

■ TRAUMA

Functional outcome and patient satisfaction with a 'self-care' protocol for minimally displaced distal radius fractures

A SERVICE EVALUATION



**A-M. Hutchison,
O. Bodger,
R. Whelan,
I. D. Russell,
W. Man,
P. Williams,
A. Bebbington**

From Swansea Bay
University Health Board,
Port Talbot, UK

Aims

We introduced a self-care pathway for minimally displaced distal radius fractures, which involved the patient being discharged from a Virtual Fracture Clinic (VFC) without a physical review and being provided with written instructions on how to remove their own cast or splint at home, plus advice on exercises and return to function.

Methods

All patients managed via this protocol between March and October 2020 were contacted by a medical secretary at a minimum of six months post-injury. The patients were asked to complete the Patient-Rated Wrist Evaluation (PRWE), a satisfaction questionnaire, advise if they had required surgery and/or contacted any health professional, and were also asked for any recommendations on how to improve the service. A review with a hand surgeon was organized if required, and a cost analysis was also conducted.

Results

Overall 71/101 patients completed the telephone consultation; no patients required surgery, and the mean and median PRWE scores were 23.9/100 (SD 24.9) and 17.0/100 (interquartile range (IQR) 0 to 40), respectively. Mean patient satisfaction with treatment was 34.3/40 (SD 9.2), and 65 patients (92%) were satisfied or highly satisfied. In total there were 16 contact calls, 12 requests for a consultant review, no formal complaints, and 15 minor adjustment suggestions to improve patient experience. A relationship was found between intra-articular injuries and lower patient satisfaction scores ($p = 0.025$), however no relationship was found between PRWE scores and the nature of the fracture. Also, no relationship was found between the type of immobilization and the functional outcome or patient satisfaction. Cost analysis of the self-care pathway V traditional pathway showed a cost savings of over £13,500 per year with the new self-care model compared to the traditional model.

Conclusion

Our study supports a VFC self-care pathway for patients with minimally displaced distal radius fractures. The pathway provides a good level of patient satisfaction and function. To improve the service, we will make minor amendments to our patient information sheet.

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Correspondence should be sent to
Anne-Marie Hutchison; email:
Anne-Marie.Hutchison@wales.
nhs.uk

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Introduction

In March 2020 due to the COVID-19 pandemic, we had to limit the number of

face-to-face consultations in our fracture clinic, and we therefore introduced a new 'self-care protocol' for minimally displaced

distal radius fractures. Musculoskeletal injuries may be treated using patient self-management protocols.¹⁻⁴ The aim of our study therefore was to determine satisfaction and functional outcome with the self-care pathway for minimally displaced distal radius fractures post COVID-19.

The specific objectives were to evaluate and report: 1) the number of patients who required surgery for the fracture, either acute or corrective; 2) patient functional outcome (Patient-Rated Wrist Evaluation (PRWE)⁵); 3) patient satisfaction (questionnaire, contact calls, requests to see a doctor, formal complaints, plus any recommendations to improve the service); 4) if a relationship exists between patient outcome and the nature of the fracture (intra-articular or extra-articular) or type of immobilization (back slab/splint); and 5) cost analysis of the self-care pathway V traditional pathway.

Methods

Literature search. Comprehensive electronic search strategies were developed for each database using a combination of relevant keywords and index headings. The search strategy was modified so that index headings relevant to each specific database were selected. A total of five databases were searched: Embase (Ovid), MEDLINE (Ovid), CINAHL (EBSCO), Allied and Complementary Medicine Database (AMED) (Ovid), and Cochrane Central Register of Controlled Trials (CENTRAL). The search strategies are provided in Supplementary Tables i to v.

