Hegeman et al, 2010), chronically heavy alcohol consumption can cause peripheral neuropathy, skeletal myopathy (Preedy et al., 2001) and has also been linked to cognitive impairment (Ridley et al., 2013). Acute intake of alcohol intake is related to orthostatic hypotension (Burke et al., 1992 and Rutan et al., 1992). There is evidence that all these conditions are linked to an increased risk of falls. Alcohol is known to have effects on motor function as well as visuospatial functioning (Sullivan et al., 2010). Although this risk is understood it is not known how this relationship may affect older patients specifically. Establishing this association can help in adequate risk assessment and aid clinicians in giving appropriate advice ((Royal College of Psychiatrists, 2011). Studies have shown alcohol to be a risk factor for falls all ages (Hingson and Howland, 1987). evidence suggests that mortality rates linked to alcohol use are higher in older people compared with younger people (Bell et al., 2000). Alcohol has been identified as a potential risk factor for falls in older people. 'At risk' drinking was present in 11% of older patients presenting to an ED with falls (Bell et al., 2000). In a review on alcohol and falls, alcohol was present acutely in 21% to 77% of fatal falls and 17% to 53% of nonfatal falls (Hingson and Howland, 1987), however was written without a focus on older people as a population or their risk of falls in relation to alcohol intake.

Considering only studies analysing older adults, increased levels of alcohol intake were associated with increased rate of falls (Paula et al., 2021, Ha et al., 2021, Qian et al., 2021 and Gade et al., 2021). They concluded that increased alcohol consumption above a certain level is likely to cause an increased risk of falls. The authors also report the increased falls seen in non-drinkers compared to those with moderate intake in their study could be accounted for by differences in other risk factors including, gender, physical activity levels and history of diabetes or cerebrovascular disease (Tan et al., 2021).

In published research, it is difficult to compare as the categorisations used for alcohol consumption varied between the papers. One study used different metrics within its own cohort to categorize alcohol intake (Meucci et al. 2019). There were also differences in how falls history and data were collected. Some published papers looked at patients who had presented with falls and looked for alcohol use whereas others asked about previous falls history and previous alcohol use. Methods of measuring alcohol intake varied from screening of textual entries in clinical records, (Shakya et al., 2020). Self-reporting of alcohol intake was used by many studies, some classifying participants as drinkers or no drinkers. (Paula et al., 2021, Ha et al., 2021, Qian et al., 2021) Whilst others used more specific measures looking at volume or units consumed. (Gide et al., 2021). Falls were measured differently amongst papers also, with some identifying patients through clinical coding of presenting with falls (Gade et al., 2021) whilst other studies used self-reported history of falls to assess how many times participants had fallen in varying periods. (Paula et al., 2021, Ha et al., 2021, Qian et al., 2021) One study screened participants and performed a TUG test to classify if participant was at risk of falls. (Pirrie et al., 2020)

The concurrent use of alcohol and medications in vulnerable frailer older adults is difficult to quantify and there is limited consensus regarding which medications interact with alcohol. This increase in alcohol use plus polypharmacy increases the risk of adverse events such as sedation, hypotension, gastro-intestinal bleeds, hypoglycaemia, and liver damage (Onder et al, 2002). In older adults, adverse drug reactions were increased by 24% when in combination with moderate alcohol use Onder et al, 2002).

The POSAMINO criteria was developed to identify PIMS by using 38 criteria (Holton et al., 2007). POSAMINO criteria consists of seven different drug classes, with 40% being medications that act on the central nervous system (CNS) including anti-PD drugs e.g. apomorphine and pramipexole. Cardiovascular agents are 9 of 38 criteria including antiplatelet, diuretics and anticoagulants as these are all metabolised by the liver. Non-steroidal anti-inflammatory drugs (NSAIDs), gabapentin (used for

neuropathic pain), opioids, and paracetamol are all analgesics that are included. The POSAMINO criteria is consensus rather than an exhaustive list of explicit criteria and includes a wide range of other drug classes, such as cardiovascular, respiratory system, musculoskeletal, malignant disease, infections, or endocrine agents. See Appendix 9.10 for the list of POSAMINO medications.

The aim was to examine whether people admitted to hospital with a fall and had a history of alcohol excess, were more likely to have greater frailty, co-morbidity burden, or risk factors for falls. It was also examined whether people with a history or current alcohol abuse associated with poor clinical outcomes in a cohort of patients admitted to the ED with a fall. A second aim was to see whether the POSAMINO criteria could be used to identify PIMs.

6.5.2 Methods

6.5.2.1 Study design

This was a retrospective analysis of patients admitted to the OPAS at Morriston Hospital in Swansea. The OPAS databank was retrospectively analysed for people with alcohol excess admitted with a fall between June 2020 and December 2022. We compared age, medication usage, CCI and CFS in people with or without alcohol excess. We reviewed patient mortality at 12 months. Alcohol Excess was defined by regularly exceeding government guidelines (>14 units a week).

The POSAMINO criteria was applied to the database to identify potentially PIMs for patients who presented with alcohol excess. This work was undertaken as part of a service evaluation of the function of OPAS within the ED.

6.5.2.2 Statistical analysis

Continuous variables are presented as the mean ± standard deviation, whilst categorical variables are presented as the number (%). Statistical significance for continuous variables was determined using student's t-test and categorical variables were determined using Chi-squared test. Statistical significance was taken at $P<0.05$.

6.5.3 Results

A total of 1516 patients presenting with falls were included for analysis from consecutive admissions from June 2020 to December 2022, with a mean age 84.8 ± 7.7 years and 561 (37.0%) were male. The mean CFS of the total cohort was 5.3 ± 1.3 and CCI was 5.6 ± 1.9, and the mean number of medications used was 8.1 ± 3.8 per patient. At 12 months' follow-up, 1129 (74.5%) patients were alive and 387 (25.5%) had died. These data are presented in Table 6.5.

Variable	All n=1516	Alcohol excess n=59	No Alcohol excess n=1457	P value
Age	84.8 (± 7.7)	75.4 (± 10.6)	84.1 (± 7.4)	P<0.001
Male	561 (37.0%)	36 (61.0%)	525 (36.0%)	P<0.001
Female	955 (63.0%)	23 (39.0%)	932 (64.0%)	
CFS	5.3 (± 1.3)	4.8 (± 1.2)	5.4 (± 1.3)	P=0.001
Number of medications	8.1 (± 3.8)	7.0 (± 3.7)	8.1 (± 3.8)	P=0.03
CCI	5.6 (± 1.9)	5.9 (± 2.4)	5.6 (± 1.9)	P=0.40
Alive	1129 (74.5%)	45 (76.3%)	1084 (74.4%)	P=0.75
Dead	387 (25.5%)	14 (23.7%)	373 (25.6%)	

Table 6.5: Patient characteristics of those admitted to the OPAS unit. *CFS* clinical frailty score, *CCI* Charlson comorbidity index. Continuous variables are presented as the mean (± standard deviation), whilst categorical variables are presented as the number (%).

With respect to those with a history or current alcohol excess, 59 (0.04%) had a history of chronic alcohol excess; 3 with acute intoxication at the time of presentation on a background of chronic misuse. Those who presented with alcohol excess were younger (75.4 years (± 10.6) vs 84.1 (± 7.4) P<0.001) and less frail as per CFS (4.8 (± 1.2) vs 5.4 (± 1.3) P=0.001). There was a significant difference in gender with males being more likely to present with a history of alcohol excess (P<0.001). There was no significant difference in CCI or mortality between the groups. When applying the POSAMINO criteria, the overall number of PIMs identified was 1.9 (± 1.4), with those PIMs contributing to increased falls of 1.4 (± 1.2). These data are presented in Figure 6.2. For the breakdown of PIMs per POSAMINO category, these are presented in Table 6.6 where there were a significantly greater number of PIMs that affect the cardiovascular and central nervous systems than the other categories.

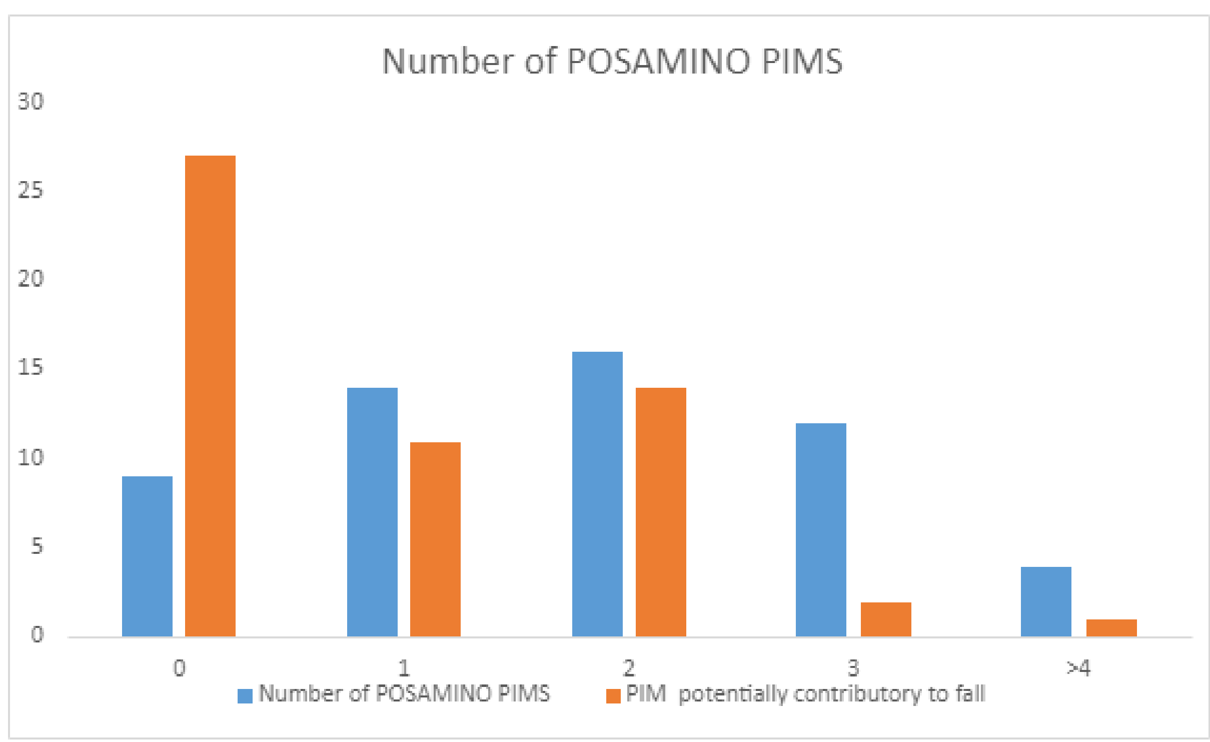


Figure 6.2: Number of POSAMINO PIMS and those that could potentially contribute to falls. *PIM* potentially inappropriate medications, *POSAMINO* Potentially Serious Alcohol–Medication Interactions in Older adults.

System	PIMS
Cardiovascular	35
Respiratory	1
Central Nervous	37
Endocrine	8
Musculoskeletal and joint diseases	13
Malignant disease/ immunosuppression	0
Infections	0

Table 6.6: Number of POSAMINO PIMs by category *PIM* potentially inappropriate medications, *POSAMINO* Potentially Serious Alcohol–Medication Interactions in Older adults

6.5.4 Conclusions

Overall, it is only possible to confirm that older patients with higher levels of alcohol consumption do experience more falls than their non-alcohol consuming peers in our sample of patients who present to the ED with falls. They also had associated greater frailty, were likely to be male and younger than their counterparts who do not drink alcohol excessively. There was no difference in mortality between groups. We showed that the POSAMINO criteria was able to identify an average of 1.9 inappropriate medications in our sample with 1.4 contributing to an increased falls risk. Increased awareness of the POSAMINO criteria can aid clinician de-prescribing decisions, especially in this cohort who are more vulnerable for recurrent falls.

Research has concluded that increased alcohol intake is associated with an increase in levels of falls. However, due to the nature of previous studies undertaken it was difficult to accurately assess the presence of a causal relationship. Current knowledge of the effect of alcohol on co-ordination and balance would point towards this increased risk likely being as a result of the effects of alcohol. However, more research would be needed to fully appreciate the risk alcohol poses to falls risk in the older population

Investigating the relationship between alcohol and falls is problematic, it is not possible to perform a randomised controlled trial of alcohol intake that would facilitate measuring falls as an outcome measure more precisely. This study and previous work have largely relied upon studies that compare participants who self-report their alcohol intake and (to a lesser extent) their incidence of falls. This approach has obvious limitations and opportunities for reporting bias as many focus on the short-term relationship between alcohol and falls, these studies are less effective in informing us on the effects of chronic alcohol use. Additionally, although some studies sought to analyse the relationship between binge drinking and falls, it is not possible to evaluate fully the effect acute intake of alcohol has on falls risk from this study.

Previous research has also reported higher risk of falls in participants who are abstinent of alcohol in comparison to patients with moderate intake of alcohol. This has inferred a protective effect of moderate alcohol in comparison to abstainers. This must be interpreted cautiously as people who abstain from alcohol are different from those who do drink more significantly than just in terms of how much alcohol they consume at the present time. In addition, adjusting for known, measurable differences between abstainers and drinkers may be inadequate to make the two groups comparable. Some of the differences that are difficult to measure include the cessation of drinking with illness or self-perceived increased falls risk. There is evidence that a substantial proportion of abstainers from alcohol are former drinkers (Wannamethee et al., 1998). This abstinent group may include former alcoholics, and indeed some evidence for increased risk of falls with a history of heavy drinking exists within the data included in this review. Patients who are on medications for unrelated chronic conditions may avoid alcohol consequently, this is especially applicable for the older population.

This study has some important limitations. Firstly, it is a retrospective study which is prone to usual biases associated with this type of study. To minimise this, patients with missing data were excluded from the analysis. Due to some patients being recently added to the databank, these do not have mortality outcomes at 12 months currently. Asking patients to self-report alcohol intake may lead to an under-estimation or under-reporting of true alcohol intake. As such this may have an impact on results as if patients underestimate or report true alcohol intake but are still falling it will decrease the trend of increased intake resulting in more falls. This limitation is difficult to overcome. One of the studies did use narrative entries to screen for alcohol use but again this was subjective based on the observations of clinicians who may have had different thresholds for documenting intoxication on arrival to an emergency department. Many of the previous studies also looked at other potential risk factors for falls, however these results were not observed for this study. As previously mentioned many did account for other variables in their analysis and remove other factors when considering data. This also relied on patients presenting to healthcare having suffered a fall to include them in their study, this may have led to some selection bias as patients

who did not injure themselves or feel the need to present for health care would not have been included. This exclusion of patients could also affect datasets potentially missing several low impact falls in patients consuming alcohol.

In conclusion, this study of fallers who present to ED shows the importance of ascertaining a patients' alcohol history to allow for thorough understanding of falls risk within individuals. Routinely using the POSAMINO criteria can aid clinician de-prescribing decisions, especially in this cohort who are more vulnerable for recurrent falls. However further research is needed to fully appreciate the causal relationship between alcohol consumption and falls. It would also be useful for further research to measure units consumed to enable development of more accurate algorithms for assessing falls risk and allow for a clearer comparison of data between studies. Current knowledge of the effect of alcohol on co-ordination and balance would point towards this increased risk likely being as a result of the effects of alcohol. However, more research would be needed to fully appreciate the risk alcohol poses to falls risk in the older population.

6.6 Overall conclusions

Falls are a huge burden and cause significant morbidity and mortality. There are many factors that contribute to falls, including frailty and multi-morbidity from chronic disease. It is recognised that polypharmacy is often beneficial. For example, secondary prevention of myocardial infarction requires the use of at least four different classes of drugs (antiplatelets, statin, ACE inhibitor, beta blocker). Patients at highest risk of inappropriate polypharmacy are those with the greatest frailty, on the most medicines and taking high risk medicines. With up to 11% of unplanned hospital admissions being attributable to harm from medicines and over 70% of these being due to elderly patients on multiple medicines, there are significant opportunities to reduce this burden by timely and effective interventions. Tools can aid physician deprescribing but as people live with increasing frailty, it is important that shared decision making occurs around prescribing and polypharmacy especially when the

person is in the last 6 months of life. This is especially important in medications that have long term effects such as medications for blood pressure, cholesterol, and cognitive impairment.

A major limitation of this chapter is that it does not assess the effectiveness or impact of de-prescribing, which would be a useful next step but is beyond the scope of this thesis. Deprescribing is the systematic process of tapering, reducing, or discontinuing medicines that may no longer be beneficial or could cause harm, particularly in older adults with multimorbidity and polypharmacy. It is a patient-centred intervention aimed at optimising medication regimens to improve outcomes and reduce harm. While deprescribing offers significant potential benefits, it also carries risks and implementation challenges that must be carefully considered (Linsky et al., 2019; Hung et al., 2024).

Deprescribing has many benefits as listed here. It reduces polypharmacy, commonly defined as the use of five or more medicines, is prevalent among older adults and is associated with increased risk of adverse drug events (ADEs), drug–drug interactions, and reduced adherence. Deprescribing can simplify medication regimens, improve adherence, and reduce the prevalence of potentially inappropriate medicines (PIMs), which are often identified using tools such as the Beers Criteria or STOPP/START guidelines (Linsky et al., 2019; Omuya et al., 2023). It can increase patient safety by discontinuing unnecessary or harmful medicines, deprescribing reduces the likelihood of ADEs, falls, delirium, and hospital admissions. Evidence suggests that targeted deprescribing interventions can significantly lower the incidence of medication-related harm, particularly in frail older adults (De Lima et al., 2023; Hung et al., 2024). Deprescribing may lead to improvements in cognitive and functional outcomes, reduce symptoms such as dizziness and confusion, and enhance overall well-being. Patients often report feeling more engaged in their care when deprescribing decisions are made collaboratively, aligning treatment with their goals and preferences (Omuya et al., 2023; Andrews et al., 2025). Reducing medicine use can lower direct drug costs and potentially decrease healthcare resource utilisation, such as emergency visits and

hospital admissions. However, evidence on overall cost-effectiveness remains mixed, as savings may be offset by increased monitoring requirements (Omuya et al., 2023). Deprescribing fosters shared decision-making and individualised care planning. It encourages clinicians to consider life expectancy, comorbidities, and patient priorities, ensuring that pharmacotherapy aligns with the patient's values and prognosis (Hung et al., 2024; Linsky et al., 2019).

It does not come without risks and challenges. Certain medicines, such as benzodiazepines, antidepressants, and opioids, require gradual tapering to avoid withdrawal symptoms. Abrupt discontinuation can lead to rebound effects or recurrence of the underlying condition, necessitating careful monitoring (Crisafulli et al., 2022). There is some clinical uncertainty around deprescribing. The evidence base for deprescribing is growing but remains limited for some drug classes. While short-term benefits are well documented, long-term outcomes such as mortality and functional status are less clear, creating uncertainty for clinicians (Linsky et al., 2025; Nizet et al., 2023). Deprescribing can be time-consuming and requires clinician expertise, patient engagement, and often multidisciplinary input. Barriers include lack of standardised protocols, fear of litigation, and resistance from patients or carers who may perceive medicine discontinuation as neglect (Hung et al., 2024; Crisafulli et al., 2022). Successful deprescribing demands ongoing assessment to detect adverse effects, symptom recurrence, or changes in clinical status. This adds complexity to care and may increase workload for healthcare teams (Hung et al., 2024). Although deprescribing interventions can reduce PIMs at the individual level, their effect on overall prevalence within healthcare systems is modest, highlighting the need for broader policy and system-level strategies (Linsky et al., 2025).

Deprescribing is a critical component of optimising medicine use in older adults. It offers substantial benefits in terms of safety, quality of life, and patient-centred care, but it is not without risks. Effective implementation requires a structured approach, shared decision-making, and robust monitoring to ensure positive outcomes. Future research should focus on long-term effects, cost-effectiveness, and strategies to overcome implementation barriers.

Chapter 7 – Providing community services

7.1 Introduction

SBUHB has an ageing demographic (People's Commissioner for Wales, 2023). Ageing is associated with multimorbidity and an increased risk of frailty. The term frailty describes a clinically recognisable syndrome of reduced resilience which results from age related decline in reserve and function across multiple physiological systems. Frailty is associated with advancing age but is not inevitable, many older people remain fit in later life (Hubbard et al., 2008, Rockwood, 2005). People who live with frailty are less able to overcome illness related to psychosocial stressors. There are several clinical indicators that suggest the presence of frailty; namely the frailty syndromes or 'Geriatric Giants' – falls, incontinence, confusion, and immobility (Hubbard et al., 2008, Rockwood, 2005). There are evidenced based clinical tools that allow healthcare professionals to recognise and grade frailty, the Rockwood Clinical Frailty Scale (Clegg et al., 2016) is mostly used. Frailty can also be identified from administrative data, in the hospital context by the HFRS (Gilbert et al., 2018) and in the community by the Electronic Frailty Index (Hopper, 2021). Frailty is associated with increased ill health, mortality, healthcare use, care dependency, and reduced quality of life. Guidelines on the management of frailty recommend its identification, and targeted clinical management using the evidence-based intervention of Comprehensive Geriatric Assessment (Oliver et al., 2014, Conroy, 2021 and Ellis et al., 2011).

Severe frailty is associated with higher healthcare usage and costs, often with poor experience and health related outcomes for the person concerned. Robust strategies for frailty prevention and preventing progression are key to good health in later life and will reduce the burden on the health and social care system in turn (Hopper, 2021, Gordon et al., 2023). Traditionally, medical care has been designed for people with single organ disease, this has created a system that is good at providing specialist care but a lack of integration leaves gaps in which people living with comorbidity and frailty, who often present with nonspecific symptoms, to fall through. Patients with undifferentiated illness represent a sizeable proportion of the work of unscheduled care (Gordon et al., 2023).

Community health services are extremely broad and cover a wide range of services. This can either be provided by primary care or from in reach from secondary care. The services also include health visiting services and school health. Many services are MDT based, relying on close working between primary and secondary care. The MDT can include allied health professionals, district nurses, mental health nurses, therapists, community nurses, and social care workers. The services tend to be provided in the patients' home, whether this is their own home or a care facility, which includes nursing, residential and care homes, but can also include clinics, schools, community hospitals, and intermediate care facilities (NHS England, 2021).

People who live in care homes should receive the same level of support as those who reside in their own home (NHS England, 2021). This is a priority of the NHS and relies on collaborative working between all the sectors (health, social care, community) and the care homes themselves. Every care home should be supported by their own MDT and there should be seamless collaboration between the different sectors. As patients in care homes are more vulnerable, there are established protocols in place. These include that an MDT assessment should be performed on every person living in a care home, within 7 working days of admission or re-admission.

This increase in the needs of older adults with frailty, plus the increased pressure on emergency services, has provided a shift in thinking (British Geriatrics Society, 2022). Older adults living with frailty need novel approaches to care, as traditional models are not effective. Community options are increasingly being developed, and hospital admissions may not always be in the best interests of the patient. This is due to a wide range of adverse outcomes associated with admissions such as delirium, decondition and nosocomial infections which all contribute to functional, physical, and cognitive decline (Creditor, 1993).

There is a lack of continuity around what these community services, which perform an enhanced function, are called. They have been traditionally referred to as Hospital at Home (HAH), but NHS England have recently introduced the term VW for these services. This is because not all the services provided by VW or HAH are in person, they also have remote monitoring technology available. Whether a service is termed a VW or HAT, they have the same aim which is to provide an alternative to traditional models of hospital inpatient care which is safe, effective and person centred (Westby et al., 2024). Both HAT and VW tend to provide a time-limited, face to face service which involves visiting the patient in their own home. The term VW is a misdemeanour as many people believe that they provide only remote and online services, which is not the case in SBUHB. In VW structure in SBUHB is an MDT which provides community based CGA and reablement (Westby et al., 2024).

Despite this, VW or HAH have not been studied extensively. A rapid synthesis of systematic reviews, not focusing on frailty, most participants had multiple chronic conditions and were older. Care at home at a hospital level improved care experience for both the patients or service users and their family members and care givers plus improved overall system efficacy (Westby et al., 2024).

7.2 Aims

The Welsh Government's Six Goals (Welsh Assembly Government, 2021), the GIRFT report on geriatrics (Jones et al., 2022) and the NHS England Right Care (NHS England, 2019) guidance concerning frailty, all clearly describe the requirement to provide an integrated system that includes secondary care, primary care, care homes, community services, ambulance services, local authorities and the voluntary sector and is centred on the needs of individual patients and focused on preventing inappropriate hospitalisation and progression of frailty. Older people living with frailty are more likely to have delayed transfers of care if they are admitted to hospital and are vulnerable to the potential adverse effects of hospital admission i.e. deconditioning, delirium and inpatient falls (Oliver et al., 2014 and Keeble et al., 2019).

People living with frailty could often have their needs best met in settings outside of acute hospital care. Assessment in a person's own home is potentially less disruptive and more effective than acute admission to hospital. Many patients living with frailty are approaching the end of their life and it is important there is appropriate shared decision making, including advance care planning. Therefore, the two main aims of this chapter are to: -

1. Provide outreach from hospital teams to intervene into NH for older, frailer adults who fall by developing an education package provided to the NH staff around falls and the adverse effects associated in particular with a long lie following a fall. The aim of this is by improving the education of NH staff, the volume of emergency calls and subsequent conveyances to hospital could be reduced with the development of the CWTCH education programme.

2. To develop a VW service, with a secondary focus on reducing fractures by creating a fracture discharge pathway (FDS) within this

7.3 Aim 1 - Providing out-reach services into NH for older adults who fall

7.3.1 Introduction

NICE define a fall as 'an unintentional event that results in a person coming to rest on the ground or another lower level, not as a result of a major intrinsic event (such as stroke or epilepsy) or overwhelming hazard (such as being pushed),' (NICE, 2013). 'A simple fall is defined as one occurring because of a chronic impairment of cognition, vision, balance, or mobility. It is distinguished from a collapse caused by an acute medical problem, such as an acute arrhythmia, transient ischaemic attack, or vertigo.' Falls are the leading cause of fatal and non-fatal injuries for those who are aged greater than 65 years old. Falls are responsible for over 36,000 deaths in older adults each year in the UK. In addition, falls are a huge burden on emergency services with around 1,200 admissions per day of older adults who falls, which is around 435,000 people a year. The cost to the NHS from falls by seniors exceeds £2.3 billion per year and is projected to surpass £3.6 billion by 2030 (Caring for Care, 2024).

Falls in NH are common and cause significant morbidity and mortality (Robertson et al., 2012). NH residents are more likely to fall than other people living in the community; they are at risk of recurrent falls as interventions and risk factor modification is more difficult due to complex health and social needs including frailty, dementia, and comorbidity (Bunn, 2020). Around 24% of UK care home residents fall each year and falls account for 40% of all deaths from injury in care facilities. Care homes are home to 400,000 older people in the UK (Age UK, 2019) with the care home population due to increase over the next 20 years (Devi et al., 2021). Around 4% of those older than 65 years and 15% of those older than 85 years live in facilities that provide 24-hour care, this can be with or without nursing input (Devi et al., 2021). Falls are common in older people, with half of those over aged 80 years fall at least once per year and falls are the most common cause of emergency hospital admission, and people may lose confidence and independence afterwards (Logan et al., 2021). Those older, frailer adults who living in care homes are 3 times more likely to fall than those living at home. They are also older, frailer, and more likely to have limited mobility than people living in the community. This group is especially vulnerable to the impact of falls (Bunn, 2020).

Most falls do not result in serious injury, but can cause the person to lose confidence, in addition to complications such as pressure damage, pneumonia and rhabdomyolysis (Royal College of Emergency Medicine (RCEM), 2021). There are also concerns regarding pressure injuries sustained on ambulances secondary to offload delays as the pressure on our ED continue to rise. In Moriston Hospital, in 2021, 456 ambulances waited greater than 6 hours to offload with 78 instances of attributable pressure injuries recorded. The hospital receives approximately 9,000 ambulance arrivals a year. In January 2022, there were 106 out of 756 ambulances waiting greater than 6 hours to offload, with 13 instances of attributable pressure injuries. Ambulance offload delays have been studied previously in Chapter 3 of this thesis.

