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Nursing perspectives on reducing sedentary behaviour in sub-acute hospital settings: A mixed methods study

Abstract

Aim and objectives

To determine the factors influencing nurses' decisions and capacity to reduce sedentary behaviour in hospital inpatients in sub-acute hospital settings.

Background

Sedentary behaviour in hospital inpatients is a complex issue that can be resistant to resolution. There is little research investigating factors influencing nurses' promotion of reduced levels of sedentary behaviour in sub-acute hospital settings.

Design

An explanatory sequential design was employed, comprising quantitative and qualitative phases.

Methods

An online survey was conducted with a convenience sample of 138 nurses from five Australian states. Logistic regression modelling identified demographic and behavioural characteristics of nurses who often encouraged patients to reduce their sedentary behaviour. In-depth interviews were conducted with 11 ward nurses and nurse managers, with the content subjected to thematic analysis. STROBE and GRAMMS checklists were employed.

Results

Nurses recognised their role in promoting reduced sedentary behaviour but faced a range of personal and organisational barriers in achieving this outcome for patients. Few nurses were aware of national physical activity and sedentary behaviour guidelines. Five themes emerged from interviews (nursing role, care challenges, expectations of advocates, teamwork, improving the experience). Overall, many nurses experienced a lack of agency in promoting reduced sedentary behaviour, and cognitive dissonance in feeling unable to undertake this role.

Conclusions

The results of this study are significant in confirming that reducing sedentary behaviour in hospital inpatients is influenced by a range of complex and multi-level factors. There is a fundamental need for organisational and clinical leadership in building a culture and climate in which staff feel empowered to promote reduced sedentary behaviour in their patients.

Relevance to clinical practice

The results of this study highlight the importance of taking action to reduce sedentary behaviour in sub-acute hospital settings. A co-design approach to developing interventions in local health services is warranted.

Keywords

hospital, nursing, physical activity, sedentary behaviour, sub-acute, rehabilitation, mixed methods

Introduction

Excessive sedentary time in hospital inpatients has been described as an ‘epidemic of immobility’ (Growdon, Shorr, & Inouye, 2017). ‘Sedentary time’ refers to the duration (e.g. hours per day) engaged in ‘sedentary behaviour’, which is defined in terms of low energy expenditure (≤ 1.5 metabolic equivalents) while awake in a sitting, reclining or lying posture (Tremblay et al., 2017). In acute settings, older adults have been shown to spend a median of just 3% of their day standing or walking (Brown, Redden, Flood, & Allman, 2009). In rehabilitation settings, where patients might be presumed to be more active, older adults (aged 65 or more years) spend as little as 5% of the day upright (Grant, Granat, Thow, & Maclaren, 2010). Combined with a near absence of physical activity, defined as “... any bodily movement produced by skeletal muscles that results in energy expenditure” (Casperson, Powell, & Christenson, 1985, p. 126), sedentary behaviour can contribute to deconditioning, pressure injuries, blood clots, infections, prolonged hospital stays and unplanned hospital re-admissions (Kortebein, Ferrando, Lombeida, Wolfe, & Evans, 2007; Kortebein et al., 2008, Krumholtz, 2013; Tasheva et al., 2020).

Sedentary behaviour in hospital inpatients is a ‘wicked problem’ (Chastin et al., 2019). While it may seem simple to fix on the surface, it is a rather complex and entangled issue that is resistant to resolution. For example, influential factors driving less physical activity and increased sedentary time may include culture (e.g. sick role expectations, ethos of the ward or hospital, risk aversion), environment (e.g. insufficient equipment, communal areas or outdoor space), people (patient, family and staff), and operational systems and processes (e.g. policy, outcome monitoring, evidence based practice) (Tasheva et al., 2020). Other research has identified key factors relating to patient signs and symptoms (e.g. weakness, pain, fatigue), tethering (e.g. intravenous line, catheter) and safety concerns (e.g. risk of falls) (Brown, Williams, Woodby, Davis, & Allman, 2007; Koenders et al., 2020).

In a national survey of nursing and allied health professionals (Freene et al., 2019), Australian nurses agreed that physical activity promotion was a part of their role, reporting that they felt confident doing this and that it was feasible to implement in their workplace. Yet, they demonstrated poor knowledge of the Australian Physical Activity and Sedentary Behaviour Guidelines (Department of Health, 2019), with only 7% of nursing respondents able to list all components of the guidelines (Freene et al., 2019). Female (compared to male) health professionals or those working in public hospitals (compared to working in private practice) in Australia were found to be half as likely to promote physical activity, regardless of discipline. If they were aware of the Physical Activity and Sedentary Behaviour Guidelines, however, they were twice as likely to promote physical activity (Freene et al., 2019). Importantly, nurses with higher levels of physical activity have been found to have higher levels of physical activity promotion practice (Fie, Norman, & While, 2013). Further, in a systematic review of factors influencing primary health care professionals' physical activity promotion behaviours, key influencing factors were found to be their knowledge, skills and positive attitudes toward physical activity promotion, as well as the availability of intervention materials (eg information booklets, exercise prescription aids, patient education materials) and the implementation of strategies to reinforce and support primary health care professionals' physical activity promotion practices, including in relation to perceptions of time poverty, competing interests and poor patient motivation (Hujig et al., 2015).

Currently, there appears to be little research investigating the complex range of factors that influence nurses to reduce sedentary behaviour of hospital inpatients, especially in relation to nursing work in sub-acute settings, such as rehabilitation and geriatric evaluation and management (GEM) wards, which have a strong focus on physical rehabilitation (Australian Institute of Health and Welfare, 2013). Therefore, the aim of this study was to determine the factors influencing nurses' decisions and capacity to encourage hospital inpatients in sub-acute settings to reduce their sedentary behaviour.

