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Occupational violence against staff in the perioperative environment

Occupational violence is a common problem in many workplaces, including health service organisations. In the perioperative environment, we are acutely aware of the problem of lateral violence, such as bullying, harassment and incivility. But as a specialty we rarely acknowledge violence perpetrated against us by patients, relatives or visitors. Anecdotally, this violence has been steadily increasing over the past decade and peaked during the current COVID-19 pandemic. Perioperative nurse leaders must be aware of the risks and implement appropriate mitigation strategies.

As a former anaesthetic and recovery nurse, I can recall several situations where I or one of my colleagues was threatened by a patient or one of their family or visitors. The most dramatic situation I recall resulted in a lock-down of the department after police informed us of a planned gang retaliation against a patient undergoing emergency surgery. More common, however, was verbal and sometimes physical abuse from patients who were confused or delirious on emerging from the anaesthetic.

Something that is frequently overlooked is the fact that occupational violence harms both the person it is directed at and anyone witnessing it. As a result, it has a significant impact on the workplace and adversely affects workers' physical and mental wellbeing. This has been shown to result in high economic, psychological and social costs for workers, organisations and the wider community. It is not a surprise that preventing occupational violence has become a priority for health services, unions and occupational safety bodies in Australia and globally.

Occupational violence can take many forms, including verbal abuse (swearing or yelling), threatening behaviour (pacing or glaring) and physical violence or sexual assault.[1] In hospitals, nurses are the most at risk because we provide close personal care to patients 24 hours a day. International reports indicate that up to 80 per cent of nurses have experienced verbal or physical assault in the workplace.[2] A recent systematic review found that Australian and New Zealand nurses reported higher occupational violence rates than those in European countries and North America.[3]

Certain hospital departments are known to have a higher incidence of occupational violence, these include emergency departments, maternity wards, paediatric wards and mental health units.[3] These areas typically have high volumes of visitors in emotive and stressful situations. In the perioperative environment, there is limited information on the prevalence of occupational violence. The area has restricted access with few visitors, which may reduce the risk. However, family and visitors experiencing emotive and stressful situations do congregate at the entry and exit points.

In some cases, occupational violence is perpetrated by people with a history of criminal or antisocial behaviour. This type of perpetrator is the most reported. In many cases,

however, the violence is due to a patient's medical condition such as emergent delirium, dementia, mental illness or hypoxia. I don't think there would be a perioperative nurse alive who has not been grabbed, scratched or hit by a patient emerging from the anaesthetic. Although common, these incidents are very rarely reported unless they result in significant injury to the patient or staff member.

The violence committed by patients because of their medical condition is frequently normalised in nursing and perceived as part of the job. Although there may not be intent on the part of the patient, this violence can still have adverse impacts on staff. I remember being punched in the nose by an elderly man who was confused in recovery. I saw stars and it brought tears to my eyes. I played it down at the time, but I do remember flinching for the next few weeks anytime a patient raised their arm. Although these assaults are considered benign, we don't know what cumulative psychological impact they are having on staff.

There are things we can do to reduce the risk of occupational violence. The layout and management of the environment can significantly contribute to risk.[4] For example, poorly manned and secured access points, isolated or obscured workstations, permissive admission policies, inadequate family communication processes and a lack of duress alarms may increase the risk.[2] I would encourage perioperative nurse leaders to conduct a risk assessment in their departments and instigate any necessary safety improvements. Hospital security services are a good resource and are usually eager to offer advice in this area.

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Integrated simulations to build teamwork, safety culture and efficient clinical services: A case study

Abstract

Background: Simulation methodology and frameworks were used to build teamwork and a safety culture, and to establish efficient clinical services within the procedure centre of a newly constructed, stand-alone, fully digital greenfield hospital. Rapid ramp up of surgical services required significant recruitment, and onboarding necessitated training of nursing and other perioperative support staff.

Methods: A two-day, immersive integrated simulation activity was carried out with the interprofessional onboarding staff participating in their usual roles. During the simulation, staff had the opportunity to apply newly acquired skills and knowledge to all stages of a patient's clinical journey through the procedure centre, including use of the integrated electronic medical record (ieMR) and non-technical skills.

Results: Department processes and workflows were rehearsed in real time before the procedure centre opened to patients. A safe environment was created for staff with formal prebriefing and debriefing delivered at the commencement and conclusion of the simulation activity.

Discussion: The integrated simulations reduced uncertainty and streamlined service delivery for staff who participated in the training, with simulations also used to foster interprofessional team training for clinical workflows. The simulation process allowed interprofessional teams (e.g. nurses, support staff, surgeons) to interact with one another prior to the facility opening.

Keywords: simulation, operating theatre, procedural, debrief, ieMR

Introduction

Simulation is increasingly being used in health care settings to allow staff training to occur in a controlled environment. Termed 'in situ simulation', this model allows deliberate practice and assessment of cognitive, psychomotor and affective skills of individuals within the actual work environment.[1] Key to the successful design and delivery of the simulation activity in this case study was ensuring that the planned simulation program could be delivered to staff across all clinical areas in the procedure centre thus integrating both perioperative and digital integrated electronic medical record (ieMR) processes and workflows. It has been shown that the effective use of in situ simulation fosters interprofessional team training and a culture of safety essential for high performance.[2]

This paper will describe how integrated simulation methodology and frameworks were used to build teamwork, safety culture and efficient clinical services within the procedure centre of a newly constructed, stand-alone greenfield hospital. The simulation activity

was delivered as a component of the training and induction program for staff new to the hospital. The simulation activity focused on testing processes and workflows within the procedure centre and training new clinical and non-clinical staff before the hospital opened to patients. The simulation was delivered as an integrated activity with the project digital team who coordinated and managed staff training for the ieMR. At the time of writing, there had not been another fully digital, greenfield hospital opened in Australia.