It is established that we are very unlikely to cause exacerbation of damage to a broken femur of an older adult who has been carefully lifted with an appropriate lifting device (Hawker and Rea, 2021). We know that once a resident has fallen, it is important that care home staff feel supported to make the best decision for their resident (Cameron et al., 2018) this involves being able to access support from the services available. This could be either out of hours General Practice (GP) services (GPOOH) and non-emergency telephone lines such as 111 (non-emergency number within UK) or emergency calls to 999 (emergency number within UK) and emergency paramedics (Logan et al., 2021). Avoiding unnecessary transfers to the ED is preferable for many older adults living with frailty. Conveying residents to hospital also depletes available staff within the care home, which can impact on care provision.

A CGA is the gold standard way of delivering holistic care for older people living with frailty and a multidisciplinary approach is needed. There is a balance required between the approach of community healthcare teams and in-reach hospital teams (BGS, 2021). Alternative care pathways for emergency medical services calls have been developed but these have been with therapists or emergency department doctors and there is no consensus on approach (Blodgett et al., 2021, Flanaghan et al., 2017 and Joy et al., 2020).

The aim of this is by improving the education of NH staff, with a novel approach, the volume of emergency calls and conveyances to hospital could be reduced. We have used an ‘extensivity’ approach (BGS, 2021) using the specialist skills and experience of an Emergency Nurse Practitioner (ENP) with the support of a consultant Geriatrician to be able to provide holistic care to residents and bridging the gap that has traditionally existed between primary and secondary care.

7.3.2 Methods

7.3.2.1 Phase 1 of CWTCH: January 2020 – February 2022

An analysis of all NH served by SBUHB including Swansea and Neath and Port Talbot locality, was conducted inclusive of all Welsh Ambulance Service (WAST) 999 calls (emergency number within UK) between 1st January 2020 to 28th February 2022 where an Emergency Ambulance vehicle attended the scene. All calls coded as falls and those that could be related to falls such as "Sick person," "Haemorrhage/lacerations," "Unconscious/fainting," "trauma injuries," "convulsions/fitting" were included, this is described as falls+ in this chapter. The outcome of the call was also analysed. This included whether the patient had been conveyed to hospital, treated at scene, redirected to GP (within hours), GPOOH or alternative services.

A scoping e-mail survey was sent out to all NH managers in the SBUHB area to evaluate how care staff treated their residents who fell. We focused on NH as they had always trained nursing staff, rather than residential homes where training nurses are always not resident. The survey was sent to all the NH managers, some of whom manage multiple NH. The survey was sent via email to all the managers via survey monkey. It was developed by Mrs Debra Clee, who is an ENP in the OPAS services. The questions that were asked pre-intervention via the survey were based on a questionnaire developed by NICE (NICE, 2013) and consisted of

1. Does the care home / facility have any guidelines or policy in place for falls?
2. Do staff move patients / residents after a fall?
3. Does the home have any lifting equipment / aids?
4. Are Emergency Services usually contacted after a fall?
5. Are patients kept nil-by-mouth (nothing by mouth), whilst waiting for emergency services to respond?

Following this scoping survey, a descriptive analysis of the data was performed to see what the NH managers and staff previously did when a resident fell. This analysis then gave a basis of what factors to focus the education package development on.

7.3.2.2 Phase 2 of CWTCH: March 2022 to May 2022

The teaching was developed and delivered by an ENP working in the OPAS at Moriston Hospital. The OPAS is a dedicated unit within the ED, accepting the care of patients directly from either the ED triage, community services, or WAST to provide a CGA for older adults. The Swansea NH were targeted first, before expanding the education programme by training a Frailty CNS to deliver the education in Neath and Port Talbot. A Geriatrics Registrar (I) aided in delivering the education programme and in developing the learning goals.

The education package focuses on the negative consequences of falls, especially complications related to long lie and advises care home staff to move patients off the floor when possible and to give analgesia and fluids as appropriate (see Appendix 9.12). Debra Clee and Dr Alexandra Burgess developed this in consultation with the data from the NH staff survey performed previously. It is based on NICE guidelines (NICE, 2013). A handout was developed which is in Appendix 9.12. Copies of this were left in the NH for staff that could not attend the face-to-face training. The session lasted around an hour and involved some education around appropriate lifting and analgesia use. The education was developed to only last an hour as many of the staff were coming in on their non-working days to attend and was given to qualified and non-qualified members of nursing staff.

The package used the acronym **'CWTCH'** which is a word translated from the Welsh language as a "hug or a cuddle" and is a commonly used word in Wales.

- **C**an you move them
- **W**ill it harm them? - Any new neck pain, back pain, anticoagulation.
- **T**reat them – pain relief, dressing wounds
- **C**up of Tea – In most cases can eat & drink
- **H**elp – when to call 999.

A second survey was performed ascertaining whether NH staff felt more confident post intervention and whether this would change their practice moving forward. The NH were advised to put this information in the admission proforma for their institution. All staff were provided with a handout with a summary of the session. Mrs Debra Clee developed the questionnaire. The survey questions that were asked post intervention via the survey were based on a questionnaire developed by North Central London Health and care services 2022 and NICE (NICE, 2013) and consisted of:

1. Has the session been helpful?
2. Have you received training previously?
3. Do you now feel more confident to move a patient off the floor?
4. Do you now feel more confident to give analgesia/regular medications?
5. Do you now feel more confident to give food and drink to a resident after an injury?
6. Are you less likely to contact emergency services?
7. Do you feel you need further training before making any of the above decisions?

The 999 calls post intervention were re-analysed to see whether there was a change following the delivery of the education package. The number of calls and type of calls were analysed. The outcome of the call was also analysed. This included whether the patient had been conveyed to hospital, treated at scene, redirect to GP (within hours), GPOOH or alternative services.

7.3.2.3 Statistical analysis

Continuous variables are presented as the mean ± standard deviation, whilst categorical variables are presented as the number (%). Statistical significance for continuous variables was determined using student's t-test and categorical variables were determined using Chi-squared test. Statistical significance was taken at $P<0.05$. For qualitative variables, they are presented as the number (%).

7.3.3 Results

7.3.3.1. Phase 1 of CWTCH: January 2020 – February 2022

In total, between 1st January 2020 to 28th February 2022, 4907 calls were to emergency services in SBUHB from NH were made, which resulted in an emergency vehicle attending the scene. Of these calls, 866 were coded as falls (17.65%) and a further 1032 were potential falls (21.07%). Of all calls, 60.45% were conveyed to hospital, 13.50% treated at scene, 26.05% referred to GP or alternative services. Including GP out of hours (OOH). The patient demographics are in table 7.1 below for the patients who were conveyed to hospital only.

Variable	Patients conveyed n=1212	OPAS n=68	Not OPAS n=1144	P value
Age (years)	80.6 (± 8.8)	86.9 (± 13.8)	80.2 (± 8.8)	P<0.001
Male (n/%)	570 (46.9%)	32 (45.5%)	565 (47.0%)	P=0.86
Female (n/%)	642 (53.1%)	38 (54.5%)	659 (53.0%)	
CFS	5.4 (± 1.5)	5.9 (± 1.3)	5.4 (± 1.5)	P<0.03
Offload (minutes)	403.0 (± 1825.3)	104.0 (± 110.8)	406.0 (± 1873.7)	P<0.05
LOS (days)	11.0 (± 19.6)	5.1 (± 8.6)	12.0 (± 20.0)	P<0.05
Readmitted	600 (32.8%)	24 (33.3%)	365 (32.7%)	P=0.94
Alive (n/%)	902 (77.8%)	61 (90.9%)	874 (76.4%)	P<0.05
Dead (n/%)	310 (22.1%)	7 (9.1%)	270(23.6%)	

Table 7.1: Patient characteristics of those aged greater than 65 years old, who were conveyed to hospital including those offloaded into OPAS. *CFS* clinical frailty score, *LOS* Length of Stay in days. Continuous variables are presented as the mean (± standard deviation), categorical variables are presented as the number (%).

The pre-education survey sent the NH managers showed that 47% of NH do not have any guidelines for falls and that patients are often kept Nil by Mouth (53% yes, 47% sometimes) and that 88.24% of fallers are not moved. Emergency services via 999 calls to WAST were contacted 88.24% of the time. The results of the pre-intervention questionnaire survey are shown in Figure 7.1 below.

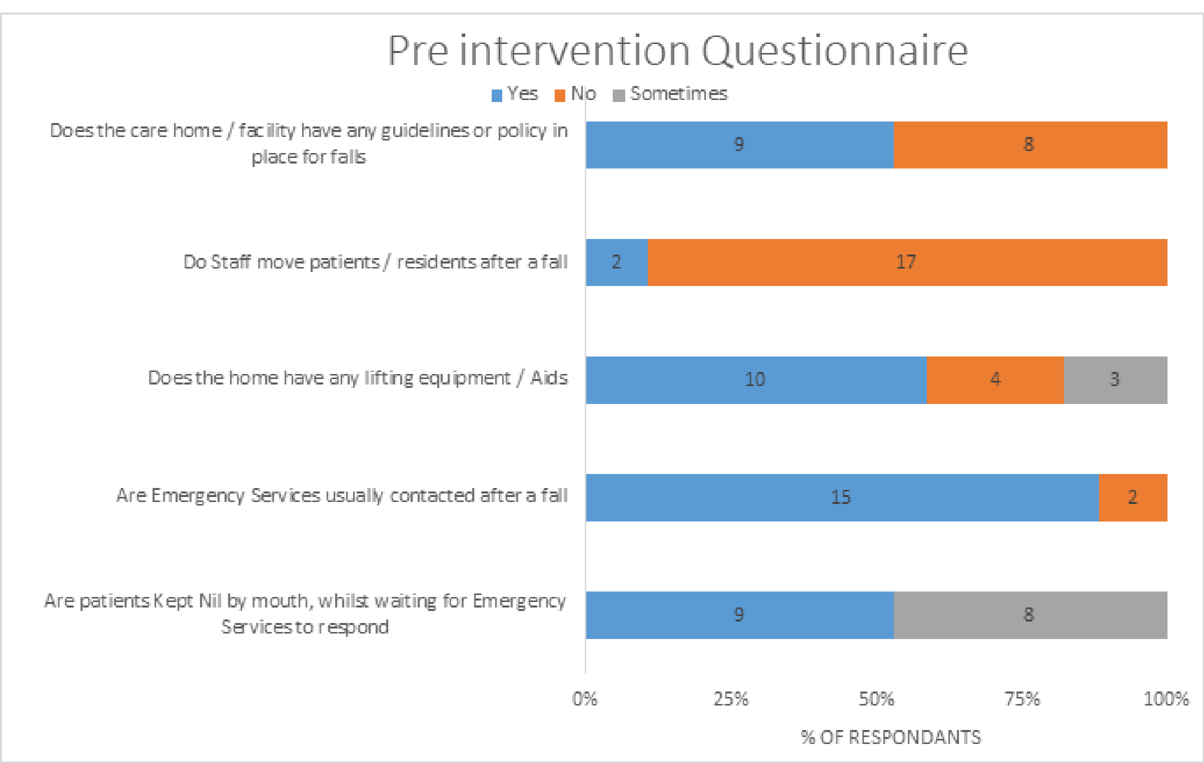


Figure 7.I: Results of pre-intervention questionnaire. The number of respondents is in %.

7.3.2 Phase 2 of CWTCH: March 2022 to May 2022

Education was offered to all NH in Swansea and Neath and Port Talbot (177 staff). Each NH manager was contacted, and they advertised the session to all their staff. The education was delivered in person by either Mrs Debra Clee, Mrs Alice Pritchberg (CNS) or Dr Alexandra Burgess. All staff completed the post training survey. One NH declined education due to staff shortages, this was despite multiple attempts made to deliver the education. A paper survey was given to all staff who attended the session. Feedback showed 100% felt more confident in giving food and drink, moving patients and all found the session helpful with 90.96% less likely to contact 999. There was a clear educational need as 77.40% had not received prior training on how to manage residents who fall. Feedback demonstrated that 96.72 % felt more confident in giving analgesia but that they worried about whether what was currently available for their residents was adequate. The results of the post-intervention questionnaire survey are shown in Figure 7.2 below.

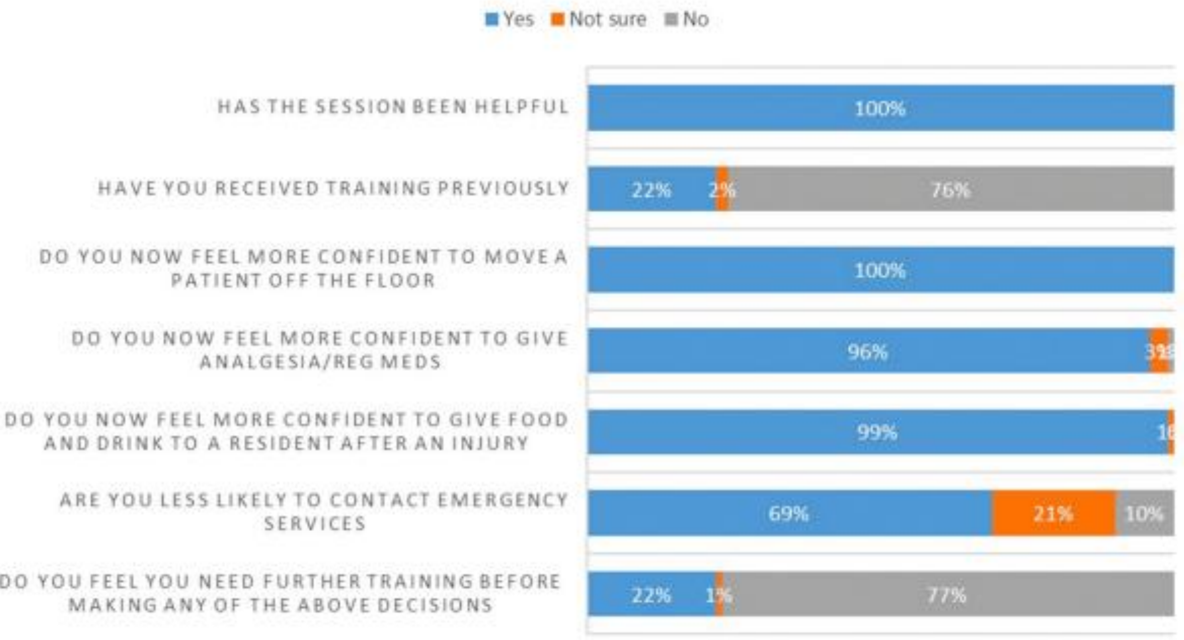


Figure 7.2: **Results of post-intervention questionnaire.** The number of respondents is in %.

Feedback from the staff that received the education included ‘I think this training is long overdue and a step in the right direction, I think the length of time people are expected to lie on a cold hard floor, with no pain relief, food or fluids needs to change so this has been great. I hope the service develops further.’ Other comments were ‘Interesting information given. Will look at implementing this into statement of purpose and admission policy’ and ‘Very helpful and educational. Been in care all my life, particularly good to know I can now move an elderly person, make them comfortable, and possibly save a life.’ Importantly staff felt that the education ‘Consolidated prior knowledge. More confident in making professional judgement on assessment and priorities of care needed.’

Following the intervention, a referral pathway was developed with the Acute-GP unit (AGPU) and Advanced Practice Paramedic (APP) colleagues who review the WAST “live stack” allowing calls to be diverted to the OPAS who offer same-day assessment.

From March to December 2022, 2084, calls from NH, 410 falls (19.7%), additional 376 potential falls (18.0%). There was significant change in conveyance to hospital using students paired t-test (P <0.05) with no change in call nature or call frequency (P >0.05). This is shown in Table 7.2 below. The data for pre-CWTCH is all the patients prior to any intervention and is from 2020 to 2022. The data for post CWTCH in 2022 is lower as only the NH that have received the education are included in the analysis. Numbers referred to the GP or GPOOH did not differ, whilst OPAS review 8.55% directly. Per month, the mean conveyance reduction was 20 patients where an emergency vehicle attended via WAST. Additionally, OPAS review an average of 16 patients from the NH directly each month, bypassing WAST entirely via our referral pathway, which was a direct result of our educational package. This data is shown in Figure 7.3 below. This has shown that the positive impact of CWTCH has been sustained many months after the education was first delivered.

Variable	**Patients pre CWTCH N=4910**	**Post CWTCH 2022 N=1645**	**Post CWTCH 2023 N=3476**	**P value**
Conveyed (%)	2968 (60.5%)	851 (51.7%)	1812 (52.2%)	P<0.001
Treated at Scene (%)	663 (13.5%)	180 (10.9%)	428 (12.3%)	P<0.05
Referred to own GP (%)	418 (8.5%)	136 (8.3%)	249 (7.2%)	P<0.05
Referred to GP Out of Hours (%)	408 (8.3%)	131 (7.9%)	247 (7.4%)	P<0.05
Other (%)	453 (9.2%)	347 (21.2%)	740 (20.9%)	P<0.001

Table 7.2: **Conveyance data pre and post CWTCH intervention**. GP *General practitioner*

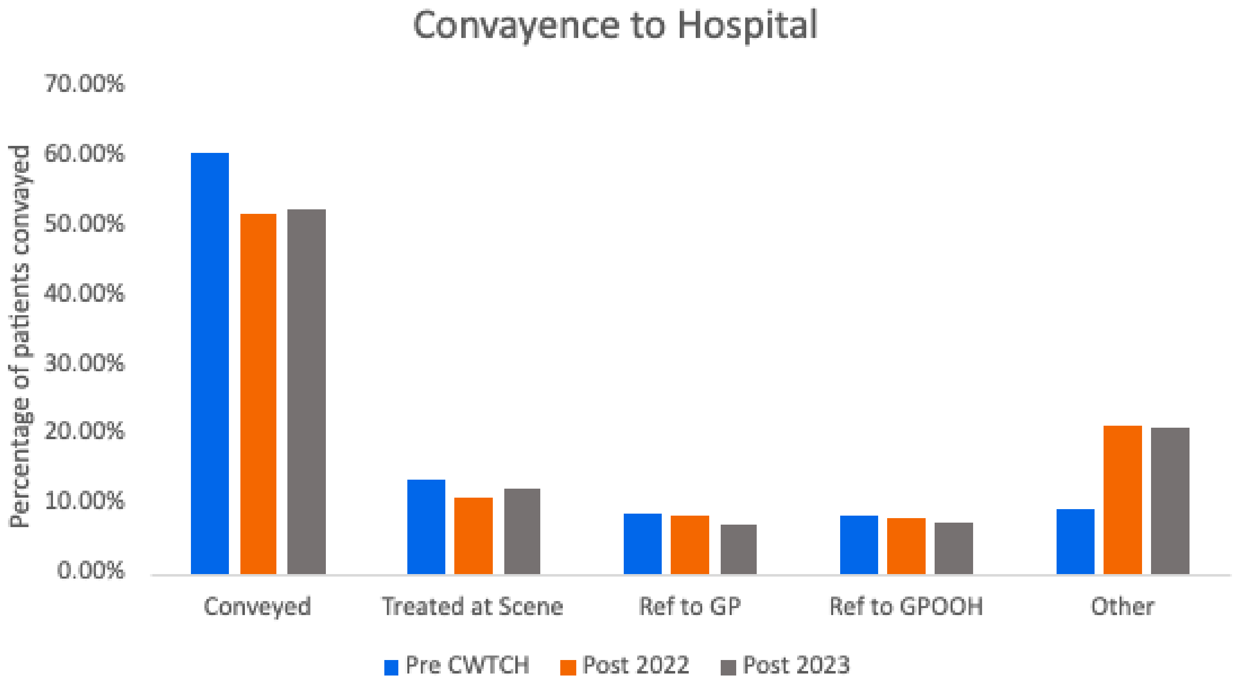


Figure 7.3: Conveyance data pre and post intervention. Other includes patients who are referred to OPAS directly. *GP* general practitioner, *GPOOH* General practitioner out of hours service.

Overall, month by month the number of calls to WAST from NH remained consistent, see Figure 7.4 below. March 2022 was when the first education package was delivered and all the NH in SBUHB had received the education by May 2022. All calls coded as Falls and those that could be related to Falls such as "Sick person," "Haemorrhage/lacerations," "Unconscious/fainting," "trauma injuries," "convulsions/fitting" were included and referred to as falls+.

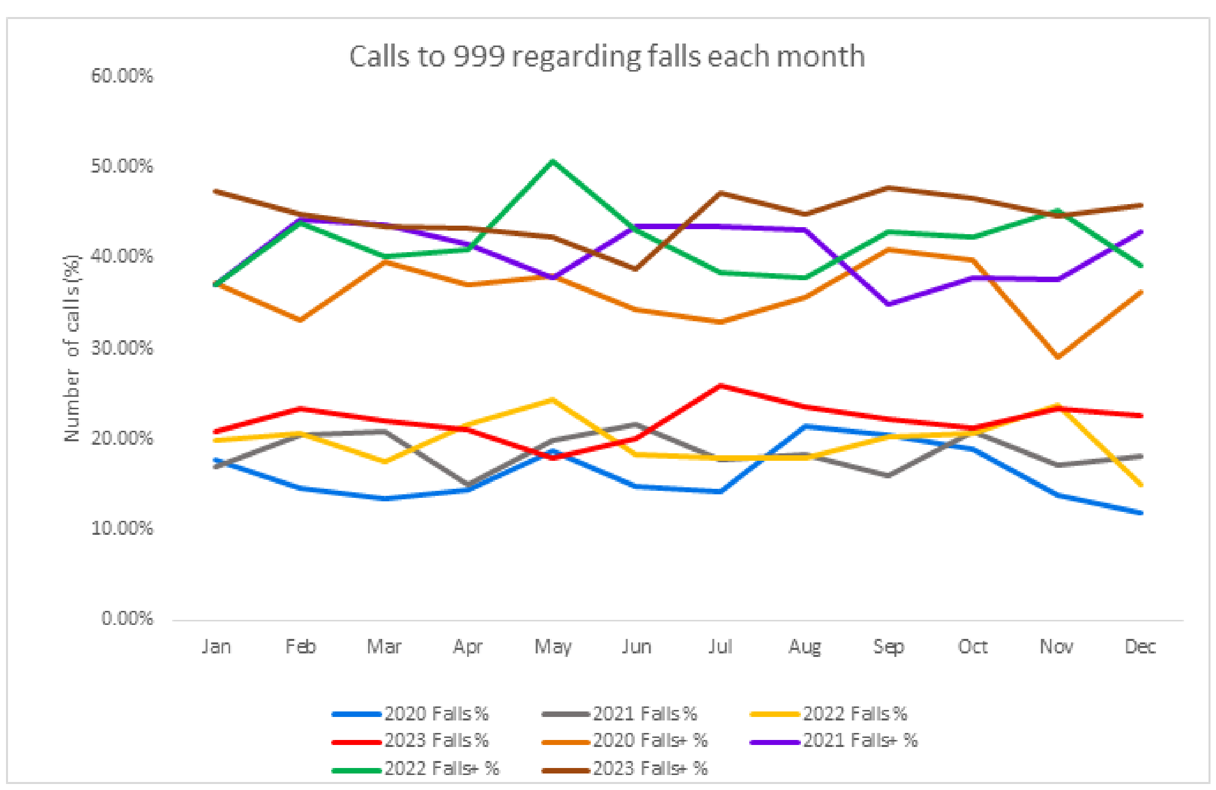


Figure 7.4: **WAST data for 999 calls in SBUHB from NH that were made which resulted in an emergency vehicle attending the scene in a % of all calls.** Falls that WAST coded as Falls are shown separately to Falls+ which include "Sick person," "Haemorrhage/lacerations," "Unconscious/fainting," "trauma injuries," "convulsions/fitting"

7.3.4 Conclusions

Falls remain a significant burden on emergency services, with a clear opportunity to improve patient outcomes and experience. An educational package developed by an ENP, delivered to NH staff in the community has shown reduction in conveyance to hospital for NH residents who fall. The data has shown that despite the number of calls remaining constant, the number of patients who are conveyed to hospital has decreased since the educational package was delivered in NH.

This data has some important limitations. The data for Welsh Ambulance Service (WAST) 999 calls is reliant on coding used by WAST and it is difficult to retrospectively say whether we are capturing all the falls. The bias has been minimised by using the same coding throughout. Due to staff sickness and annual leave, the team only visited each NH on one occasion but provided resources which can be distributed to all staff and ensured that the NH manager in every home attended the educational session to upskill missing staff members. The team also provided contact details, and all NH have the option to have further educational sessions in the future, despite the majority of staff feeling that one session was enough. With the new referral pathway, it is difficult to conclude how conveyance reduction is directly related to the education alone but is rather the combination of education plus a collaborative approach. Future directions include expanding post-fall education to WAST first responders to be able to assess those who fall in Residential Homes and in their own homes including piloting a rapid-response vehicle to assess fallers in the community.

Other limitations to be aware of include the multiple confounders in this data. The referral pathway mentioned above is a direct result of the CWTCH intervention and its data has not been separately analysed. The pathway was developed after the team had delivered the package to all the NH homes and the pathway itself may have been the primary driver of change; however, its independent impact was not evaluated. It was also impossible to examine whether there were changes in national or local guidelines, GP and community care protocols, and ambulance triage processes during the study period may have contributed to observed outcomes. The creation of the VW services was also at a similar time, and these may have been ultised appropriately to avoid admissions. Any overlap with the COVID-19 pandemic represents a major confounder, as the pre-CWTCH data was collected between 2020 and 2022. Pandemic-related restrictions and evolving admission thresholds substantially altered clinical practice and community pathways, which could have influenced conveyance rates irrespective of CWTCH. These limitations highlight the need for caution when attributing causality to the CWTCH intervention alone.

By improving education to staff in NH, adverse outcomes to NH residents who fall can be reduced to maximise recovery from the fall that resident is given the right care, at the right time, in the right place. Also, collaboration between AGPU, WAST and OPAS shows significant conveyance reduction, ultimately delivering a better patient experience and system efficiency. This formed the basis for developing the VW structure seen in SBUHB, which is detailed below.

7.4 Aim 2 - To develop a VW service and then develop a focus on reducing fractures by creating a fracture discharge pathway (FDS).

The aim of this section was to develop a VW service in SBUHB and then to progress this further with a focus on reducing fractures by creating a fracture discharge pathway (FDS). The data collected in this analysis is primarily PROM and PREM data based on a qualitative questionnaire to access patient satisfaction within these services with then additional data on FDS and admission avoidance.

7.4.1 Introduction

7.4.1.1 VW

Published research has shown that early CGA in association with a measurable Frailty outcome such as the CFS is beneficial (Cameron et al., 2018). The addition of frailty data to assess the physiological effects of an acute illness can guide mortality prediction (Cameron et al., 2018). CGA has been shown to improve outcomes both in the admission-decision process (by helping triage complex older patients) and by reducing adverse outcomes post admission (Logan et al., 2021).

Identifying frail patients who may benefit from CGA is essential for individuals and overall system efficiency. However, patient selection is difficult to achieve with usual bed management processes and there is a growing need to develop alternative

pathways. To facilitate this, VW have been developed (British Geriatrics Society, 2022). Hospital at Home and VW have been used interchangeably, and the different models have the same aim, which is to provide a safe, effective, and person-centred alternative to hospital inpatient care. An RCP Wales document defines Hospital at Home as providing short-term, intensive, hospital-level care for acute medical problems in a patient's home (Royal College of Physicians, 2022). VW are a time-limited service enabling people who have an acute condition or exacerbation of a chronic condition requiring hospital-level care to receive this care in the place they call home, either as an alternative to hospital admission or by facilitating an earlier discharge from hospital. As healthcare services are asked to provide care to an ageing population, the development of robust intermediate care services is a core component of the required response. The VW exist to provide CGA, either to prevent hospital admission or deterioration in the community or step-down care to coordinate reablement, the transition to chronic disease specific services and ensure the discharge process and transition to primary care goes smoothly.