Methods

Enrolled and registered nurses working in inpatient sub-acute settings in Australia were invited to participate in this mixed methods study. The study comprised an explanatory, sequential design, in two phases over a 12-month period from September 2018. Phase 1 involved nurses completing an online questionnaire or a paper-based questionnaire in hospital settings, in order to obtain an overall picture of the characteristics of a range of factors influencing nurses' decisions and capacity to encourage reduced sedentary behaviour in sub-acute hospital inpatients. Phase 2 comprised individual interviews of ward-based nurses and nurse leaders from participating health services, in order to obtain their in-depth perspectives on reducing sedentary behaviour in sub-acute hospital settings. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) checklist for cross-sectional studies and Good Reporting of A Mixed Methods Study (GRAMMS) checklist (<https://www.equator-network.org/>) were employed (Supplementary File).

Phase 1

Participants and recruitment

Phase 1 was conducted in two stages. Firstly, an online survey, developed in Qualtrics (Provo, USA), targeted nurses working in sub-acute settings. The survey was promoted by advertisement in an edition of the newsletters or magazines distributed by Australian Nursing and Midwifery Federation (ANMF) branches in the States of Queensland, Tasmania and Western Australia, and the New South Wales Nurses and Midwives Association. ANMF branches in the Northern Territory and South Australia did not promote the survey. In the second stage, nurses at four Australian hospitals (one metropolitan hospital in the Australian Capital Territory, and one regional and two metropolitan health services in the State of Victoria) were introduced to the study by a member of the research

team during information sessions held on hospital wards, and were asked to complete a hard copy version of the questionnaire. Session scheduling was facilitated by ward-based and senior managers. The hospitals were selected on the basis of research team members' existing adjunct appointments or collaborations. To establish if the study sample was broadly representative of the population of nurses in Australia, respondent characteristics were compared with demographic data published in the most recent Australian Nursing and Midwifery Workforce report (Australian Institute of Health and Welfare, 2016).

Questionnaire design

The questionnaire comprised 86 items. These included demographic items about respondent age, sex, hospital governance (e.g. private/public), years of experience, number of nursing shifts per week, number of patients treated per shift, additional education (e.g. in psychology) and how often they encouraged reduced sedentary behaviour in their patients. The questionnaire also included items adapted from the questionnaire used in earlier studies of Australian nurses, doctors and allied health professionals (Freene et al., 2019, Shirley et al., 2010, van der Ploeg et al., 2007), concerning respondents' own physical activity level, amount of sedentary behaviour, barriers to encouraging reduced sedentary behaviour in their patients, the feasibility of strategies to reduce patients' sedentary behaviour, and awareness and description of the key components of the Australian Physical Activity and Sedentary Behaviour Guidelines for Adults (Department of Health, 2019). For the open text description of the Guidelines, responses must have referred to all core components, namely accumulating 150-300 minutes of moderate intensity physical activity or 75-150 minutes of vigorous intensity physical activity or a combination of both each week, muscle strengthening exercise at least two days per week and minimising time spent in prolonged sitting (Department of Health, 2019).

There were additional questionnaire items relating to factors influencing nurses' decisions to promote reduced sedentary behaviour in patients. These items were adapted from a questionnaire employed to identify factors influencing Australian physiotherapists' promotion of physical activity to patients with musculoskeletal conditions (Kunstler, Cook, Kempa, Halloran, & Finch, 2019), which was based on the validated Determinants of Implementation Behaviour Questionnaire (DIBQ) (Hujig et al., 2014). The development and validation of the DIBQ drew on the widely employed Theoretical Domains Framework (TDF) (Cane, O'Connor, & Michie, 2012), which resulted in an 18-domain structure that provides a comprehensive, theory informed approach to identifying the determinants of behaviour.

For the current study, the DIBQ items were modified to be relevant to sedentary behaviour and nurses. The 'socio-political context' domain was excluded as it was considered to be less relevant for nurses working in hospitals. Each of the remaining 17 behavioural domains contributed between two and five items to the questionnaire (Appendix 1). Most items were scored using a five-point Likert scale (strongly agree to strongly disagree), with seven items being reverse-scored. Given the extant research undertaken on the DIBQ, further psychometric evaluation of the 17 behavioural domains was not undertaken. In the final questionnaire item, participants were invited to provide their contact details if they agreed to participate in a future one-on-one semi-structured interview (Phase 2).

Statistical analyses

To facilitate analysis and reporting, and consistent with complementary literature (Freene et al., 2019; Shirley et al., 2010), the response to the primary outcome "How often did you encourage your patients to be less sedentary in the last month?" was dichotomised at the median category, namely '10 or more occasions per month' (more often) and 'less than 10 occasions per month' (less often). A

single score was derived for each of the 17 behavioural domains by determining the most frequent (ie modal) response to the set of questions within each domain. Where it was not possible to determine a single mode within each domain (e.g. where there were an even number of agree/disagree responses), a response of 'neither agree nor disagree' was applied. Each of the multiple-response option variables was then transformed into binary variables (e.g. agree versus neutral/disagree). Personal physical activity and sedentary behaviour levels were dichotomised (yes/no) according to meeting the guidelines of 30 minutes of moderate-to-vigorous physical activity 5 days/week (Department of Health, 2019) and self-reporting sedentary behaviour of seven hours or more per day, which has been found to be associated with increased all-cause mortality (Ku, Steptoe, Liao, Hsueh, & Chen, 2018). Frequencies and percentages were used to summarise categorical variables. Median and interquartile ranges (IQRs), and mean and 95% confidence intervals (CI) were used to summarise continuous variables.