Background

The Surgical Treatment and Rehabilitation Service (STARS) is a new, 182 bed, fully digital, greenfield facility that welcomed its first surgical and procedural patients on 8 February 2021. The procedure centre at STARS has seven operating theatres, three procedural rooms, two Post Anaesthesia Care Units, a central sterilising unit (CSU) and a day surgery unit.

The initial project brief for the new service was that the procedure centre would open only gastroenterology services and the

Table 1. Stages of the simulation process

Stage 0	Planning	• Identify objectives and expected outcomes of the activity. • Identify key stakeholders for the activity and any initial physical or technology constraints, staff information needed, available resources and required resources. • Determine if any upskilling of simulation team is required.
Stage 1	Preparation	• Analyse all available data. • Form training team for activity (encourage interprofessional team members). • Engage with key stakeholders. • Identify how many simulations are required. • Finalise draft simulation activities on a standardised template. • Schedule regular simulation reviews with the training team. • Conduct tabletop walk-through when simulation drafts are completed.
Stage 2	Rehearsal	• Re-engage key stakeholders and arrange time to walk through the entire simulation in the designated clinical area if possible. • Make any required changes to simulation. • Repeat rehearsal of simulation if required. • Ensure required resources are available for the activity.
Stage 3	Delivery	• Allocate members of the simulation team to facilitate appropriate simulation activity. • Prebrief participants, deliver simulation, debrief participants. • Gather feedback and evaluation forms from participants.
Stage 4	Debriefing	• Debrief simulation team and training team members.
Stage 5	Evaluation and reporting	• Make any required adjustments to written simulation. • Review simulation participant feedback and evaluations. • Provide written report to department leads and key stakeholders. • Recommend adjustments to process and procedures where appropriate and relevant. • Provide required education support to clinical area after the simulation activity.

Table 2: Constraints

Physical constraints	Technological constraints	Staffing constraints
• Project team located in a building off site. • Unable to enter hospital building site.	• No prior ieMR experience. • ieMR was built for STARS during project. • Workflows needed to be developed. • ieMR training occurred on different hospital builds. • Hardware fit-out unknown.	Mixed staffing model for anaesthetics. Desire for STARS to adopt interprofessional approach. Unknown requirements of STARS education research alliance (SERA). Several changes to workforce model. Simulation experience of staff unknown.

CSU in 2021, with surgical services scheduled to commence in 2022. However, in light of the worldwide COVID-19 pandemic, by the end of May 2020 it was announced that surgical services would be commissioned 12 months earlier to assist with post-pandemic recovery management. When planning commenced for the training and induction program, and the utilisation of an integrated simulation model, recruitment of hospital staff had not begun and a final workforce model was not yet available. It was unknown what level of perioperative experience the staff recruited to STARS would bring. Thus, an innovative approach to inducting and orientating new staff in a new facility was needed to rapidly build a cohesive team.

Objective

This paper aims to describe the simulation process applied in this case study, which can be adapted for use in clinical settings to orient staff and test workflows and processes. Specific case study examples will be used to assist with demonstrating the stages of the simulation process (see Table 1), which are based on prior simulation education and experiential learning of the STARS perioperative team.

The simulation process

Planning (Stage 0)

The objective communicated by project leads was to develop an integrated induction and orientation program for the new staff that would commence in the procedure centre at STARS, incorporating simulation activities where appropriate. Previous greenfield hospital sites had been opened within Queensland; however, opening a new hospital as a fully digital greenfield site had not previously occurred. As a result, benchmarking against other integrated programs was not possible. Our program approach was developed from the perioperative nurse educator's prior simulation experience and informed by literature.

Operating theatres and procedural centres are made up of interprofessional teams that follow clearly defined processes supported by policy, procedure and legislation. Throughout the development of the training and induction program, the perioperative nurse educator and clinical coaches worked in collaboration with key stakeholders – including nurse unit managers (NUMs); the nursing, medical and anaesthetics directors; project leads and subject matter experts – on process, policy and procedure development through a series of working parties. Initial planning for the training and induction program commenced with some isolation and constraints (see Table 2). These were worked through systematically and shared with additional team members as these staff came on board.

The initial outcome measure nominated by the perioperative nurse educator for the integrated training program was that recruited staff will be work ready and provide safe patient care at the completion of their assigned induction and training program.

Preparation (Stage 1)

Clinical nurses who had successfully obtained a position at STARS joined the training and induction team approximately four months before the scheduled onboarding date for new STARS staff.

The clinical nurses fulfilled a coaching role during the final project stages. The clinical nurses reported after onboarding that they had no prior experience with writing and facilitating simulation activities. It was essential to build their knowledge of simulation for

the activity to be successful, so reprioritising of activities occurred. Simulation education and support was provided by the perioperative nurse educator to the clinical nurse coaches during this stage of the process.