The community services provided within geriatrics are wide ranging (British Geriatrics Society, 2014). The majority tend to be time limited, MDT based providing step up service from Primary care or a step-down service from secondary care providing assessment, treatment, and rehabilitation. This can provide a robust alternative from traditional medical models (British Geriatrics Society, 2022). Despite VW and HAH services, being thought of as relatively new, these services have been around for many years (British Geriatrics Society, 2022). The teams tend to consist of a senior clinician with support from an MDT plus the ability to be able to access urgent inpatient investigations as required. As the services provided by either VW or HAH is time limited, they are not equipped for managing long term chronic health conditions.

NHS England have identified nine principles upon which a VW should be built (British Geriatrics Society, 2022). These principles state that VW should:

1. Provide acute clinical care delivered by a multidisciplinary team (MDT) if clinically appropriate, led by a named consultant practitioner (including a nurse or AHP consultant) or suitably trained GP with relevant experience and training, with clear lines of clinical responsibility and governance.
2. Have clearly defined criteria to admit and reside, supported by daily clinical review, by an MDT if clinically appropriate, to provide a safe and robust service.
3. Ensure that patients are given clear information on who to contact if their symptoms worsen, including out of hours. There should be clear pathways to support early recognition of deterioration and appropriate escalation processes in place to maintain patient safety. Training on escalation processes should also be provided to carers, staff, the MDT, etc., as necessary.
4. Provide patients (and/or their carers) with adequate information to allow informed consent and understanding of their care, and to support the use of equipment or digital technology such as mobile phones, apps, web-based tools, or wearables.
5. Have access to specialty advice and guidance/diagnostics equivalent to acute hospital access as appropriate to enable timely clinical decision-making.
6. Deliver time-limited interventions and monitoring based on the clinical need for a secondary care bed.
7. Be fully aligned or integrated with other service development programmes, including urgent community response (UCR), SDEC and unscheduled care across their systems.
8. Be developed for a range of conditions/symptoms/settings and should track specific metrics that measure appropriate outcomes to demonstrate patient safety and sustainability.
9. Ensure that the use of digital technology does not exclude any patient group and offer alternatives should patients lack the ability to fully use the technology.

Unfortunately, in Wales, despite both HAH and VW models being used for many years, there is no national model or governmental central support, and every health board has differing models. The RCP in Wales have recommended that the Welsh Assembly government provide additional investment in providing care at home (Royal College of Physicians, 2022). HAH and VW services have been operational in Wales for several years but are not as widespread as in other parts of the UK. There is also no central support from Government to increase the provision of hospital care closer to home (Royal College of Physicians, 2022). The RCP have called for additional investment in Welsh health and care services closer to home (Royal College of Physicians, 2022).

With respect to whether HAH or VW have an evidence base, there is evidence that they improve clinical effectiveness by early supported discharge models and admission avoidance (Sheppard et al., 2021). The evidence surrounding clinical outcomes including mortality is equant to that of inpatient care. With regards to length of stay (LOS), the evidence is mixed but this may indicate that those who were on a VW or HAH received a more thorough CGA.

Patient or carer experience has previously been examined as part of a Cochrane reviews of HAH which found that patient satisfaction may be greater than for inpatient care (Sheppard et al., 2021) and provided patient centred care (Norman et al., 2023). With regards to carers, there is some research Sheppard et al., 2021 and Norman et al., 2023) which indicates that VW can increase caregiver stress and that it is important to involve family members and caregivers throughout the entire process. Service satisfaction questionnaires can lack rigour and provide false assurance of service quality as service users typically report high satisfaction but may have received poor care (Whelan et al., 2011). Patient reported outcome measures (PROMs) are considered to be more objective as the questions are designed to encourage the user to describe their actual experience of their care received (Kingsley et al., 2017). Experience and outcome are measured differently as PROMs are questionnaires measuring the patients' views of their health status. Patient reported experience

measures (PREMs) are questionnaires measuring the patients' perceptions of their experience whilst receiving care. There is no recognised PROM or PREM specifically designed for needs of frail older people and PROMs and PREMs are rarely used to inform quality and continuity in services at transitions of care (e.g. at discharge from hospital)

It is proposed that by using PROMS and PREMS as part of the VW in SBUHB, there is the direct ability to accurately determine patient and carer experience and develop improved pathways.

7.8.1.2 FDS

In 2022, SBUHB non-surgical fragility fracture patients had an average length of stay of 30 days. The SBUHB patient cohort with a fractured neck of femur who are aged over 65 had an average length of stay of 36 days with 720 admissions in 2022 alone. The GIRFT average is 19 days LOS. High local incidence of femoral fractures is believed to be contributed by historical failures to identify and treat non-femoral fragility fractures.

'Osteoporosis is a disease characterized by low bone mass and structural deterioration of bone tissue, with a consequent increase in bone fragility and susceptibility to fracture' (Sernbo and Jonell, 1993). Fragility fractures are intricately linked to osteoporosis and fractures tend to appear at low impact, i.e. a fall from standing height or less and tend to commonly occur in the wrist, spine, and hip. In England and Wales, it is estimated that annually around 180,000 fractures occur because of osteoporosis. Early identification of osteoporosis can prompt clinicians to consider risk assessments and treatments. Fractures have huge economical costs with hip fractures being the costliest, with the costs being estimated at £1.8 billion in 2000, increasing to £2.2 billion by 2025 (Burge et al. 2001). Non-femoral fragility fractures can be very painful and lead to a reduced life expectancy and quality of life.

Hip fractures require prolonged hospitalisation and can be fatal in up to 20% of patients, with 50% having a permanent disability post fracture and 30% of patients recovering to a pre-fracture level of function (Sernbo and Jonell, 1993). Hip fracture incidence is predicted to rise from 70,000 per year in 2006, to 91,500 in 2015 and 101,000 in 2020 (Department of Health and Social Care, 2006).

The additional need for wraparound medical, nursing, pharmacist, and therapies support of these frail elderly patient cohort with multiple co-morbidities prevented their early discharge. Deconditioning and healthcare acquired infections are inevitable challenges for patients requiring hospital admission, therefore longer inpatient stays often resulted in infection, deterioration, and loss of confidence for this combined patient cohort (Burge et al. 2001). Silo-working amongst multi professional teams in Secondary Care, Primary Care and third sector services prevented responsive, seamless transfer of care due to a lack of awareness and communication between teams. Patients were being failed due to the lack of collaboration between core teams capable of providing a fluid patient pathway from point of identification to the end point of rehabilitation. Cost efficiencies associated with avoidable admissions and reduction in length of hospital stay needed to be addressed for this cohort of patients due to the ongoing pressure to reduce bed occupancy within secondary care sites. Staff feedback from multi professional teams in Trauma & Orthopaedics, front door services and the VW in-reach team highlighted the frustrations around the lack of responsive pathway to support the quick turnaround and discharge of these patients back into their own home environment for ongoing care and rehabilitation. Evidence shows patients will be more mobile within a shorter period in familiar and supported environments such as their own homes (Burge et al. 2001). The Fracture Discharge Service was born from the need to do better for patients and prevent avoidable harm through breaking down barriers between services and promoting effective collaborative working.

7.4.2 Methods

7.4.2.1 VW

VW data from June 2023 to May 2024 was analysed. PROMS and PREMS were collected by the VW team at set time points in the patient journey. Demographic data was collected prior to the first patient interaction, and the PROM and PREM qualitative questionnaire data was collected. This data was collected using the PRO-MAPP digital interface ensuring inter-user consistency. This was collected primarily by the band 4 Assistant Practitioners using an iPad, prospectively whilst they were visiting the patients at home. This also enabled PREM data to be collected with the patient's care givers at the same time. The Assistant practitioners were trained by digital intelligence and the VW clinical lead on how to use the PRO-MAPP digital interface which also stores the data. It was collected on initial home visit by the VW team and at the last encounter with the VW team.

SBUHB is covered by eight community clusters (240 virtual beds), each with their own VW and the VW governance structure includes the routine collection of person-centred metrics. SBUHB covers a population of 390,000 with an annual budget of around £1 billion and the VW were set up in 2022 with a budget of just under £3 million. There are 5 VW in Swansea locality (Bay, Penderi, City, Cwmtawe and Llwcher) and 3 in Neath and Port Talbot (Upper Valleys, Afan and Neath), see Figure 7.5. The clusters range in size from the Upper Valleys which serves a population of 32,138 to Bay which serves a population of 75,221. The virtual wards exist to provide CGA, either to prevent hospital admission or deterioration in the community or step-down care to coordinate re-ablement, the transition to chronic disease specific services and ensure the discharge process and transition to primary care goes smoothly. Each Cluster based VW has a Clinical Manager (this is a band 7 nurse that oversees the VW), GP, Consultant Geriatrician, Pharmacist, Occupational Therapist, Physiotherapist, Band 4 Assistant Practitioner, Specialist nurses such as COPD, DM and Heart Failure, Band 3 Health care support Administrator and a Dietician.

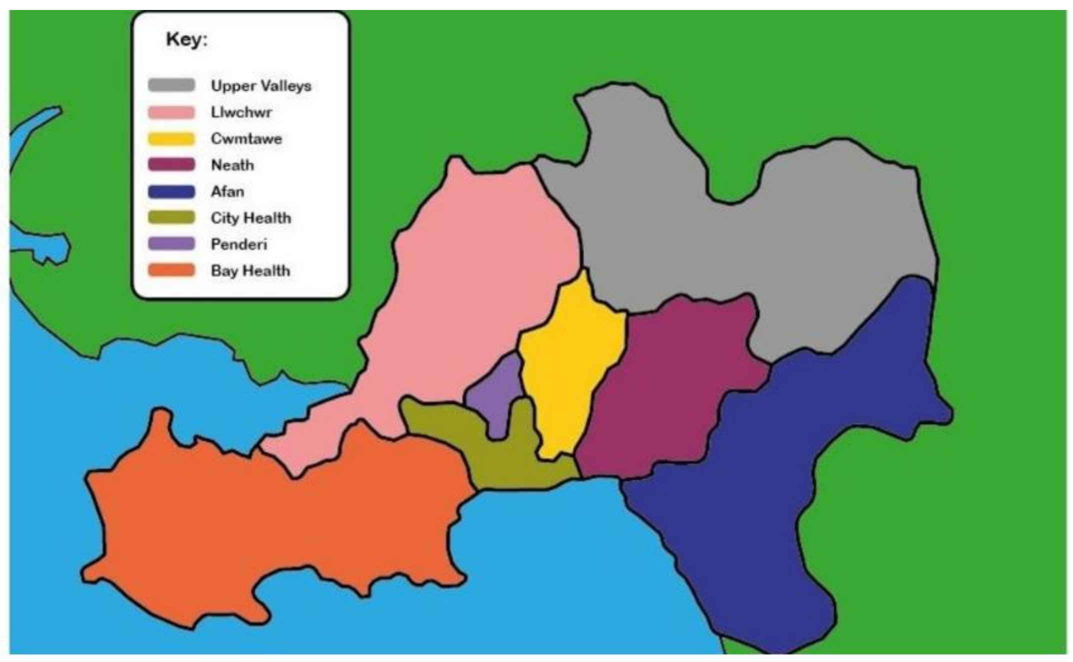


Figure 7.5. VW Clusters within SBUHB from SBUHB SharePoint

The VW in SBUHB were originally developed in 2021 with a pilot of 4 clusters as a scoping exercise, performed by Dr Elizabeth Davies. These 4 clusters were matched in socio-economic status to the other 4. The patients who were referred to the VW were from primary care only, with no interventions from secondary care and patients were identified using the electronic frailty index (EFI). The EFI is automatically calculated in primary care by the primary care software such as Education Management Information System (EMIS) and identifies patients who should be on a frailty register. The EFI uses a cumulative deficit model and looks a wide variety of 36 ICD codes including clinical symptoms and signs and diseases. It has only been validated in primary care and is not used in secondary care (Clegg et al., 2016) as secondary care is not able to use the same software for the EFI to be calculated. In this VW pilot within SBUHB, in those clusters with a VW, there were 9% less patients conveyed to hospital, indicating that the VW were able to perform an enhanced, step-up care model to usual primary care. This formed the basis for the funding for the VW to be rolled out to all the clusters within SBUHB.

As well as receiving referrals from secondary care, primary care and across the community we also use technology to identify patients from GP records, and hospital records, who have a high chance of a hospital admission, and each cluster has a weekly virtual MDT meeting. Patients that have been admitted onto the VW are discussed during this meeting and a plan is agreed for their care. The VW staff will then action that plan and communicate outcomes to the patient's GP and other teams involved in the patient's care. Most patients will have face to face reviews with several VW team members in their own home and may attend hospital for clinic or diagnostics. Despite being called a virtual ward, the service does not provide digital monitoring, and care is delivered face to face in the patient's home, in clinic or at the GP surgery (often a mix of all). Most patients attending the virtual wards are elderly (average age of 84 years old) have frailty scores of 6 or above. Approximately 20% of the patients being stepped down from hospital after a prolonged stay with the challenges that brings. Thirty percent have had a recent fall, the majority have several geriatric syndromes, have high rates of attendance to secondary care and are in the complex stage of frailty but still living at home. As healthcare services are asked to provide care to an ageing population, the development of robust intermediate care services is a core component of the required response.

There is an in-reach service to identify patients who are in the hospital, or ED, who could be admitted into the VW to avoid a hospital admission, or to move the patient out of hospital sooner. This includes Clinical Specialist Nurses plus a GP and a link to a Geriatrician. As part of this there is also specialist FDS for patients that have had a fragility fracture or are post-surgery. This team proactively work with the VW in the community to optimise their care in the community, avoid difficulties in transition to discharge in terms of medication reconciliation and follow up care and prevent readmission or admission in the first place. There is a close link with the OPAS at Morriston Hospital in Swansea. The team can provide a way into VW and provide increased clinical input if needed. This link also enables quick investigation and clinical assessment e.g. a patient who sustains a fall on anticoagulation, providing a rapid pathway for relevant investigations avoiding the need to go to an ED.

The inclusion criteria for admission to the VW is broad. This includes frail patients who have experienced deterioration, and/or a fall, and would benefit from wrap around MDT input to keep them at home. Also, frail patients with complex needs who would benefit from the input of an MDT to manage their care and keep them at home. It also includes any patient aged over 65 with a high number of recent hospital admissions. Patients who also benefit from VW can be end of life/palliative patients that is already at home and has wider health needs that could be met by an MDT. The focus is to reduced LOS so the VW prioritise patients in hospital who could be discharged earlier with the wrap around care we can provide in their home, or usual residence or patients that have suffered from a fragility fracture or is recovering post-surgery following fracture repair. The VW classify frail patients as those with a CFS of greater than 5.

The VW are not suitable for all patients and there is an exclusion criterion. This is mainly patients requiring a package of care long term as the VW does not have the staff or the funding to provide this for more than a set period. Also, patients who are fit to be discharged on a standard pathway, for example district nursing, home first should be discharged on the current services available. The VW does not have the clinical structure to care for acutely ill patients or patients requiring routine GP follow up, as this is an enhanced, rather than a replacement service.

7.4.2.2 FDS

When developing the FDS, a collaboration was formed between the following key services so that once patients were identified as eligible, they were placed on the FDS pathway and discharged with VW support. The key services that participated included:

1. OPAS for identification of the front door fragility fractures

2. Trauma and Orthopaedics (T&O) team for identification of suitable fractured NOF patients

3. Physiotherapy representatives from T&O and front door services to aid with early identification, assessment, and transfer of care

4. Virtual Ward in-reach/community teams to function as the platform to pull patients out of secondary care and provide the ongoing care in the community

5. Early Discharge Service to provide short term bridging of care, ongoing physiotherapy input, and general rehabilitation

7.4.2.3 Statistical analysis

Continuous variables are presented as the mean ± standard deviation, whilst categorical variables are presented as the number (%). Statistical significance for continuous variables was determined using student's t-test and categorical variables were determined using Chi-squared test. Statistical significance was taken at $P < 0.05$.

7.4.3 Results

7.4.3.1 Overall results

A total of 2564 patients were included for analysis from consecutive admissions from June 2023 to May 2024. Of the entire cohort, the mean age was 86.8 ± 8.4 years and 1452 (58.9%) were female. The majority, 1441 (56.2%), were referred from secondary care, primarily from acute frailty services such as OPAS, with the remainder identified by primary care. In total, 582 PROMS and 472 PREMS were collected.

7.4.3.2 PROMS results for service users

Overall, 583 PROMS were collected. The PROMS showed significant reported improvements in mobility, self-care, usual activities, pain, and anxiety & depression (P<0.001) after VW input. Each variable was assessed on a 5-point Likert scale, with 1 being “No” and 5 being “Extreme”. This was based on previous work on PROMS and PREMS (Kingsley et al., 2017). The questions are described in more detail in table 7.3 The questions asked the patient to report self-Improvements. before and after the VW involvement. The PROMS were collected at the start and at a set time point during the patients VW experience. This indicates that our VW were able to provide an improvement in patients’ health and wellbeing this is shown in table 7.3.

	1 –No problems		2 – Slight problems		3 – Moderate problems		4 – Severe problems		5 – Unable to		P Value
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	
Mobility	103 (17.6%)	141 (24.2%)	146 (25%)	212 (36.4%)	188 (32.3%)	141 (24.2%)	82 (14%)	35 (6%)	64 (11%)	54 (9.3%)	P<0.01
Self-care	164 (28.2%)	206 (35.4%)	153 (26.3%)	184 (31.6%)	131 (22.5%)	107 (18.4%)	61 (10.5%)	33 (5.7%)	73 (12.5%)	52 (8.9%)	P<0.01
Ability to perform ADLS	78 (13.5%)	128 (22.0%)	131 (22.5%)	175 (30.1%)	166 (28.5%)	145 (24.9%)	82 (14.0%)	40 (6.9%)	125 (21.5%)	93 (16.0%)	P<0.01
Pain and discomfort	180 (31.0%)	238 (40.9%)	167 (28.7%)	191 (32.8%)	136 (23.5%)	110 (18.9%)	67 (11.5%)	38 (6.5%)	31 (5.4%)	6 (1.0%)	P< .01
Anxiety and depression	236 (40.6%)	252 (43.3%)	167 (28.7%)	196 (33.7%)	104 (17.8%)	91 (15.6%)	52 (8.9%)	29 (5.0%)	23 (4.0%)	14 (2.4%)	P<0.01

Table 7.3: **PROMS outcome data.** *Pre* virtual ward intervention, *Post* Post virtual ward intervention, *ADLS* Activities of daily living

7.4.3.3 PREMS results for service users

Overall, 472 PREMS were collected The PREMS indicated that most patients found the VW had been explained well prior to referral (84.0%), were contacted promptly (95.6%), staff were professional and friendly (100%), provided patient-centred care (94.2%), staff were contactable (92.4%), were glad they avoided or reduced the length of hospital admission (95.3%). This was again using a 5-point Likert scale, with 1 being “Strongly agree/Always” and 5 being “Strongly disagree / Never”. When analysing the data, “Strongly agree/Always” and “Agree / Often” were classed as positive responses. The questions and responses are in Table 7.4 below. With respect to word maps for PREMS, again the experience is overall incredibly positive, shown in figures 7.6 to 7.7. This provides support for our in-reach team who are able to explain the service prior to the patient being discharged to the VW.

Question	1 – Strongly agree / Always	2 – Agree / Often	3 – Undecided / Sometimes	4 – Disagree / Rarely	5 – Strongly Disagree / Never
VW had been explained to the service user prior to referral to the service	217 (53.6%)	133 (32.8%)	18 (4.4%)	13 (3.2%)	24 (5.9%)
VW had contacted the service user promptly	273 (67.4%)	116 (28.6%)	10 (2.4%)	3 (0.7%)	3 (0.7%)
VW staff were friendly and professional	323 (79.8%)	82 (20.2%)	0	0	0
VW had involved the service user in discussions around their care	258 (63.7%)	126 (31.1%)	16 (4.0%)	3 (0.7%)	2 (0.5%)
VW had fulfilled the patients aims	244 (60.2%)	132 (32.6%)	22 (5.2%)	6 (1.4%)	1 (0.2%)
VW been contactable by the service user	243 (59.9%)	136 (33.6%)	18 (4.4%)	6 (1.4%)	2 (0.5%)
The service user had been confident that the VW would fulfil their needs	295 (72.1%)	84 (20.1%)	18 (4.4%)	2 (0.5%)	6 (1.4%)
The Service user was glad to go home	280 (88.3%)	20 (6.3%	11 (3.5%)	3 (0.9%)	3 (0.9%)
Service user's mood had improved n returning home	43 (67.2%)	4 (6.3%)	13 (20.3%)	2 (3.1%)	2 (3.1%)

Table 7.4: PREMS outcome data for service users

Is there anything you feel we could have done differently or better?

Figure 7.6: Word map for PREMs focusing on whether the service user felt like the VW could have done anything differently or better

Do you have any comments you would like to make about your experience of being on the virtual ward?

Figure 7.7: Word map for PREMs focusing on general comments the service user made about the VW

7.4.3.4 PREMS results for care givers

When speaking with 78 caregivers, they were happy the patients' needs were met (100%), and the VW positively impacted their lives as carers (90.1%). This was again using a 5-point Likert scale, with 1 being "Definitely" and 5 being "Never". When analysing the data, "Definitely" and "Probably" were classed as positive responses. This is represented in Table 7.5. When looking at the word maps for PREMS, again the experience is overall incredibly positive, shown in figure 7.8.

Question	1 – Definitely	2 – Probably	3 – Possibly	4 – Probably not	5 – Definitely not
VW met the needs of the service user	65 (83.3%)	7 (9.0%)	6 (7.7%)	0	0
VW had impacted on their lives as carers	46 (58.9%)	18 (23.1%)	7 (9.0%)	7 (9.0%)	0

Table 7.5: PREMS outcome data for care givers

Figure 7.8: Word map for PREMs focusing on whether the caregiver felt like the VW could have done anything differently or better

7.4.3.5 FDS

From March 2023 to March 2024, the service identified 457 patients, 312(68.7%) Female, with a median age 86 years. When looking at the type of fracture, 157(34.6%) patients had a femoral fracture and 300 (65.4%) were non-femoral fragility fractures, majority identified by OPAS, with 206 (68.7%) being discharged same day. Overall, admission was avoided in 207 (45.3%) patients and 247 (54.6%) had an early discharge/reduced LOS with 3 (0.1%) re-admissions avoided. The mean LOS on discharge is 6.6 days with a calculated monthly bed saving of 13.9 days across the service. The breakdown of fracture type and outcome is shown in Figure 7.9 below.

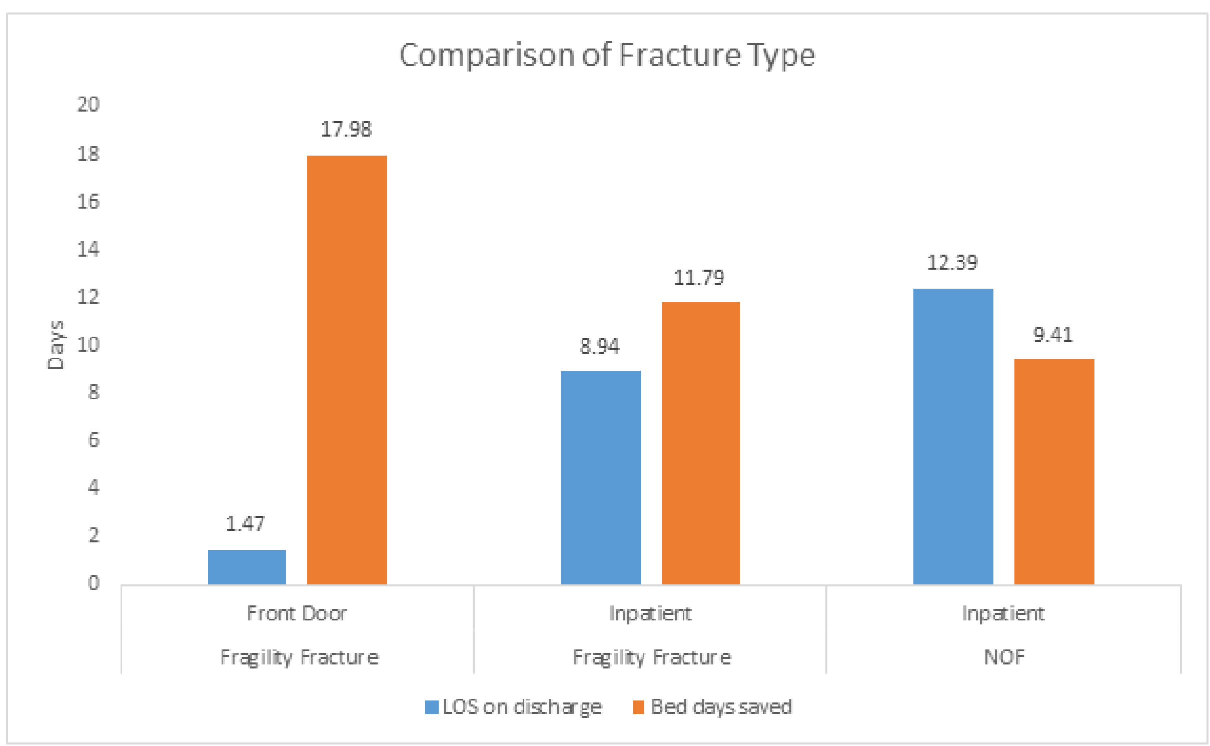


Figure 7.9: Outcomes of FDS. *LOS* Length of stay, *NOF* Neck of Femur fracture.

7.4.4 Conclusion

Overall, there was high patient and care-giver satisfaction with the VW service with the PROM data suggested a significant positive impact on patient outcomes. The PREM data showed that service user and care giver satisfaction was generally positive. By using PROM and PREMs as part of the VW model, these matrices can be used to further improve and develop the VW as it is beneficial to have constant feedback on the VW service.

Assessment in a person's own home is potentially less disruptive and more effective than acute admission to hospital. Many patients living with frailty are approaching the end of their life and it is important there is appropriate shared decision making, including advance care planning. The virtual ward should offer comprehensive geriatric assessment to people who are identified as living with moderate frailty (potentially amenable to intervention) or moderate to severe frailty who experience a functional change (most commonly presenting with falls or delirium) (Oliver et al., 2014

and Gordon et al., 2023). A holistic assessment of both physical and mental health should be undertaken and an intervention or signposting to other services instigated as appropriate. MDT meetings should continue for individuals on a continuing basis until frailty status stabilises or improves and identified issues are appropriately managed.

There are some limitations. Not all the patients referred to the VW have been sampled which is a missed opportunity and there was a variability between data collection between clusters, some clusters such as Afan having had a quarter of all responses, which shows a disparity. It also makes it difficult to compare data across clusters as there were large gaps in the data. It is important to encourage staff within all the VW clusters to collect PROM and PREM data.

There are limitations using PROMS and PREMS. Previous research (Kingsley et al., 2017) has indicated that PROMS and PREMS should be collected at home at a time which suits the patient, which we have achieved here. It is also thought that patient demographics can affect the data, which we are unable to control for here, but further data collecting across all clusters should account for this. By using questionnaires to determine causal differences between patients, is tricky as it is difficult to accurately determine patient experience on a Likert Scale, but the free text boxes and word maps have matched with the PROMS and PREMS scoring. This indicates that there is overall satisfaction with the services provided.