Logistic regression modelling was employed to identify demographic and behavioural factors that were associated with how often nurses encouraged reduced sedentary behaviour in their patients. Listwise deletion was undertaken with missing data. All variables were entered into the model that showed a significant association ($p < 0.10$) with this outcome on preliminary, univariate logistic regression analyses, to avoid the potential exclusion of important variables (Bursac, Gauss, Williams & Hosmer, 2008). Non-significant ($p < 0.05$) variables in the model were identified using Wald tests, and were individually removed using a backward, stepwise approach. The most parsimonious model was determined and compared with the initial model using likelihood ratio tests and the remaining variable coefficients assessed to ensure that they had not substantially changed, indicating potential confounding. The model was then assessed for goodness of fit (Hosmer-Lemeshow chi-squared test with 10 groups, and area under the receiver operator characteristic curve). Adjusted odds ratios (AORs) with 95% confidence intervals are reported for nurses who 'very often' in the last month encouraged reduced sedentary behaviour in their patients. In alignment with recommendations for

sample size in relation to independent variables (IVs) in multiple regressions ($50 + 8[IVs]$) (Tabachnick, & Fidell, 2014), our final sample exceeded the minimum number of respondents required ($50 + 8 \times 4$). All analyses were performed using Stata Version 15 (Texas Station, USA).

Phase 2

Ward nurses working in sub-acute settings, who had consented to be contacted for the follow-up interviews in the Phase 1 questionnaires, were engaged in individual interviews. A nurse leader from each health service, who had initially provided permission to the research team to conduct the study in their hospital wards, was also asked to participate in an individual interview. In-depth interviews were conducted in-person or by telephone to explore perceptions of nurses' motivation and efforts to reduce sedentary time, as well as barriers and enablers to promoting reduced sedentary behaviour in hospital inpatients. Guiding interview questions were prepared in advance and then developed further after Phase 1 by interviewers to enhance understanding of the results from the first phase (Appendix 2).

Reflecting the approach advocated by Braun and Clarke (2006), interview data were recorded and listened to repeatedly, then transcribed by the interviewing members of the research team. The transcripts were then checked back with the audio recordings and subjected to thematic analysis to elicit codes and themes from the data, which were discussed and agreed upon by the research team. Rigour was ensured by transcript checking against the audio recordings, the use of short memos in a logbook by interviewers, and recording and reporting of data by seniority of nurse. Two expert qualitative research authors (DH, TR) reviewed patterns in the data and thematic findings, supporting the trustworthiness of interpretations.

Ethical considerations

In responding to the online questionnaire, respondents were first required to read a plain language information statement describing the study and established risk management strategies. They were then required to consent or not consent to participate in the study. Consenting respondents were then offered the questionnaire items to complete. A secondary verbal consent was obtained prior to each follow-up interview. Approval to conduct the study was granted by the Human Research Ethics Committees of the University of Canberra (2018-0294), Federation University (E18-012), Monash University (17340), Ballarat Health Service (4851), Alfred Health (512/18) and Peninsula Health (5197/PH-2019).

Results

Phase 1 results

A total of 138 nurses completed the questionnaire from five Australian states (Table 1). Most respondents were female (86.2%), with a mean age of 40.9 (95% CI 38.7-43.0) years and mean weekly hours worked of 34.3 (95% CI 33.06-35.56). This is consistent with the published demographic profile of Australian nurses (Australian Institute of Health and Welfare, 2016), with 89.3% being female ($\chi^2=1.4$, $p=0.24$), having a mean age of 44.3 years and working a mean of 33.5 hours per week. Fewer than 15% reported any additional training in psychology, health promotion or exercise science. Less than half (44%) met the Guidelines (Department of Health, 2019). Almost half (48%) reported sitting/lying while awake (ie being sedentary) for seven hours or more per day. Only 7% of respondents were assessed as being aware of core components of the Australian Physical Activity and Sedentary Behaviour Guidelines for Adults (Department of Health, 2019), described above, and none were able to correctly describe the Guidelines in full (Box 1). Less than half (45%) indicated that

they had encouraged reduced sedentary behaviour in their patients 10 or more times in the last month.

Box 1. Nurses' descriptions of the Australian Physical Activity and Sedentary Behaviour Guidelines

"Something about 30 m intentional activity per day, maybe?" (Female, 28 years)
"30 minutes - 1 hour of physical activity 4-5 times a week, of moderate physical activity" (Female, 21 years)
"Healthy lifestyle leads to healthy being, thinking, sharpens the mind and decreases diseases and conditions causing disease" (Female, 36 years)
"Reducing sedentary behaviours increases health benefits in adults and decreases morbidity and mortality" (Female, 33 years)
"At least 30mins moderate exercise every day" (Female, 37 years)
"Physical activity every day, limit time spent sitting during the day aim for 300 min of moderate exercise each week, aim for 10,000 steps a day" (Female, 44 years)

Lack of time was perceived to be a barrier to encouraging reduced sedentary behaviour for 53% of respondents (Table 2). Few nurses (<10%) perceived a lack of counselling skills or interest in encouraging patients in reducing sedentary behaviour to be barriers and, of all activities for encouraging reduced sedentary behaviour, the highest number of respondents (67%) indicated that brief counselling integrated into care was a feasible strategy. The majority of respondents agreed that encouraging patients in reducing sedentary behaviour is an 'automatic' behaviour (nature of the behaviour, 89%), that they intended to do this in the next three months (intentions, 86%) and that it was part of their work as a nurse to do so (social/professional role and identity, 89%). Most respondents (77%), however, disagreed that patients were motivated to reduce their sedentary behaviour.

For the included behavioural domains, in univariable analysis, five of the seven domains were associated with encouraging patients in reducing sedentary behaviour 'more often' (Table 3). However, only four remained in the final multivariable model with optimal model fit (Hosmer-Lemeshow GoF $p=0.97$, AUC=0.73). Two variables in the final model were significantly and independently associated with respondents more often encouraging patients in reducing sedentary

behaviour. Behavioural regulation, which relates to nurses having a clear plan for delivering the intervention (even when patients are not motivated or where there are competing interests or time restrictions), had a strong, positive association (AOR 2.75, 95% CI 1.11-6.79). Social influences, which relate to nurses believing that people with whom they work are helpful and willing to listen where there are challenges to care provision, had a strong, negative association (AOR 0.20, 95% CI 0.07-0.58).

Phase 2 results

Interviews were conducted with 11 female nurses (8 ward nurses and 3 nurse leaders) working in sub-acute settings in metropolitan and regional health services in Victoria and New South Wales, Australia. Five main themes emerged from analysis of the in-depth interview transcripts – ‘nursing role’, ‘care challenges’, ‘expectations of family, friends and advocates’, ‘teamwork’ and ‘improving experiences’.

