

Exploring the workplace culture and leadership within PET CT departments across the United Kingdom



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ABSTRACT

Introduction: Positron Emission Tomography (PET) uses a positron camera and Computed Tomography (CT) to locate radionuclide concentrations within a patient's body for various referral pathways, including oncology, cardiology, and neurology. The PET-CT imaging rollout across the United Kingdom (UK) is a mix of National Health Service and private provider sites, with a varied skills mix in the workforce. This study aims to explore the workplace culture and leadership within a private provider PET-CT departments across the UK to understand the current challenges.

Method: A $n = 39$ question cross-sectional survey using purposive sampling of a single private provider of PET-CT sites across the UK ($n = 260$) was conducted. The survey was divided into $n = 6$ sections: demographics, teamwork, standards and processes, professional development, workload levels, and work environment questions. Data analysis applied descriptive statistics and thematic analysis for recurring themes and patterns.

Results: Twenty-five responses were received, providing a range of answers on what makes an effective team, from communication (64%), collective decision-making (28%), the efficiency of standardisation of protocols (68%), and adequate work environments (72%). Key barriers included variation of protocols across sites (64%), lack of work appraisals (28%), and time to complete mandatory training (48%), and daily tasks (60%).

Conclusion: Findings present opportunities to improve the culture and leadership by reviewing staffing levels, workforce planning, training and communication. Specifically, the dissemination of information between teams was identified as an area for future improvement.

Implications for practice: Improvements to communication, allocated time for training and career opportunities would assist staff retention and teamwork. Future research into the standardisation of PET-CT protocols would be beneficial.

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Introduction

A PET-CT scan is a radiological imaging technique combining two types of scans: Positron Emission Tomography (PET) using positron-type cameras and Computed Tomography (CT) to locate anatomical radionuclide concentrations of typical and atypical metabolic or biochemical activity within a patient's organs and tissues.

The PET-CT imaging capacity in England has increased from around 11,000 PET-CT scans per year in 2005 to 40,000 in 2010¹ to over 275,300² PET-CT scans across all providers (the National

Health Service (NHS), independent sector and charitable organisations) in 2024.³

PET-CT imaging referrals range from oncology (cancer), which accounts for around 97% of referrals,³ from Cardiology (heart disease), Neurology (brain disorders) and infection or inflammatory disorders.⁴ The PET-CT imaging technique uses a radioactive tracer (dependent upon the examination/organ/condition being assessed) injected into the patient to highlight physiological areas of high metabolic uptake and activity corresponding to the investigated disease type.

United Kingdom (UK) PET-CT department workforce typically consists of an interdisciplinary team encompassing consultant

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radiologists (who set imaging protocols, and interpret examinations), nuclear medicine technologists and diagnostic radiographers (who care for patients, prepare and administer the radiopharmaceuticals, and operate the equipment), medical physicists (who ensure quality and safety of the imaging equipment, and radiation dose), administrative staff (handling patient records and appointments), and clinical assistants (who assist patient preparation, care, and procedures). Staffing depends on the PET-CT department's local context (static versus mobile), operating hours, and patient demand, which may require additional therapeutic radiographers, nursing or pharmacy support depending on procedures.^{5,6}

Currently, in the UK, there are multiple demands upon imaging services, ranging from increased demand for oncology referrals⁷⁻⁹ workforce shortfalls affecting the expansion of PET-CT across England.^{3,10} Radiotracer/isotope production shortages are due to limitations of the number of cyclotron facilities and the volume that can be produced, partly due to global manufacturing disruptions affecting service provision.¹¹

Literature review

Husband et al.⁶ published a strategy to enhance the provision of PET-CT services across the UK by standardising it into a consistent service model. The approach focuses on access to radiopharmaceutical production, investment in multidisciplinary staff training, workforce upskilling, quality assurance and auditing programmes for service improvement. Furthermore, a survey by Dickson and Eve⁹ of PET-CT service provision in the UK highlighted critical challenges in standardising services, including the suggestion of consistent imaging protocols, ongoing training to keep abreast of equipment and technological advancements. At a local level, PET-CT departments might struggle with specific recommendations like referral demands or staffing levels; exploring practice standardisation could benefit employee integration and retention.