There are some barriers about accessing the VW from within secondary care. The newly funded frailty strategy within SBUHB is working to integrate the VW with the community acute clinical teams and the acute frailty service to provide a robust integrated interface team that can deal with referrals (urgent and non-urgent) from the community and secondary care in a more agile way through a single point of referral and provide a fully integrated response according to patient need and not traditional

service boundaries. The virtual ward team should be able to offer effective home and community based reablement services, including direct access to inpatient reablement for patients who require it. This facilitates 'step-up' care to avoid admissions, and 'step down' care to support post hospital care.

The high demand seen in planned and unscheduled care has made it imperative that we create a robust and integrated service for older people. An integrated system requires the creation of a single point of access which has the capability to signpost a patient, according to their individual needs to the most capable provider within the network of aligned frailty services. Patients presenting with frailty are not a homogenous group of people. Diverse and specialist skills are required to tailor individualised management plans, which is often omitted or delayed for a sizeable proportion of patients presenting with urgent care needs.

Current data shows fractured NOF patients are being pulled out of secondary care as early as day 3 post op with the necessary wraparound support to rehabilitate at home. Fragility fractures are being identified at the front door and turned around the same day back to their home environment with support from therapies, nursing, pharmacy, and medical teams. Patient and family feedback themes include quicker discharge, better outcomes for loved ones, improved mobility, and better wellbeing associated with being at home, wraparound care helped improve other aspects of lifestyle.

In conclusion, it has been shown that by embedding PROMS and PREMs data collecting into a VW interface, has demonstrated a positive impact of the service, in a way which has not been shown previously. Further research is needed to ensure that the data is collected evenly around clusters; to enable comparisons between clusters and this data can be used to expand the VW service within SBUHB.

7.5 Overall conclusions

By improving education to staff in NH, adverse outcomes especially related to those secondary to falls with a long lie to NH residents who fall can be reduced to maximise recovery from the fall that resident is given the right care, at the right time, in the right place. Hospital admission can be avoided in several patients, and the negative side effects e.g. delirium can be reduced. Also, collaboration between AGPU, WAST and OPAS shows significant conveyance reduction, ultimately delivering a better patient experience and system efficiency.

Within the VW structure, A Step-up referral pathway has been created between Virtual Ward and OPAS to ensure a seamless referral route is in place for any patients who require rapid assessment or diagnostics. OPAS will accept these patients directly from Virtual Ward and discharge back to their care once the intervention is complete. This avoids unnecessary admission or re-admission. Overall, there was high patient and care-giver satisfaction with the VW service with the PROM data suggested a significant positive impact on patient outcomes. The PREM data showed that service user and care giver satisfaction was generally positive. By using PROM and PREMs as part of the VW model, these matrices can be used to further improve and develop the VW as it is beneficial to have constant feedback on the VW service.

Collaborative working has created an early supported discharge pathway. Femoral fracture patients are discharged earlier, some 3 days post-op, with the necessary support to continue reablement at home. Fragility fractures are identified at the front door and offered same-day discharge with ongoing comprehensive geriatric assessment and reablement within the virtual wards with positive feedback from patients and their families. Single-profession collaboration; bringing secondary care and primary care colleagues together to identify barriers to referral and agree a pathway for safe, effective discharge. To date this has been widely used by FDS OT, PT, Medical and Nursing teams. Virtual Ward collaboration with T&O and ED colleagues by representing FDS on board rounds to help identify the most appropriate

patients and discuss discharge pathways with the named clinician. A seamless VW referral pathway has ensured continued communication from ‘ward to home’ with patients and family having same day contact to ensure they remain supported, informed, and confident of the care plan in place.

Falls remain a significant burden on ED and WAST and we have shown education plus collaboration between AGPU, VW, WAST and OPAS shows significant conveyance reduction, ultimately delivering a better patient experience and system efficiency. This has the potential for multiple areas of cost saving, from the ambulance call out themselves with each call-out has a cost per hour of £101.34, with average offload for those >65 years old being 406 minutes, saving £27,000 per month on offloads alone plus the cost savings from reducing the impact of non-femoral fragility fractures. Further work should be focused on analysing the VW data in more detail, to see which patients benefit the most from these services.

Chapter 8 – Overall conclusions and discussions

8.1 Introduction

This chapter examines the conclusions of each individual chapter and then provides an overall conclusion to the thesis.

8.2 Specific chapter conclusions

8.2.1 Chapter 1 - Introduction and Systematic literature review

The aim of this chapter was to undertake a systematic literature review of published studies investigating clinical frailty interventions. This specifically focused on whether a physical specialist assessment unit based in the Emergency Department improved patient centred outcomes for those patients aged over 65 years old. This review aims to assess whether either a liaison team in the ED or a unit-based CGA model improves outcomes that matter most to older patients, including activities of daily living (ADL) improvement or maintenance, timely discharge shown by a reduced length of stay (LOS), reduced readmissions, and reduced admission rate.

The overall review showed a shift towards holistic, patient-centred care models for frail older adults in the ED. It does not have an influence whether the approach is unit or liaison based but more that effective frailty management requires addressing medical, functional, and social needs in an integrated manner and considering care both during the ED visit and in transition to other settings. This is achieved by a CGA, by a team of trained professionals, rather than the actual physical setting. It appears that the best outcome for older, frailer adults is to have a geriatrician led, MDT team to provide a structured assessment with integration with community teams. Further research is needed to look specifically at patient reported measures. This thesis will focus on different methods of identifying frailty and how patient specific outcome measures can be improved. This was a gap in the current research which is what this MD aims to address.

8.2.2 Chapter 2

The aim of this chapter was to describe what the OPAS is and how it was developed. The service was described in detail, and how the database was used for this MD thesis. This thesis was a service-based evaluation which took place at clinical sites across SBUHB. The project was taken in collaboration with the COTE team in Swansea who have supported the design of this study. The OPAS data was used for most of this thesis, and I was fortunate to be able to use the data and develop multiple different pathways, mentioned in the chapters below.

The OPAS database and OPAS service has provided a logical stepping stone for the remainder of this thesis to try a find a solution to the problems noted above. This will specifically focus on whether a physical specialist assessment unit based in the ED improves patient centred outcomes. As part of this, another aim is to determine the best approach for prehospital treatment of patients with frailty, focusing on Proactive Care and finally to determine the best approach for in-hospital treatment of patients with frailty, particularly focusing on pathway management and MDT input, improving reactive care. It is only by working as a team, that front door, inpatient, and community services can be linked to provide the best, holistic care for frailer, older patients.

8.2.3 Chapter 3

The aims of this chapter were to examine how frailty scoring, and the identification of frail patients can be used to improve outcomes at this crucial stage, between hospital admission and seeking medical input. During the admission-decision process, shared decision making, especially in frailer, older adults is essential. Aim 1 was to analyse at ambulance offload delays and how frailty influences this. Aim 2 was to look at the HFRS and how this can be applied to patients in the ED and how the CFS links with the HFRS.

With respect to aim 1, in conclusion, those with increased AOD had increased 6-month mortality and increased hospital LOS, especially prevalent in those aged over 65 years old. We have shown that with a frailty specific area which specialist staff who can perform a comprehensive geriatric assessment for these patients can significantly improve patient outcomes and experience. There were extremely high rates of bed occupancy by older frail patients. This is why it is important that we identify frailty at the front door, even prior to hospital admission. This has never been evaluated before in an ED, especially comparing patients who were offloaded into a frailty-specific area and those who remained under usual care.

There are multiple ways of identifying frailty in the ED, as examined in Aim 2. The HFRS and CFS both have their benefits and identifying older people at risk of adverse outcomes in hospital can allow a system to provide frailty-specific interventions throughout their stay. To aid triaging and in identifying who would benefit from the input of the OPAS in Morriston Hospital, ED, both scores were analysed. Overall, The HFRS was significantly associated with CFS and age in our ED population. The frailty flag that was developed using the HFRS data has been amended as the HFRS identified 57% of the retrospective OPAS cohort, and with the addition of greater than 80years of age, the modified score identifies greater than85% of service users. In our sample, the majority of those with CFS <5 and flagged as High/Intermediate HFRS, had a CFS of 4 (66 of 72 patients) and these “Pre-frail” patients would also benefit from a CGA. This has important consequences as those classed as “Low” frailty per HFRS still had an average CFS of 4.4 and would also benefit from a CGA. This shows the importance of frailty assessment as a means of identifying those who need a CGA. Since the beginning of November 2023, the daily proportion of patients in the ED who are flagged by the HFRS is 38% (mean average). There is clearly a failure in providing timely assessment and onward movement through the system for this group of patients within the department. The ED regularly experiences poor patient flow and overcrowding, this impacts on the delivery of key targets, system efficiency, patient experience, and outcomes. The inability of the current system to manage frailty effectively is a major driver in this failure.

8.2.4 Chapter 4

Identifying frail patients who may benefit from CGA is essential for individuals and overall system efficiency. However, patient selection is difficult to achieve with usual bed management processes and there is a growing need to develop alternative pathways which tend to focus on ambulatory care or SDEC. The aim of this chapter was to retrospectively apply these scoring systems to service users who attended the OPAS to evaluate the applicability of patient selection scoring systems to identify older frail patients who were suitable for SDEC. This will identify people at risk of adverse outcomes in hospital to provide a system of frailty-specific interventions throughout their stay and to provide a way of stratifying who would be suitable for SDEC. The most frequently cited and tested scores are the Amb (Ala et al., 2012), the GAPS (Cameron et al., 2014) and START (DInh et al., 2016).

This analysis was the first comparing all three scores in the UK and in a specific frailer, older population. In our centre, the same day discharge was 78% for patients, despite having high incidences of delirium, high CFS and CCI, therefore, perhaps a more useful principle for promoting ambulatory care is to assume that all patients are suitable for ambulatory care until proved otherwise. Further research is needed to delve into what factors can assist signposting who is suitable for SDEC in this unique population.

8.2.5 Chapter 5

The aim of this section of work was to develop a novel SDEC score for older, frailer adults, called the F. SDEC score. Several scores have been developed to identify SDEC patients from ED triage and acute medical intakes. Scores are designed to improve system efficiency, overcrowding and patient experience but none have been developed for older adults. Previous work has shown that existing scores e.g. GAPS, START and Amb Score were not able to predict admission in our population (see Chapter 4).

The efficacy of the F. SDEC score is comparable to the results derived in validation cohorts of existing and recommended scores. The F. SDEC score is currently being prospectively assessed in our new integrated frailty hub which comprising of patients from all streams within the hospital and community. This includes direct from the ambulance service, from nursing homes, escalations from the ACT in the community, SDEC, ED and the AMU. Frailty is a dynamic measure which is not fixed, and there can be a major bias in calculating the CFS especially when external factors such as cognitive impairment can limit someone's functional ability. Evidence shows that clinical judgement, alongside an MDT providing a CGA is gold standard care, which is difficult to provide using traditional methods. The F. SDEC score can hopefully be used to streamline this process and help identify patients who are suitable to be discharged on the right pathway early on, making sure they get care in the right place and reducing length of stay. The earlier we can transfer care to a VW or community service such as ACT will be better for patient care and flow and LOS. This is the first frailty specific ambulatory score developed and multi-centred tested is needed to further prove its efficacy.

8.2.6 Chapter 6

Falls are a huge burden and cause significant morbidity and mortality. There are many factors that contribute to falls, including frailty and multi-morbidity from chronic disease. It is recognised that polypharmacy is often beneficial. For example, secondary prevention of myocardial infarction requires the use of at least four different classes of drugs (antiplatelets, statin, ACE inhibitor, beta blocker). Patients at highest risk of inappropriate polypharmacy are those with the greatest frailty, on the most medicines and taking high risk medicines. Tools can aid physician deprescribing but as people live with increasing frailty, it is important that shared decision making occurs around prescribing and polypharmacy especially when the person is in the last 6 months of life. This is especially important in medications that have long term effects such as medications for blood pressure, cholesterol, and cognitive impairment.

The first aim of this chapter was to apply the STOPPFrail criteria to identify PIMs in frail older adults with poor predicted one-year survival and to determine the proportion of older adults in which STOPPFrail criteria are applicable and to measure the prevalence of STOPPFrail PIMs and identify potential medication cost savings. In conclusion, STOPPFrail was able to identify several PIMs in a front door setting and when used as part of a CGA, can help clinicians deprescribe. Those who were identified as being eligible also had increased mortality, frailty, and multi-morbidity. STOPPFrail has been incorporated into the routine structured medication review process within the local services. This was the first study of its kind applying the STOPPFrail criteria in an ED population.

The second aim was to examine whether people with T2D admitted to hospital with a fall, were more likely to have greater frailty, co-morbidity burden, or risk factors for falls and use guidelines to assist with deprescribing. In conclusion, Falls are a significant burden, and hypoglycaemia-inducing agents may contribute to the greater mortality observed in people with T2D. People with T2D had a similar CFS, were more likely to be male and be prescribed more concomitant medicines. Clinician awareness can support de-prescribing for frail patients with HbA1c less than 64mmol/mol. There should be increased awareness of the impact of hypoglycaemia, especially in those using insulin or gliclazide. Individualised care plans detailing co-morbidities, presence of frailty or functional loss (including cognition), individualised agreed goals of treatment, medications, frequency of monitoring, target capillary blood glucose and HbA1c, blood pressure and serum lipid levels are helpful. Other modifiable risk factors such as alcohol excess should be studied. This has not been previously studied in an ED population.

The final aim was to examine whether people admitted to hospital with a fall and had a history of alcohol excess, were more likely to have greater frailty, co-morbidity burden, or risk factors for falls. It was also examined whether people with a history or current alcohol abuse associated with poor clinical outcomes in a cohort of patients admitted to the ED with a fall. A second aim was to see whether the POSAMINO

criteria could be used to identify PIMs to assist with deprescribing. This study of fallers who present to ED shows the importance of ascertaining a patients' alcohol history to allow for thorough understanding of falls risk within individuals. Routinely using the POSAMINO criteria can aid clinician de-prescribing decisions, especially in this cohort who are more vulnerable for recurrent falls. However further research is needed to fully appreciate the causal relationship between alcohol consumption and falls. It would also be useful for further research to measure units consumed to enable development of more accurate algorithms for assessing falls risk and allow for a clearer comparison of data between studies. Current knowledge of the effect of alcohol on co-ordination and balance would point towards this increased risk likely being because of the effects of alcohol. However, more research would be needed to fully appreciate the risk alcohol poses to falls risk in the older population. This has not been previously studied in an ED population in a subset of older adults who fall.

8.2.7 Chapter 7

The Welsh Government's Six Goals for Urgent Care Programme (Welsh Assembly Government, 2021), the GIRFT report on geriatrics (Jones et al., 2022) and the NHS England Right Care (NHS England, 2019) guidance concerning frailty, all clearly describe the requirement to provide an integrated system that includes secondary care, primary care, care homes, community services, ambulance services, local authorities and the voluntary sector and is centred on the needs of individual patients and focused on preventing inappropriate hospitalisation and progression of frailty. Older people living with frailty are more likely to have delayed transfers of care if they are admitted to hospital and are vulnerable to the potential adverse effects of hospital admission i.e. deconditioning, delirium and inpatient falls (Oliver et al., 2014 and Keeble et al., 2019). People living with frailty could often have their needs best met in settings outside of acute hospital care. Assessment in a person's own home is potentially less disruptive and more effective than acute admission to hospital. Many patients living with frailty are approaching the end of their life and it is important there is appropriate shared decision making, including advance care planning.

By providing outreach from hospital teams to intervene into NH for older, frailer adults who fall by developing an education package provided to the NH staff around falls and the adverse effects associated. By improving education to staff in NH, adverse outcomes to NH residents who fall can be reduced to maximise recovery from the fall that resident is given the right care, at the right time, in the right place. Also, collaboration between AGPU, WAST and OPAS shows significant conveyance reduction, ultimately delivering a better patient experience and system efficiency.

The results have shown that by embedding PROMS and PREMs data collecting into a VW interface, has demonstrated a positive impact of the service, in a way which has not been shown previously. Further research is needed to ensure that the data is collected evenly around clusters; in order to enable comparisons between clusters and this data can be used to expand the VW service within SBUHB. Within the VW structure, A Step-up referral pathway has been created between Virtual Ward and OPAS to ensure a seamless referral route is in place for any patients who require rapid assessment or diagnostics. OPAS will accept these patients directly from Virtual Ward and discharge back to their care once the intervention is complete. This avoids unnecessary admission or re-admission. Overall, there was high patient and care-giver satisfaction with the VW service with the PROM data suggested a significant positive impact on patient outcomes. The PREM data showed that service user and care giver satisfaction was generally positive. By using PROM and PREMs as part of the VW model, these matrices can be used to further improve and develop the VW as it is beneficial to have constant feedback on the VW service.

Collaborative working has created an early supported discharge pathway. Femoral fracture patients are discharged earlier, some 3 days post-op, with the necessary support to continue reablement at home. Fragility fractures are identified at the front door and offered same-day discharge with ongoing comprehensive geriatric assessment and reablement within the virtual wards with positive feedback from patients and their families. Single-profession collaboration; bringing secondary care and primary care colleagues together to identify barriers to referral and agree a

pathway for safe, effective discharge. To date this has been widely used by FDS Occupational Therapists, Physiotherapists, Medics, and Nursing teams. Virtual Ward collaboration with T&O and ED colleagues by representing FDS on board rounds to help identify the most appropriate patients and discuss discharge pathways with the named clinician. A seamless Virtual Ward referral pathway has ensured continued communication from 'ward to home' with patients and family having same day contact to ensure they remain supported, informed, and confident of the care plan in place.

8.3 Overall conclusions

Frailty needs to be considered as part of a whole systems approach. A 'one size fits all' does not work as work, as frailty cannot occur in isolation. It must fit with a health care system's strategic plan recognising the need to deliver a high-quality and sustainable system. During the admission-decision process, shared decision making, especially in frailer adults is essential. This MD aimed to examine the different approaches and how they affect adverse patient outcomes and experiences.

In December 2023, in SBUHB, 67.55% of the medical beds occupied at Morriston were occupied by patients aged over 70 years and 41.4% occupied by those aged over 80 years. Deconditioning during hospital admission and resultant dependency on social care are common in SBUHB. A more robust offer for frailty at the interface between community and acute services is required to intervene earlier, avoid admissions and prevent the harms of admission for those who require it by ensuring recognition of frailty and offering rapid specialist intervention.

There were approximately 6,500 admissions in the over 80's through ED and AMAU and 11,500 aged over 70 years old in the 6 months between October 2023 and April 2024. Not all these patients will be frail, but these numbers are considerably higher than the activity of current acute frailty services and indicate a likely mismatch of service provision to demand (approximately 2,000 patients being assessed by OPAS

and the Older Person's Short Stay Unit in 6 months). This indicates that an improvement in service provision and integration with community services may offer considerable benefit to the wider system by admission avoidance and reducing the risk of deconditioning and hospital acquired harm.

Falls remain a significant burden on ED and WAST and we have shown education plus collaboration between AGPU, VW, WAST and OPAS shows significant conveyance reduction, ultimately delivering a better patient experience and system efficiency. This has the potential for multiple areas of cost saving, from the ambulance call out themselves with each call-out has a cost per hour of £101.34, with average offload for those >65 years old being 406 minutes, saving £27,000 per month on offloads alone plus the cost savings from reducing the impact of non-femoral fragility fractures. To facilitate this, Hospital at Home and VW aim to provide a safe, effective, and person-centred alternative to hospital inpatient care. VW are a time-limited service enabling people who have an acute condition or exacerbation of a chronic condition requiring hospital-level care to receive this care in the place they call home, either as an alternative to hospital admission or by facilitating an earlier discharge from hospital.

This thesis demonstrates that improving outcomes for older adults living with frailty requires a coherent, system-wide approach spanning the pre-hospital environment, the Emergency Department (ED), acute hospital care, ambulatory pathways, and community-based services. The collective findings from each chapter highlight several overarching conclusions relevant to contemporary frailty care and service design.

First, the systematic literature review established that the key determinant of improved patient-centred outcomes is not the physical location of frailty assessment—whether unit-based or delivered via a liaison model—but the consistent provision of CGA by a skilled multidisciplinary team. Effective frailty care necessitates a holistic, integrated

approach that addresses medical, functional, and social domains and ensures continuity across care settings.

The development and application of the OPAS provided a robust framework for examining frailty pathways within the urgent and emergency care system. Findings from the analysis of ambulance offload delays, frailty stratification tools and patient flow highlight the importance of identifying frailty at the earliest opportunity, ideally prior to admission. Given the substantial burden of frail older adults on ED capacity and bed occupancy, early recognition and timely access to specialist assessment are essential for improving outcomes and system efficiency.

The evaluation of existing SDEC scoring systems demonstrated that widely used tools such as GAPS, START and the Amb score are poorly calibrated for frail, older populations. This evidence gap informed the development of the novel F. SDEC score, the first frailty-specific ambulatory triage tool designed to support early discharge, reduce length of stay, and facilitate timely reablement. Early findings indicate promising performance, although further prospective and multi-centre validation is required.

The chapters addressing medication review underscored the substantial potential for harm associated with polypharmacy in frail older adults, particularly in those with limited life expectancy or at heightened risk of falls. Applying STOPPFrail and POSAMINO within an ED population for the first time identified significant opportunities for deprescribing and optimisation of medication regimens. These tools, when embedded within CGA-led pathways, support safer prescribing practices and align treatment with individual goals of care.

The analyses relating to falls, type 2 diabetes and alcohol excess emphasised the multifactorial nature of falls risk and demonstrated the value of detailed, individualised assessment. The findings highlight the need for clinicians to recognise modifiable contributors such as hypoglycaemia risk or harmful alcohol use and to integrate these into personalised management plans that reflect frailty status and functional capacity.

Finally, the evaluation of VW models and associated collaborative pathways demonstrated the benefits of integrated, cross-sector working in reducing avoidable hospital conveyance, facilitating early supported discharge, and improving patient and carer experience. The inclusion of PROMs and PREMs provided evidence of positive patient-perceived impact and offers a mechanism for continuous service improvement. Enhanced coordination between OPAS, community teams, care homes, ambulance services, and secondary care exemplify the type of integrated, person-centred approach advocated in national frailty and urgent care policy.

In summary, this thesis provides new evidence that frailty is best managed through early identification, timely CGA-led intervention, and robust integration across hospital and community services. By developing and evaluating novel tools, examining gaps in current practice, and demonstrating the value of collaborative models of care, this work contributes meaningful insights into how health systems can better meet the needs of older adults living with frailty. The findings reinforce the vital importance of multidisciplinary expertise, individualised care planning, and seamless transitions in achieving outcomes that matter most to patients—maintaining independence, avoiding unnecessary admission, and mitigating the risks associated with acute hospital care. It is only by working as a team, that front door, inpatient, and community services can be linked to provide the best, holistic care for frailer, older patients.

8.4 Future directions

Providing the right care to the right person in the right place is imperative. The F. SDEC score can hopefully be used to streamline this process and help identify patients who are suitable to be discharged on the right pathway early on, making sure they get care in the right place and reducing length of stay. The earlier we can transfer care to a VW or community service such as ACT will be better for patient care and flow and LOS. This is the first frailty specific ambulatory score developed and multi-centred tested is needed to further prove its efficacy.

Further research is needed especially now OPAS has now moved from an ED based liaison model to a Physical Specialist Assessment Units (PSAU) model. Both involve MDT input including physiotherapy, occupational therapy, and geriatric assessment, have been proposed to optimize outcomes. OPAS provides a CGA which is a targeted intervention, aiming to integrate physical assessment and rehabilitation planning early in the care pathway. Analysis is needed to see how patient outcomes have differed with these different approaches as this is a unique scenario where the same team has performed both interventions.

Further research is also needed on chronic diseases in older adults who fall, especially with regards to heart failure and polypharmacy. A small pilot study analysing patients from Acute clinical team reviewed due to having significant side effects from heart failure (HF) treatment. Identified by a community geriatrician from January to August 2023. In total, 139 patients including 76 males and 63 females with a mean age 84.3 ± 6.5 years were retrospectively analysed. When looking at demographics, 122 came from own home with 17 patients from a RH or NH. The CFS prior to treatment was 5.4 ± 1.9 with an increased CFS after 6 months treatment of 5.7 ± 1.9 ($P < 0.001$). The mean CMI was 6.9 ± 1.8 with a NYHA (New York Heart Association) score of 2.4 ± 0.8. The average numbers of medications for HF were 2.8 ± 1 and the average Pillars of treatment was 1.9 ± 1.1. No difference in Type of HF (HFrEF/HFpEF) with CFS ($P=0.99$), Age ($P=0.10$) but HFREF had increased mortality ($P<0.001$). Those with

diabetes had increased mortality ($P<0.001$). Those admitted with dementia/delirium were frailer and had higher pro BNP. Overall, 29 (20.9%) died in 6 months with 115 (82.7%) seen by falls services, 33 admitted (28.7%) and 8 (24.2%) had sustained a fracture following a fall. Only 45 (32.3%) had improvement in left ventricular function. This was a small pilot study with a biased sample so the HF team database needs to analyse in the same way before any conclusions can be made.

Chapter 9 – Appendices

9.1 Approval from R&D and Dr Davies

Department for the Care of the Elderly
Morriston Hospital
Swansea
SA6 6NL

Our Ref:	ED/LK/	Contact:	Louise King (Secretary)
Your Ref:		Direct Line:	01792 530746
Date:	02/06/2025	Email:	Louise.L.King@wales.nhs.uk

To Whom It May Concern,

Re: Project Approval – "Interventions in Acute Frailty" by Dr Alexandra Burgess

I confirm that the project entitled "Interventions in Acute Frailty", submitted by Dr Alexandra Burgess, was reviewed in line with the governance procedures of Swansea Bay University Health Board.

A consultant colleague discussed the proposed project—using routinely collected service data and patient feedback—with the local NHS Research Ethics Committee. Following review, the committee advised that the work falls squarely within the remit of service evaluation and quality assurance, and as such, does not require formal ethical approval.

The proposal was subsequently discussed with the Clinical Governance Committee of Swansea Bay University Health Board. The committee confirmed that the project could proceed in full as a quality improvement initiative, consistent with the principles of good clinical governance and appropriate use of existing service data.

This letter affirms that the necessary governance and ethical considerations have been addressed and that the project is compliant with institutional and national standards for service evaluation.

Yours sincerely,

Dictated but not signed to expedite communication

Dr Elizabeth Davies
Clinical Director
Care of the Elderly & Frailty Services
Swansea Bay University Health Board

9.2 OPAS Referral form

OUT OF HOURS REFERRAL FOR THE OLDER PERSONS ASSESSMENT SERVICE (OPAS)

Affix patient sticker

Patient's Phone Number ....

Date.. Time..............................

Referred by..

Position..

Reason for referral, eg. CGA, Physio. OT...

Brief history (description of case)..
....
....
....

Clinical questions and actions required, including urgency...
....
....
....

PMH...
....
....
....
....
....

Medication...
....
....
....
....
Allergies..

Clinical Frailty Score (CFS)...

Has patient been seen by OPAS before Y/N............

Does Patient have carers...

Does patient use mobility aids...

Other services involved...
....

Will patient need transport to OPAS................................

Older Peoples Assessment Service
OPAS
Gwasanaeth Asesu Pobl Hŷn

9.3 The example of the hospital frailty risk score interface as shown on the ED system in Morriston Hospital

The patients identified in red are those who are identified by the frailty flag

9.4 Data collection form for HFRS created on Microsoft forms

HFRS Data collecting form

The survey will take approximately 4 minutes to complete.

* Required

1. Hospital Number *

2. Gender *

- Woman
- Man
- Non-binary
- Prefer not to say

3. Age *

4. DOB

5. Postcode

6. CFS *

- ◯ 1
- ◯ 2
- ◯ 3
- ◯ 4
- ◯ 5
- ◯ 6
- ◯ 7
- ◯ 8
- ◯ 9

7. Presenting Complaint

[ ]

8. Presenting Complaint is Frailty Syndrome

- ☐ Dementia / Delirium
- ☐ Falls
- ☐ Polypharmacy
- ☐ Unmet Care Needs
- ☐ Continence
- ☐ Reduced Mobility
- ☐ Other

9. HFRS Flag?

- ◯ Yes
- ◯ No
- ◯ Unsure (Alex to Check)

9.5 Amb Score

An AMB score of >5 identifies patients who are potentially suitable for AEC.