Theme 1. Nursing role

Consistent with the quantitative results, only one nurse was familiar with the Australian Physical Activity and Sedentary Behaviour Guidelines for Adults (Department of Health, 2019). However, despite this lack of familiarity, all but one nurse agreed that encouraging patients to reduce sedentary behaviour was a part of the nursing role:

I definitely think it's part of my role.... We work as part of teams, 1-2-3 people working together, always a team effort. It takes more than one nurse to get people up. (Dianna, GEM ward nurse leader)

Further, when there were opportunities to consider new ways of undertaking their role, of engaging patients in being more engaged, more active.

'End PJ paralysis' [an intervention to promote dressing and mobility, and thus reduce sedentary time], although not very well promoted, was a great help. Many resources went into it. With our model of care, there was a social aspect that was a great success, they started friendship groups, lots of activities, we had the Melbourne Cup [a much lauded, annual horse race in Victoria] down in the lounge, and they watched the tennis together. It's been so positive. We used to really encourage them to go just once, now they want to go all the time. But some nurses still need to learn it's not [just] about wheeling people down there.
(Teresa, sub-acute services nurse leader)

Theme 2. Care challenges

Participants described lack of time and resources as the greatest barriers to promoting reduced sedentary behaviour on the ward. Most participants identified the need for change in relation to reducing sedentary behaviour, and that more time and skilled staff are required to achieve improved outcomes. The lack of resources includes not only the number of available nurses but also the need for specialised skills and expertise to motivate patients to be more active, especially given the increasing levels of patient acuity and disability.

I am usually too time poor to reduce sedentary behaviour, under pressure to get workload done, let alone change sedentary behaviour. (Francine, GEM ward nurse)

Reducing sedentary behaviour is an extra. So it's not my priority. (Jenny, Rehabilitation ward nurse)

All the patients are over 65. I notice recently patients are a lot more unwell, some patients taking 2, 3, 4 nurses to do basic nursing care. This takes all of those nurses away from other patients. It takes a lot of time to get them up, to take them for a walk. (Dianna, GEM ward nurse leader)

There are barriers related to the degree of burden and disability. "Get up and going Bob" requires a level of expertise, confidence and experience in the workplace. The area we find regularly now is bariatric rehabilitation. It is jolly hard to get up and going, and there is the physicality and psychology of that, needing motivational skills. (Michelle, sub-acute services nurse leader)

Theme 3. Expectations and involvement of family, friends and advocates

Most participants noted that the expectations of families can be barriers to the 'getting up and moving' approach on the ward, with family members assuming patients should rest in older age and poor health.

There are also expectations of families, advocacy by protective families for reasons such as fear, grief, all of which have a role to play. What is considered reasonable? For example, "Dad's in his 80s, does he need to do this?" It is a common mindset of the family of an older person and there is generational impact. (Michelle, sub-acute services nurse leader)

On the other hand, participants also discussed families asking what they can do to be supportive and enable participation of their family member in the 'getting up and moving' activities. Participants described some things that easily enabled participation.

Families can help by providing really comfortable shoes and clothing. We know patients are less likely to participate if not comfortable. This is not an expectation in acute hospitals.... The promotional stuff is great for example posters in the dining room, but it won't translate if patients don't have what they require to participate. (Michelle, sub-acute services nurse leader)

We involved family members at mealtimes ... [by walking to] ... the lounge and it has improved nutritional intake by bringing in ... [special]... food and contributing to the social aspects. One brought Italian food and they loved it. (Teresa, sub-acute services nurse leader)

Some participants expressed their concern for those who have elderly relatives or no relatives visiting at all. Nurses stand in for family when needed and keep the motivation going, when able to do so.

Some family members very much want to be part of taking them for a walk, but they are elderly themselves, it's not safe to do so. And sometimes I have to say, 'I don't have time', sometimes I can come back in an hour. (Dianna, GEM ward nurse leader)

Some don't have a family. I just give them moral support and motivation and make them realise there are things they can do, what they can achieve. Just guiding them as a nurse. (Kate, GEM ward nurse)

Theme 4. Teamwork

Participants had mixed views on the recognition of the role of nurses in care team management, and if their voice was really heard. They reported being uncertain if their views and approach were

valued, which was a barrier to reducing sedentary behaviour, since nurses are with patients for the longest period each day.

I don't know if our multidisciplinary communication is always that great. I think nurses get left out of the conversation a lot. (Jenny, rehabilitation ward nurse)

Nurses look after them [the patients] all the time but [most] aren't allowed at these [case conference/management] meetings. I know we are just a cog in the wheel. I don't get how the managers know what level they [the patients] are up to. (Sally, rehabilitation ward nurse)

The participants acknowledged the clinical decisions of other professions and reported that nurses have variable clinical leadership initiatives.

Going to a team meeting is good ... they say to the patient, this is what we are aiming for, do you agree that you will sit up for lunch every day ... it's a team effort. (Dianna, GEM ward nurse leader)

I like to read the physio notes every day and then just have an idea what their actual functional goals and actual functional levels are like. Pushing people to achieve those tiny little goals like 'oh, we walked to the toilet', 'oh, we brushed our teeth at the sink'. (Jenny, rehabilitation ward nurse)

I think we play a pretty important role, we are with our patients every day and we have the time to get in there and encourage the exercises that [the] physio suggested. (Jenny, rehabilitation ward nurse)

A patient had some psych problems and was depressed. She could easily get out of bed if she wants. Most of the time she just lies in bed and chooses to be incontinent. One day her case manager came and had a talk to the nurses and talked to her too. The case manager wanted her to sit out of bed for meals and use the toilet. After that, the nurses really encouraged her to do that (with success). (Nellie, rehabilitation ward nurse)

We work closely with our physios and OTs. Everyone is quite focused on getting people up. We will go and ask them for help if we are struggling with a patient. It's quite easy to ask a physio, to get a different person's approach. (Dianna, GEM ward nurse leader)

Theme 5. Improving the experiences

The participants reported on the need to improve the experience for patients and staff in relation to promoting reduced sedentary time. Firstly, there was a focus on understanding the patient perspective on isolation and boredom, and considering how to improve the day-to-day experience for patients. Secondly, there was a focus on improving the experience for nurses, recognising the educational needs of the high number of junior and casual staff in understanding sedentary behaviour, and understanding the barrier of the 'historical approach to care,' and improving their practice experience and motivation.