Azzolini, Ricciardi, and Gray¹² advise three components (structure, systems, and culture) that healthcare organisations can adopt to enhance service delivery and performance. In radiology departments, these components impact service efficiency, patient safety and quality of care,¹³ however, they can often influence negative behaviours that affect morale, stress and contribute to burnout.¹⁴⁻¹⁹ Azzolini, Ricciardi, and Gray¹² advise culture is challenging to change in organisations, as it is "a pattern of shared basic assumptions that a group learns as it solves its problems of external adaptation and internal integration, that has worked well enough to be considered valid and, therefore, to be taught to new members as the correct way to perceive, think, and feel in relation to those problems". Therefore, local workplace culture significantly influences new employees who adopt the department's social norms, values, communication styles, and work ethics.^{20,12,21}

Corazzini et al.²¹ identified six themes for workplace culture change: relationships, standards and expectations, motivation and vision, workload, respect for personhood and physical environment. Each theme provides examples of barriers and facilitators to implement leadership and culture change in healthcare settings. This study aims to explore the workplace culture and leadership within PET-CT departments across the United Kingdom (UK) using an adaptation of these themes.²¹

Method

Institutional ethical approval was obtained from Swansea University, the PET-CT private provider company also approved the survey for internal distribution to its employees. The study used a cross-sectional survey (supplementary data) to collect trends in

responses (quantitative) and free-text descriptions (qualitative). A pilot of the survey was tested before distribution by two fellow students, which allowed peer review of the format, layout, and wording, with no changes needed.

Purposive sampling was used to recruit from the $n = 260$ staff members from PET-CT scanning centres across the UK from Alliance Medical Ltd. Data were collected via Microsoft Forms.²² Before completing the survey, participants received an information sheet on the nature of their participation, the purpose of the study, what information would be gathered, how the results would be disseminated, informed consent, and the right to withdraw.

The survey link was sent electronically via internal email service within the PET-CT private provider to recruit participants from a range of roles, including technologists, radiographers, managers, clinical assistants, and administrators.

The questionnaire collected anonymous responses and consisted of $n = 6$ sections: demographic ($n = 7$ questions), teamwork ($n = 7$ questions), standards and processes ($n = 6$ questions), professional development ($n = 7$ questions), workload levels ($n = 7$ questions), and work environment ($n = 5$ questions). The survey used a combination of yes/no and open questions to allow participants to expand their opinions and explore the reasoning and justification in responses (variables).

Responses were analysed using SPSS Statistics,²³ with categorical yes/no data assessed with descriptive statistics for response counts and percentages. Free-text open-ended questions were analysed using thematic analysis²⁴ for reoccurring patterns/themes using a Microsoft Excel²⁵ codebook imported into NVivo.²⁶

Results

The questionnaire was sent to $n = 260$ Alliance Medical Ltd PET-CT employees in the UK, achieving $n = 25$ responses. The mean completion time was 20 min. Demographics show 64% ($n = 16/25$) were female, the predominant age was 45–55 years old (28%; $n = 7/25$), with postgraduate qualifications (32%; $n = 8/25$), employment in healthcare for over 20 years (40%; $n = 10/25$) and within PET-CT for 2–5 years (32%; $n = 8/25$; Table 1). Common roles were PET-CT technologists (28%; $n = 7/25$), clinical assistants (24%; $n = 6/25$), and PET-CT radiographers (20%; $n = 5/25$).

Team working

Seven questions explored participants' perspectives of team working within their PET-CT department. All respondents agreed they work as a team (100%; $n = 25/25$), with 88% ($n = 22/25$) having defined areas of responsibility within their role (Fig. 1).

Participants listed key components of an effective team with communication (64%; $n = 16/25$), the most common theme critical for teamwork. Further responses included good leadership to set clear objectives, roles and responsibilities, collaboration, professionalism (including respect for colleagues), and working together to achieve common goals. Specific responses included:

"Helping each other and asking for help when required, compiling useful, correct and informative handovers for covering leave/absence" Participant 6.

"Clear communication, Good timekeeping, giving colleagues the time and space to concentrate on their job, consideration for your colleagues, pulling your weight!" Participant 14.