The clinical nurse coaches were assisted to develop and write simulations using the simulation quality improvement tool template (see Appendix 1). The simulations were written, developed and tested over a three-month period. Practice standards of the Australian College of Perioperative Nurses (ACORN) and Australian and New Zealand College of Anaesthetists (ANZCA) informed the design of the simulation content. Digital workflows and the models of care developed during the project were also reviewed and incorporated into the simulation design.

The priority at this stage was to determine what was achievable and what was required to ensure a trained and work-ready nursing team. With the challenge for our team being to bridge the gap between architectural plans and real-world efficient and effective patient care,[3] the perioperative induction and training team focused on developing key simulation scenarios. These simulations were designed to bring together individual training activities from the induction program, processes, workflows, non-technical skills and all professional groups into the clinical space.

A foundation patient journey simulation was written. This simulation covered the patient's perioperative journey from arrival to the procedure centre through to discharge after the procedure. Additional simulations were written by the training team which added to the foundation patient journey simulation for each specific area. Activities such as specimen handling, calling for medical imaging assistance, accessing the automated medication dispensing system (pyxis, med station and Anaesthetic A station) and providing pain relief to a patient were included into the simulations developed. Integrated into each stage of the patient's journey was the use of the digital ieMR and the related workflows.

Table 3: Simulations

Operating theatre and procedure rooms	Post Anaesthesia Care Unit (PACU)
1. Normal patient journey 2. Can't intubate, can't oxygenate (CICO) 3. Specimen management 4. Malignant hyperthermia 5. Blood management 6. X-ray / Image intensifier (II) required 7. MRSA (endoscopy suite) 8. Allergy (endoscopy suite) 9. Normal patient (double procedure endoscopy suite) 10. Equipment failure (endoscopy suite) 11. Aggressive patient	12. Normal patient journey 13. Patient requires a surgical review 14. Patient requires pain protocol 15. Management of aggressive patient 16. Patient requires x-ray, post-surgical procedure

A total of fourteen integrated simulation scenarios were written; the planned scenarios were interprofessional activities that engaged with relevant departments outside of the procedure centre, where required. A point of concern raised by the team during preparation was that there were still key decisions and workflows outstanding as the simulations were being developed. There was also some conflicting information on processes that included other departments, such as transporting of a specimen to pathology. Therefore, there were 16 patient scenarios in the final simulations (see Table 3). The team acknowledged that the simulations would be updated when additional information became available or decisions were endorsed.

For the simulation activity to be successful, multiple simulated patients were required. This provided a logistical challenge which was overcome with a creative solution that allowed the challenge to be managed in house. New staff onboarding to STARS were to be used both as patients and in their usual roles for the activity. This ensured that all new staff participated in the simulation activity over the two days. Staff were split into two groups with half of the new staff acting as patients and the other half as staff members on the first day of the simulation and then swapping over on the second day. It was felt that this approach would maximise learning opportunities and promote team building and use of non-technical skills.

Digital trainers were engaged and assisted with creating patient profiles in the ieMR that covered a variety of surgical specialities and procedures. Patient profiles were staged so that staff could interact with the ieMR during the simulation as they would for an actual surgical patient. It is reported in literature that digital transformation of a hospital is a disruptive event and can cause a decline in time efficiency, described in literature as digital deceleration.[4] By providing new staff with the opportunity to practice using the ieMR during the simulation and prior to the hospital opening, it was hoped that the potential impact of digital deceleration would be decreased at STARS.

An invitation to participate in the simulation activity was extended to other professional groups after consultation. We experienced good engagement from other groups including medical and administrative staff, theatre support officers and staff from inpatient surgical ward, pathology/blood bank, pharmacy and digital support. Once the initial drafts of the simulations were completed, they were peer-reviewed and the perioperative NUMs were invited to complete a walk-through of the simulation with the training team. If required, the simulation flow was adjusted, and additional walk-throughs were completed. Collaboration with other key stakeholders occurred to refine sub-processes within the simulation scenarios before the final simulation documents were signed as ready for the rehearsal stage of the process.

The simulation activity was planned to run on the final two days of the training and induction program. This included having four operating theatres and one endoscopy room as part of the activity, with each patient completing a full patient journey. In total, the team was aiming for twenty patients to pass through the department on each of the simulation days. This target was above the scheduled number of patients who were booked for procedures in the first week of STARS welcoming patients.

Rehearsal (Stage 2)

Two individual simulations were delivered to key stakeholders prior to the simulations being finalised for use in the training and induction program:

1. a foundation simulation of a patient journey through the operating theatre
2. a foundation simulation of an endoscopy patient journey through the procedure rooms.