It's staggering how much time they [patients] spend alone. There's a potential connection here. Isolation and boredom is one thing. If we tackle the boredom, we tackle the sedentary behaviour, there is a link, and we will solve the social isolation. Enabling nurses to be the coach for getting people up, and there's definitely an educational aspect. (Michelle, sub-acute services nurse leader)

Rehab nursing is quite specialised ... we need education ... focus away from task-centred to patient centred. (Nancy, GEM ward nurse)

The historic approach to patient care, the 'doing to', the patient is in fact in a bed convalescing for the reason of nursing care. That's one potential barrier. It's particularly a barrier when there are casual staff filling a vacant shift, not part of the regular team, not familiar with our methodology with an old mindset of 'doing to', that rest and convalescence is good for the patient. There are also perceptions of 'doing to' is good if time poor. If I do it, I will effectively save time all round. (Michelle, sub-acute services nurse leader)

Discussion

In this mixed methods study, we sought to determine factors that influence nurses' decisions and capacity to encourage reduced sedentary behaviour in sub-acute hospital inpatients. Overall, the integrated results provide substantial evidence of nurses understanding that they have a key role in reducing sedentary behaviour. However, they demonstrated that they had less than optimal personal knowledge and behaviour relating to their own well-being regarding physical activity and sedentary behaviour, which could be a source of cognitive dissonance for them given the evidence-based imperative to promote reduced levels of sedentary behaviour in patients. This is an important consideration because, as highlighted by de Vries and Timmins (2016), cognitive dissonance can interfere with reflective nursing practice and, rather than fuelling efforts to improve patient care, it can lead to a steady decline in patient care standards and resignation to substandard patient care. Indeed, less than half of nurses surveyed had encouraged patients in reducing sedentary behaviour.

Nurses also identified considerable workplace-based barriers to executing their role in reducing sedentary behaviour. In both phases of the study, time constraints were reported as a key challenge

to the provision of optimal care. Participants in the Phase 2 interviews frequently reported being time poor, having high workloads, and lacking quality time with patients. These findings supported the Phase 1 results in relation to a perceived lack of time to promote reduced sedentary behaviour in patients. In both phases of the study, the issues of patient and family expectations and motivation to be active were highlighted as key challenges for nurses. From the qualitative interviews, the historical model of 'let them rest' was identified as pervading the thinking of patients' relatives and carers, despite current evidence of harm from bed rest and inactivity, especially for older patients (Tanner et al., 2015; Tasheva et al., 2020). We also found that nurses supported this model, to some degree, in their actions when 'doing things for' the patient because it was more time efficient.

Again, while it was clear that nurses understood they had a role in promoting reduced sedentary behaviour, perceptions of time poverty, high workloads and antithetical patient and family expectations about the need for patients to be active are further potential generators of cognitive dissonance in nursing staff. These could be viewed as further strong pull factors against efforts to improve patient care as it relates to reducing sedentary behaviour and promoting greater mobility. Nonetheless, the evidence from the regression modelling suggested that, where nurses had the capacity to push through those pull factors, there was a greater likelihood of promoting reduced sedentary behaviours in their patients.

A number of other important concerns emerged in this study, particularly from the qualitative analyses. Care challenges were a notable concern for staff, on a number of levels. As highlighted by Barker and Soh (2018), compared to younger people, older people are likely to have more difficulty walking, higher levels of medication usage and comorbidities such as arthritis and dementia, which are likely to impact on their mobility. It should be noted, however, that these are not necessarily contraindications to mobilisation. Nonetheless, in our study, nurses reported that the number of patients who require specialised psychological and physical care, often by two, three or four nurses

at a time – such as those admitted for bariatric rehabilitation or with barrier-nursing requirements – is increasing. This additional burden for ward staff took them away from working with the patients allocated to them for the shift, reducing their availability for assisting patients with a range of activities, including promoting reduced sedentary behaviour.

At the practice level, even if nursing staff were aware of and understood the need to act in relation to the isolation, boredom and relatively immobile day-to-day experience of many of their patients, they felt that their voices were not heard and that their input was not valued by their nursing, allied health and medical colleagues. For example, nurses reported that they were not invited to engage in case management meetings, where individual patient progress and care planning is undertaken. While it is hard to imagine that all nursing staff would be able to come off the ward to participate in case management meetings, it seems counterintuitive that those providing direct patient care, who may have quite intimate knowledge of the patient and their family/carers, would not be able to make important contributions to care planning and advocate for the patient in relation to the patients' needs and aspirations. When added to the nurses' perceptions of time poverty, high workloads, and patient and family resistance to promoting reduced sedentary time, these findings suggest that nurses generally did not have a sense of agency – the feeling of being in control over one's actions and their consequences (Moore, 2016) – in engaging patients in reducing sedentary behaviour.

A notable absence in the results of this study relates to the impact of environmental design in the reduction of sedentary behaviour in inpatients. Environmental design concerns have been reported as barriers to promoting reduced sedentary time and increased patient mobility. For example, in a large qualitative study of informants from the three metropolitan rehabilitation services in the Australian State of South Australia, Killington et al. (2019) identified four primary themes in ensuring the promotion of patient well-being and recovery – patient choice in terms of what to do and where

to go outside of therapy sessions; being able to access outdoor areas to stay in touch with the natural environment and have access to loved ones; accessing opportunities and spaces for socialisation with family, friends and other patient; as well as for ward configurations to align with patient and family-centred models of care (Killington et al., 2019).