"Firstly, team members have to get along with each other. Communication is another vital part of working as a team. Each member has to know every aspect of their role to help out others when it is needed. Everyone has to strive towards the same goal

Table 1
Demographic information of participants.

| Demographics (Individual-level variables) | Count (n) | Percent (%) |
|---|-----------|-------------|
| Age | | |
| 18–24 years old | 1 | 4 |
| 25–34 years old | 5 | 20 |
| 35–44 years old | 6 | 24 |
| 45–54 years old | 7 | 28 |
| 55–64 years old | 4 | 16 |
| >65 years old | 1 | 4 |
| Gender | | |
| Female | 16 | 64 |
| Male | 9 | 36 |
| Other | 0 | |
| Prefer not to say | 0 | |
| Race/Ethnicity | | |
| White | 21 | 84 |
| Hispanic or Latino | 0 | |
| Black or African American | 2 | 8 |
| Asian/Pacific Islander | 1 | 4 |
| Other | 1 | 4 |
| Prefer not to say | 0 | |
| Education | | |
| Secondary Education | 2 | 8 |
| Post-Secondary Education | 4 | 16 |
| Vocational Qualification | 4 | 16 |
| Undergraduate Degree | 7 | 28 |
| Post-graduate Degree | 8 | 32 |
| Doctorate (PhD) | 0 | |
| Prefer not to say | 0 | |
| Role | | |
| Administrator | 4 | 16 |
| Clinical Assistant | 6 | 24 |
| PET CT Assistant Practitioner | 0 | |
| PET CT Technologist | 7 | 28 |
| PET CT Radiographer | 5 | 20 |
| Unit Manager | 3 | 12 |
| Other | 0 | |
| Healthcare working years | | |
| <1 year | 2 | 8 |
| 2–5 years | 4 | 16 |
| 6–10 years | 2 | 8 |
| 10–15 years | 2 | 8 |
| 15–20 years | 5 | 20 |
| >20years | 10 | 40 |
| PET-CT working years | | |
| <1 year | 2 | 8 |
| 2–5 years | 8 | 32 |
| 6–10 years | 7 | 28 |
| 10–15 years | 4 | 16 |
| 15–20 years | 3 | 12 |
| >20years | 1 | 4 |

and have a clear picture of what needs to be achieved." Participant 16.

"Good communication, being able to bring up alternative ways of working, being able to ask questions, each person being aware of their own and other people's roles, keeping in mind what is best for the patient, being able to have a laugh together." Participant 19.

Working within a team also involves collective decision-making; participants associated this task with communication strategies (28 %; n = 7/25). This theme was repeated throughout responses detailing sharing information, obtaining opinions, and situational awareness of evolving and changing daily tasks and responsibilities. Individual responses highlighted:

"Adequate information given, which might impact the day, is passed on directly so staff are made aware." Participant 5.

"Having confidence in your colleagues/knowing what they can/feel confident to do." Participant 12.

"All team members being aware of what is going on throughout the day and taking responsibility for certain tasks, then letting everyone else know what they are doing." Participant 14.

The strategies used included digital communication (email, intranet newsletters; 64 %; n = 16/25) and daily in-person meetings (32 %; n = 8/25). Participants were aware of various means of communication but perceived existing information pathways as ineffective. To improve departmental communication, participants recommended face-to-face meetings (20 %; n = 5/25), departmental visits from higher management (28 %; n = 7/25), training (20 %; n = 5/25), and better organisation of documents and intranet resources (12 %; n = 3/25).

Standards and processes

Participants were asked six questions concerning standardisation of local departmental clinical protocols (patient preparation, radiopharmaceutical tracer uptake levels, glucose acceptance levels, etc.) With 68 % (n = 17/25) stating this will help facilitate efficiency (16 %; n = 4/25), consistency (32 %; n = 8/25), and safety (36 %; n = 9/25) when collaborating between sites due to staff shortages. However, barriers were noted, including variations across departments (64 %; n = 16/25) of the patient booking process (16 %; n = 4/25) and PET-CT examination scans, equipment, and the local Administration of Radioactive Substances Advisory Committee (ARSAC) holders' (24 %; n = 6/25). Mixed responses reflected concerns, with specific examples included:

"Nationally agreed best practice would ensure consistent outcomes across services at maximum efficiency." Participant 13.

"The protocols should be based on the most up-to-date evidence, not the personal preference of individuals. It would also lead to less mistakes when working at different sites. It would mean that all equipment would have to be the same, though, and I'm not sure if this would be possible as new, more up-to-date scanners and equipment have been fitted over time." Participant 19.