Each simulation was delivered as a structured and orderly run-through of a patient journey from admission to the unit at reception to discharge from the unit post-procedure. Throughout the simulation, participants were given the opportunity to provide in-time feedback. However, rather than immediately adjusting the planned simulation process based on this feedback, the feedback was noted on the simulation template and discussed at the facilitated debrief. This approach allowed experienced personnel to apply their collective skills without interruption and subsequently allowed them to review and discuss the advantages and disadvantages of their behaviours, decisions and actions.[5]

The debriefing following the simulation activity involved the interprofessional team, the participants in the simulation and the observers of the simulation. The debrief used a plus–delta framework to document things that went well during the simulation (pluses) and opportunities for improvement (deltas) or things that didn't work well. Pluses are items that the individual or team want to maintain and build upon. Deltas are things that can be changed so the individual or team may be more effective. Ideally an effective plus–delta debrief generates two lists of behaviours which prompts further discussion, reflection and learning.[6]

The simulated journey of an endoscopy patient was rehearsed with key stakeholder's present. At the completion of the first simulation rehearsal there were still questions and undefined processes that needed to be finalised before the workflow of the patient journey through the endoscopy suite could be endorsed and the simulations used for onboarding new staff. Examples of concerns raised in the debrief by participants included the digital and clinical workflows for specimen management and the pathway for dirty scopes to be transported for reprocessing. Members of the training team and department leaders took specific actions from the rehearsal debrief to follow up at the conclusion of the first simulation activity. A second simulation rehearsal was facilitated a week later. It was determined at the completion of the second simulation rehearsal that the endoscopy simulations could now be used for training the new staff.

Delivery (Stage 3)

The simulations were held on the final two days of the training and induction program. Approximately 140 nursing staff and anaesthetic assistants participated in the simulation activity. Additional professional groups were also invited to participate; these included medical staff, patient support officers, administration staff and staff located in other

departments including medical imaging and the surgical ward. Each simulation session included a prebrief, simulation activity and debrief. Staff came to the simulation activity with a basic understanding of what the processes would be in the department, and the relevant applications and digital systems that would be used, after attending classroom sessions with facilitators. The simulations were designed to provide an opportunity for staff to consolidate training, knowledge and newly gained skills by rehearsing processes and care delivery in their clinical area. The training simulations were slower and less structured than the rehearsal simulations; however, adherence to policy, procedure and perioperative standards were maintained. This approach allowed time for staff members to identify when they were unsure and seek assistance from support options that were available to them (i.e. digital floor walkers, clinical nurse coaches, perioperative nurse educator) when required. The staff actively worked through the relevant simulated processes at each stage of the patient's perioperative journey either independently or with support. There were also several parallel processes that could be observed as staff worked through the training simulations, including:

- testing staff and identifying how the proposed processes were interpreted and applied by staff in the clinical space
- testing the suitability of the processes that had been put in place through the project
- testing if staff could use the digital systems (e.g. ieMR) after they had received classroom training
- ascertaining if the combined processes and systems worked together as expected.

Prebrief

A training team prebrief session was held with the clinical nurse coaches prior to the prebrief session for the new staff members. Significant support was provided to the clinical nurse coaches to ensure that they were comfortable with their simulation and how they planned to run their simulation session.

A prebrief was held for all simulation participants and support staff prior to the simulation activity commencing. A prebriefing sets up clear expectations for participants who may have variable simulation experiences.[7] The perioperative nurse educator encouraged staff to fully engage in the activity and reinforced that a priority was ensuring the psychological safety of all simulation participants. It was discussed with staff that during the simulation activities it is safe to make mistakes and trial new processes. The perioperative nurse educator encouraged staff to report any identified safety or efficiency concerns to a member of the training team. In a psychologically safe environment staff members do not fear disciplinary action or punishment for admitting mistakes – they speak up, discuss problems and mistakes, learn from others and solve problems. These behaviours ultimately result in improvements in systems and processes that lead to safe environments for both patients and staff members.[8] During the prebrief, half of the staff were allocated to either a specific theatre, procedure room, post anaesthetic unit or day surgery unit to be a part of the team for the area. The other half of the staff were allocated to the role of the patient for the activity. The flow of the simulations through their operating theatre or procedure room (e.g. normal patient journey, specimen management, CICO, x-ray or image intensifier required) was discussed with participants. Digital support facilitators were allocated to an area and participants were then taken to their specific area and a smaller huddle of the specific teams was facilitated by the clinical nurse coach allocated to the area. Staff allocated to the role of the patient were taken to the procedure centre waiting area to get ready for admission.

Simulation activity

The first simulation activity for all teams was a normal patient journey and then the complexity of the simulations was gradually increased. This allowed the team to settle into the activity and their allocated area. This approach helped staff become familiar with other team members and the processes related to caring for their patient. Effective information flow between perioperative phases, physical locations and clinicians affects the quality of care that perioperative teams provide.[9] We wanted minimal stress to be placed on staff and relationships to allow team work to grow organically throughout the simulation activity as acute stress has been shown to affect decision-making and teamwork.[10] The ieMR training domain was used for the simulation activity throughout the entire patient journey. Staff members in each of the operating theatres were provided with a simulated patient list that had been generated from the ieMR by the digital team. During the simulations staff were encouraged to follow and test clinical processes and workflows. All issues and questions raised by the staff during the activity were explored and corrected in real time.

The simulation activity used four operating theatres and one endoscopy room with four patients in each room. Each patient

completed a full journey through the department and were cared for by an interprofessional team of staff including administration officers, nurses, theatre assistants, doctors, allied health practitioners, medical imaging staff and pharmacists. For the first day of the simulation activity the plan was to facilitate 20 patient journeys. In practice, the simulation was ceased after 18 patients had passed through the department. The total simulation run time was approximately five hours.