Literature review. Before introducing the self-management protocol, we conducted a review of the literature to determine the current evidence in relation to self-care pathways for this injury. A review of the literature revealed a paucity of evidence in this area. All reviews, reports, guidelines, and clinical trials that contained details regarding self-management of minimally displaced distal radius fractures were included. Papers that included paediatrics or displaced fractures were excluded. Following the search and removal of duplications, 44 abstracts were reviewed. No studies were found that had investigated the impact of a self-care protocol for patients with minimally displaced distal radius fractures. A further search was therefore conducted of leading UK Virtual Fracture Clinics (VFCs) with repositories: Glasgow and Brighton and Sussex.^{6,7} However, again no studies investigating self-care protocols for this injury were found.

Ethics. The Joint Study Review Committee (JSRC) at Swansea Bay University Health Board classified this study as service evaluation, and therefore ethical approval was not required.

Study group. A minimally displaced distal radius fracture was defined as a fracture that could clearly be seen on the radiograph and with less than 10° of dorsal angulation. Only patients with both radiological and clinical findings of a minimally displaced distal radius fracture were included in the study.

Development of self-care protocol. The self-care protocol consisted of all patients with a suspected minimally displaced distal radius fracture being referred from the emergency department (ED) and the minor injuries unit (MIU) to our VFC. At the VFC, without the patient being present an orthopaedic consultant and a physiotherapist/nurse reviewed the patient's notes and radiographs and confirmed the diagnosis of a minimally displaced distal radius fracture, and the patient was discharged directly via an advice letter. The advice included: the orthopaedic consultant's VFC note; patient information sheets on the safe removal of the cast as per British Society for Children's Orthopaedic Surgery guidelines^{8,9}/removal of the splint at home; and an exercise sheet advising the patient of what to do after the immobilization period (Supplementary Material). Contact details were also provided for patients who may have had any problems.

Data collection. All 101 patients were contacted by a medical secretary at a minimum of six months post-injury. The medical secretaries completed the questionnaires with the patients over the telephone.

Outcome measures. Surgical intervention required acute or corrective to the fracture: this was recorded as binary data "yes" or "no".

Patient-Rated Wrist Evaluation: the PRWE rates wrist function in two (equally weighted) sections concerning the patient's experience of pain and disability to give a score out of 100 (with 100 being the worst score).⁵ The PRWE is the most sensitive outcome measure for patients sustaining this specific injury.¹⁰

Patient satisfaction: the patient satisfaction questionnaire asked the patient to rate their level of satisfaction with: their treatment, outcome of their hand/wrist, self-removal of cast/splint, and the information they received using a ten-point scale (10 very satisfied, 0 not satisfied) for each of the questions. To quantify the results, we classified scores of: 0 to 10 = very dissatisfied, 11 to 20 = dissatisfied, 21 to 30 = satisfied, and 31 to 40 = highly satisfied. The four elements correlated strongly with each other, showing "Good" internal consistency (Cronbach's alpha 0.861). Furthermore, principal component analysis suggested that over 70% of all variation within the set was captured by one dimension. Therefore, we felt it was reasonable to create a single satisfaction score by adding all four elements together with equal weighting. The number of contact calls was defined as patients who reported that they had contacted the clinic or any health professional for advice about their injury during the study period. Formal complaints were defined as reported complaints to the complaints department of the health board. Each patient was also asked if any improvements should be made to the service. All patients who expressed concerns about their injury during the data collection review were offered a follow-up consultation with the hand surgeon.

Statistical analysis. All data were analyzed by a statistician using SPSS version 27 (IBM, USA) for each of the outcome measures. Surgical intervention was measured by collation of total number of patients requiring surgery, while PRWE was measured using mean (standard deviation (SD)) and median (interquartile range (IQR)).

Patient satisfaction was measured using the following criteria: questionnaire (median and IQR – percentage of patients very dissatisfied, dissatisfied, satisfied, and very satisfied); contact calls (collation of number and description); formal complaints (collation of total number); suggestions for improvements to service (collation and description); and follow-up with surgeon – collation and description.

Relationship between outcome and certain variables: an analysis was conducted to determine if any relationship existed between either of the outcome measures (PRWE and patient satisfaction questionnaire) and the patient's age, sex, nature of the fracture (intra/extra-articular), the type of support used (back-slab, futuro splint, or soft cast), or duration of time since injury.