"We have different ARSACs assigned to each site, and they have different levels of experience. My understanding is that the advice given by ARSAC is determined based on their skill set/ability to interpret the images, so I think it's sensible to have site-specific protocols." Participant 17.

Participants suggested improving standards and work processes by recruiting more scanning and support staff (64 %; n = 16/25) and increasing the capacity of imaging equipment and room layout (48 %; n = 12/25) to assist with the local patient demand.

Professional development question

Seven questions were asked about professional development, learning and training. Concerning yearly role appraisals, 72 % (n = 18/25) of participants reported reviewing their career development, although only 56 % (n = 14/25) had enough time for mandatory training during work hours. Additionally, 60 % (n = 10/25) were aware of development opportunities to enhance career progression and job satisfaction.

Support to develop careers included group discussions with peers on clinical cases, imaging reviews and various roles (i.e. apprenticeships, reporting roles, coaching, mentoring, CT specialist, etc). Further comments specifically highlighted:

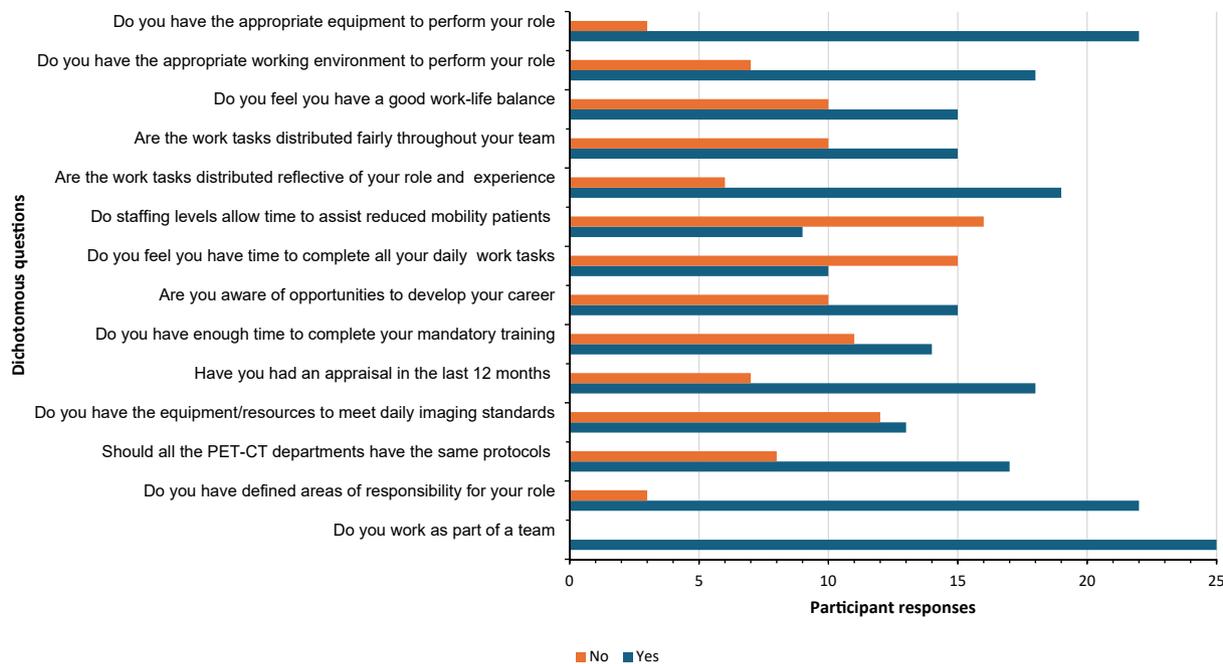


Figure 1. Participants' responses to questions related to teamwork, workplace standards and processes, professional development, workload, and the work environment.

"Realistic assessment of individual needs and aspirations via annual reviews." Participant 13.

"From the perspective of a business, we should identify future roles and skills that come with it, which will be essential for the business to develop further. Then identify those employees who show interest in and engagement towards that field of expertise. Lastly, offer them the opportunity to take part in that specific professional development program" Participant 16.

"Booking support to allow time for any additional training, as I just about manage my mandatory training." Participant 17.

"More educational opportunities relevant to PET-CT. The courses at some institutes that provide this are very full." Participant 25.