Variable	Points
Female sex	1
Age <80	1
Has access to personal / public transport	1
IV treatment not anticipated by treating doctor	1
Not acutely confused	1
MEWS score = 0 1	1
Not discharged from hospital within previous 30 days	1

9.6 GAPS score

Variable	Points
Age	1 point per decade
National Early Warning Score	1 point per point on NEWS
Triage category	
3	5
2	10
1	20
Referred by GP	10
Arrived by ambulance	5
Admitted within last twelve months	5
Age 1 point per decade	Age 1 point per decade

9.7 START Score

Variable	Points
Age (%)	
16–19years	0
20–39 years	+1
40–59 years	+3
60–79 years	+6
≥80 years	+9
Ambulance arrival	+4
Triage category	
1	+24
2	+16
3	+11
4	+5
5	0
Admission within 30 days	+3
Hour of presentation	
08:00–17:59	+1
18:00–22:59	0
23:00–07:59	0
Presenting problem	
Abdominal, gastrointestinal	+2
Cardiovascular	−3
General symptoms	0
Febrile illness	+3
Injury	−4
Respiratory	0
Musculoskeletal	−3
Neurological	−1
Mental health	−2
Toxicological	−2
Ear, nose and throat/eye/head and neck	−6

Administrative	−3
Genitourinary	−1
Social	+1
Endocrine	0
Obstetrics, gynaecology	−3
Skin, allergy	−2
Other medical	+5

9.8 F. SDEC score

Variable	Points
Gender	
Female	0
Male	1
Age	
<69	0
70-79	0.5
80 – 89	1
>90	1.5
Presenting complaint	
Fall	0
General Med	2
News score	
0-1	0
2-3	1.5
≥4	3
CFS	
1-3	0
4	0.5
5-6	1
7-9	1.5
CCI	
<5	0
5-7	0.5
≥7	1
Discharged last 30 days	
No	0
Yes	0.5
4AT	
0	0
1-3	1

≥4	2
Living situation	
Alone with No POC/ Social support	1
Alone with POC/ Social support	0.5
Spouse / Family	0
NH/ RH/ Other LT care facility	0
Coping at home	
Yes	0
No	2

9.9 STOPPFrail – Version 2

STOPPFrail is a list of potentially inappropriate prescribing indicators designed to assist physicians with stopping such medications in older patients (≥ 65 years) who meet ALL of the criteria listed below:

1. End-stage irreversible pathology
2. Poor one-year survival prognosis
3. Severe functional or severe cognitive impairment or both

Symptom control is the priority rather than prevention of disease progression

The decision to prescribe/not prescribe medications to the patient, should also be influenced by the following issues:

1. Drug adherence/compliance is difficult
2. Administration of the medication is challenging
3. Monitoring of the medication effect is challenging

Drug adherence/ compliance is difficult   Section A: General

A1: Any drug that the patient persistently fails to take or tolerate despite adequate education and consideration of all appropriate formulations.

A2: Any drug without clear clinical indication.

Section B: Cardiology system

B1. Lipid lowering therapies (statins, ezetimibe, bile acid sequestrants, fibrates, nicotinic acid and acipimox)

These medications need to be prescribed for a long duration to be of benefit. For short-term use, the risk of adverse drug events (ADEs) outweighs the potential benefits

B2. Alpha-blockers for hypertension

Stringent blood pressure control is not required in very frail older people. Alpha blockers in particular can cause marked vasodilatation, which can result in marked postural hypotension, falls and injuries

Section C: Coagulation system

C1: Anti-platelets

Avoid anti-platelet agents for primary (as distinct from secondary) cardiovascular prevention (no evidence of benefit)

Section D: Central Nervous System

D1. Neuroleptic antipsychotics

Aim to reduce dose and discontinue these drugs in patients taking them for longer than 12 weeks if there are no current clinical features of behavioural and psychiatric symptoms of dementia (BPSD)

D2: Memantine

Discontinue and monitor in patients with moderate to severe dementia, unless

memantine has clearly improved BPSD (specifically in frail patients who meet the criteria above)

Section E: Gastrointestinal System

E1. Proton Pump Inhibitors

Proton Pump Inhibitors at full therapeutic dose ≥ 8/52, unless persistent dyspeptic symptoms at lower maintenance dose

E2: H2 receptor antagonist

H2 receptor antagonist at full therapeutic dose for ≥ 8/52, unless persistent dyspeptic symptoms at lower maintenance dose

E3. Gastrointestinal antispasmodics

Regular daily prescription of gastrointestinal antispasmodics agents unless the patient has frequent relapse of colic symptoms because of high risk of anti-cholinergic side effects

Section F: Respiratory System

F1. Theophylline.

This drug has a narrow therapeutic index, requires monitoring of serum levels, and interacts with other commonly prescribed drugs putting patients at an increased risk of ADEs

F2. Leukotriene antagonists (Montelukast, Zafirlukast)

These drugs have no proven role in COPD, they are indicated only in asthma (50)

Section G: Musculoskeletal System

G1: Calcium supplementation

Unlikely to be of any benefit in the short term

G2: Anti-resorptive/bone anabolic drugs *FOR OSTEOPOROSIS* (bisphosphonates, strontium, teriparatide, denosumab)

G3. Selective Oestrogen Receptor Modulators (SERMs) for osteoporosis

Benefits unlikely to be achieved within 1 year, increased short-intermediate term risk of associated ADEs particularly venous thromboembolism and stroke

G4. Long-term oral NSAIDs

Increased risk of side effects (peptic ulcer disease, bleeding, worsening heart failure etc.) when taken regularly for ≥ 2 months

G5. Long-term oral steroids

Increased risk of side effects (peptic ulcer disease etc.) when taken regularly for ≥ 2 months. Consider careful dose reduction and discontinuation

Section H: Urogenital System

H1. 5-alpha reductase inhibitors

No benefit with long term urinary bladder catheterisation

H2. Alpha blockers

No benefit with long term urinary bladder catheterisation

H3. Muscarinic antagonists

No benefit with long term urinary bladder catheterisation, unless clear history of painful detrusor hyperactivity

Section I: Endocrine System

I1. Diabetic oral agents

Aim for monotherapy. Target of HbA1c <8%/64mmol/mol. Stringent glycaemic control is unnecessary

I2. ACE-Inhibitors for diabetes

Stop where prescribed only for prevention and treatment of diabetic nephropathy. There is no clear benefit in older people with advanced frailty with poor survival prognosis

I3. Angiotensin Receptor Blockers (ARBs)

Stop where prescribed only for prevention and treatment of diabetic nephropathy. There is no clear benefit in older people with advanced frailty with poor survival prognosis

I4. Systemic oestrogens for menopausal symptoms

Increases risk of stroke and VTE disease. Discontinue and only consider recommencing if recurrence of symptoms

Section J: Miscellaneous

J1. Multi-vitamin combination supplements

Discontinue when prescribed for prophylaxis rather than treatment

J2. Nutritional supplements (other than vitamins)

Discontinue when prescribed for prophylaxis rather than treatment

J3: Prophylactic Antibiotics

No firm evidence for prophylactic antibiotics to prevent recurrent cellulitis or UTIs

Disclaimer (STOPPFrail)

Whilst every effort has been made to ensure that the potentially inappropriate prescribing criteria listed in STOPPFrail are accurate and evidence-based, it is emphasized that the final decision to avoid or initiate any drug referred to in these criteria rests entirely with the prescriber. It is also to be noted that the evidence base underlying certain criteria in STOPPFrail may change after the time of publication of these criteria. Therefore, it is advisable that prescribing decisions should take account of current published evidence in support of or against the use of drugs or drug classes described in STOPPFrail.

9.10 POSAMINO criteria

Cardiovascular system

1. Heavy alcohol consumption with multiple antihypertensive combinations Rationale: Concurrent use of alcohol consumption and antihypertensives may increase the risk of orthostatic hypotension.

2. Heavy alcohol consumption with warfarin (and phenindione) Rationale: Heavy episodic alcohol consumption is associated with an increased risk of major bleeds.

3. Heavy alcohol consumption with regular use of low-dose aspirin (75mg) Rationale: Heavy alcohol consumption combined with aspirin may cause a small increase in gastrointestinal blood loss.

4. Heavy alcohol consumption with both regular and as required nitrates (e.g., glyceryl trinitrate, isosorbide dinitrate and isosorbide mononitrate) Rationale: The combined haemodynamic effects of alcohol and nitrates may increase the risk of exaggerated hypotension.

5. Heavy alcohol consumption with the vasodilatory medication nicorandil Rationale: The combined haemodynamic effects of alcohol and nicorandil may increase the risk of exaggerated hypotension. 6. Heavy alcohol consumption with the combined use of both nitrates and vasodilator medication (e.g., nicorandil) Rationale: The combined

haemodynamic effects of alcohol with nitrates and vasodilator drugs may increase the risk of exaggerated hypotension.

7. Heavy alcohol consumption with diuretics (e.g., loop diuretics (furosemide), thiazide diuretics (Bendroflumethiazide), and potassium-sparing diuretics (amiloride)) Rationale: The concurrent use of alcohol and antihypertensives may increase the risk of orthostatic hypotension.

8. Heavy alcohol consumption with alpha blockers (e.g., terazosin) Rationale: The concurrent use of alcohol and antihypertensives may increase the risk of orthostatic hypotension.

9. Heavy alcohol consumption with centrally acting antihypertensives (e.g., clonidine or methyldopa) Rationale: Alcohol consumption combined with centrally acting antihypertensives may increase the risk of sedation and/or orthostatic hypotension.

Respiratory system

1. Any alcohol consumption with first-generation antihistamines (e.g., promethazine) Rationale: Concurrent alcohol consumption with first-generation antihistamines can increase the risk of sedation.

Central nervous system

1. Heavy alcohol consumption with benzodiazepines (e.g., diazepam) and benzodiazepine-related medications (e.g., zopiclone) Rationale: Alcohol consumption combined with benzodiazepines and benzodiazepine-related medications may enhance CNS depressant effects.

2. Heavy alcohol consumption combined with opioids Rationale: Alcohol consumption combined with opioids may enhance CNS depressant effects of alcohol.

3. Heavy alcohol consumption with duloxetine Rationale: Heavy alcohol consumption combined with duloxetine may increase the risk of hepatotoxicity.

4. Heavy alcohol consumption with all antipsychotics Rationale: Alcohol consumption combined with antipsychotics may increase the risk of sedation.

5. Any alcohol consumption with barbiturates Rationale: Alcohol consumption combined with barbiturates may increase the risk of sedation.

6. Heavy alcohol consumption with antiepileptic drugs (AEDs) Rationale: Heavy alcohol consumption can increase the risk of seizures and sedation in patients taking AEDs.

7. Any alcohol consumption with tricyclic antidepressants Rationale: Alcohol consumption combined with antidepressants may enhance the CNS depressant effects of alcohol.

8. Any alcohol consumption with tetracyclic antidepressants Rationale: Alcohol consumption combined with antidepressants may enhance the CNS depressant effects of alcohol.

9. Any alcohol consumption with mirtazapine Rationale: Alcohol consumption combined with antidepressants may enhance the CNS depressant effects of alcohol.

10. Any alcohol consumption with monoamine oxidase inhibitors (MAOIs) Rationale: A potentially life-threatening hypertensive reaction can develop in patients taking non-selective MAOIs who consume drinks rich in tyramine (e.g., wines, beers, and non-alcoholic beers)

11. Heavy alcohol consumption with long-term regular paracetamol use (e.g., 1 g four times a day) Rationale: Heavy alcohol consumption may increase the risk of paracetamol hepatotoxicity especially if alcohol intake is abruptly stopped.

12. Heavy alcohol consumption with gabapentin (when used for neuropathic pain) Rationale: Alcohol combined with medications for neuropathic pain may increase the risk of sedation.

13. Heavy alcohol consumption with pramipexole or amantadine Rationale: Alcohol combined with pramipexole, or amantadine may increase the risk of sedation

14. Heavy alcohol consumption with apomorphine Rationale: Alcohol combined with apomorphine may increase the risk of orthostatic hypotension.

15. Heavy alcohol consumption with levodopa (alone or in combination with carbidopa) Rationale: Alcohol combined with levodopa (alone or in combination with carbidopa) may increase the risk of orthostatic hypotension.

Endocrine

1. Heavy alcohol consumption with insulin Rationale: Alcohol consumption may enhance the hypoglycaemic effect of insulin.

2. Heavy alcohol consumption with metformin Rationale: Heavy alcohol consumption combined with metformin may increase the risk of lactic acidosis.

3. Heavy alcohol consumption with sulphonylureas Rationale: Alcohol consumption can enhance the hypoglycaemic effects of antidiabetics.

4. Heavy alcohol consumption with meglitinides (e.g., nateglinide) Rationale: Alcohol consumption can enhance the hypoglycaemic effects of antidiabetics.

5. Heavy alcohol consumption with thiazolidinediones (e.g., pioglitazone) Rationale: Alcohol consumption can enhance the hypoglycaemic effects of antidiabetics.

Musculoskeletal and joint diseases

1. Heavy alcohol consumption with any non-steroidal anti-inflammatory drugs (NSAIDs) (including COX-2 inhibitors) Rationale: Heavy alcohol consumption and NSAID use carry an increased risk of gastrointestinal bleeds.

2. Heavy alcohol consumption combined with methotrexate or leflunomide Rationale: Heavy alcohol consumption combined with methotrexate or leflunomide may increase the risk of hepatotoxicity.

3. Heavy alcohol consumption with oral muscle relaxants (e.g., baclofen) Rationale: Concurrent alcohol consumption and muscle relaxants can increase the risk of CNS depression.

Malignant disease and immunosuppression

1. Any alcohol consumption with procarbazine Rationale: A disulfiram-like reaction can occur when alcohol is given with procarbazine.

2. Heavy alcohol consumption with interferon alpha or interferon beta Rationale: Heavy alcohol consumption combined with interferons may increase the risk of hepatotoxicity and reduce the response to treatment with interferon.

Infection

1. Heavy alcohol consumption with antimycobacterial medications such as isoniazid, pyrazinamide, ethionamide and rifampicin (alone or in combination) Rationale: Alcohol combined with antimycobacterial medications can increase the risk of hepatotoxicity.

2. Any alcohol consumption with cycloserine Rationale: Alcohol consumption may increase the risk of seizures in patients taking cycloserine.

3. Any alcohol consumption with metronidazole or tinidazole Rationale: A disulfiram-like reaction can occur when alcohol is given with metronidazole

9.11 Guideline - The Management of Diabetes in the Older Adult

1. **Frailty and Diabetes**

Frailty is a state of vulnerability which leads to a range of adverse outcomes including a decline in physiological reserve, mobility, and an increased risk of falls. There are several ways to objectively define frailty, and we suggest using the Clinical Frailty Scale (CFS, see figure 1).[1] This is a commonly accepted model which is practical and easy to implement in routine practice. This guideline is generally aimed for people aged over 70 years and with a CFS ≥ 5, based on the recommendations outlined by the Joint British Diabetes Societies for Inpatient Care (JBDS-IP)[2], Association of British Clinical Diabetologists (ABCD)[3] and National Institute for Health and Care Excellence (NICE)[4]. One in six hospital beds are occupied by a person with diabetes and most of these are elderly patients. Such patients are well-established to have a greater length

of hospital stay, morbidity and mortality than those without diabetes.[5] Particular consideration of medications used to avoid clinical harm in this group is needed, given their greater risk.

2. **Recommendations**

- People with diabetes aged over 65 years should receive a risk factor evaluation for conditions and factors associated with risk of hospital admissions:
  - Poorly controlled diabetes (see glycaemic targets below)
  - History of hypoglycaemia
  - Poor nutritional intake
  - Cardiovascular risk factors
  - Co-morbidities including recent disabling stroke or fracture
  - Polypharmacy with potential drug interactions
  - Unmet care needs and activities of daily living
  - Risk of hyperglycaemic emergencies such as diabetic ketoacidosis (DKA) or hyperosmolar hyperglycaemic state (HHS)
  - Risk of falls
- Individualised care plans detailing co-morbidities, presence of frailty or functional loss (including cognition), individualised agreed goals of treatment, medications, frequency of monitoring, target capillary blood glucose and HbA1c, blood pressure and serum lipid levels are helpful
- Older patients with diabetes particularly those with catheters should be regularly reviewed for urinary infections

- Assess the older person’s ability, capacity, and preference for self-management of diabetes (including blood-glucose testing and injection administration)

- Ensure that care routines such as the timing of medications with meals and blood glucose testing are managed to reduce risk of hyper or hypoglycaemia

- Discharge planning preparation needs to ensure that the older person, their carers and primary or community diabetes teams fully understand the care plan and any post-discharge medicines adjustments that may be required

CLINICAL FRAILTY SCALE

Score	Category	Description
1	VERY FIT	People who are robust, active, energetic and motivated. They tend to exercise regularly and are among the fittest for their age.
2	FIT	People who have **no active disease symptoms** but are less fit than category 1. Often, they exercise or are very **active occasionally**, e.g., seasonally.
3	MANAGING WELL	People whose **medical problems are well controlled**, even if occasionally symptomatic, but often are **not regularly active** beyond routine walking.
4	LIVING WITH VERY MILD FRAILTY	Previously “vulnerable,” this category marks early transition from complete independence. While **not dependent** on others for daily help, often **symptoms limit activities**. A common complaint is being “slowed up” and/or being tired during the day.
5	LIVING WITH MILD FRAILTY	People who often have **more evident slowing**, and need help with **high order instrumental activities of daily living** (finances, transportation, heavy housework). Typically, mild frailty progressively impairs shopping and walking outside alone, meal preparation, medications and begins to restrict light housework.
6	LIVING WITH MODERATE FRAILTY	People who need help with **all outside activities** and with **keeping house**. Inside, they often have problems with stairs and need **help with bathing** and might need minimal assistance (cuing, standby) with dressing.
7	LIVING WITH SEVERE FRAILTY	**Completely dependent for personal care**, from whatever cause (physical or cognitive). Even so, they seem stable and not at high risk of dying (within ~6 months).
8	LIVING WITH VERY SEVERE FRAILTY	Completely dependent for personal care and approaching end of life. Typically, they could not recover even from a minor illness.
9	TERMINALLY ILL	Approaching the end of life. This category applies to people with a **life expectancy <6 months**, who are **not otherwise living with severe frailty.** (Many terminally ill people can still exercise until very close to death.)

SCORING FRAILTY IN PEOPLE WITH DEMENTIA

The degree of frailty generally corresponds to the degree of dementia. Common **symptoms in mild dementia** include forgetting the details of a recent event, though still remembering the event itself, repeating the same question/story and social withdrawal.

In **moderate dementia**, recent memory is very impaired, even though they seemingly can remember their past life events well. They can do personal care with prompting.

In **severe dementia**, they cannot do personal care without help.

In **very severe dementia** they are often bedfast. Many are virtually mute.

DALHOUSIE UNIVERSITY

Clinical Frailty Scale ©2005-2020 Rockwood, Version 2.0 (EN). All rights reserved. For permission: **www.geriatricmedicineresearch.ca**

Rockwood K et al. A global clinical measure of fitness and frailty in elderly people. CMAJ 2005;173:489-495.

Figure 1: Clinical Frailty Scale

3. **Key areas of glucose management**

Glycaemic targets

As with any person with diabetes, the target HbA1c should be individualised based on co-morbidities, frailty and patient wishes. Whilst NICE recommend a target HbA1c 48-58mmol/mol (6.5%-7.5%) in most people with diabetes, some people benefit from a relaxed glycaemic target (e.g. those with frailty, falls or reduced life expectancy). This is because tighter HbA1c targets are typically associated with polypharmacy and an increased falls and hypoglycaemia risk, resulting in a risk of harm. The JBDS-IP recommend relaxing the target HbA1c up to 70mmol/mol (8.5%) and random blood glucose targets 6.7-11.1 mmol/L in people with significant frailty (CFS ≥ 5). Often, the goal of treatment in people with diabetes and frailty is to achieve a good quality of life rather than tight glycaemic control. In practice this means avoiding diabetes-related emergencies such as hypoglycaemia, DKA and HHS using the least number of medications possible with the safest side-effect profile.

Medication choices

In older adults and those with frailty, cautious medication selection for treatment of diabetes is important, to minimise the risk of harm (which is greater in these patients) and to obtain the greatest benefit from the fewest medications. Similarly, as people with diabetes get older and typically acquire co-morbidity and frailty, clinicians should consider the need to de-escalate treatments which may cause harm, if appropriate. Frequently, such de-escalation happens following a hypoglycaemic event but should occur proactively if the patients' glycaemic control is below their target thresholds. The factors which should be considered when deciding upon the use of different diabetes medication classes in people with diabetes and frailty are summarised in Table 1.

Avoidance of hypoglycaemia

Hypoglycaemia is often a significant concern in older adults with diabetes and is a major cause of harm and hospital admission in this group. Healthcare professionals caring for older people with diabetes should evaluate their risk of hypoglycaemia and use medications with the lowest risk of hypoglycaemia and other side-effects. The risk of hypoglycaemia is greater in those with some co-morbidities (e.g. chronic kidney or liver disease, dementia with variable eating) and naturally influenced by the nutritional state. People with diabetes and frailty should always have a glucose > 6.0mmol/L and HbA1c > 59mmol/mol (7.5%) to minimise the risk of hypoglycaemia. Patients who have a severe hypoglycaemic event or glucose/HbA1c levels below the recommended targets should have a comprehensive diabetes review to de-escalate therapies.

To minimise the risk of hypoglycaemia in older adults with diabetes:

- Offer a bedtime snack to reduce risk of nocturnal hypoglycaemia
- Monitor dietary intake, especially patients with variable eating habits such as those with dementia or some gastrointestinal conditions
- Hold some classes of diabetes medication (e.g. metformin, SGLT-2 inhibitors, sulfonylureas, and insulin) if poor oral intake and below-target blood glucose.
- Aim target glucose 6.7-11.1 mmol/L and HbA1c > 59mmol/mol (7.5%). Seek GP or diabetes team input if concerned
- Monitor the patient's capillary glucose levels appropriately in accordance with their diabetes treatments (2-4 measurements daily, see COIN guidance)
- Always have a fully stocked hypo box on all hospital wards
- Support the carers of people with diabetes to recognise, diagnose, and treat hypoglycaemia [**Community only**]

- Consider the need for district nurse support for glucose monitoring and/or delivery of injectable therapies if concerned [**Community only**].

- Use diabetes medications which are associated with the lowest possible risk of hypoglycaemia to minimise the risk of HHS or DKA

Table 1: Diabetes medication classes in people with diabetes and frailty

Drug Class	Examples	Advantages	Disadvantages	Comments
Biguanides	Metformin	Low risk of hypoglycaemia. Low cost. Generally, well tolerated.	Limited use in CKD. Gastrointestinal upset.	Used until eGFR <30mL/min. Extended release has fewer GI side-effects.
Sulphonylurea	Gliclazide Glibenclamide	Low cost. Can be used in moderate-severe CKD.	High risk of hypoglycaemia.	Avoid if inconsistent eating (e.g. people with dementia). Consider discontinuing if also using insulin.
Thiazolinediones	Pioglitazone	Low risk of hypoglycaemia. Can be used in CKD.	Contraindicated in heart failure, anaemia, fractures, bladder cancer. Low cost.	Can be useful if high insulin resistance.

Dipeptidyl peptidase-4 (DPP-4) inhibitors	Linagliptin Saxagliptin Sitagliptin	Low risk of hypoglycaemia. Well-tolerated. Can be used in CKD.	Modest HbA1c reduction. Medium/high cost.	Easily combined with basal insulin in a low complexity regimen
Sodium-glucose co-transporter-2 (SGLT-2) inhibitors	Canagliflozin Dapagliflozin Empagliflozin Ertugliflozin	Low risk of hypoglycaemia. Good efficacy. Improved CHF, CKD outcomes.	Risk of adverse events.	Risk of UTIs, thrush and DKA in elderly and long-standing diabetes
Glucagon-like peptide-1 (GLP-1) analogues	Dulaglutide, Liraglutide, Semaglutide	Low risk of hypoglycaemia. Once-weekly preparations.	Injectable. GI side effects & weight loss. High cost.	Monitor for weight loss and GI side effects. Doses adjust in CKD.
Insulin	Basal Premixed Basal-Bolus	No ceiling effect Numerous forms/regimes available	High risk of hypoglycaemia Carer training Frequent glucose monitoring	Basal-only regime improves management complexity and reduces risk of hypoglycaemia

4. **Other medication for the control of cardiovascular risk factors**

Blood pressure

A blood pressure target < 150/90mmHg is often appropriate in people with diabetes and frailty, dependency, risk of falls and/or postural hypotension. When considering dose escalation of anti-hypertensive therapy, consider the risks of falls and postural hypotension, measuring the lying and standing blood pressure when possible. Starting at a low dose with cautious up-titration is the safest approach with blood pressure and renal function monitoring. As per NICE guidance, the preferred first-line treatment is with angiotensin-converting enzyme (ACE) inhibitors or angiotensin-receptor blockers (ARBs) given the cardio-renal benefits in people with diabetes. Anti-hypertensive escalation using thiazide-like diuretics or dihydropyridine calcium channel blockers may be needed. Down-titration or withdrawal of anti-hypertensive medications may be required in those with increasing frailty and dependence. Consider moving anti-hypertensive therapy to nighttime to reduce falls risk during the day.

Lipids

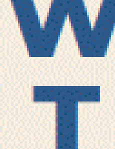
Elderly patients with diabetes are often at the highest risk of cardiovascular events, and pharmacotherapy to reduce this risk should always be considered. All people with diabetes should have an annual lipid profile. Once primary dyslipidaemia is confirmed, atorvastatin 20mg (or an alternative low dose statin) is reasonable. Whilst the use of statins is associated with muscle-related symptoms in up to 10% of patients, it is typically dose-dependent and so low dose treatment is appropriate in the majority of people.

9.12- CWTCH Handout given to all staff.

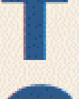
Created by Debra Clee, with support from Dr Alexandra Burgess and Dr Elizabeth Davies. Based on NICE guidelines (NICE, 2013)

What can we do to for our older adults who fall
to reduce exposure to a long lie?
We can give them a CWTCH

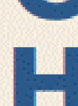
Can you move them



Will it harm them (any new neck or back pain)



Treat (wounds / pain relief)



Cup of tea (in most cases they can eat/drink)

H

Chapter 10 – Bibliography

Afilalo, J., Mottillo, S., Xue, X., Colacone, A., Morais, J. A., Delaney, J. S., & Afilalo, M. (2020). Frailty and adverse outcomes in older adults being discharged from the emergency department: A prospective cohort study. CJEM, 22(1), 65-73.

Age UK. (2019). Later life in the United Kingdom. https://www.nahh.org.uk/uploads/laterlifeuk_factsheet.pdf

Ageing Collaborators. (2022). Global, regional, and national burden of diseases and injuries for adults 70 years and older: Systematic analysis for the Global Burden of Disease 2019 Study. BMJ, 376.

Åhlund, K., Bäck, M., Öberg, B., et al. (2017). Effects of comprehensive geriatric assessment on physical fitness in an acute medical setting for frail elderly patients. Clinical Interventions in Aging, 12, 1929-1939.

Ala, L., Mack, J., Shaw, R., Gasson, A., Cogbill, E., Marion, R., Rahman, R., Deibel, F., & Rathbone, N. (2012). Selecting ambulatory emergency care (AEC) patients from the medical emergency in-take: The derivation and validation of the Amb score. Clinical Medicine (London), 12(5), 420-426.