For the second day of the simulation activity adjustments were made based on educator observations and feedback from the training team and participants. One of the simulation scenarios was changed from CICO to blood management. This change occurred to ensure that management of two key emergency scenarios was explored with staff. The simulated patients were decreased by one patient in the operating theatres due to the time it was taking for staff to work through the activity. The number of simulated patients allocated to the endoscopy rooms was left unchanged as this group was not experiencing the same time challenges. The total simulation run time for day two was four hours.

The PACU staff were able to use the ieMR and the Pyxis medication station to check and administer medications to patients. Staff practised retrieving and preparing patient-controlled analgesia devices for patients. Patients were discharged from the PACU to the day surgery unit and simulated discharge of patients from the procedure centre to home was also practised.

End of activity debrief

Properly facilitated debriefing sessions enable simulation participants to feel comfortable with being open and honest about their simulation experience.[11] A debrief was held on each day of the simulation activity for the participants and support staff and was led by the perioperative nurse educator using a plus–delta framework. It was reiterated to staff that the debrief was a safe space to share thoughts, experiences and feedback, and that debriefing is an essential part of participating in simulation activities. If multidisciplinary perioperative teams are to meet their learning objectives they must reflect on their experiences and test their understanding of knowledge gained.[11] The clinical nurse coaches then took the staff back to their clinical areas and held an additional debrief that was focused on a specific clinical area. Feedback provided by participants indicated that the second, smaller debrief proved to be a great team building and information-sharing exercise for the new staff.

Debriefing (Stage 4)

After the first day of simulation training, a debrief was held with the training team by the perioperative nurse educator to determine if any changes needed to be made to the activity before it was facilitated again the following day. The feedback and information obtained in this debrief informed some minor adjustments to the simulation for the following day, including the removal of one patient from the list in each operating theatre. It was also decided that a simulation on blood management would replace the CICO simulation for the second day of the simulation activity.

Evaluation and reporting (Stage 5)

Evaluation occurred at different key stages of the project. Primary evaluation of the patient journey simulations was the first evaluation activity completed when the two simulations were reviewed and adjusted after desktop activities and walk-through rehearsals with key stakeholders. The purpose of the primary evaluation was to ensure clinical accuracy and simulation efficiency before delivering the simulation to participants.

During the development of the simulation activity the training team determined that Kirkpatrick's evaluation model would be appropriate to assist with final evaluation of the activity. Kirkpatrick's model has four levels: reaction, learning, job performance and organisational impact. It is outcome and objective orientated and is a summative evaluation model.[12]

Key evaluation data was collected by the training team through conversations and observations during the simulations and from participant feedback given during plus–delta debriefing and participants' written feedback collected via an optional questionnaire. A secondary simulation evaluation was completed at the end of the first day of the activity by the training team. This evaluation led to some minor changes and improvements to the planned activity for the following day. Participants were encouraged throughout the activity to self-evaluate, reflect on their practice and take the opportunity to consolidate their skills. Some participants did seek assistance from a member of the simulation team if additional support was required.

All feedback collected was reviewed by the perioperative nurse educator and the clinical nurse coaches. The feedback was compiled and given to the nursing director and

NUMs to review (see Appendix 2). The simulation team reported that level 3 evaluation on Kirkpatrick's evaluation model was achieved for the simulation activity. Staff were observed applying and consolidating learnings from didactic ieMR training sessions and orientation activities in the procedure centre throughout the patient journey and additional scenario simulations. It was not possible to assess if level four of Kirkpatrick's model, organisational impact, was achieved as the facility was not yet operational.

Discussion

Ensuring that all project objectives were met and a successful in situ simulation was delivered proved to be both a challenging and rewarding experience for the training team. Planning a successful training and onboarding program for a large number of staff whose experience and skill set were largely unknown required a unique approach. The training team recognised that it was essential that newly recruited staff were provided with the opportunity to consolidate learnings from didactic sessions and test newly developed workflows and processes in the clinical area before the facility welcomed patients. Petrosoniak et al.[2] define in situ simulation as a team-based training technique conducted in the actual patient care environment using equipment and resources from that unit and involving actual members of the health care team. Adding to the simulation being delivered in the actual procedure centre we integrated ieMR workflows into our patient journey simulations and ensured that support staff were available to help simulation participants when they required assistance. Because the objective of an ieMR is to facilitate the complete patient journey across all hospitals, units and professions in a health service organisation,[13] we felt that it was essential for the simulations to include as many ieMR workflows as possible for participants to practice their newly acquired knowledge and skills. Taking an integrated, in situ and interprofessional approach to our training simulations made the development and facilitation of the simulations complex and unique.

We felt our most valuable simulation was the foundation patient journey simulation. Nickson et al.[14] state that testing new health care facilities through simulation can trial workflows, address ergonomic issues and identify latent safety threats before 'going live'. The patient journey simulation was the first simulation written and tested by the training and induction team. This simulation followed the complete perioperative patient journey and informed the development of the additional simulations. Brazil[15] reports that designing simulations to focus on systems and processes rather than knowledge and skills can assist with embedding processes and procedures and offer diagnostic opportunities when preparing to open new facilities or services. Once the foundation simulation was written and finalised it was then possible to begin writing other simulations for the activity.