Workload levels

Among the participants, 60 % (n = 15/25) felt they didn't have the time to complete all daily clinical tasks, which increased to 64 % (n = 16/25) if assisting reduced mobility patients or urgent operational tasks. Participants suggested a variety of opinions on shift patterns (44 %; n = 11/25) and emphasised workload affected scheduled breaks (28 %; n = 7/25):

"Difficult to change shift patterns in 12-hour days without significant impact on work/life balance." Participant 13.

"To ensure that all staff get a break, there has to be an allocated time during the scanning day to ensure that all staff can leave the scanning environment whilst leaving enough staff still with patients." Participant 19.

Participants felt that the clinical work tasks allocated reflected their role and experience (76 %; n = 19/25). While 60 % (n = 15/25) believed the tasks were distributed fairly across the team, and working long shift patterns (fewer days) provided a good work-life balance. To improve work-life balance, the participants suggested increasing workforce numbers (16 %; n = 4/25) and advanced rota

notification (16 %; n = 4/25) with emphasis around the flexibility needed for overrunning worklists:

"Having the ability to be flexible, sometimes you have to work late for business needs, so it would be nice to have the opportunity to take the time back rather than submit it as overtime, as some of us value our time more." Participant 15.

Working environments

In the final questions on working environments, 72 % (n = 18/25) of participants stated having an appropriate working environment, while 88 % (n = 22/25) responded they had the correct equipment for their clinical role. Suggestions for improvements to the physical working environments, including better facilities, break rooms for staff and ergonomic adjustments to patient changing rooms and toilets.

Discussion

The survey findings highlighted key points about workplace culture and leadership within PET-CT departments. Responses included the importance of communication and collaboration for a positive team working culture and effective leadership to maintain clear objectives for every team member, whilst respecting and recognising individuals' skills. Although there was mixed consensus on whether standardisation would benefit PET-CT departments, given the variability of staff, equipment and leadership at each site. Low staffing levels were evident throughout many of the responses, highlighting the need to increase recruitment to meet patient demand. Participants advocated increasing training opportunities (both external career progression opportunities and internal mandatory requirements) to reduce attrition and improve retention.

Key aspects were identified with suggestions for improvements, all linked to experiences of leadership and management support, emphasising implementing additional coaching and

mentoring schemes to promote a positive work environment. Common and recurring themes included communication, training, workload levels, management support and organisation.

Communication was identified as the key team skill for working effectively, with examples including emails, staff meetings, and intranet updates. However, participants perceived that the quality, level of detail and information disseminated to individuals and teams could also be improved through staff education, such as:

"The weekly email, most of which is not relevant to our department." Participant 6.

"Provide more structured information when changes are made." Participant 12.

Findings suggest that improving the quality of communication could be highlighted within mandatory training for healthcare organisations to ensure staff communicate clearly and effectively. Promoting an open communication culture also helps to share the organisation's values.²⁷

Training was a common topic throughout the survey, with responses highlighting the difficulty of completing mandatory training due to workload and time constraints. Participants perceived that a lack of support for external postgraduate education opportunities can be a barrier to career progression:

"More staffing would give staff time for development." Participant 12.

"Postgraduate training in the different areas. I'm a PET-CT technologist and would like to do CT training." Participant 20.

"There is never enough time to do any training if you are admin staff as the pressure to book, book, book is always there." Participant 9.

The responses indicate that training affected all staff, from clinical to administrative, with time a significant factor in completion due to workload. However, staff education has numerous advantages, including employee retention,²⁸ job satisfaction,²⁹ staff morale,²⁹ productivity and efficiency²⁸ and increased patient satisfaction.³⁰ Specific responses to improving training focused on new employees completing inductions, allowing staff to mentor them, establishing time scales to achieve training standards and meeting the company's values.³⁰ Individual responses concentrated on supplementary training in skills in CT (especially for technologists without a radiography background) and advanced practice roles and career progression.^{31,32} Furthermore, the need for allocated time for continuing professional development (CPD)³³ activities ranging from staff group discussions (i.e. review clinical cases), literature reviews, short courses and conferences, which would be in line with statutory requirements for radiographers^{33,34} and best practice guidance for technologists.³⁵⁻³⁸