Alakare, J., Kemp, K., Strandberg, T., Castrén, M., Jakovljević, D., Tolonen, J., & Harjola, V. P. (2021). Systematic geriatric assessment for older patients with frailty in the emergency department: A randomised controlled trial. BMC Geriatrics, 21(1), 408.

Aliberti, M. J. R., Covinsky, K. E., Apolinario, D., Smith, A. K., Lee, S. J., Fortes, S. Q., Melo, J. A., Souza, N. P. S., Avelino-Silva, T. J., & Jacob, W. (2019). 10-minute targeted geriatric assessment predicts disability and hospitalization in fast-paced acute care settings. Journals of Gerontology Series A: Biological Sciences and Medical Sciences, 74(10), 1637-1642.

Alshibani, A., Alharbi, M., & Conroy, S. (2021). Under-triage of older trauma patients in prehospital care: A systematic review. European Geriatric Medicine, 12(5), 903-919.

Alshibani, A., Alharbi, M., & Conroy, S. (2023). Frailty identification in prehospital care: A scoping review of the literature. Open Access Emergency Medicine, 15, 227-239.

Alshibani, A., Banerjee, J., Lecky, F., Coats, T. J., Alharbi, M., & Conroy, S. (2021). New horizons in understanding appropriate prehospital identification and trauma triage for older adults. Open Access Emergency Medicine, 13, 117-135.

Alshibani, A., Coats, T., Maynou, L., et al. (2022). A comparison between the clinical frailty scale and the hospital frailty risk score to risk stratify older people with emergency care needs. BMC Emergency Medicine, 22, 171.

Alshibani, A., Singler, B., & Conroy, S. (2021). Towards improving prehospital triage for older trauma patients. Zeitschrift für Gerontologie und Geriatrie, 54(2), 125-129.

Anand, A., Cheng, M., Ibitoye, T., MacLullich, A. M. J., & Vardy, E. R. L. C. (2022). Positive scores on the 4AT delirium assessment tool at hospital admission are linked to mortality, length of stay, and home time: Two-centre study of 82,770 emergency admissions. Age and Ageing, 51(3).

Andrews, N., Brooks, C., Board, M., et al. (2025). Medicine optimisation and deprescribing intervention outcomes for older people with dementia or mild cognitive impairment: A systematic review. Drugs & Aging, 42(3), 275–294.

Anzaldi, L. J., Davison, A., Boyd, C. M., Leff, B., & Kharrazi, H. (2017). Comparing clinician descriptions of frailty and geriatric syndromes using electronic health records: A retrospective cohort study. BMC Geriatrics, 17(1), 248.

Aprahamian, I., Aricó de Almeida, G. V., de Vasconcellos Romanin, C. F., Gomes Caldas, T., Antunes Yoshitake, N. T., Bataglini, L., Mori Lin, S., Alves Pereira, A., Nara Alegrini Longhi, L., Mamoni, R. L., & Martinelli, J. E. (2019). Frailty could predict death in older adults after admission at emergency department? A 6-month prospective study from a middle-income country. The Journal of Nutrition, Health & Aging, 23(7), 641-647.

Association of Ambulance Chief Executives. (2024). National ambulance data demand, response, and hospital handover data to the end of December 2023. Association of Ambulance Chief Executives.

Association of British Clinical Diabetologists. (2019). Managing frailty and associated comorbidities in older adults with diabetes: Position statement on behalf of the Association of British Clinical Diabetologists (ABCD). https://abcd.care/sites/abcd.care/files/site_uploads/Resources/Position-Papers/ABCD-Position-Paper-Frailty.pdf

Atkin, C., Gallier, S., Wallin, E., et al. (2022). Performance of scoring systems in selecting short stay medical admissions suitable for assessment in same day emergency care: An analysis of diagnostic accuracy in a UK hospital setting. BMJ Open, 12, e064910.

Atkins, C. G. K., & Das, S. (2021). A critique of the use of the clinical frailty scale in triage. American Journal of Bioethics, 21(11), 67-68.

Baker, D. (2020). No assumptions should be made about people's quality of life irrespective of any disability. The BMJ. https://blogs.bmj.com/bmj/2020/03/31/daniel-baker-no-assumptions-should-be-made-about-peoples-quality-of-life-irrespective-of-any-disability/

Ballabio, C., et al. (2008). A comprehensive evaluation of elderly people discharged from an emergency department. Internal and Emergency Medicine, 3(3), 245-249.

Barnes, D. E., Palmer, R. M., Kresevic, D. M., et al. (2012). Acute care for elders units produced shorter hospital stays at lower costs while maintaining patients' functional status. Health Affairs, 31(10), 30.

Basic, D., & Shanley, C. (2015). Frailty in an older inpatient population: Using the clinical frailty scale to predict patient outcomes. Journal of Aging and Health, 27(4), 670-685.

Bauernfreund, Y., Butler, M., Ragavan, S., & Sampson, E. L. (2018). TIME to think about delirium: Improving detection and management on the acute medical unit. BMJ Open Quality, 7(3).

Baxter, C. T., & Offord, N. J. (2022). Frailty on the acute medical take. Clinical Medicine (London), 22(4), 298-301.

Baztán, J. J., Suárez-García, F. M., López-Arrieta, J., Rodríguez-Mañas, L., & Rodríguez-Artalejo, F. (2009). Effectiveness of acute geriatric units on functional decline, living at home, and case fatality among older patients admitted to hospital for acute medical disorders: Meta-analysis. BMJ, 338, b50.

Beauchet, O., Fung, S., Launay, C. P., Afilalo, J., Herbert, P., Afilalo, M., & Chabot, J. (2018). Predicting a long hospital stay after admission to a geriatric assessment unit: Results from an observational retrospective cohort study. Maturitas, 115, 110-114.

Beauchet, O., Fung, S., Launay, C. P., Cooper-Brown, L. A., Afilalo, J., Herbert, P., Afilalo, M., & Chabot, J. (2019). Screening for older inpatients at risk for long length of stay: Which clinical tool to use? BMC Geriatrics, 19(1), 156.

Béland, E., Nadeau, A., Carmichael, P. H., Boucher, V., Voyer, P., Pelletier, M., Gouin, É., Daoust, R., Berthelot, S., Lamontagne, M. E., Morin, M., Lemire, S., Vu, T. T. M., & Émond, M. (2021). Predictors of delirium in older patients at the emergency department: A prospective multicentre derivation study. CJEM, 23(3), 330-336.

Bell, A. J., Talbot-Stern, J. K., & Hennessy, A. (2000). Characteristics and outcomes of older patients presenting to the emergency department after a fall: A retrospective analysis. Medical Journal of Australia, 173(4), 176-177.

Bertoni, A. G., Julie, S., et al. (2002). Diabetes-related morbidity and mortality in a national sample of U.S. elders. Diabetes Care, 25, 471-475.

Bird, S. R., Kurowski, W., Dickman, G. K., & Kronborg, I. (2007). Integrated care facilitation for older patients with complex health care needs reduces hospital demand. Australian Health Review, 31(3), 451-461.

Bleijenberg, N., Drubbel, I., Schuurmans, M. J., et al. (2016). Effectiveness of a proactive primary care program on preserving daily functioning of older people: A cluster randomized controlled trial. Journal of the American Geriatrics Society, 64, 1779-1788.

Blodgett, J. M., Robertson, D. J., Pennington, E., & Ratcliffe, D. (2021). Alternatives to direct emergency department conveyance of ambulance patients: A scoping review of

the evidence. Scandinavian Journal of Trauma, Resuscitation and Emergency Medicine, 29, 1-21.

Blomaard, L. C., Mooijaart, S. P., van Meer, L. J., Leander, J., Lucke, J. A., de Gelder, J., Anten, S., Gussekloo, J., & de Groot, B. (2021). Geriatric screening, fall characteristics and 3- and 12-month adverse outcomes in older patients visiting the emergency department with a fall. Scandinavian Journal of Trauma, Resuscitation and Emergency Medicine, 29(1), 43.

Bo, M., Bonetto, M., Bottignole, G., Porrino, P., Coppo, E., Tibaldi, M., Ceci, G., Raspo, S., Cappa, G., & Bellelli, G. (2016). Length of stay in the emergency department and occurrence of delirium in older medical patients. Journal of the American Geriatrics Society, 64(5), 1114-1119.

Bo, M., Fonte, G., Pivaro, F., Bonetto, M., Comi, C., Giorgis, V., Marchese, L., Isaia, G., Maggiani, G., Furno, E., Falcone, Y., & Isaia, G. C. (2016). Prevalence of and factors associated with prolonged length of stay in older hospitalized medical patients. Geriatrics & Gerontology International, 16(3), 314-321.

Bonne, S., & Schuerer, D. J. (2013). Trauma in the older adult: Epidemiology and evolving geriatric trauma principles. Clinical Geriatrics Medicine, 29(1), 137-150.

Borenstein, J. E., Aronow, H. U., Bolton, L. B., et al. (2016). Identification and team-based interprofessional management of hospitalized vulnerable older adults. Nursing Outlook, 64, 137-145.

Briggs, R., Coughlan, T., Collins, R., O'Neill, D., & Kennelly, S. P. (2013). Nursing home residents attending the emergency department: Clinical characteristics and outcomes. QJM: An International Journal of Medicine, 106(9), 803-808.

Briggs, R., McDonough, A., Ellis, G., Bennett, K., O'Neill, D., & Robinson, D. (2022). Comprehensive geriatric assessment for community-dwelling, high-risk, frail, older people. Cochrane Database of Systematic Reviews.

British Geriatrics Society and O'Mahony, S. (2021). COVID-19: Preventing nosocomial infection in older people. British Geriatrics Society in association with the Royal College of General Practitioners and Age UK.

British Geriatrics Society. (2014). Fit for frailty: Consensus best practice guidance for the care of older people living with frailty in community and outpatient settings. British Geriatrics Society in association with the Royal College of General Practitioners and Age UK.

British Geriatrics Society. (2014). Recognising frailty. British Geriatrics Society. https://www.bgs.org.uk/resources/recognising-frailty

British Geriatrics Society. (2021). Ambitions for change – Improving healthcare in care homes. British Geriatrics Society. https://www.bgs.org.uk/policy-and-media/ambitions-for-change-report-on-improving-healthcare-in-care-homes-launched

British Geriatrics Society. (2021). Right time, right place: Urgent community-based care for older people. British Geriatrics Society. https://www.bgs.org.uk/righttimerightplace

British Geriatrics Society. (2022). Bringing hospital care home: Virtual wards and hospital at home for older people. British Geriatrics Society. https://www.bgs.org.uk/resources/bringing-hospital-care-home

Brousseau, A. A., Dent, E., Hubbard, R., Melady, D., Emond, M., Mercier, E., Costa, A. P., & Multinational Emergency Department Study Group. (2018). Identification of older adults with frailty in the emergency department using a frailty index: Results from a multinational study. Age and Ageing, 47(2), 242-248.

Bunn, E. A. (2020). Setting priorities to inform assessment of care homes' readiness to participate in healthcare innovation: A systematic mapping review and consensus. International Journal of Environmental Research and Public Health, 17(3), 987.

Burge, R. T., Worley, D., Johansen, A., Bhattacharyya, S., & Bose, U. (2001). The cost of osteoporotic fractures in the UK: Projections for 2000-2020. Journal of Medical Economics, 4(1-4), 51-62.

Burke, V., Beilin, L. J., German, R., et al. (1992). Postural fall in blood pressure in the elderly in relation to drug treatment and other lifestyle factors. QJM: An International Journal of Medicine, 84, 583-591.

Burns, E., & Kakara, R. (2018). Deaths from falls among persons aged ≥65 years - United States, 2007-2016. MMWR Morbidity and Mortality Weekly Report, 67, 509-514.

Calf, A. H., Lubbers, S., van den Berg, A. A., van den Berg, E., Jansen, C. J., van Munster, B. C., de Rooij, S. E., & ter Maaten, J. C. (2020). Clinical impression for identification of vulnerable older patients in the emergency department. European Journal of Emergency Medicine, 27(2), 137-141.

Cameron, A., Jones, D., Logan, E., et al. (2018). Comparison of Glasgow Admission Prediction Score and Amb Score in predicting need for inpatient care. Emergency Medicine Journal, 35(4), 247-251.

Cameron, A., Rodgers, K., Ireland, A., Jamdar, R., & McKay, G. A. (2015). A simple tool to predict admission at the time of triage. Emergency Medicine Journal, 32(3), 174-179.

Cameron, I. D., Dyer, S. M., Panagoda, C. E., Murray, G. R., Hill, K. D., Cumming, R. G., & Kerse, N. (2018). Interventions for preventing falls in older people in care facilities and hospitals. Cochrane Database of Systematic Reviews, 12, 184.

Campmany, M. P., Romeu, J. R., Andion, M. B., & Vales, S. B. (2019). Development of a comprehensive, multidisciplinary program of care for frailty in an emergency department. European Geriatric Medicine, 10(1), 37-46.

Caplan, G. A., Williams, A. J., Daly, B., & Abraham, K. (2004). A randomized, controlled trial of comprehensive geriatric assessment and multidisciplinary intervention after discharge of elderly from the emergency department—The DEED II study. Journal of the American Geriatrics Society, 52, 1417-1423.

Caring for Care. (2024). Slips, trips, and falls: Risks for older adults and prevention strategies for care settings. https://caringforcare.co.uk/falls-prevention-in-care-setting-and-nice-guidelines/

Carpenter, C. R., Shelton, E., Fowler, S., Suffoletto, B., Platts-Mills, T. F., Rothman, R. E., & Hogan, T. M. (2015). Risk factors and screening instruments to predict adverse outcomes for undifferentiated older emergency department patients: A systematic review and meta-analysis. Academic Emergency Medicine, 22(1), 1-21.

Cawthorn, P., Harrison, S., Barrett-Connor, E., & Fink, H. (2006). Alcohol intake and its relationship with bone mineral density, falls, and fracture risk in older men. Journal of the American Geriatrics Society, 54, 1649-1657.

Centers for Disease Control and Prevention. (2013). The state of aging and health in America. Atlanta, GA: Centers for Disease Control and Prevention, US Dept of Health, and Human Services.

Centers for Disease Control and Prevention. (2016). Costs of falls among older adults. https://www.cdc.gov/falls/data/fall-cost.html

Charlson, M. E., Carrozzino, D., Guidi, J., & Patierno, C. (2022). Charlson comorbidity index: A critical review of clinimetric properties. Psychotherapy and Psychosomatics, 91, 8-35.

Charlton, K., Sinclair, D. R., Hanratty, B., et al. (2022). Measuring frailty and its association with key outcomes in the ambulance setting: A cross-sectional observational study. BMC Geriatrics, 22, 935.

Checa-Lopez, M., Rodriguez-Laso, A., Carnicero, J. A., et al. (2023). Differential utility of various frailty diagnostic tools in non-geriatric hospital departments of several countries: A longitudinal study. European Journal of Clinical Investigation, 53, e13979.

Chehrehgosha, M., Vatan, R. F., Alizadeh Khoei, M., Sharifi, F., Aminalroaya, R., Vahabi, Z., Zendedel, A., & Hekmat, H. (2021). Role of frailty in prediction of hospitalized older adult patient’s outcomes: A prospective study. Turkish Journal of Medical Sciences, 51(5), 2324-2333.

Cheng, L. Y., Leung, S. Y., & Leung, M. K. W. (2022). The association of glycemic control and fall risk in diabetic elderly: A cross-sectional study in Hong Kong. BMC Primary Care, 23, 192.

Chong, E., Zhu, B. R., Ng, S. H. X., Tan, H. Y., Goh, E. F., Molina, J. D., Pereira, M. J., Kaur, P., Baldevarona-Llego, J., Chia, J. Q., Chong, A., Cheong, S., Foo, C. L., Chan, M., & Lim, W. S. (2022). Emergency department interventions for frailty (EDIFY): Improving functional outcomes in older persons at the emergency department through a multicomponent frailty intervention. Age and Ageing, 51(2).

Chong, E., Zhu, B., Tan, H., Molina, J. C., Goh, E. F., Baldevarona-Llego, J., Chia, J. Q., Chong, A., Cheong, S., Kaur, P., Pereira, M. J., Ng, S. H. X., Foo, C. L., Chan, M., & Lim, W. S. (2021). Emergency department interventions for frailty (EDIFY): Front-door geriatric care can reduce acute admissions. Journal of the American Medical Directors Association, 22(4), 923-928.e925.

Choutko-Joaquim, S., Tacchini-Jacquier, N., Pralong D'Alessio, G., & Verloo, H. (2019). Associations between frailty and delirium among older patients admitted to an emergency department. Dementia and Geriatric Cognitive Disorders Extra, 9(2), 236-249.

Church, S., Rogers, E., Rockwood, K., & Theou, O. (2020). A scoping review of the clinical frailty scale. BMC Geriatrics, 20(1), 1-8.

Clark, S., Shaw, C., Padayachee, A., Howard, S., Hay, K., & Frakking, T. T. (2019). Frailty and hospital outcomes within a low-socioeconomic population. QJM: An International Journal of Medicine, 112(12), 907-913.

Clegg, A., Bates, C., Young, J., et al. (2016). Development and validation of an electronic frailty index using routine primary care electronic health record data. Age and Ageing, 45(3), 353-360.

Clegg, A., Young, J., Iliffe, S., et al. (2013). Frailty in elderly people. Lancet, 381(9868), 752-762.

Collard, R. M., Boter, H., Schoevers, R. A., & Oude Voshaar, R. C. (2012). Prevalence of frailty in community-dwelling older persons: A systematic review. J Am Geriatr Soc, 60(8), 1487–1492.

Conroy, S. (2021). Silver Book II: British Geriatrics Society. https://www.bgs.org.uk/resources/silver-book-ii

Conroy, S. P., Ansari, K., Williams, M., et al. (2014). A controlled evaluation of comprehensive geriatric assessment in the emergency department: The Emergency Frailty Unit. Age and Ageing, 43(1), 109-114.

Conroy, S. P., Stevens, T., Parker, S. G., & Gladman, J. R. F. (2011). A systematic review of comprehensive geriatric assessment to improve outcomes for frail older people being rapidly discharged from acute hospital: 'Interface geriatrics'. Age and Ageing, 40(4).

Conroy, S., & Dowsing, T. (2013). The ability of frailty to predict outcomes in older people attending an acute medical unit. Acute Medicine, 12(2), 74-76.

Continuing with the corrections:

Costa, N. A., Minicucci, M. F., Pereira, A. G., de Paiva, S. A. R., Okoshi, M. P., Polegato, B. F., Zornoff, L. A. M., Villas Boas, P. J. F., Atherton, P. J., Phillips, B. E., Banerjee, J., Gordon, A. L., & Azevedo, P. S. (2021). Current perspectives on defining and mitigating frailty in relation to critical illness. Clinical Nutrition, 40(11), 5430-5437.

Counsell, S. R., Holder, C. M., Liebenauer, L. L., et al. (2000). Effects of a multicomponent intervention on functional outcomes and process of care in hospitalized older patients: A randomized controlled trial of Acute Care for Elders (ACE) in a community hospital. Journal of the American Geriatrics Society, 48, 1572.

Creditor, M. C. (1993). Hazards of hospitalization of the elderly. Annals of Internal Medicine, 118, 219.

Crews, R. T., Yalla, S. V., Fleischer, A. E., & Wu, S. C. (2013). A growing troubling triad: Diabetes, aging, and falls. Journal of Aging Research, 2013, 342650.

Crilly, J., Keijzers, G., Tippett, V., et al. (2015). Improved outcomes for emergency department patients whose ambulance off-stretcher time is not delayed. Emergency Medicine Australasia, 27, 216-224.

Crisafulli, S., Poluzzi, E., Lunghi, C., et al. (2022). Deprescribing as a strategy for improving safety of medicines in older people: Clinical and regulatory perspective. Frontiers in Drug Safety and Regulation, 2, 1011701.

Curtin, D., Gallagher, P., & O'Mahony, D. (2021). Deprescribing in older people approaching end-of-life: Development and validation of STOPPFrail version 2. Age and Ageing, 50(2).

Dawson, L. P., Andrew, E., Stephenson, M., et al. (2022). The influence of ambulance offload time on 30-day risks of death and re-presentation for patients with chest pain. Medical Journal of Australia, 217(5), 253-259.

De Lima, B., Rowan, E., Motulsky, A., & Morgan, E. (2023). Primary care provider-led approach to deprescribing potentially inappropriate medications in older adults. Gerontology & Geriatric Medicine, 9, 1–5.

De Stampa, M., Vedel, I., Buyck, J. F., Lapointe, L., Bergman, H., Beland, F., & Ankri, J. (2014). Impact on hospital admissions of an integrated primary care model for very frail elderly patients. Archives of Gerontology and Geriatrics, 58(3), 350-355.

Deandrea, S. (2010). Risk factors for falls in community-dwelling older people: A systematic review and meta-analysis. Epidemiology, 21(5), 658-668.

Dent, E., & Hoogendijk, E. O. (2014). Psychosocial factors modify the association of frailty with adverse outcomes: A prospective study of hospitalised older people. BMC Geriatrics, 14, Article 108.

Dent, E., Morley, J. E., Cruz-Jentoft, A. J., et al. (2019). Physical frailty: ICFSR international clinical practice guidelines. Nat Rev Dis Primers, 5(1), 1–23.

Department of Health. (2006). Hospital episode statistics. http://www.hesonline.org.uk/Ease/servlet/ContentServer?siteID=1937&categoryID=192

Devi, R., Goodman, C., Dalkin, S., Bate, A., Wright, J., Jones, L., & Spilsbury, K. (2021). Attracting, recruiting, and retaining nurses and care workers working in care homes: The need for a nuanced understanding informed by evidence and theory. Age and Ageing, 50(1), 65-67.

Dhalwani, N. N., Fahami, R., Sathanapally, H., Seidu, S., Davies, M. J., & Khunti, K. (2017). Association between polypharmacy and falls in older adults: A longitudinal study from England. BMJ Open, 7, e016358.

Di Bari, M., Giordano, A., Tonarelli, F., Carreras, G., Grifoni, S., Benvenuti, E., Ruggiano, G., Lazzari, B., Ungar, A., & Balzi, D. (2022). Estimating prognosis and frailty in persons aged ≥75 years in the emergency department: Further validation of dynamic silver code. Journal of the American Medical Directors Association, 23(1), 87-91.

Dinh, M. M., Russell, S. B., Bein, K. J., et al. (2016). The Sydney triage to admission risk tool (START) to predict emergency department disposition: A derivation and internal validation study using retrospective state-wide data from New South Wales, Australia. BMC Emergency Medicine, 16, 46.

Eagles, D., Perry, J. J., Sirois, M. J., Lang, E., Daoust, R., Lee, J., Griffith, L., Wilding, L., Neveu, X., & Emond, M. (2017). Timed up and go predicts functional decline in older patients presenting to the emergency department following minor trauma. Age and Ageing, 46(2), 214-218.

Eagles, D., Yadav, K., Perry, J. J., Sirois, M. J., & Emond, M. (2018). Mobility assessments of geriatric emergency department patients: A systematic review. CJEM, 20(3), 353-361.

Ebker-White, A., Bein, K. J., & Dinh, M. M. (2018). Extending the Sydney triage to admission risk tool (START+) to predict discharges and short stay admissions. Emergency Medicine Journal, 35, 471-476.

Ekdahl, A. W., Alwin, J., Eckerblad, J., Husberg, M., Jaarsma, T., Mazya, A. L., Milberg, A., Krevers, B., Unosson, M., Wiklund, R., & et al. (2016). Long-term evaluation of the ambulatory geriatric assessment: A frailty intervention trial (AGe-FIT): Clinical outcomes and total costs after 36 months. Journal of the American Medical Directors Association, 17(3), 263-268.

Ekdahl, A. W., Sjostrand, F., Ehrenberg, A., Oredsson, S., Stavenow, L., Wisten, A., Wardh, I., & Ivanoff, S. D. (2015). Frailty and comprehensive geriatric assessment organized as CGA-ward or CGA-consult for older adult patients in the acute care setting: A systematic review and meta-analysis. European Geriatric Medicine, 6(6), 523-540.

Ekerstad, N., Karlson, B. W., Andersson, D., Husberg, M., Carlsson, P., Heintz, E., & Alwin, J. (2018). Short-term resource utilization and cost-effectiveness of comprehensive geriatric assessment in acute hospital care for severely frail elderly patients. Journal of the American Medical Directors Association, 19(10), 871-878.e872.

Ekerstad, N., Östberg, G., Johansson, M., & Karlson, B. W. (2018). Are frail elderly patients treated in a CGA unit more satisfied with their hospital care than those treated in conventional acute medical care? Patient Preference and Adherence, 12, 233-240.

Eklund, K., Wilhelmson, K., Gustafsson, H., Landahl, S., & Dahlin-Ivanoff, S. (2013). One-year outcome of frailty indicators and activities of daily living following the randomised controlled trial: "Continuum of care for frail older people". BMC Geriatrics, 13, 76.

Elias, J., Bowen, R., Hassanzadeh, S. T., Pendlebury, D., & Lasserson, D. (2017). Does the AMB score improve ambulatory care decision making for older patients? A service evaluation of an emergency multidisciplinary unit. Age and Ageing, 46(suppl_1), i35-i38.

Elias, L., Maiden, G., Manger, J., & Reyes, P. (2021). Teaming up for more comprehensive care: Case study of the geriatric flying squad and emergency

responders (Ambulance, Police, Fire and Rescue). Journal of Integrated Care, 29(4), 377-389.

Elliott, A., Hull, L., & Conroy, S. P. (2017). Frailty identification in the emergency department—a systematic review focussing on feasibility. Age and Ageing, 46(3), 509-513.

Elliott, A., Phelps, K., Regen, E., & Conroy, S. P. (2017). Identifying frailty in the emergency department—feasibility study. Age and Ageing, 46(5), 840-845.

Elliott, A., Taub, N., Banerjee, J., et al. (2021). Does the clinical frailty scale at triage predict outcomes from emergency care for older people? Annals of Emergency Medicine, 77(6), 620-627.

Ellis, G., Gardner, M., Tsiachristas, A., et al. (2017). Comprehensive geriatric assessment for older adults admitted to hospital. Cochrane Database of Systematic Reviews, 9.

Ellis, G., Jamieson, C. A., Alcorn, M., & Devlin, V. (2012). An acute care for elders (ACE) unit in the emergency department. European Geriatric Medicine, 3(4), 261-263.

Ellis, G., Marshall, T., & Ritchie, C. (2014). Comprehensive geriatric assessment in the emergency department. Clinical Interventions in Aging, 9, 2033-2043.

Ellis, G., Whitehead, M. A., O'Neill, D., Langhorne, P., & Robinson, D. (2011). Comprehensive geriatric assessment for older adults admitted to hospital. The Cochrane Database of Systematic Reviews, CD006211.

Émond, M., Grenier, D., Morin, J., Eagles, D., Boucher, V., Le Sage, N., Mercier, É., Voyer, P., & Lee, J. S. (2017). Emergency department stay associated delirium in older patients. Canadian Geriatrics Journal, 20(1), 10-14.

European Commission. (2020). The ageing Europe - Looking at the lives of older people in the EU. The Publications Office of the European Union.

Evans, S. J., Sayers, M., Mitnitski, A., & Rockwood, K. (2014). The risk of adverse outcomes in hospitalized older patients in relation to a frailty index based on a comprehensive geriatric assessment. Age and Ageing, 43(1), 127-132.

Eyigor, S., Kutsal, Y. G., Duran, E., Huner, B., Paker, N., Durmus, B., Sahin, N., Civelek, G. M., Gokkaya, K., Doğan, A., Günaydın, R., Toraman, F., Cakir, T., Evcik, D., Aydeniz, A., Yildirim, A. G., Borman, P., Okumus, M., & Ceceli, E. (2015). Frailty prevalence and related factors in the older adult-FrailTURK project. Age (Dordrecht), 37(3), 9791.