Both outcome measures (PRWE and satisfaction) had distributions that were highly skewed, rendering parametric methods unsuitable. As a consequence, non-parametric methods were used where any pairwise analysis was conducted. In line with SAMPL reporting guidelines¹¹ when using such methods, we report median and IQR rather than mean and SD.

We used Spearman correlation and Mann-Whitney U test throughout, and for all tests report both the p-value and the test used (SC or M-W, respectively). All significant test results are accompanied by some measure of effect size, usually a difference in median scores. Statistical significance was set at $p < 0.05$.

We also made use of Cronbach's alpha and principal component analysis to assess the validity of the patient satisfaction score.

Cost analysis: a cost analysis was performed to calculate the estimated costs associated with our self-management protocol in comparison to the traditional model that had preceded it, with the support of the health board finance department. There was no standardized protocol for the management of these injuries prior to the introduction of our standardized self-management pathway during COVID-19. There was resulting variation in how these injuries were managed. We have therefore estimated the cost of a traditional model based on the following typical minimum scenario seen prior to the VFC: a patient would have been seen in ED/MIU and the diagnosis confirmed with a radiograph, placed in a plaster back-slab and sling and referred to fracture clinic being seen ideally within 72 hours, where the back-slab would have been exchanged for a synthetic cast and a repeat radiograph. Patients would be brought back to the clinic to have the cast removed at four to six weeks before

being discharged to physiotherapy if required. No socio-economic cost analysis was performed.

Results

Demographic data. Between March and October 2020, 149 new trauma patients aged 17 years and over were reviewed in the VFC and diagnosed by an orthopaedic consultant as having a minimally displaced distal radius fracture.

A specialist consultant hand surgeon reviewed all radiographs and identified a proportion where the diagnosis was found to be wrong: 31 false positive diagnoses, ten displaced fractures, two unable to find radiographs, plus five patients who were deceased. This resulted in a final cohort of 101 patients. There were no patients during the study period who were subsequently diagnosed with a fracture that had been initially missed (false negative).

The 101 minimally displaced distal radius fracture patients accounted for 3% of the total referrals (3,133) our VFC received during the study period. A final cohort of 71 patients were included in the study (Figure 1).

The mean time until the telephone review with the secretary was 248 days or eight months (186 to 310 days/six to 12 months). The mean age of the patients was 60 years (19 to 98) and the majority of patients were female (75%, $n = 55/71$). A total of 51 were extra-articular fractures and 20 were intra-articular fractures. In addition, 57 were immobilized in back-slabs, two in soft casts, nine in futuro splints, and three refused any form of immobilization.

Surgical intervention. No patients required acute or corrective surgery to the fracture.

Patient pain and functional outcome. PRWE mean score was 23.9 (SD 24.9) and median score was 17.0 (IQR 0 to 40). Patients with extra-articular fractures scored a mean 9.1 points (95% confidence interval (CI) -24.1 to 5.9, standard error (SE) 7.3; $p = 0.236$, Mann-Whitney U test) less than those with intra-articular fractures (Table I).

Patient satisfaction. Patient satisfaction questionnaire: mean patient satisfaction with treatment was 34.3/40 (SD 9.2); Table II provides the breakdown of the results of each of the questions. Overall 65 patients (92%) were satisfied or highly satisfied with their experience (Table III). Four patients were dissatisfied and two were highly dissatisfied, and all six were offered a review with the consultant. Of these, one failed to attend the appointment, three patients did not complain of any problems with the wrist as they had problems with arthritic pains from other joints in the upper limb unrelated to the injury, and one patient had misunderstood the doctor's note and thought pantrapezial osteoarthritis was Paget's disease.

Contact calls: overall 16/71 patients (22%) reported that they had contacted the clinic during the study period as a source of help following VFC discharge (Table IV).