Although this paper describes the application of a framework for simulation development for our new facility, the proposed framework is flexible and can be applied in other settings to support the development of teams and safety culture, and to test workflows and processes. We recommend using a quality improvement approach when developing a simulation activity for clinicians if there is limited simulation experience within the simulation faculty, as this framework is widely understood in health care and is adaptable and flexible. Other health care organisations who may choose to adopt this framework could consider designing a research project in addition to using this simulation framework to support design and facilitation of a simulation. Our team determined that running a parallel research project was out of scope for our team and this activity.

We observed a noticeable difference in staff behaviour between the first and second day of our simulation activity. Staff communication improved and group discussions occurred organically. The teams demonstrated improved efficiency and confidence with the use of the ieMR and patient flow through the department. Many of the barriers to good teamwork and communication in health care can be attributed to organisational, educational and cultural factors.[16] It was unclear if the behaviour improvements observed were due to staff becoming more comfortable with their role, with using the ieMR, with their team members or with the overall simulation activity. The clinical nurse coaches reported that feedback received from participants during the simulation activity had led to them reflecting on the activity and changing their plans for how they would approach patient care, staff allocation and the completion of key activities on the first day that patients were welcomed into the department.

Incorporating processes and staff from different departments in the simulation activity proved to be valuable. For example, it was discovered that the PACU was not listed as an available location on the hospital task allocation service. This meant that it would be a manual process for staff to request patient

transport from PACU to the ward, which is inefficient. Once identified in the simulation, this issue was resolved by the relevant support team. Medical imaging staff were also able to come into the procedure centre and familiarise themselves with the department layout and identify the most appropriate pathways for them to bring their imaging equipment into the rooms.

There were constraints that occurred with the simulation activity delivery that were largely out of the control of the induction and training team. These constraints included difficulties with the ieMR training domain, not being able to allocate monitors to the patients during the simulation activity, and some equipment not being available in the department. Involving the CSU in the simulation activity was not possible due to the department needing to focus on completing the processing of instruments for the opening of the hospital. An additional constraint was that the department opened following a pre-determined surgical ramp up. This meant that there was still a progressive onboarding of staff after the department began treating patients; thus, several staff members did not get the opportunity to participate in the simulation training prior to 'going live'. It is unknown at this time if this affected their transition into the department.

In summary, the key lessons learnt from this project are:

- A structured simulation model assisted the clinical coaches to stay focused and on track during the planning and writing of the simulation activity.
- Staff appreciated the opportunity at the end of the two-week induction and training program to consolidate and rehearse learnings from didactic classroom sessions and to socialise with other staff members prior to the facility welcoming patients.
- Using external people in the role of simulated patients instead of new staff to the hospital may have provided different experiences and outcomes from the activity.
- Remaining flexible and adaptive throughout the entire project and adjusting the simulation activity as processes and policies became finalised was essential.
- Having new staff participate in simulation activities and debriefing and welcoming their feedback during the training and induction program has ensured that these activities have become a part of the work culture at STARS.

Conclusion and recommendations

Using integrated simulation as a methodology to support development of processes and procedures, introduction of new procedures and testing of workflows within clinical units can seem like an overwhelming activity to develop and implement. However, this is an achievable task for all clinicians when a structured approach is adopted and consultation with subject matter experts and key stakeholders occurs.

Our recommendations for clinicians wanting to undertake a large-scale simulation activity include:

- Nominate a designated lead who may or may not have prior simulation experience.
- Determine what the key priorities are for the simulation and what the criteria for inclusion in the simulations will be.
- Complete walk-throughs or rehearsals of the simulation activity before the activity is delivered to participants. Make any last-minute changes required to the simulation at this point.
- Create a safe environment for staff by providing a comprehensive prebrief and debrief for all simulation activities.
- Ensure participants in the simulation perform their usual roles for the activity so that all learnings from training can be transferred into clinical practice.

The advantage of writing and facilitating process simulations is that they can be run using a scaffolded approach by gradually increasing the number of different sub-processes included within an overall process, if required. It is also possible to step back to the beginning point of a process and revisit the tasks for that section of the process.

As department and organisation requirements can change rapidly, it is also essential to design project or service/process simulations that are adaptable and flexible to meet identified needs. As our department continues to transition to a business-as-usual model, we have identified additional opportunities where we can use simulation to build and refine our surgical service and we have a department where staff are now familiar and comfortable with simulation.

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Appendices

Appendix 1: Simulation quality improvement tool

Stage 1	Presentation				
Plan		Do			Study
Predicted process/outcomes		Was the process or outcome achieved? (Please circle one.)		• Observe simulation • Record observations • Analyse data	• Compare data to predicted process/ outcomes • Debriefing data analysis (What? Why? How? When?)
1.1	Patient arrives at hospital on day of procedure.	Yes	No		
1.2	Patient presents to administration officer on ground floor. Patient takes lift to Level 2, procedure centre, and presents to administration officer at reception desk.	Yes	No		
1.3	Administration officer checks patient details are correct and processes admission file.	Yes	No		
1.4	Allergy/alert status checked/ confirmed.	Yes	No		
1.5	Administration officer places ID arm band on patient.	Yes	No		
1.6	Admission nurses notified of patient arrival. • Will there be physical CDC? • Where is it? • Where will it go once the patient is processed by administration officer?	Yes	No		
1.7	Administration officer to complete patient information tracking board.	Yes	No		

Appendix 2: Compiled feedback

Integrated workflow scenarios day 1

Facilitator feedback obtained on the run

From medical imaging participant:

- door shut on C arm of II when it was being brought into theatre
- call for 30 minutes in advance
- Karen to advise where contrast is going to be kept
- different types of contrast Omnipaque, Visipaque (used when people have a known reaction to contrast), Ultravist
- x-ray went well in theatre
- ward collected the patient without issue
- when nerve centre was used to try and order a bed and transfer it was noted that PACU was not a location listed on nerve centre.