Fallon, A., Kilbane, L., Briggs, R., Dyer, A., Nabeel, S., McElwaine, P., Collins, R., Coughlan, T., O'Neill, D., Ryan, D., & Kennelly, S. P. (2018). Screening for frailty in older emergency department patients: The utility of the Survey of Health, Ageing and Retirement in Europe Frailty Instrument. QJM: An International Journal of Medicine, 111(3), 151-154.

Ferrucci, L., et al. (2005). Inflammaging and frailty. J Gerontol A Biol Sci Med Sci, 60(7), 760–767.

Fehlmann, C. A., Nickel, C. H., Cino, E., Al-Najjar, Z., Langlois, N., & Eagles, D. (2022). Frailty assessment in emergency medicine using the clinical frailty scale: A scoping review. Internal and Emergency Medicine, 17(8), 2407-2418.

Flanaghan, C., Uttley, D., & Smith, G. (2017). Pennine Lancashire falls response service. UK: East Lancashire Hospitals and Northwest Ambulance Service.

Flood, K. L., Maclennan, P. A., McGrew, D., et al. (2013). Effects of an acute care for elders unit on costs and 30-day readmissions. JAMA Internal Medicine, 173, 981.

Fried, L. P., et al. (2001). Frailty in older adults: Evidence for a phenotype. J Gerontol A Biol Sci Med Sci, 56(3), M146–M156.

Fox, J., Pattison, T., Wallace, J., Pradhan, S., Gaillemin, O., Feilding, E., Butler, L., & Vilches-Moraga, A. (2016). Geriatricians at the front door: The value of early comprehensive geriatric assessment in the emergency department. European Geriatric Medicine, 7(4).

Gade, G. V., Jørgensen, M. G., Ryg, J., et al. (2021). Development of a multivariable prognostic prediction model for 1-year risk of falling in a cohort of community-dwelling older adults aged 75 years and above (PREFALL). BMC Geriatrics, 21.

Gaffney, L., Jonsson, A., Judge, C., Costello, M., O'Donnell, J., & O'Caoimh, R. (2022). Using the "Surprise Question" to predict frailty and healthcare outcomes among older adults attending the emergency department. International Journal of Environmental Research and Public Health, 19(3), Article 1709.

Gale, E. A., & Gillespie, K. M. (2001). Diabetes and gender. Diabetologia, 44(1), 3-15.

Ge, L., Yap, C. W., Heng, B. H., & Tan, W. S. (2020). Frailty and healthcare utilisation across care settings among community dwelling older adults in Singapore. BMC Geriatrics, 20(1), 389.

Gilbert, T., & Conroy, S. (2017). Frailty on the acute medical unit. British Journal of Hospital Medicine (London), 78(10), C152-C155.

Gilbert, T., Neuburger, J., Kraindler, J., et al. (2018). Development and validation of a hospital frailty risk score focusing on older people in acute care settings using electronic hospital records: An observational study. Lancet, 391(10132), 1775-1782.

Giroux, M., Sirois, M. J., Boucher, V., Daoust, R., Gouin, É., Pelletier, M., Berthelot, S., Voyer, P., & Émond, M. (2018). Frailty assessment to help predict patients at risk of delirium when consulting the emergency department. Journal of Emergency Medicine, 55(2), 157-164.

Goldstein, J., Hubbard, R. E., Moorhouse, P., & Andrew, M. K. (2013). Feasibility of using information derived from a care partner to develop a frailty index based on comprehensive geriatric assessment. Journal of Frailty and Aging, 2(1), 15-21.

Goldstein, J., Hubbard, R. E., Moorhouse, P., Andrew, M. K., Mitnitski, A., & Rockwood, K. (2015). The validation of a care partner derived frailty index based upon comprehensive geriatric assessment (CP-FI-CGA) in emergency medical services. Canadian Journal of Emergency Medicine.

Goldstein, J., Jensen, J. L., Carter, A. J., Travers, A. H., & Rockwood, K. (2015). The epidemiology of prehospital emergency responses for older adults in a provincial EMS system. Canadian Journal of Emergency Medicine, 17(5), 491-496.

Goldstein, J., Travers, A., Hubbard, R., Moorhouse, P., Andrew, M. K., & Rockwood, K. (2014). Assessment of older adults by emergency medical services: Methodology and feasibility of a care partner comprehensive geriatric assessment (CP-CGA). Canadian Journal of Emergency Medicine, 16(5), 370-383.

Gordon, A. L., Martin, F., Mistry, S., Harwood, R. H., & Dhesi, J. (2023). Whether from a position of strength or weakness, geriatric medicine has work to do to drive up standards in health care for older people. Age and Ageing, 52(11).

Green, J., Kirby, K., & Hope, S. (2018). Ambulance clinicians’ perceptions, assessment, and management of frailty: Thematic analysis of focus groups. British Paramedic Journal, 3(3), 23-33.

Gretarsdottir, E., Jonsdottir, A. B., Sigurthorsdottir, I., Gudmundsdottir, E. E., Hjaltadottir, I., Jakobsdottir, I. B., Tomasson, G., Jonsson, P. V., & Thorsteinsdottir, T. (2021). Patients in need of comprehensive geriatric assessment: The utility of the InterRAI emergency department screener. International Emergency Nursing, 54, Article 100943.

Grundstrom, A. C., Guse, C. E., & Layde, P. M. (2012). Risk factors for falls and fall-related injuries in adults 85 years of age and older. Archives of Gerontology and Geriatrics, 54(3), 421-428.

Gwyther, H., Shaw, R., Jaime Dauden, E. A., et al. (2018). Understanding frailty: A qualitative study of European healthcare policymakers' approaches to frailty screening and management. BMJ Open, 8(1).

Ha, V. T., Nguyen, T. N., Nguyen, T. X., et al. (2021). Prevalence and factors associated with falls among older outpatients. International Journal of Environmental Research and Public Health, 18(8), 4041.

Haagsma, J. A., Olij, B. F., Majdan, M., et al. (2020). Falls in older aged adults in 22 European countries: Incidence, mortality, and burden of disease from 1990 to 2017. Injury Prevention, 26(Suppl 1), i67-i74.

Hae, H. W., Kim, Y., Suh, Y., Lee, J., Lee, E., Lee, E., Choi, J. Y., Kim, K. I., & Lee, J. Y. (2022). Prevalence of potentially inappropriate medications based on the STOPPFrail criteria in frail older patients with limited life expectancy: A cross-sectional study. BMC Geriatrics, 22(1), 367.

Hammami, S., Zarrouk, A., Piron, C., Almas, I., Sakly, N., & Latteur, V. (2020). Prevalence and factors associated with frailty in hospitalized older patients. BMC Geriatrics, 20(1), 144.

Han, S. J., Jung, H. W., Lee, J. H., Lim, J., Moon, S. D., Yoon, S. W., Moon, H., Lee, S. Y., Kim, H., Lee, S. R., & Jang, I. Y. (2021). Clinical frailty scale, K-FRAIL questionnaire, and clinical outcomes in an acute hospitalist unit in Korea. Korean Journal of Internal Medicine, 36(5), 1233-1241.

Harding, S. (2020). Comprehensive geriatric assessment in the emergency department. Age and Ageing, 49(6), 936-938.

Harris, W., Lucas, P. V., Eyles, H., & Parker, L. (2018). Paramedic assessment of frailty: An exploratory study of perceptions of frailty assessment tools. Irish Journal of Paramedicine, 3(1), 1-10.

Hartley, P. J., Keevil, V. L., Alushi, L., Charles, R. L., Conroy, E. B., Costello, P. M., Dixon, B., Dolinska-Grzybek, A. M., Vajda, D., & Romero-Ortuno, R. (2019). Earlier physical therapy input is associated with a reduced length of hospital stay and reduced care needs on discharge in frail older inpatients: An observational study. Journal of Geriatric Physical Therapy, 42(2), E7-E14.

Hawker, M., & Rea, R. (2021). Responding to falls in care homes: Two innovations. Warrington: Involve.

Hegeman, J., et al. (2010). Even low alcohol concentrations affect obstacle avoidance reactions in healthy senior individuals. BMC Research Notes, 3, 243.

Heppenstall, C., Chiang, A., & Hanger, C. (2018). Readmissions to hospital in a frail older cohort receiving a community-based transitional care service. New Zealand Medical Journal, 131(1484), 38-45.

Hewitt, J., Carter, B., Vilches-Moraga, A., et al. (2020). COPE study collaborators. The effect of frailty on survival in patients with COVID-19 (COPE): A multicentre, European, observational cohort study. Lancet Public Health, 5(8).

Hingson, R., & Howland, J. (1987). Alcohol as a risk factor for injury or death resulting from accidental falls: A review of the literature. Journal of Studies on Alcohol and Drugs, 48, 212-219.

Hoeck, S., François, G., Geerts, J., Van der Heyden, J., Vandewoude, M., & Van Hal, G. (2012). Healthcare and home-care utilization among frail elderly persons in Belgium. European Journal of Public Health, 22(5), 671-677.

Hollinghurst, J., Fry, R., Akbari, A., Clegg, A., Lyons, R. A., Watkins, A., & Rodgers, S. E. (2019). External validation of the electronic frailty index using the population of Wales within the Secure Anonymised Information Linkage Databank. Age and Ageing, 48(6), 922-926.

Holton, A. E., Gallagher, P. J., Ryan, C., Fahey, T., & Cousins, G. (2017). Consensus validation of the POSAMINO (POtentially Serious Alcohol-Medication INteractions in Older adults) criteria. BMJ Open, 7(11), e017453.

Holton, A. E., Keeney, C., Ryan, B., et al. (2020). Prevalence of potentially serious alcohol–medication interactions in older adults in a community pharmacy setting: A cross-sectional study. BMJ Open, 10, e035212.

Holton, A., Boland, F., Gallagher, P., et al. (2019). Potentially serious alcohol–medication interactions and falls in community-dwelling older adults: A prospective cohort study. Age and Ageing, 48(6), 824-831.

Hominick, K., McLeod, V., & Rockwood, K. (2016). Characteristics of older adults admitted to hospital versus those discharged home, in emergency department patients referred to internal medicine. Canadian Geriatrics Journal, 19(1), 9-14.

Hopper, A. (2021). Geriatric medicine GIRFT programme national specialty report February 2021. GIRFT is delivered in partnership with the Royal National Orthopaedic Hospital NHS Trust, NHS England, and NHS Improvement. https://gettingitrightfirsttime.co.uk/wp-content/uploads/2021/09/Geriatric-Medicine-Sept21h.pdf

Hörlin, E., Munir Ehrlington, S., Henricson, J., John, R. T., & Wilhelms, D. (2022). Inter-rater reliability of the clinical frailty scale by staff members in a Swedish emergency department setting. Academic Emergency Medicine, 29(12), 1431-1437.

Huang, H. H., Chang, J. C. Y., Tseng, C. C., Yang, Y. J., Fan, J. S., Chen, Y. C., Peng, L. N., & Yen, D. H. T. (2021). Comprehensive geriatric assessment in the emergency department for the prediction of readmission among older patients: A 3-month follow-up study. Archives of Gerontology and Geriatrics, 92, Article 104255.

Huang, Y. L., McGonagle, M., Shaw, R., Eastham, J., Alsaba, N., Lin, C. C., & Crilly, J. (2023). Models of care for frail older persons who present to the emergency department: A scoping review of the literature. International Emergency Nursing, 66, Article 101250.

Hubbard, R. E., O'Mahony, M. S., & Woodhouse, K. W. (2008). Characterising frailty in the clinical setting—a comparison of different approaches. Age and Ageing, 38(1), 115-119.

Hung, A., Kim, Y. H., & Pavon, J. M. (2024). Deprescribing in older adults with polypharmacy. BMJ, 385, e074892.

Hung, W. W., Ross, J. S., Farber, J., & Siu, A. L. (2013). Evaluation of the mobile acute care of the elderly (MACE) service. JAMA Internal Medicine, 173, 990.

Hunt, K., Walsh, B., Voegeli, D., & Roberts, H. (2013). Reducing avoidable hospital admission in older people: Health status, frailty and predicting risk of ill-defined conditions diagnoses in older people admitted with collapse. Archives of Gerontology and Geriatrics, 57(2), 172-176.

Imman, T., Konstant-Hambling, R., Fluck, R., et al. (2021). The hospital frailty risk score—outcomes in specialised services. Age and Ageing, 50(2), 511-518.

Jarman, H., Crouch, R., Baxter, M., et al. (2021). Feasibility and accuracy of ED frailty identification in older trauma patients: A prospective multi-centre study. Scandinavian Journal of Trauma, Resuscitation and Emergency Medicine, 29.

Jay, S., Whittaker, P., McIntosh, J., & Hadden, N. (2017). Can consultant geriatrician led comprehensive geriatric assessment in the emergency department reduce hospital admission rates? A systematic review. Age and Ageing, 46(3), 366-372.

Johnell, O., & Kanis, J. A. (2006). An estimate of the worldwide prevalence and disability associated with osteoporotic fractures. Osteoporosis International, 17(12), 1726-1733.

Joint British Diabetes Societies for Inpatient Care. (2019). Inpatient care of the frail older adult with diabetes. https://www.diabetes.org.uk/resources-s3/2019-10/frailty-jbds-ipfinal-28-10-19.pdf

Jones, D., Song, X., Mitnitski, A., & Rockwood, K. (2005). Evaluation of a frailty index based on a comprehensive geriatric assessment in a population-based study of elderly Canadians. Aging Clinical and Experimental Research, 17(6), 465-471.

Jones, H. E., Anand, A., Morrison, I., Hurding, S., Wild, S. H., Mercer, S. W., & Shenkin, S. D. (2023). Impact of MidMed, a general practitioner-led modified comprehensive geriatric assessment for patients with frailty. Age and Ageing, 52(3), Article afad006.

Jones, S., & Maxwell, M. (2016). Ambulatory care for older people living with frailty: An innovative use of the medical day hospital. Future Hospital Journal, 3(2), 106-108.

Jones, S., Moulton, C., Swift, S., et al. (2022). Association between delays to patient admission from the emergency department and all-cause 30-day mortality. Emergency Medicine Journal, 37, 807-810.

Jørgensen, R., & Brabrand, M. (2017). Screening of the frail patient in the emergency department: A systematic review. European Journal of Internal Medicine, 45, 71-73.

Joseph, A. M., et al. (2017). Mitochondrial dysfunction in ageing and frailty. J Gerontol A Biol Sci Med Sci, 72(11), 1634–1642.

Joseph-Williams, N., Elwyn, G., & Edwards, A. (2014). Knowledge is not power for patients: A systematic review and thematic synthesis of patient-reported barriers and facilitators to shared decision making. Patient Education and Counseling, 291-309.

Joy, T., Ramage, L., Mitchinson, S., et al. (2020). Community emergency medicine: Taking the ED to the patient: A 12-month observational analysis of activity and impact of a physician response unit. Emergency Medicine Journal, 37, 530-539.

Just, K. S., Dormann, H., Schurig, M., et al. (2020). The phenotype of adverse drug effects: Do emergency visits due to adverse drug reactions look different in older people? Results from the ADRED study. British Journal of Clinical Pharmacology, 86, 2144-2154.

Kaeppeli, T., Rueegg, M., Dreher-Hummel, T., et al. (2020). Validation of the clinical frailty scale for prediction of thirty-day mortality in the emergency department. Annals of Emergency Medicine, 76(3), 291-300.

Keeble, E., Roberts, H. C., Williams, C. D., Van Oppen, J., & Conroy, S. P. (2019). Outcomes of hospital admissions among frail older people: A 2-year cohort study. British Journal of General Practice, 69(685), e555-e560.

Kelly, A., Conell-Price, J., Covinsky, K., et al. (2010). Length of stay for older adults residing in nursing homes at the end of life. Journal of the American Geriatrics Society, 58, 1701-1706.

Keyes, D. C., Singal, B., Kropf, C. W., et al. (2014). Impact of a new senior emergency department on emergency department recidivism, rate of hospital admission, and hospital length of stay. Annals of Emergency Medicine, 63(5), 517-524.

Kim, H., Higgins, P. A., Canaday, D. H., Burant, C. J., & Hornick, T. R. (2014). Frailty assessment in the geriatric outpatient clinic. Geriatrics & Gerontology International, 14(1), 78-83.

Kingsley, C., & Patel, S. (2017). Patient-reported outcome measures and patient-reported experience measures. BJA Education, 17(4), 137-144.

Knight, T., Atkin, C., Martin, F. C., et al. (2022). Frailty assessment and acute frailty service provision in the UK: Results of a national 'day of care' survey. BMC Geriatrics, 22(1), 1-9.

Kojima, G. (2015). Prevalence of frailty in nursing homes: A systematic review and meta-analysis. Journal of the American Medical Directors Association, 16, 940-945.

Kojima, G., Iliffe, S., & Walters, K. (2018). Frailty index as a predictor of mortality: A systematic review and meta-analysis. Age and Ageing, 47(2), 193-200.

Kypta, V. (2018). Southeast Coast Ambulance Service Foundation Trust/Coastal West Sussex CCG/Sussex Community Foundation Trust: Review of the fall's response vehicle pilot. UK: NHS Southeast Coast Ambulance Service.

Laberge, S., & Crizzle, A. M. (2019). A literature review of psychotropic medications and alcohol as risk factors for falls in community dwelling older adults. Clinical Drug Investigations, 39(2), 117-139.

Lacas, A., & Rockwood, K. (2012). Frailty in primary care: A review of its conceptualization and implications for practice. BMC Medicine, 10, 4.

Laguë, A., Voyer, P., Ouellet, M. C., Boucher, V., Giroux, M., Pelletier, M., Gouin, É., Daoust, R., Berthelot, S., Morin, M., Minh Vu, T. T., Lee, J., Brousseau, A. A., Sirois, M. J., & Émond, M. (2018). Using the Bergman-Paris question to screen seniors in the emergency department. CJEM, 20(5), 753-761.

Laine, J., Salminen, M., Viikari, L., Vahlberg, T., Viikari, P., Tuori, H., Wuorela, M., Rautava, P., & Viitanen, M. (2019). Urgent geriatric outpatient clinic - Easy access to comprehensive geriatric assessment for older home-dwelling persons living with frailty. European Journal of Emergency Medicine.

Landefeld, C. S., Palmer, R. M., Kresevic, D. M., et al. (1995). A randomized trial of care in a hospital medical unit especially designed to improve the functional outcomes of acutely ill older patients. New England Journal of Medicine, 332, 1338.

Larsson, G., Holmén, A., & Ziegert, K. (2017). Early prehospital assessment of non-urgent patients and outcomes at the appropriate level of care: A prospective exploratory study. International Emergency Nursing, 32, 45-49.

Lavan, A. H., Gallagher, P., Parsons, C., & O'Mahony, D. (2017). STOPPFrail (Screening Tool of Older Persons Prescriptions in Frail adults with limited life expectancy): Consensus validation. Age and Ageing, 46, 600-607.

Lavan, A. H., O'Mahony, D., & Gallagher, P. (2019). STOPPFrail (Screening Tool of Older Persons' Prescriptions in Frail adults with a limited life expectancy) criteria: Application to a representative population awaiting long-term nursing care. European Journal of Clinical Pharmacology, 75(5), 723-731.

Lee, J., Sirois, M. J., Moore, L., Perry, J., Daoust, R., Griffith, L., Worster, A., Lang, E., & Emond, M. (2015). Return to the ED and hospitalisation following minor injuries among older persons treated in the emergency department: Predictors among independent seniors within 6 months. Age and Ageing, 44(4), 624-629.

Leung, T. H., Leung, S. C., & Wong, C. K. G. (2020). The effectiveness of an emergency physician-led frailty unit for the living-alone elderly: A pilot retrospective cohort study. Hong Kong Journal of Emergency Medicine, 27(3), 162-167.

Lewis, E. T., Dent, E., Alkhouri, H., et al. (2019). Which frailty scale for patients admitted via emergency department? A cohort study. Archives of Gerontology and Geriatrics, 80, 104-114.

Li, C. M., Chen, C. Y., Li, C. Y., Wang, W. D., & Wu, S. C. (2010). The effectiveness of a comprehensive geriatric assessment intervention program for frailty in community-dwelling older people: A randomized, controlled trial. Archives of Gerontology and Geriatrics.

Li, M., Vanberkel, P., & Carter, A. J. E. (2019). A review on ambulance offload delay literature. Health Care Management Science, 22(4), 658-675.

Lin, C. F., Lin, P. C., Hu, S. Y., Tsan, Y. T., Liao, W. K., Lin, S. Y., & Lin, T. C. (2021). Comprehensive geriatric assessment and clinical outcomes in the older people at the emergency department. International Journal of Environmental Research and Public Health, 18(11), 6164.

Linsky, A., Gellad, W. F., Linder, J. A., & Friedberg, M. W. (2019). Advancing the science of deprescribing: A novel comprehensive conceptual framework. Journal of the American Geriatrics Society, 67(10), 2018–2022.

Linsky, A. M., Motala, A., Booth, M., et al. (2025). Deprescribing in community-dwelling older adults: A systematic review and meta-analysis. JAMA Network Open, 8(5), e259375.

Liu, J., Palmgren, T., Ponzer, S., Masiello, I., & Farrokhnia, N. (2021). Can dedicated emergency team and area for older people reduce the hospital admission rate? - An observational pre- and post-intervention study. BMC Geriatrics, 21(1), Article 115.

Logan, P. A., Horne, J. C., Gladman, J. R. F., Gordon, A. L., Sach, T., Clark, A., et al. (2021). Multifactorial falls prevention programme compared with usual care in UK care homes for older people: Multicentre cluster randomised controlled trial with economic evaluation. BMJ, 375.

Lord, S. R., Ward, J. A., Williams, P., et al. (1993). An epidemiological study of falls in older community-dwelling women: The Randwick falls and fractures study. Australian Journal of Public Health, 17, 240-245.

Lyons, A., Romero-Ortuno, R., & Hartley, P. (2019). Functional mobility trajectories of hospitalized older adults admitted to acute geriatric wards: A retrospective observational study in an English university hospital. Geriatrics & Gerontology International, 19(4), 305-310.

MacKenzie, H. T., Tugwell, B., Rockwood, K., & Theou, O. (2020). Frailty and diabetes in older hospitalized adults: The case for routine frailty assessment. Canadian Journal of Diabetes, 44(3), 241-+.

Magner, S., Carey, S., Harrington, G., Ward, L., Smyth, H., Purcell, R., Callaly, L., O'Caheny, C., Pender, C., Buckley, B., & et al. (2022). Geriatrician-led comprehensive geriatric assessment in the emergency department: A cost-effective service approved by patients. Age and Ageing, 51, iii63-iii64.

Malmivaara, A., Heliovaara, M., Knekt, P., et al. (1993). Risk factors for injurious falls leading to hospitalization or death in a cohort of 19,500 adults. American Journal of Epidemiology, 138, 384-394.

Mazya, A. L., Garvin, P., Unosson, M., & Ekdahl, A. W. (2016). Outpatient comprehensive geriatric assessment: Effects on frailty. European Geriatric Medicine, 7, S16.

Mazzola, P., Tassistro, E., Di Santo, S., Rossi, E., Andreano, A., Valsecchi, M. G., Cherubini, A., Marengoni, A., Mossello, E., Bo, M., Inzitari, M., Di Bari, M., Udina, C., Latronico, N., Paolillo, C., Morandi, A., & Bellelli, G. (2021). The relationship between frailty and delirium: Insights from the 2017 Delirium Day study. Age and Ageing, 50(5), 1593-1599.

McGrath, J., Almeida, P., & Law, R. (2019). The Whittington frailty pathway: Improving access to comprehensive geriatric assessment: An interdisciplinary quality improvement project. BMJ Open Quality, 8(4), e000798.

McNamara, R., Donnelly, K., Boyle, N., Menzies, D., Hollywood, R., Little, E., Tiernan, E., Donohoe, K., Delaney, A., Duffy, F., Feeney, E., & O'Hanlon, S. (2020). Community frailty response service: The ED at your front door. Emergency Medicine Journal, 37(11), 714-716.

Meucci, R. D., Runzer-Colmenares, F. M., Parodi, J. F., & de Mola, C. L. (2019). Falls among the elderly Peruvian Andean communities and the rural far south of Brazil: Prevalence and associated factors. Journal of Community Health, 45, 363-369.

Meyer, M., Schwarz, T., Renkawitz, T., et al. (2021). Hospital frailty risk score predicts adverse events in revision total hip and knee arthroplasty. International Orthopaedics, 45(11), 2765-2772.

Mooijaart, S. P., Nickel, C. H., Conroy, S. P., Lucke, J. A., van Tol, L. S., Olthof, M., Blomaard, L. C., Buurman, B. M., Dundar, Z. D., de Groot, B., Gasperini, B., Heeren, P., Karamercan, M. A., McNamara, R., Mitchell, A., van Oppen, J. D., Sanchez, F. J. M., Schoon, Y., Singler, K., & Wallace, J. (2021). A European research agenda for geriatric emergency medicine: A modified Delphi study. European Geriatric Medicine, 12(2), 413-422.

Morley, J. E., et al. (2013). Frailty consensus: A call to action. J Am Med Dir Assoc, 14(6), 392–397.

Mowbray, F. I., Ellis, B., Schumacher, C., Heckman, G., de Wit, K., Strum, R. P., Jones, A., Correia, R. H., Mercier, E., & Costa, A. P. (2023). The association between frailty and a nurse-identified need for comprehensive geriatric assessment referral from the emergency department. Canadian Journal of Emergency Medicine.

Mowbray, F., Brousseau, A.-A., Mercier, E., Melady, D., Émond, M., & Costa, A. P. (2020). Examining the relationship between triage acuity and frailty to inform the care of older emergency department patients: Findings from a large Canadian multisite cohort study. Canadian Journal of Emergency Medicine, 22(1), 74-81.

Mukamal, K. J., Mittleman, M. A., Longstreth, W. T. Jr., et al. (2004). Self-reported alcohol consumption and falls in older adults: Cross-sectional and longitudinal analyses of the cardiovascular health study. Journal of the American Geriatrics Society, 52, 1174-1179.

Munce, S. E., Straus, S. E., & Jaglal, S. B. (2014). Chronic disease and falls in community-dwelling Canadians over 65 years old: A population-based study exploring associations with number and pattern of chronic conditions. BMC Geriatrics, 14, 22.

Nathaniel, Z., & Amin, K. (2016). Redesigning care for frail older people: The impact of an elderly care pathway on admission avoidance, length of stay and readmission rates. Healthy Aging Research, 5, Article 14.

National Health Service England. (2021). What is community medicine? https://www.england.nhs.uk/community-health-services/ehch/

National Institute for Clinical Excellence. (2020). COVID-19 rapid guideline: Critical care in adults. NICE guideline 2020 ([NG159]).

National Institute for Health and Care Excellence. (2015). Falls in older people. https://www.nice.org.uk/guidance/qs86

Newell, M. A., Rotondo, M. F., Toschlog, E. A., et al. (2009). The elderly trauma patient: An investment for the future? Journal of Trauma and Acute Care Surgery, 67(2), 337-340.

Nghiem, S., Afoakwah, A., Scuffham, P., & Byrnes, J. (2021). Hospital frailty risk score and adverse health outcomes: Evidence from longitudinal record linkage cardiac data. Age and Ageing, 50(5), 1778-1784.

NHS Acute Frailty Network. (2021). Clinical frailty scale: Frailty & COVID-19: Why, what, how, where & when. Acute Frailty Network is hosted by NHS Elect. https://www.acutefrailtynetwork.org.uk/Clinical-Frailty-Scale

NHS Bath and NE Somerset. (2017). Royal United Hospital Bath and Southwestern Ambulance Service: Falls rapid response service. UK: NHS.

NHS Digital. (2019). National diabetes inpatient audit England. https://files.digital.nhs.uk/F6/49FA05/NaDIA%202019%20-%20Full%20Report%20v1.1.pdf

NHS England. (2019). NHS RightCare: Frailty toolkit optimising a frailty system. Increasing numbers of people are at risk of developing frailty.