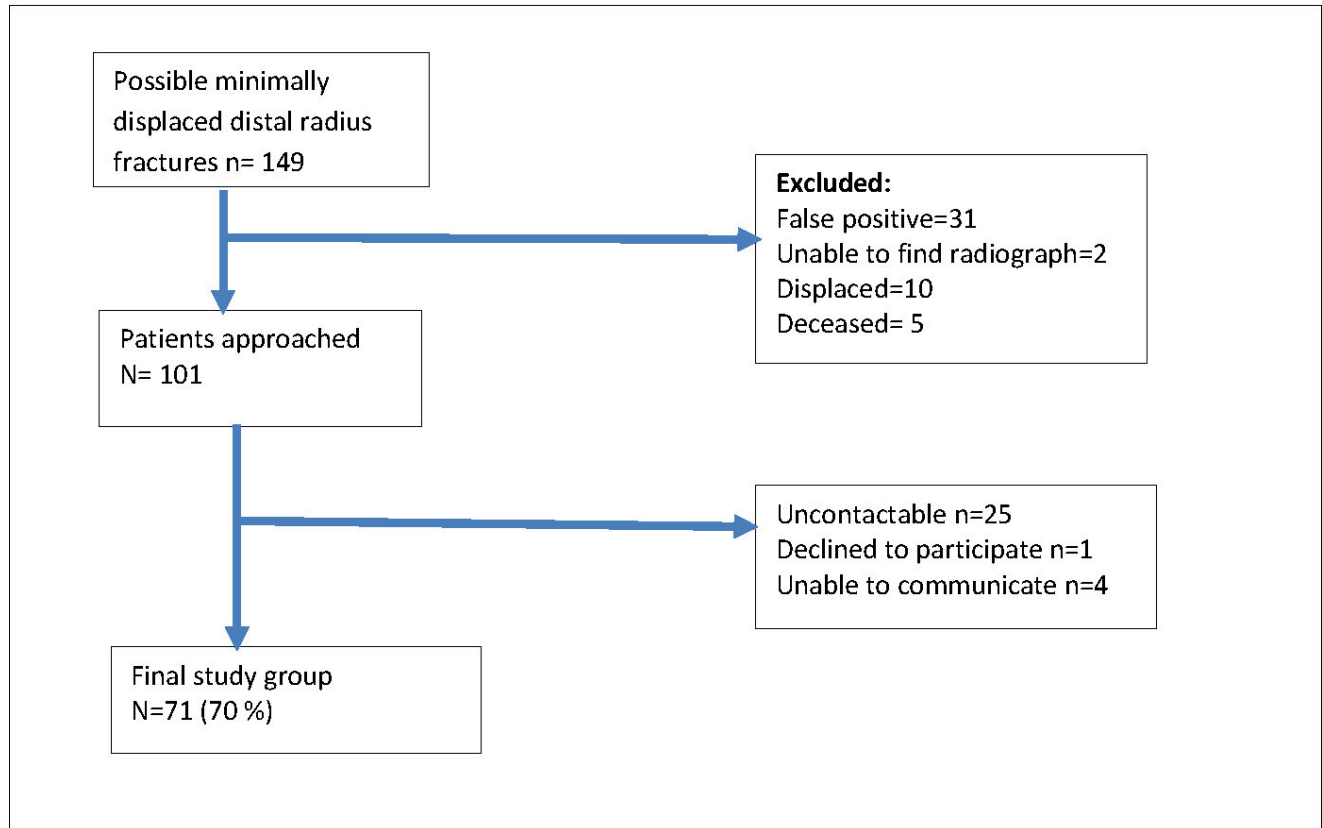


Fig. 1
Flow chart of study group.

Table I. Summary of the clinical score.

PRWE	Mean (SD; range)	Median (IQR)
Minimally displaced DRF	23.9 (24.9; 0 to 100)	17.0 (0.0 to 40.0)
Intra-articular	30.4 (29.5; 0 to 100)	17.3 (3.8 to 52.9)
Extra-articular	21.3 (22.6; 0 to 92)	17.0 (0.0 to 35.0)

DRF, distal radius fracture; IQR, interquartile range; PRWE, Patient-Rated Wrist Evaluation; SD, standard deviation.