Feedback from PACU CN:

- PACU buzzers not showing in OT
- PACU team leader to pay attention to patient name
- nerve centre not working properly, no PACU listed
- no contact number for wards
- need to work out the bed process from the ward
- when it was simulated that a patient went straight to ICU there was no communication to PACU. This feedback was provided to the staff in this theatre from the PACU CN.
- Should the BP cuff come with the patient from theatre to PACU?
- important to always discontinue pain protocol in the ieMR even if it is not used (safety issue)
- no IV poles available
- no bins available.

Plus–delta notes taken from overall debrief at end of the activity

Plus	Delta
• communication • teamwork • friendliness • admin staff did really well • problem solving was undertaken • everybody kept a level head • seeing how ieMR fits within our daily activities • facilitators did a really good job	• hand hygiene practices not so great • anaesthetic start time needs to be uniform • some confusion about when 2nd and 3rd pre-op checks should be done • anaesthetic assistant won't be able to get drugs if they need to pick up the patient • location of emergency resuscitation equipment • TSOs were not in endo • MRO process from admissions • need a whiteboard in theatre to identify staff • surgical safety checklist – be mindful you cannot bring previous practices to STARS and expect them to happen • pre-op patient privacy • PACU difficult to communicate with TSOs. Are spare dect phones available as we don't have time to call several different phone numbers? • Does a patient need to be awake for the surgical safety checks to be undertaken? • people don't know each other AO staff – Day surgery staff • flow of beds – need to discuss workflows with NUMS and bed storage • no one told the last patient for the simulation that they had been cancelled • nobody asked patients about COVID-19 • AOs to ask what procedure the patient is having done

Integrated workflow scenarios day 2

Notes on the run:

- Some confusion witnessed in PACU when a code button was pushed with which way to bring the resuscitation trolley to the patient bed side.
- 4 x theatres with 3 x patients in each theatre. 1 x GE room with 4 x patients

Plus–delta notes from final activity debrief

Plus	Delta
• calmer flow in theatre space • good to see the patient journey • approximately five staff members present who did not attend simulations on the previous day • a staff member who was playing the role of a patient stated that even though she knew it was not real she still got nervous being taken into the theatre but found the staff friendly and caring • smooth patient experience	• endoscopy flow worse today • anaesthetic assistants require more assistance with ieMR • it is important to share infection status of patient with PACU • have a team huddle in areas prior to case to confirm details • anaesthetic questions – need to be communicated

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ACORN Papua New Guinea ANGAU Memorial Hospital redevelopment clinical support program (Part 1)

This article is the first in a series that will describe ACORN's role in the redevelopment of the ANGAU Memorial Hospital in Lae, Papua New Guinea.

Background

The Australian Government Department of Foreign Affairs and Trade (DFAT) committed to funding the redevelopment of the ANGAU Memorial Hospital (AMH) in Lae, Papua New Guinea (PNG). DFAT engaged Johnstaff International Development (JID) as the Project Manager Contract Administrator for the AMH redevelopment project. JID are program management specialists who work with organisations that fund international programs in low- and middle-income countries to provide end-to-end project management and health advisory expertise.

The AMH is the second largest hospital in Papua New Guinea. It plays a fundamental role as the district hospital for 149 000 people in Lae, the provincial hospital for the 675 000 people of Morobe, and a regional referral hospital for the 1.9 million residents of the Momase region (Morobe, Madang, East Sepik and West Sepik).

ANGAU Memorial Hospital, Lae

Project outline

The Australian College of Perioperative Nurses (ACORN) was contracted by JID to be the expert body to advise on all aspects of perioperative care to enable the commissioning of the new operating room suite (ORS) and central sterilising unit (CSU) at AMH. ACORN provided an expert consultancy team known as the Perioperative Clinical Advisory Team (PCAT) to undertake the required work for the key deliverables that were aimed at ensuring a standard of care that will be safe for the patients undergoing surgical procedures provided by Morobe Provincial Health Authority.

The PCAT consisted of a perioperative lead and three perioperative nurse advisors with expertise in education, commissioning of a new ORS facility and sterilisation practices. The team had the cultural awareness required for the work as three members of the team had lived or worked in PNG, had collaborated with the PNG Perioperative Nurses Society (PNGPNS) and had knowledge of the hospital settings in Port Moresby and Lae. The fourth member had participated in the early development of the Pacific perioperative practice bundle (PPPB), a collaboration between ACORN and the Pacific Island Countries to develop and implement a bundle of infection prevention standards and practice audit tools to improve consistency of perioperative practice in the 14 participating Pacific Island countries.