Determining why environmental design concerns did not come to light in the current study is, perhaps, speculative but may be founded in assumptions about and priorities for health care delivery prevalent at the time of hospital design and constructions, as well as internalised by those working in the wards (Bromley, 2012). The fact that, particularly from the Phase 2 qualitative study, nurse respondents primarily focussed on issues relating to operational working conditions, shared care planning and decision-making, and collaboration with patients and families in reducing sedentary behaviour, suggests that any environmental design concerns were entirely subordinate to these three elements.

Our findings point to the importance of organisational and clinical leaders facilitating the strengthening of staff self-efficacy and staff agency in promoting reduced sedentary behaviour. This would include promoting and supporting ongoing education and training, which are fundamental for maintaining and enhancing nursing knowledge and skills. Further, as suggested in recent Danish research (Steensgaard, Kolbaek, Jensen & Angel, 2020), empowering nurses to have more active involvement in patient engagement and care planning, including through knowledge and skills development, has the effect of increasing their capacity and willingness to identify, speak up about and act on inferior work practices. This is a particularly important consideration, given the already identified factors that may mitigate against sound, reflective and purposive nursing practice. There was some evidence in our study, for example, that programs such as End PJ Paralysis, an initiative originating in the United Kingdom (<https://endpjparalysis.org/>), which was implemented State-wide

in the Australian State of Victoria (Safer Care Victoria, 2020), provided a degree of awareness and empowerment to ward nurses in implementing strategies to reduce patient sedentary time.

In integrating the results of this research, it is important to consider how the insights gained can be applied in the context of the structural complexities of sub-acute service provision. Implementation frameworks, such as the Consolidated Framework for Implementation Research (CFIR) (Damschroder, Aron, Keith, Kirsh, Alexander & Lowery, 2009), have been developed to assess contextual determinants within local settings. Such frameworks enable the systematic identification of barriers, their determinants, change methods for addressing them and the development or selection of specific strategies (Waltz et al., 2019). While the use of mixed methods is a strength of the current study, complex and wicked problems, such as reducing sedentary behaviour, would benefit from more systematic assessment of implementation contexts to improve intervention implementation and effectiveness. The CFIR, which is composed of five broad domains with specific constructs relating to the intervention, inner and outer settings, individuals and the implementation process (Damschroder et al., 2009), encompasses wider organisational and system factors and could provide a pragmatic structure for approaching the multi-level problem of reducing sedentary time in hospital inpatients.

We found that there are a complex array of barriers and facilitators to promoting reduced sedentary behaviour in patients in Australian sub-acute care settings. Of particular importance is the fundamental role of organisational and clinical leadership in building a culture and climate in which staff feel capable and empowered to promote reduced sedentary time in their patients. This necessarily involves consideration being given to staff workloads, resource management, and education and training needs, as well as actively engaging with colleagues, patients and their families in this endeavour. As asserted by Chastin et al. (2019), a system-based approach is required with local health care teams and key stakeholders to co-create sustainable solutions. The results of this

study provide a basis for undertaking that task with local sub-acute service providers and service users.

Limitations

There are some limitations to this study, particularly in relation to the overall generalisability of the results. Firstly, the Phase 1 online survey attracted respondents from across Australia who worked in a broad range of sub-acute hospital settings, with most respondents residing in the State of Victoria, but this was a small convenience sample from an unknown distribution base and population of sub-acute nurses. Consequently, while the demographic profile was otherwise similar to that of all Australian nurses, it could not be considered a representative sample of nurses working in Australian sub-acute settings. Secondly, the survey questionnaire was originally focussed on physical activity, rather than sedentary behaviour, and the reliability and validity of the scale items, including those items constituting the 17 behavioural domains, was not established in the current study. Thirdly, the survey results may have been subject to selection bias, whereby nurses interested in physical activity and sedentary behaviour may have been more motivated to respond to the online survey. Similarly, while every effort was taken to achieve a reasonably representative sample of sub-acute hospital ward nurses and managers for the Phase 2 qualitative interviews, the sample was primarily drawn from one inner metropolitan, one outer metropolitan and one regional health service in the State of Victoria, and only female nurses were interviewed. Finally, there may be functional and cultural differences between rehabilitation and GEM wards that were not differentiated in this research. Despite these limitations, this mixed methods study has offered important insights into factors that influence the promotion of reduced sedentary behaviour in sub-acute hospital settings, especially in relation to the cross-verification of findings across the two phases of the study.

Conclusions

This mixed methods study of Australian nurses working in sub-acute hospitals provides important insights relevant to national and international service settings. The results confirm that reducing sedentary behaviour for inpatients is subject to a range of complex and multi-level factors that make it a truly wicked problem. Factors can be related to the nurses' knowledge and skills, the acknowledgement and internalisation of the nurses' role in promoting and exemplifying the importance of reducing sedentary behaviour, their empowered engagement in planning and decision-making for patient care, the diversity of disease profiles of patients, patients' expectations and motivation, including of their loved ones, the structure and functioning of the working environment for nursing staff (including in relation to time pressures, workload allocations and the availability other resources that support care delivery), and service design factors that promote and support patient activity, engagement and recovery. The results of this study may help raise awareness about the importance of taking a strategic approach to reducing sedentary behaviour in sub-acute hospital settings. The results may also provide a basis for co-designing interventions at the local health service level for this express purpose.

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What does this paper contribute to the wider global clinical community?