NHS Health A to Z. (2019). Conditions: Falls. https://www.nhs.uk/conditions/falls/

NHSI. (2019). Same-day acute frailty services: Published by NHS Improvement, NHS England, the Ambulatory Emergency Care Network, and the Acute Frailty Network. https://improvement.nhs.uk/documents/2984/SDECguidefrailtyMay2019_update.pdf

NICE. Type 2 diabetes in adults: Management. https://www.nice.org.uk/guidance/ng28/chapter/Recommendations

Nizet, P., Evin, A., Brociero, E., Victorri Vigneau, C., & Huon, J.-F. (2023). Outcomes in deprescribing implementation trials and compliance with expert recommendations: A systematic review. BMC Geriatrics, 23, 428.

Norman, G., Bennett, P., & Vardy, E. R. L. C. (2023). Virtual wards: A rapid evidence synthesis and implications for the care of older people. Age and Ageing, 52(1), afac319.

Nouvenne, A., Ticinesi, A., Cerundolo, N., Prati, B., Parise, A., Chiussi, G., Frosio, L., Guerra, A., Brianti, E., Fabi, M., & Meschi, T. (2022). Implementing a multidisciplinary rapid geriatric observation unit for non-critical older patients referred to hospital: Observational study on real-world data. Aging Clinical and Experimental Research, 34(3), 599-609.

Nuffield Trust. (2024). Ambulance handover delays. We explore how often ambulance handovers are delayed by over 30 minutes. Nuffield Trust.

Nyborg, G., Straand, J., Klovning, A., & Brekke, M. (2015). The Norwegian General Practice–Nursing Home criteria (NORGEP-NH) for potentially inappropriate medication use: A web-based Delphi study. Scandinavian Journal of Primary Health Care, 33, 134-141.

Nygaard, H., Henriksen, M., Suetta, C., & Ekmann, A. (2022). Comparison of two frailty screening tools for acutely admitted elderly patients. Danish Medical Journal, 69(8).

O'Caoimh, R., Costello, M., Small, C., Spooner, L., Flannery, A., O'Reilly, L., Heffernan, L., Mannion, E., Maughan, A., Joyce, A., Molloy, D. W., & O'Donnell, J. (2019). Comparison of frailty screening instruments in the emergency department. International Journal of Environmental Research and Public Health, 16(19), Article 3626.

O'Shaughnessy, Í., Robinson, K., O'Connor, M., Conneely, M., Ryan, D., Steed, F., Carey, L., Leahy, A., Shanahan, E., Quinn, C., Galvin, R. (2022). Effectiveness of acute

geriatric unit care on functional decline, clinical and process outcomes among hospitalised older adults with acute medical complaints: A systematic review and meta-analysis. Age and Ageing, 51(4), afac081.

O'Shaughnessy, Í., Romero-Ortuno, R., Edge, L., Dillon, A., Flynn, S., Briggs, R., Shields, D., McMahon, G., Hennessy, A., Kennedy, U., Staunton, P., McNamara, R., Timmons, S., Horgan, F., & Cunningham, C. (2021). Home FIRsT: Interdisciplinary geriatric assessment and disposition outcomes in the emergency department. European Journal of Internal Medicine, 85, 50-55.

O'Mahony, D., O'Sullivan, D., Byrne, S., O'Connor, M. N., Ryan, C., & Gallagher, P. (2014). STOPP/START criteria for potentially inappropriate prescribing in older people: Version 2. Age and Ageing, 44, 213-218.

Office for Health Improvement & Disparities. Public health profiles (Counties and UAs from April 2021). https://www.gov.uk/government/organisations/office-for-health-improvement-and-disparities/about/statistics

Office for National Statistics. (2012). Population ageing in the UK and its constituent countries and the European Union. Office for National Statistics.

Older Persons' Substance Misuse Working Group. (2011). Our invisible addicts (College Report CR165). Royal College of Psychiatrists. http://www.rcpsych.ac.uk/files/pdfversion/CR165.pdf

Oliver, D., Foot, C., & Humphries, R. (2014). Making our health and care systems fit for an ageing population. https://www.kingsfund.org.uk/sites/default/files/field/fieldpublicationfile/making-health-care-systems-fit-ageing-population-oliver-foot-humphries-mar14.pdf

Omuya, H., Nickel, C., Wilson, P., & Chewning, B. (2023). A systematic review of randomised-controlled trials on deprescribing outcomes in older adults with polypharmacy. International Journal of Pharmacy Practice, 31(4), 349–368.

Onder, G., Landi, F., Della Vedova, C., et al. (2002). Moderate alcohol consumption and adverse drug reactions among older adults. Pharmacoepidemiology and Drug Safety, 11, 385-392.

Onder, G., Liperoti, R., Fialova, D., et al. (2012). Polypharmacy in nursing home in Europe: Results from the SHELTER study. Journal of Gerontology: Series A, 67, 698-704.

Ostapenko, V. S., Runikhina, N. K., Tkacheva, O. N., & Sharashkina, N. V. (2016). Screening tools for frailty in ambulatory care. Advances in Gerontology, 29(2), 306-312.

Panel, A. B. C. U. E. (2015). Updated Beers criteria for potentially inappropriate medication use in older adults. Journal of the American Geriatrics Society, 63, 2227-2246.

Parker, S. G., McLeod, A., McCue, P., Phelps, K., Bardsley, M., Roberts, H. C., & Conroy, S. P. (2017). New horizons in comprehensive geriatric assessment. Age and Ageing, 46(5).

Partridge, J. S. L., Harari, D., & Dhesi, J. K. (2012). Frailty in the older surgical patient: A review. Age Ageing, 41(2), 142–147.

Patrizio, E., Bergamaschini, L. C., & Cesari, M. (2019). Developing a frailty index from routinely collected data in the emergency department among hospitalized patients. European Geriatric Medicine, 10(5), 727-732.

Paula, T. C. S., Chagas, C., Henrique, A. E. G., Castro-Costa, E., Lima-Costa, M. F., & Ferri, C. P. (2021). Alcohol consumption among older adults: Findings from the ELSI-Brazil study. International Journal of Geriatric Psychiatry, 37(1), 1-7.

Piffer, I., Goetz, C., Zevering, Y., André, E., Bourouis, Z., & Blettner, N. (2020). Ability of emergency department physicians using a functional autonomy-assessing version of the triage risk screening tool to detect frail older patients who require mobile geriatric team consultation. The Journal of Nutrition, Health & Aging, 24(6), 634-641.

Pilotto, A., Cella, A., Pilotto, A., Daragjati, J., Veronese, N., Musacchio, C., Mello, A. M., Logroscino, G., Padovani, A., Prete, C., & Panza, F. (2017). Three decades of comprehensive geriatric assessment: Evidence coming from different healthcare settings and specific clinical conditions. Journal of the American Medical Directors Association, 18(2), 192.e1-192.e11.

Pirrie, M., Saini, G., Angeles, R., Marzanek, J., Parascandalo, J., & Agarwal, G. (2020). Risk of falls and fear of falling in older adults residing in public housing in Ontario, Canada: Findings from a multisite observational study. BMC Geriatrics, 20, 9.

Ponsford, M. J., Jefferies, R., Davies, C., et al. (2021). Burden of nosocomial COVID-19 in Wales: Results from a multicentre retrospective observational study of 2508 hospitalised adults. Thorax, 76(12), 1246-1249.

Preedy, V. R., Adachi, J., Ueno, Y., et al. (2001). Alcoholic skeletal muscle myopathy: Definitions, features, contribution of neuropathy, impact, and diagnosis. European Journal of Neurology, 8, 677-687.

Preston, L., Chambers, D., Campbell, F., Cantrell, A., Turner, J., & Goyder, E. (2018). What evidence is there for the identification and management of frail older people in the emergency department? A systematic mapping review. NIHR Journals Library.

Public Health England. (2022). Guidance - falls: Applying all our health. https://www.gov.uk/government/publications/falls-applying-all-our-health/falls-applying-all-our-health

Puig Campmany, M., Ris Romeu, J., Blázquez Andión, M., & Benito Vales, S. (2019). Development of a comprehensive, multidisciplinary program of care for frailty in an emergency department. European Geriatric Medicine, 10(1), 37-46.

Puts, M. T. E., et al. (2017). Interventions to prevent or reduce frailty in older adults: A systematic review. Ageing Res Rev, 40, 75–87.

Pulok, M. H., Theou, O., van der Valk, A. M., & Rockwood, K. (2020). The role of illness acuity on the association between frailty and mortality in emergency department patients referred to internal medicine. Age and Ageing, 49(6), 1071-1079.

Qian, X. X., Chau, P. H., Kwan, C. W., et al. (2021). Investigating risk factors for falls among community-dwelling older adults according to WHO's risk factor model for falls. The Journal of Nutrition, Health & Aging, 25(4), 425-432.

Quinn, J., Buchanan, S., Myint, P. K., et al. (2020). Older patients are more likely to breach the 4-hour target in Scotland. Emergency Medicine Journal, 37, 807-810.

Quinn, T. J., Mooijaart, S. P., Gallacher, K., & Burton, J. K. (2019). Acute care assessment of older adults living with frailty. BMJ, 364, Article l13.

Rapp, K., Freiberger, E., Todd, C., et al. (2014). Fall incidence in Germany: Results of two population-based studies, and comparison of retrospective and prospective falls data collection methods. BMC Geriatrics, 14, 105.

Ribbe, M. W., Ljunggren, G., Steel, K., et al. (1997). Nursing homes in 10 nations: A comparison between countries and settings. Age and Ageing, 26(Suppl 2), 3-12.

Ribbink, M. E., Gual, N., MacNeil-Vroomen, J. L., Ricart, J. A., Buurman, B. M., & Inzitari, M. (2021). Two European examples of acute geriatric units located outside of a general hospital for older adults with exacerbated chronic conditions. Journal of the American Medical Directors Association, 22(6), 1228-1234.

Rickard, F., Ibitoye, S., Deakin, H., et al. (2021). The clinical frailty scale predicts adverse outcome in older people admitted to a UK major trauma centre. Age and Ageing, 50(3), 891-897.

Ridley, N. J., Draper, B., & Withall, A. (2013). Alcohol-related dementia: An update of the evidence. Alzheimer's Research and Therapy, 5, 3.

Right Care, Right Place, First Time. (2021). Six goals for urgent and emergency care: Policy handbook for 2021 to 2026. https://www.gov.wales/sites/default/files/publications/2023-05/six-goals-for-urgent-and-emergency-care_0.pdf

Robertson, D. A., Savva, G. M., & Kenny, R. A. (2013). Frailty and cognitive impairment—A review of the evidence and causal mechanisms. Ageing Res Rev, 12(4), 840–851.

Robertson, K., Logan, P., Ward, M., Pollard, J., Gordon, A., Williams, W., et al. (2012). Thinking falls – taking action: A falls prevention tool for care homes. British Journal of Community Nursing, 17(5), 206-209.

Robson, G., Comacho, R., Sinclair, A., Buxton, S., Gregson, C., Smith, A., & Ballham, S. (2018). The frailty flying squad: A multi-disciplinary team approach to comprehensive geriatric assessment in the emergency department. Age and Ageing, 47.

Rockwood, K. (2005). A global clinical measure of fitness and frailty in elderly people. Canadian Medical Association Journal, 173(5), 489-495.

Rockwood, K., & Mitnitski, A. (2007). Frailty in relation to the accumulation of deficits. J Gerontol A Biol Sci Med Sci, 62(7), 722–727.

Rockwood, K., & Theou, O. (2020). Using the clinical frailty scale in allocating scarce health care resources. Canadian Geriatrics Journal, 23(3), 210-215.

Rodríguez-Molinero, A., Narvaiza, L., Gálvez-Barrón, C., et al. (2015). Falls in the Spanish elderly population: Incidence, consequences, and risk factors. Revista Española de Geriatría y Gerontología, 50, 274-280.

Rolfson, D. B., et al. (2006). Validity and reliability of the Edmonton Frail Scale. Age Ageing, 35(5), 526–529.

Romero-Ortuno, R., Forsyth, D. R., Wilson, K. J., Cameron, E., Wallis, S., Biram, R., & Keevil, V. (2017). The association of geriatric syndromes with hospital outcomes. Journal of Hospital Medicine, 12(2), 83-89.

Romero-Ortuno, R., Wallis, S., Biram, R., et al. (2016). Clinical frailty adds to acute illness severity in predicting mortality in hospitalized older adults: An observational study. European Journal of Internal Medicine, 35, 24-34.

Royal College of Emergency Medicine (RCEM). (2021). RCEM learning – Falls.

Royal College of Physicians of London. (2014). Acute care toolkit 10 – Ambulatory emergency care. https://www.rcplondon.ac.uk/guidelines-policy/acute-care-toolkit-10-ambulatory-emergency-care

Royal College of Physicians Wales. (2022). No place like home: Using virtual wards and 'hospital at home' services to tackle the pressures on urgent and emergency care. https://www.rcplondon.ac.uk/news/rcp-cymru-wales-calls-investment-hospital-home-services-and-social-care-keep-patients-home

Rumley-Buss, A., Thompson, D., Gladman, J., et al. (2016). Improving acute care for older people at scale - the Acute Frailty Network. Acute Medicine, 15(4), 165-220.

Rutan, G. H., Hermanson, B., Bild, D. E., et al. (1992). Orthostatic hypotension in older adults. The cardiovascular health study. Hypertension, 19, 508-519.

Rutberg, H., Borgstedt Risberg, M., Sjödahl, R., et al. (2014). Characterisations of adverse events detected in a university hospital: A 4-year study using the global trigger tool method. BMJ Open, 4(5).

Salvato, M., Solbiati, M., Bosco, P., et al. (2022). Prospective comparison of AMB, GAP and START scores and triage nurse clinical judgement for predicting admission from an ED: A single-centre prospective study. Emergency Medicine Journal, 39, 897-902.

Salvi, F., Morichi, V., Grilli, A., Lancioni, L., Spazzafumo, L., Polonara, S., Abbatecola, A. M., De Tommaso, G., Dessi-Fulgheri, P., & Lattanzio, F. (2012). Screening for frailty in elderly emergency department patients by using the Identification of Seniors At Risk (ISAR). Journal of Nutrition, Health & Aging, 16(4), 313-318.

Schultz, M., Rosted, E., & Sanders, S. (2015). Frailty is associated with a history with more falls in elderly hospitalised patients. Danish Medical Journal, 62(6).

Serina, P., Lo, A. X., Kocherginsky, M., et al. (2021). The clinical frailty scale and health services use for older adults in the emergency department. Journal of the American Geriatrics Society, 69(3), 837-839.

Sernbo, I., & Johnell, O. (1993). Consequences of a hip fracture: A prospective study over 1 year. Osteoporosis International, 3(3), 148-153.

Shah, R., Borrebach, J. D., Hodges, J. C., Varley, P. R., Wisniewski, M. K., Shinall, M. C. Jr., Arya, S., Johnson, J., Nelson, J. B., Youk, A., Massarweh, N. N., Johanning, J. M., & Hall, D. E. (2020). Validation of the risk analysis index for evaluating frailty in ambulatory patients. Journal of the American Geriatrics Society, 68(8), 1818-1824.

Shakya, I., Bergen, G., Haddad, Y. K., Kakara, R., & Moreland, B. L. (2020). Fall-related emergency department visits involving alcohol among older adults. Journal of Safety Research, 74, 125-131.

Shang, N., Liu, H., Wang, N., Guo, S., & Ma, L. (2022). Comparison of three frailty screening instruments for prediction of adverse outcomes among older adults in the emergency department. Geriatrics & Gerontology International, 22(10), 851-856.

Shepperd, S., Goncalves-Bradley, D. C., Straus, S. E., & Wee, B. (2021). Hospital at home: Home-based end-of-life care. Cochrane Database of Systematic Reviews, CD009231.

Shipway, D., Koizia, L., Winterkorn, N., Fertleman, M., Ziprin, P., & Moorthy, K. (2018). Embedded geriatric surgical liaison is associated with reduced inpatient length of stay in older patients admitted for gastrointestinal surgery. Future Healthcare Journal, 5(2), 108-116.

Shrier, W., Dewar, C., Parrella, P., et al. (2021). Agreement and predictive value of the Rockwood clinical frailty scale at emergency department triage. Emergency Medicine Journal, 38, 868-873.

Shumway-Cook, A., Ciol, M. A., Hoffman, J., et al. (2009). Falls in the Medicare population: Incidence, associated factors, and impact on health care. Physical Therapy, 89, 324-332.

Silvester, K. M., Mohammed, M. A., Harriman, P., Girolami, A., & Downes, T. W. (2014). Timely care for frail older people referred to hospital improves efficiency and reduces mortality without the need for extra resources. Age and Ageing, 43(4), 472-477.

Simon, N. R., Jauslin, A. S., Bingisser, R., & Nickel, C. H. (2022). Emergency presentations of older patients living with frailty: Presenting symptoms compared with non-frail patients. American Journal of Emergency Medicine, 59, 111-117.

Soong, J. T., Rolph, G., Poots, A. J., & Bell, D. (2020). Validating a methodology to measure frailty syndromes at hospital level utilising administrative data. Clinical Medicine (London), 20(2), 183-188.

Staudenmayer, K. L., Hsia, R. Y., Mann, N. C., Spain, D. A., & Newgard, C. D. (2013). Triage of elderly trauma patients: A population-based perspective. Journal of the American College of Surgeons, 217(4), 569-576.

Stenbacka, M., Jansson, B., Leifman, A., et al. (2002). Association between use of sedatives or hypnotics, alcohol consumption, or other risk factors and a single injurious fall or multiple injurious falls: A longitudinal general population study. Alcohol, 28, 9-16.

Stewart, D., Lang, E., Wang, D., & Innes, G. (2019). Are emergency medical services offload delay patients at increased risk of adverse outcomes? Canadian Journal of Emergency Medicine, 21(4), 505-512.

Stiffler, K. A., Finley, A., Midha, S., & Wilber, S. T. (2013). Frailty assessment in the emergency department. Journal of Emergency Medicine, 45(2), 291-298.

Stolze, H., Klebe, S., Zechlin, C., Baecker, C., Friege, L., & Deuschl, G. (2004). Falls in frequent neurological diseases. Journal of Neurology, 251, 79-84.

Strain, W. D., Down, S., Brown, P., Puttanna, A., & Sinclair, A. (2021). Diabetes and frailty: An expert consensus statement on the management of older adults with type 2 diabetes. Diabetes Therapy, 12(5), 1227-1247.

Stuck, A. E., et al. (2002). Comprehensive geriatric assessment: A meta-analysis. Lancet, 356(9240), 563–569.

Sullivan, E. V., Harris, R. A., & Pfefferbaum, A. (2010). Alcohol's effects on brain and behaviour. Alcohol Research and Health, 33(1-2), 127-143.

Sum, G., Nicholas, S. O., Nai, Z. L., Ding, Y. Y., & Tan, W. S. (2022). Health outcomes and implementation barriers and facilitators of comprehensive geriatric assessment in community settings: A systematic integrative review. BMC Geriatrics, 22(1), 379.

Tan, G. J., Tan, M. P., Luben, R. N., et al. (2022). The relationship between alcohol intake and falls hospitalization: Results from the EPIC-Norfolk. Geriatrics & Gerontology International, 21(8), 657-663.

Taverner, S., Eng, C., Watson, R., et al. (2022). A series of diabetic ketoacidosis associated with the use of sodium-glucose co-transporter-2 inhibitors in secondary care. Diabetes & Metabolic Syndrome, 16, 102658.

Taylor, J. K., Gaillemin, O. S., Pearl, A. J., Murphy, S., & Fox, J. (2016). Embedding comprehensive geriatric assessment in the emergency assessment unit: The impact of the COPE zone. Clinical Medicine, 16(1), 19-24.

Teixeira, L., Araújo, L., Duarte, N., & Ribeiro, O. (2019). Falls and fear of falling in a sample of centenarians: The role of multimorbidity, pain and anxiety. Psychogeriatrics, 19(5), 457-464.

Theou, O., Campbell, S., Malone, M. L., & Rockwood, K. (2018). Older adults in the emergency department with frailty. Clinics in Geriatric Medicine, 34(3), 369-386.

Theou, O., Squires, E., Mallery, K., Lee, J. S., Fay, S., Goldstein, J., Armstrong, J. J., & Rockwood, K. (2018). What do we know about frailty in the acute care setting? A scoping review. BMC Geriatrics, 18(1), 139.

Theou, O., Stathokostas, L., Roland, K. P., et al (2011). The effectiveness of exercise interventions for the management of frailty: a systematic review. *Journal of aging research*, *2011*, 569194.

Thompson, A., & Wennike, N. (2015). Testing the AMB score - Can it distinguish patients who are suitable for ambulatory care? Clinical Medicine (London), 15(3), 222-224.

Thorpe, O., McCabe, E., Herrero, E. M., Doyle, W. O., Dillon, A., Edge, L., Flynn, S., Mullen, A., Davis, A., Molamphy, A., Kirwan, A., Briggs, R., Lavan, A. H., Shields, D., McMahon, G., Hennessy, A., Kennedy, U., Staunton, P., Kidney, E., & Romero-Ortuno, R. (2022). Scoring the clinical frailty scale in the emergency department: The Home FIRsT experience. Journal of Frailty, Sarcopenia and Falls, 7(2), 95-100.

Tian, Q., Zhang, M., Deng, Y. T., Duan, J. X., Tu, Q., Cao, Y., Zhu, Q. L., Yu, W. H., & Lu, Y. (2016). Does gait speed replace comprehensive geriatric assessment in the elderly? International Journal of Gerontology, 10(4).

Timmonen, M., Haapea, M., Similä, H., et al. (2020). Association between chronic diseases and falls among a sample of older people in Finland. BMC Geriatrics, 20, 225.

Tinetti, M. E., Speechley, M., & Ginter, S. F. (1998). Risk factors for falls among elderly persons living in the community. New England Journal of Medicine, 319, 1701-1707.

Turner, G., & Clegg, A. (2014). Best practice guidelines for the management of frailty: A British Geriatrics Society, Age UK, and Royal College of General Practitioners report. Age and Ageing, 43(6), 744-747.

Understanding Wales' Ageing Population: Key Statistics. (2023). An independent voice and champion for older people. Older People's Commissioner for Wales. https://olderpeople.wales/wp-content/uploads/2023/06/Understanding-Wales-ageing-population-May-2023.pdf

van Dam, C. S., Hoogendijk, E. O., Mooijaart, S. P., Smulders, Y. M., de Vet, R. C. W., Lucke, J. A., Blomaard, L. C., Otten, R. H. J., Muller, M., Nanayakkara, P. W. B., Trappenburg, M. C., & Peters, M. J. L. (2021). A narrative review of frailty assessment in older patients at the emergency department. European Journal of Emergency Medicine, 28(4), 266-276.

van Dam, C. S., Trappenburg, M. C., Ter Wee, M. M., Hoogendijk, E. O., de Vet, R., Smulders, Y. M., Nanayakkara, P. B., Muller, M., & Peters, M. L. (2022). The prognostic accuracy of clinical judgment versus a validated frailty screening instrument in older patients at the emergency department: Findings of the AmsterGEM study. Annals of Emergency Medicine, 80(5), 422-431.

van den Broek, S., Westert, G. P., Hesselink, G., & Schoon, Y. (2023). Effect of ED-based transitional care interventions by healthcare professionals providing transitional care in the emergency department on clinical, process and service use outcomes: A systematic review. BMJ Open, 13(3).

van Kempen, J. A., Melis, R. J., Perry, M., Schers, H. J., & Rikkert, M. G. (2015). Diagnosis of frailty after a comprehensive geriatric assessment: Differences between family physicians and geriatricians. Journal of the American Board of Family Medicine, 28(2), 240-248.

Veronese, N., Custodero, C., Demurtas, J., Smith, L., Barbagallo, M., Maggi, S., Cella, A., Vanacore, N., Aprile, P. L., Ferrucci, L., & Pilotto, A. (2022). Comprehensive geriatric assessment in older people: An umbrella review of health outcomes. Age and Ageing, 51(5).

Vinik, A. I., Camacho, P., Reddy, S., et al. (2017). Aging, diabetes, and falls. Endocrine Practice, 23, 1117-1139.

Vogel-Sprott, M., & Barrett, P. (1984). Age, drinking habits and the effects of alcohol. Journal of Studies on Alcohol and Drugs, 45, 517-521.

Wald, H. L., Glasheen, J. J., Guerrasio, J., Youngwerth, J. M., & Cumbler, E. U. (2011). Evaluation of a hospitalist-run acute care for the elderly service. Journal of Hospital Medicine, 6, 313-324.

Wallis, S. J., Wall, J., Biram, R. W., & Romero-Ortuno, R. (2015). Association of the clinical frailty scale with hospital outcomes. QJM: An International Journal of Medicine, 108(12), 943-949.

Wannamethee, G., & Shaper, A. G. (1988). Men who do not drink: A report from the British Regional Heart Study. International Journal of Epidemiology, 17, 307.

Warnier, R. M. J., van Rossum, E., Van Velthuijsen, E., Mulder, W. J., Schols, J., & Kempen, G. (2016). Validity, reliability, and feasibility of tools to identify frail older patients in inpatient hospital care: A systematic review. Journal of Nutrition, Health & Aging, 20(2), 218-230.

Watanabe, Y., Yamada, Y., Yoshida, T., Yokoyama, K., Miyake, M., Yamagata, E., Yamada, M., Yoshinaka, Y., & Kimura, M. (2020). Comprehensive geriatric intervention in community-dwelling older adults: A cluster-randomized controlled trial. Journal of Cachexia, Sarcopenia and Muscle, 11(1), 26-37.

Welsh Assembly Government. (2021). Six goals for urgent and emergency care: Policy handbook for 2021 to 2026. https://www.gov.wales/sites/default/files/publications/2022-09/six-goals-for-urgent-and-emergency-care_1.pdf

Westby, M., Ijaz, S., & Savović, J. (2024). Virtual wards for people with frailty: What works, for whom, how and why—a rapid realist review. Age and Ageing, 53(3), afae039.

Westgard, T., Hammar, I. A., Dahlin-Ivanoff, S., & Wilhelmson, K. (2020). Can comprehensive geriatric assessment meet frail older person's needs? Results from the randomized controlled study CGA-Swed. Geriatrics, 5, 101.

Whelan, P. J., Reddy, L., & Andrews, T. (2011). Patient satisfaction rating scales vs patient related outcome and experience measures. Psychiatrist, 35, 32-33.

Wilhelmson, K., Andersson Hammar, I., Westgård, T., Holmquist Henrikson, L., & Dahlin-Ivanoff, S. (2022). Positive effects on activities of daily living one year after receiving comprehensive geriatric assessment - Results from the randomised controlled study CGA-Swed. BMC Geriatrics, 22(1), 180.

Wong, C. W. (2018). Frailty assessment: Clinical application in the hospital setting. Hong Kong Medical Journal, 24(6), 623-628.

World Health Organization. (2021). Falls. https://www.who.int/news-room/fact-sheets/detail/falls

Wou, F., Gladman, J. R., Bradshaw, L., Franklin, M., Edmans, J., & Conroy, S. P. (2013). The predictive properties of frailty-rating scales in the acute medical unit. Age and Ageing, 42(6), 776-781.

Yang, Y., Hu, X., Zhang, Q., & Zou, R. (2016). Diabetes mellitus and risk of falls in older adults: A systematic review and meta-analysis. Age and Ageing, 45(6), 761-767.

Zaccardi, F., Davies, M. J., Dhalwani, N. N., et al. (2016). Trends in hospital admissions for hypoglycaemia in England: A retrospective, observational study. Lancet Diabetes & Endocrinology, 4(8), 677-685.

Zulfiqar, A. A. (2021). Creation of a new frailty scale in primary care: The Zulfiqar Frailty Scale (ZFS). Medicines (Basel), 8(4).