Formal complaints: there were no formal complaints.

Suggestions to improve the service for future patients: 56 patients were happy with the service and said no improvements were required, while 15 suggestions were made to improve the service (Table V).

Requests to see the surgeon: when contacted by the secretary, 12/71 patients (17%) requested a review with the doctor. Of these seven were discharged with reassurance, one required a carpal tunnel decompression, one was referred to the pain clinic for consideration of a denervation of the posterior interosseous nerve, and three failed to attend the follow-up appointment.

Relationship between outcomes and variables. Neither age nor sex was found to have any association with patient outcomes, nor did the type of support used show a statistically significant association with either PRWE or satisfaction. However, we did observe that patients with

intra-articular injuries reported lower satisfaction levels ($p = 0.025$, Mann-Whitney U test) with median scores of 33 (IQR 11) and 40 (IQR 6) for intra- and extra-articular cases, respectively. There was no corresponding, measurable statistical difference in PRWE scores, however. We observed a positive significant association between the time since injury and the satisfaction score ($p = 0.046$, Spearman's rank correlation coefficient). At six months the mean satisfaction was 30.9 (SD 12.7), but this increased progressively to reach the highest level of 37.2 (SD 3.9) at ten to 12 months. No such association was observed between time since injury and PRWE (Table VI).

Cost analysis of assumed traditional fracture clinic vs self-care protocol. Table VII shows that the cost of the traditional model was £224.95 per patient compared to £98.23 per patient for our new self-care model, which represents a saving of £126.72 (56%) per patient. Given

Table II. Mean satisfaction score for each question out of 10.

Patient satisfaction	Mean (SD)	Median (IQR)
Self-management	8.7 (2.7)	10.0 (8.0 to 10.0)
Final outcome	8.0 (2.9)	10.0 (6.0 to 10.0)
Information	8.6 (3.2)	10.0 (10.0 to 10.0)
Cast removal	8.7 (3.0)	10.0 (10.0 to 10.0)
Total	34.3 (9.2)	40.0 (32.0 to 40.0)

IQR, interquartile range; SD, standard deviation.

Table III. Percentage of patients satisfied with the service.

Satisfaction questionnaire	Number of patients (%)
Highly satisfied (31 to 40)	49 (70)
Satisfied (21 to 30)	16 (23)
Dissatisfied (11 to 20)	4 (4)
Very dissatisfied (0 to 10)	2 (3)

that we saw 71 patients over an eight-month period, this equates to a cost of £24,069.65 per year for the traditional model compared to £10,510.61 for the new self-care model, which is an estimated savings of £13,559.04 per year.

Discussion

While other studies have reported self-management protocols to be successful for the management of certain trauma injuries,¹⁻⁴ to our knowledge this study is the first to investigate a self-care protocol for patients with minimally displaced distal radius fractures. It shows that patients can be safely treated using this new self-care model with demonstrable benefits in the key domains of quality healthcare and with good patient satisfaction. It adds to the growing body of evidence that direct discharge VFC pathways of care can be safely implemented to reduce the number of patients who need to attend a face-to-face fracture clinic appointment.

Patient safety is paramount in the implementation of any new protocol, and a fear in its deployment was the possibility of poor functional outcomes. However, none of our patients needed acute or corrective surgery for the fracture and they reported a PRWE median score of 17 (IQR 0 to 40) while the majority of patients (n = 65 (92%)) were either satisfied or highly satisfied.

In our new model of care, patients were provided with a letter and information sheet on how to manage their injury, including removing the splint or cast at home; this greatly increased the responsibility on our patients compared to our historic model where patients were brought back for a next day face-to-face consultation. It also differed notably to other centres' VFC pathway for this injury, where a clinician (physiotherapist or nurse) arranges a telephone consultation with the patient. Despite this, 65 (92%) of our patients were satisfied or

Table IV. Nature of the contact calls.