- The research reported in this study confirms that reducing the extent of sedentary time experienced by inpatients in sub-acute hospital settings is subject to a range of complex and multi-level factors that make it a truly wicked problem
- The results of this research provide a basis for undertaking a strategic approach to reducing sedentary behaviour in inpatients
- The results of the research point to the important role of organisational and nursing leaders in promoting and supporting the engagement of all key stakeholders in co-creating sustainable solutions to the reduction of sedentary behaviour in inpatients

Table 1. Characteristics of Australian nurse respondents (n=138) and association with primary outcome

Characteristic	n (%)	p*
Sex, n (%) female	119 (86.2)	0.46
Age in years, median (IQR) ^a	39 (30 – 51)	0.24
Years in practice, median (IQR) ^b	9 (2.5 – 18.5)	0.11
State (n=130)		0.89
Vic	101 (77.7)	
NSW	12 (9.2)	
Qld	6 (4.6)	
ACT	5 (3.9)	
WA	3 (2.3)	
Tas	3 (2.3)	
Hospital type		0.52
Public	129 (93.5)	
Private	7 (5.1)	
Other	2 (1.5)	
Nursing shifts per week, median (IQR) ^c	4 (4 – 5)	0.92
Number of patients each shift, median (IQR) ^a	5 (5 – 5)	0.46
Hours worked each week, median (IQR) ^d	36 (32 – 40)	0.62
Has psychology training ^e	21 (15.3)	0.32
Has health promotion training ^b	18 (13.2)	0.63
Has exercise science training ^f	10 (7.4)	0.23
At least 30 mins physical activity five days/week	60 (43.5)	0.13
Sedentary for seven or more hrs/day	66 (47.8)	0.29
Aware of PASB guidelines ^g	9 (7.4)	0.38
Encouraged patients to be less sedentary		
Less often (<10 times in last month)	72 (55.0)	N/A
More often (≥10 times in last month)	59 (45.0)	

^a missing: n=11; ^b missing: n=2; ^c missing: n=17; ^d missing: n=4; ^e missing: n=1; ^f missing: n=3; ^g missing: n=16

*p value for association with primary outcome (Encouraged patients to be less sedentary)

Table 2. Responses from Australian nurses (n=138) and association with primary outcome

Questions	n (%) agree	p*
The following factors often prevent you from encouraging patients to be less sedentary		
Lack of time ^a	69 (52.7)	0.81
Lack of counselling skills ^b	9 (7.0)	0.42
Lack of interest in promoting less sedentary behaviour ^c	6 (4.6)	0.84
The following activities for encouraging patients to be less sedentary are feasible		
Brief counselling integrated into your care ^d	82 (67.2)	0.57
Separate one-on-one interactions ^e	78 (64.5)	0.25
Group sessions ^e	73 (60.3)	0.69
Distribution of resources (e.g. brochures) ^e	79 (65.3)	0.20
Theoretical domains framework items		
Behavioural regulation (e.g. <i>I have a clear plan for how I will deliver this intervention</i>) ^f	78 (63.4)	0.03
Beliefs about capabilities (e.g. <i>For me, giving attention to the intervention is easy</i>) ^g	75 (56.8)	0.85
Beliefs about consequences (e.g. <i>For me, encouraging patients to be less sedentary on the ward is worthwhile</i>) ^g	92 (69.7)	0.42
Goals (e.g. <i>Addressing other patient problems are a higher priority than delivering this intervention</i>) ^h	78 (61.9)	0.07
Innovation (e.g. <i>It is possible for me to tailor this intervention to patients' needs</i>) ^b	78 (60.5)	0.74
Innovation strategy (e.g. <i>My workplace provides training to deliver this intervention</i>) ^a	86 (65.7)	0.19
Intentions (e.g. <i>I intend to deliver this intervention in the next three months</i>) ^a	113 (86.3)	0.03
Knowledge (e.g. <i>I know how to deliver this intervention</i>) ^g	100 (75.8)	0.21
Nature of the behaviour (e.g. <i>Encouraging patients to be less sedentary is something I do automatically</i>) ^a	116 (88.6)	0.01
Negative emotions (e.g. <i>When I encourage patients to be less sedentary on the ward, I feel nervous</i>) ⁱ	20 (16.1)	0.42
Optimism (e.g. <i>In my work as a nurse in uncertain times, I usually expect the best</i>) ^f	102 (82.9)	0.89
Organisation (e.g. <i>My workplace provides all necessary resources to deliver this intervention</i>) ^j	91 (67.9)	0.07
Patients (e.g. <i>Patients receiving sedentary behaviour interventions from me are motivated to do it</i>) ^k	29 (23.2)	0.54
Positive emotions (e.g. <i>When I encourage patients to be less sedentary on the ward, I feel optimistic</i>) ^k	108 (86.4)	0.04
Skills (e.g. <i>I have been trained in delivering this intervention</i>) ^b	97 (75.2)	0.35
Social influences (e.g. <i>Professionals with whom I work are willing to listen to my problems with delivering this intervention</i>) ⁱ	89 (71.8)	0.01
Social/professional role and identity (e.g. <i>Delivering this intervention is part of my work as a nurse</i>) ^a	117 (89.3)	0.58

^a missing: n=7; ^b missing: n=9; ^c missing: n=8; ^d missing: n=16; ^e missing: n=17; ^f missing: n=5; ^g missing: n=6; ^h missing: n=12; ⁱ missing: n=14; ^j missing: n=4; ^k missing: n=13

*p value (bolded where < 0.05) for association with outcome (Encouraged patients to be less sedentary)

Table 3. Unadjusted (OR) and adjusted (AOR) associations with more often encouraging patients in reducing sedentary behaviour (n=113)

Characteristic (agree cf. disagree)	OR	(95% CI)	AOR	(95% CI)
Behavioural regulation (e.g. I have a clear plan for how I will deliver this intervention)	2.43	1.11, 5.30*	2.75	1.11, 6.79*
Goals (e.g. Addressing other patient problems are a higher priority than delivering this intervention)	2.02	0.95, 4.26		
Intentions (e.g. I intend to deliver this intervention in the next three months)	4.26	1.15, 15.76*	8.06	0.92, 70.60
Nature of the behaviour (e.g. Encouraging patients to be less sedentary is something I do automatically)	13.23	1.67, 104.56*		
Organisation (e.g. My workplace provides all necessary resources to deliver this intervention)	0.50	0.24, 1.04		
Positive emotions (e.g. When I encourage patients to be less sedentary on the ward, I feel optimistic)	3.38	1.03, 11.04*	3.80	0.90, 15.95
Social influences (e.g. Professionals with whom I work are willing to listen to my problems with delivering this intervention)	0.34	0.15, 0.78*	0.20	0.07, 0.58**