Workforce shortages were identified as a barrier to the broader rollout of the service.³⁹ Perkins et al.⁴⁰ have recommended national and regional accredited multi-professional training programmes across the public and private sectors to support workforce growth. The Institute of Physics and Engineering in Medicine (IPEM) 2023 workforce report⁴¹ projections estimate that 12 % of all nuclear medicine posts are currently vacant, with an additional 58 % of staff (technologists to medical physics support staff) needed for safe service provision. These operational inefficiencies due to staff and equipment underuse reflect similarities with studies by Toscas and Nascimento⁴² and Manzana et al.⁴³

A high workload was frequently cited as a barrier to completing training, taking breaks and reviewing policies. The responses displayed that 60 % felt the daily workload was distributed unfairly; for example, in the role and/or place of work. Additionally, 64 % of the participants stated there was insufficient staff available to assist with reduced mobility patients or urgent operational tasks. Cook et al.⁵ advise the need to assess clinical staff requirements against the challenge of an unpredictable patient demand to develop business continuity plans. Additionally, department processes should adequately meet the needs of patient-centred care.^{44,45} The adverse effects of a high workload include increased burnout and sickness, attrition, and errors,^{46,47} with errors in PET-CT potentially having higher patient consequences than other diagnostic imaging tests.^{48,49}

A study by Elliott et al.⁵⁰ found service pressure, process-driven clinical environments, the effects of shift working, and staff shortages contribute to detrimental effects of burnout risks in the profession. Proposed solutions in the responses mentioned improved equipment (newer scanners and autoinjectors), split or overlapping shifts, and managers working clinically to cover breaks. Potentially, this might align the demand of patients booked to the staffing resources, examination times and equipment.⁵¹⁻⁵³ Gallach et al.,⁵⁴ recommend strategic planning using patient demand and growth to assist projections of scalable workforce planning and resources to address geographical inequalities of imaging departments.^{54,55}

Management support was a repeated topic throughout the survey responses, particularly from line managers and clinical leads. The Society of Radiographers⁵⁶ recommends that "Service managers have overall responsibility for planning and delivery of current and future services that are responsive to needs and within available resources underpinned by relevant specialist knowledge and skills".⁶² Many line managers still hold clinical responsibilities, which impacted coaching and team development priorities.³⁰ The transition⁵⁷ from a clinical role to a line manager can be stressful, impacting staff,⁵⁸ patient care and experience.⁵⁹⁻⁶¹

The responses debated whether standardising procedures and protocols would benefit the organisation. While staff agreed that standardising could reduce errors, facilitate cross-site work for staff, assist patients visiting multiple sites, and ease reviewing images and examinations from multiple sites, similar to Toscas et al.⁴² findings, staff acknowledged this would be the ARSAC holder's responsibility.

Limitations

The researchers acknowledge that the response rate limits the findings' generalisability across all private provider PET-CT departments (mobile and static) within the UK. Additionally, the questionnaire length might have been a confounding factor in the response rate. There was a lack of responses from key stakeholders, including ARSAC roles, that may highlight unexplored themes. Some participants referenced 'company values', and opinions were divided; this study did not explore this in-depth, but it recommends future studies to determine the understanding and appreciation of these. Likewise, a deeper exploration of leadership models and the impact of standardisation of PET-CT protocols was not studied but would benefit from review in the future.

Conclusion

The survey findings highlight opportunities to enhance culture and leadership through targeted staff recruitment and strategic workforce planning to alleviate the workload burden on the

existing workforce. Additionally, the communication culture hindered the effective dissemination of information within and between teams, highlighting a need for improvement. Transformational leadership at both local and national levels, which prioritises staff training needs and provides ample opportunities for career progression and development, is essential.

Further research is recommended on workforce retention strategies and standardisation of protocols, leadership models, and engagement of key stakeholders to enhance PET-CT scanning services.

Ethics approval and consent to participate

Ethical approval for this study was obtained from *Swansea University*.

Written informed consent was obtained for anonymised participant survey information to be published in this article.

Availability of data

Data required for this study may be made available by the author(s) upon reasonable request.

Author contributions

SAMF: Conceptualisation, Methodology, Data analysis, Writing-Original/Journal Draft preparation

GN: Supervision

PL: Mentoring, Data analysis, Writing- Journal Draft preparation, Reviewing and Editing

Generative AI use

During the preparation of this work the author(s) did not use any AI TOOL/SERVICE*, the author(s) reviewed and edited the content as needed and take(s) full responsibility for the content of the publication.

Conflicts of interest statement

The authors declare that they have no competing interests

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Appendix A. Supplementary data

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