Reason for call	Number with problem	Number brought back to clinic
Pain	6	0
Plaster problem		
Loose	1	0
Tight	1	1
Splint changed to cast	1	1
Advice on ROP	4	0
Requested an X-ray	2	0
Data missing	1	0

ROP, removal of plaster.

Table V. Patient suggestions on how to improve the service.

Comment	Number of patients the comment was suggested by
No changes required	56
Have an X-ray to check the fracture has healed	4
Clinic follow-up after removal of cast	4
Don't go to Morriston Hospital	1
Contact number required	2
NHS physio	1
Treatment explanation	1

highly satisfied with the service and 56/71 reported that no changes to the service were required.

The telephone support line gave the protocol added flexibility and made the service more responsive to patient needs, offering a route back to the service if required. There were 16 contact calls and 12 requests for a review with the doctor. Only four patients required further intervention. All other patients were discharged with reassurance and advice. The high number of patients seeking help highlights the importance of investigating patient satisfaction, and not just patient outcome scores, when implementing new pathways.

To help improve the service and address the issues that patients were seeking help or advice for, we analyzed the reason for the contact calls, the result of the consultation with the doctor, and the patient feedback to improve the service. Most patients required additional information and reassurance regarding ongoing pain, as well as reassurance that a 'routine check radiograph' was not required, neither of which are in the information booklet. We therefore have plans to amend the booklet to include information around these issues. Four patients also called for advice on removing the cast. We plan to amalgamate the removal of plaster information into the advice sheet to make the process simpler, as well as create a YouTube video for patients to access.

We also did a separate analysis of the six patients who had reported poor satisfaction. They were not a certain demographic of patient: three had problems

Table VI. Correlation of Patient-Rated Wrist Evaluation and satisfaction with age, sex, nature of the injury, support, and duration of time since injury.

Relationship	p-value
Age vs PRWE	0.224*
Age vs satisfaction	0.292*
Sex vs PRWE	0.454†
Sex vs satisfaction	0.315†
Nature of injury‡ vs PRWE	0.236†
Nature of injury vs satisfaction	0.025†
Support§ vs PRWE	0.983†
Support vs satisfaction	0.669†
Time to follow-up vs PRWE	0.159*
Time to follow-up vs satisfaction	0.046*

Statistical significance was set at $p < 0.05$.

*Spearman's rank correlation coefficient.

†Mann-Whitney U test.

‡Intra-articular or extra-articular fracture.

§Back-slab, furturo splint, or soft cast.

PRWE, Patient-Rated Wrist Evaluation.

Table VII. Cost analysis of assumed traditional fracture clinic versus self-management protocol per patient seen.

Items	Cost, £	Numbers required for the traditional model	Cost for items in the traditional model, £	Numbers required for VFC model	Cost for items with the new protocol, £
ED or MIU visit	13.26	1	13.26	1	13.26
Radiograph & report	80	2	160	1	80
Back-slab & sling	1.30	1	1.30	1	1.30
Synthetic cast	3.76	1	3.76	0	0
Fracture clinic visit	46.63	2	93.26	0	0
VFC	3.67	0	0	1	3.67
Total for each model			224.95		98.23

ED, emergency department; MIU, minor injuries unit; VFC, Virtual Fracture Clinic.

which were unrelated to the fracture (arthritis in other joints), one misunderstood the clinic note and thought they had Paget's disease, and one failed to attend the review appointment arranged with the doctor. We cannot address any of these issues to improve the service. However, for one patient the advice leaflet on how to remove the plaster was again not sent to the patient. This will hopefully be resolved as stated above once the booklets are amalgamated.

This study had a response rate of 70% with a large cohort of 101 patients. This high response rate may be explained by the fact that the consultation was conducted over the telephone rather than via a postal consultation.

The new process not only reduces over-medicalization of this injury, but also demonstrates additional economic benefits. Compared to a traditional system, this avoided 71 initial outpatient fracture clinic attendances along with the potential follow-up appointments, 71 cast changes, and 71 repeat radiographs, resulting in an overall saving of £13,500 per annum.