Hosmer-Lemeshow GoF (10 groups) p = 0.97
Area Under ROC Curve (AUC) = 0.73

* p<0.05 (bolded); ** p<0.01 (bolded)

Appendix 1. TFR domains and related questionnaire items

TDF Domain	Questionnaire items (*reverse scored)
1. Behavioural regulation	When considering the intervention, I have a clear plan for: <ol style="list-style-type: none"> 1. How I will deliver this intervention. 2. Under what circumstances I will deliver this intervention. 3. How to deliver this intervention when patients are not motivated. 4. How to deliver this intervention when there is little time.
2. Beliefs about capabilities	<ol style="list-style-type: none"> 1. For me, giving attention to the intervention is easy. 2. For me, delivering the content of the intervention is easy. 3. I am confident that I can deliver the intervention. 4. I am confident that I can deliver the intervention even when there is little time. 5. I am confident that I can deliver the intervention even when patients are not motivated.
3. Beliefs about consequences	<ol style="list-style-type: none"> 1. For me, encouraging patients to be less sedentary on the ward is worthwhile. 2. If I encourage patients to be less sedentary It will be effective 3. If I encourage patients to be less sedentary they will be appreciative 4. * If I encourage patients to be less sedentary it will NOT help them become less sedentary. 5. When I encourage patients to be less sedentary I get recognition from the work context.
4. Goals	<ol style="list-style-type: none"> 1. Addressing other patient problems are a higher priority than delivering this intervention. 2. Addressing other patient problems are more urgent than delivering this intervention.
5. Innovation	<ol style="list-style-type: none"> 1. It is possible for me to tailor this intervention to patients' needs. 2. This intervention is well-suited to daily practice on the ward. 3. This intervention is simple to deliver on the ward.
6. Innovation strategy	<ol style="list-style-type: none"> 1. My workplace provides training to deliver this intervention 2. My workplace provides sufficient intervention materials to support implementation and delivery. 3. My workplace provides assistance with delivering this intervention. 4. My workplace provides support meetings where I can get my questions answered about delivering this intervention.
7. Intentions	<ol style="list-style-type: none"> 1. I intend to deliver this intervention in the next three months 2. My intention to deliver this intervention in the next three months is strong. 3. I will definitely deliver this intervention in the next three months.
8. Knowledge	<ol style="list-style-type: none"> 1. I know how to deliver this intervention. 2. Objectives of this intervention and my role in this are clearly defined for me. 3. * I DO NOT know what my responsibilities are. 4. I know exactly what is expected from me.

TDF Domain	Questionnaire items (*reverse scored)
9. Nature of the behaviour	<ol style="list-style-type: none"> 1. Encouraging patients to be less sedentary is something I do automatically. 2. Encouraging patients to be less sedentary is something I do without having to consciously remember. 3. Encouraging patients to be less sedentary is something I do without thinking. 4. * Encouraging patients to be less sedentary is something I often forget.
10. Negative emotions	<ol style="list-style-type: none"> 1. When I encourage patients to be less sedentary on the ward, I feel nervous. 2. When I encourage patients to be less sedentary on the ward, I feel pessimistic. 3. When I encourage patients to be less sedentary on the ward, I feel uncomfortable.
11. Optimism	<ol style="list-style-type: none"> 1. In my work as a nurse in uncertain times, I usually expect the best. 2. * In my work as a nurse I am never optimistic about the future. 3. In my work as a nurse overall, I expect more good things to happen than bad.
12. Organisation	<ol style="list-style-type: none"> 1. My workplace provides all necessary resources to deliver this intervention. 2. Government and local hospitals/health services provide sufficient support to deliver interventions like this. 3. I can count on support from the management of my workplace when things get tough. 4. The management of my workplace is willing to listen to my problems with delivering this intervention. 5. The management of my workplace is helpful when delivering this intervention.
13. Patients	<ol style="list-style-type: none"> 1. Patients receiving sedentary behaviour interventions from me are motivated to do it. 2. * Patients receiving sedentary behaviour interventions from me are NOT positive about the intervention.
14. Positive emotions	<ol style="list-style-type: none"> 1. When I encourage patients to be less sedentary on the ward, I feel optimistic. 2. When I encourage patients to be less sedentary on the ward, I feel cheerful. 3. When I encourage patients to be less sedentary on the ward, I feel comfortable.
15. Skills	<ol style="list-style-type: none"> 1. I have been trained in delivering this intervention. 2. * I DO NOT have the skills to deliver this intervention. 3. I have experience delivering this intervention.
16. Social influences	<ol style="list-style-type: none"> 1. Professionals with whom I work are willing to listen to my problems with delivering this intervention. 2. Professionals with whom I work are helpful with delivering this intervention.
17. Social/professional role and identity	<ol style="list-style-type: none"> 1. Delivering this intervention is part of my work as a nurse. 2. * As a nurse, it is NOT my job to deliver this intervention. 3. It is my responsibility as a nurse to deliver this intervention.

Appendix 2. Guiding interview questions

Perceptions of nurses and promoting reduced sedentary behaviour

Do you think encouraging patients to be less sedentary on the ward is part of your role?

Do you know what the Australian adult physical activity and sedentary behaviour guidelines are?

Barriers to promoting reduced sedentary behaviour in hospital

What are some of the barriers to encouraging patients to be less sedentary on the ward?

Please list as many as you can think of, and describe how these barriers make it difficult for you to promote less sedentary behaviour on the ward.

Enablers to promoting reduced sedentary behaviour in hospital

Please describe how you encourage patients to be less sedentary on the ward?

What are some of the things that make it easier for you to do this?

Suggestions for incorporating the promotion of reduced sedentary behaviour into routine hospital-based nursing practice

Do you have any suggestions for how we could incorporate promotion of less sedentary behaviour into routine hospital-based nursing practice?