All our patients' notes and radiographs were reviewed in VFC and a decision on management was made by a consultant orthopaedic surgeon. Interestingly, when these radiographs were rechecked for inclusion in this

study by a specialist hand surgeon, 43 patients were excluded (ten were displaced, 31 did not have radiological signs of a fracture, and two were unable to find the radiographs). The over-diagnosis of the fracture may reflect the medico-legal environment we work in. Since ten patients were displaced, this could question the diagnostic accuracy for these fractures and further studies are required to look at the reliability of orthopaedic clinicians' diagnoses of minimally displaced distal radius fractures from radiographs.

There were limitations in conducting the follow-up via questionnaire data, with none of the patients being examined following their management. We are therefore unable to comment on objective features, including range of motion and grip strength.

This study was based on short-term follow-up (median 8 months (IQR 7 to 10)) and, therefore, we are unable to comment on longer-term outcomes.

As this was a pragmatic study design and we could not justify exposing patients to additional clinical review or ionizing radiation exposure, we did not routinely measure angulation or shortening.

The patient satisfaction questionnaire had not been tested for reliability, validity, or sensitivity, since no questionnaire exists.

Prior to the introduction of the 'self management' protocol pre COVID-19, we did not collect any data from our patients, and the lack of these data means that no comparison can be made to our traditional practice. A consequence of this is that while we can demonstrate improvements in efficiency and reduced cost, we are unable to show that this will lead directly to improvements in patient outcomes. However, given that the mean PRWE score was 23.9 (SD 24.9), it is unlikely that effectiveness will have been compromised. Furthermore, the reduced time patients spend in the system and the consistency, equality in treatments and investigations offered has been shown to yield satisfactory patient experience, which may have an impact on outcomes.

In conclusion, a self-management plan for minimally displaced distal radius fractures resulted in our patients expressing high satisfaction with this treatment approach and good functional outcomes. No adverse effects were found in this cohort of patients. There were also cost saving benefits to the Swansea Bay University Health Board. This way of working should therefore be continued and will help with service pressures during the COVID-19 recovery plan, while minor adjustments to the patient information sheet are required to improve patient satisfaction. This redesigned process has substantial benefits for patients, as there were fewer hospital visits by avoiding unnecessary appointments.



Take home message

- Patients with minimally displaced distal radius fractures who self-manage their injury at home have: 1) satisfactory outcome in terms of pain, function, and satisfaction; and 2) no lengthy fracture clinic waits.

Supplementary material



Tables showing the search strategies used across five databases, and an advice sheet for self-care following a broken wrist.

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Author information:

- A-M. Hutchison, PhD, MSc, BSc Hons, Consultant Physiotherapist
- R. Whelan, BA (Hons), PGDip, MA, MCLIP, Library & Knowledge Service Manager
- I. D. Russell, MB BCH, Consultant Trauma & Orthopaedic Surgeon
- W. Man, MBChB PgDip FRCS, Consultant Orthopaedic Surgeon
- P. Williams, BScHons, MB BCH, FRCS (Tr&Orth), Consultant Trauma & Orthopaedic Surgeon and Clinical Director
- A. Bebbington, MBBCh, FRCS (Tr&Orth) Swansea Bay University Health Board, Port Talbot, UK.
- O. Bodger, PhD, BSc Hons, Senior Lecturer in Statistics, School of Medicine Swansea University, Swansea, UK.

Author contributions:

- A-M. Hutchison: Conceptualization, Data curation, Methodology, Project administration, Resources, Validation, Visualization, Writing – original draft, Writing – review & editing.
- O. Bodger: Data curation, Formal Analysis, Validation, Writing – original draft, Writing – review & editing.
- R. Whelan: Resources, Writing – original draft, Writing – review & editing.
- I. D. Russell: Conceptualization, Methodology, Validation.
- W. Man: Conceptualization, Methodology.
- P. Williams: Conceptualization, Methodology, Visualization, Writing – original draft, Writing – review & editing.
- A. Bebbington: Conceptualization, Methodology, Resources, Supervision, Visualization, Writing – original draft, Writing – review & editing.

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