The aim of the PCAT was to work collaboratively with key ANGAU multidisciplinary staff and national health stakeholders to ensure standards, guidelines, sustainable workflows and data collection was achieved to support the efficient management of the new ORS and CSU. This aligned with an overarching aim of ensuring the community of Lae has access to safe surgical care as per the World Health Organization (WHO) target of universal health coverage. While the overall objective is the commissioning preparedness, the multidisciplinary approach was based on meeting identified key deliverables in sequence to enable the timely training, capacity and mentoring of the AMH staff to function within the new perioperative environment.

The project began in February 2021 with a completion date of 31st December 2021. However, the surge of COVID-19 within PNG saw the project timelines extend into 2023. This paper will describe the project aims and objectives, and the outcomes that have been achieved to date. A second paper will report on the overall outcomes at the conclusion of the project.

Scoping design

The current AMH ORS and CSU complex has a combined area with four operating rooms and inadequate sterilising and recovery areas. Only two operating rooms are in use with limited equipment and consumables, and staffing that does not meet PNG National Health Service Standards. The 24/7 staffing does not include staff for the recovery area and there are usually only two nursing staff with an anaesthetic assistant for each room. ORS and CSU staff do not have access to perioperative specialty training and most staff are trained on the job.

The new ORS has four operating rooms and a dedicated CSU. The new complex will provide a centre for surgical and procedural services that include planned day surgery, in-patient surgical procedures and emergency surgery. It will operate 24 hours a day, seven days per week.

Staff surveys identified that there were gaps in education and knowledge in clinical practice principles within the perioperative and sterilisation setting. Medical education was outside of the scope of the project. However, the governance, operational flows and ORS efficiency are all multidisciplinary and require collaboration from all teams with leadership from both nursing and medicine to succeed. Therefore, the primary educational focus was nursing with other deliverables aimed at the multidisciplinary teams.

The PCAT team were reliant upon in-country JID staff and meetings via Zoom using low bandwidth internet connection to gather information and data for a scoping report. The collection process was also difficult with the COVID-19 situation. The team used alternative communication processes like WhatsApp when internet connection was poor. These meetings faced various challenges from not only variable internet reliability but also inattendance of key nursing staff due to multiple factors (sick leave, workload, shift availability and COVID-19). However, once engagement was established at the local level the flow of information slowly increased as COVID-19 impacts decreased. The team was then able to identify the gaps in documentation, orientation, standard operating procedures, rostering and clinical practices, and make recommendations for the key deliverables of the project.

Key deliverables

Four key deliverables were identified:

1. Development of a monitoring and evaluation framework including a governance structure and risk management plan.

2. Implementation of perioperative and central sterilising unit standards for practice and an associated education program.
3. Development of guidelines and processes to support nursing management and leadership inclusive of workflows, emergency responses, staffing, data management and ORS activity indicators.
4. Development and implementation of standard operating procedures and procedures regarding the new furniture, fixtures and equipment.

The second deliverable listed above has largely been achieved through:

- the development of practice standards (the PNG Perioperative Standards for Practice), together with a sustainable education program relating to the standards
- the delivery of an education and training program
- operating procedures for the CSU (CSU Safety Operating Procedures) that relate to the standard for the reprocessing re-usable medical devices (RMDs).

PNG Perioperative Standards for Practice (PNGPSP)

PNG had no defined or endorsed national perioperative standards for practice. This project was an opportunity to improve perioperative practices in PNG with the implementation of national and endorsed perioperative standards for practice.

The PNGPSP were developed theoretically using the following resources:

- PNG *National Health Service Standards*
- PNG *National Infection Prevention and Control Guidelines for Health Services*
- WHO guidelines for safe surgery and decontamination and reprocessing of RMDs
- International Federation of Perioperative Nurses (IFPN) perioperative guidelines
- ACORN *Standards for Perioperative Nursing in Australia*
- Pacific perioperative practice bundle.

Seven standards were produced.

Standard 1: Perioperative attire

Standard 2: Aseptic technique

Standard 3: Surgical hand antisepsis, gowning and gloving

Standard 4: Skin preparation and draping

Standard 5: Accountable items

Standard 6: Safe perioperative environment

Standard 7: Re-usable medical devices

The draft standards were circulated to the perioperative nurses at AMH and, by the PNG Perioperative Nurses Society (PNGPNS), to perioperative nurses across PNG for comment. The feedback that was received enabled the PCAT to amend the standards so they were fitting to nursing practice in PNG and were within the scope of resources available.

The PNGPSP incorporates appendices that apply to:

- Pre-operative patient checklist
- Surgical hand scrubbing procedures (three- and five-minute)
- Surgical hand rubbing procedure
- Accountable items count sheet
- Papua New Guinea Surgical Safety Checklist
- ORS and CSU environmental cleaning audit
- Perioperative patient journey audit forms (measured against the standards)
- Perioperative safety guidelines (relating to positioning the patient, diathermy safety, pneumatic tourniquet safety, sharps handling and disposal, and specimen collection)
- WHO recommendations for staffing CSU

The count sheet and surgical safety checklist can be utilised across all perioperative environments in PNG, therefore, enabling a safe, consistent approach to perioperative documentation.

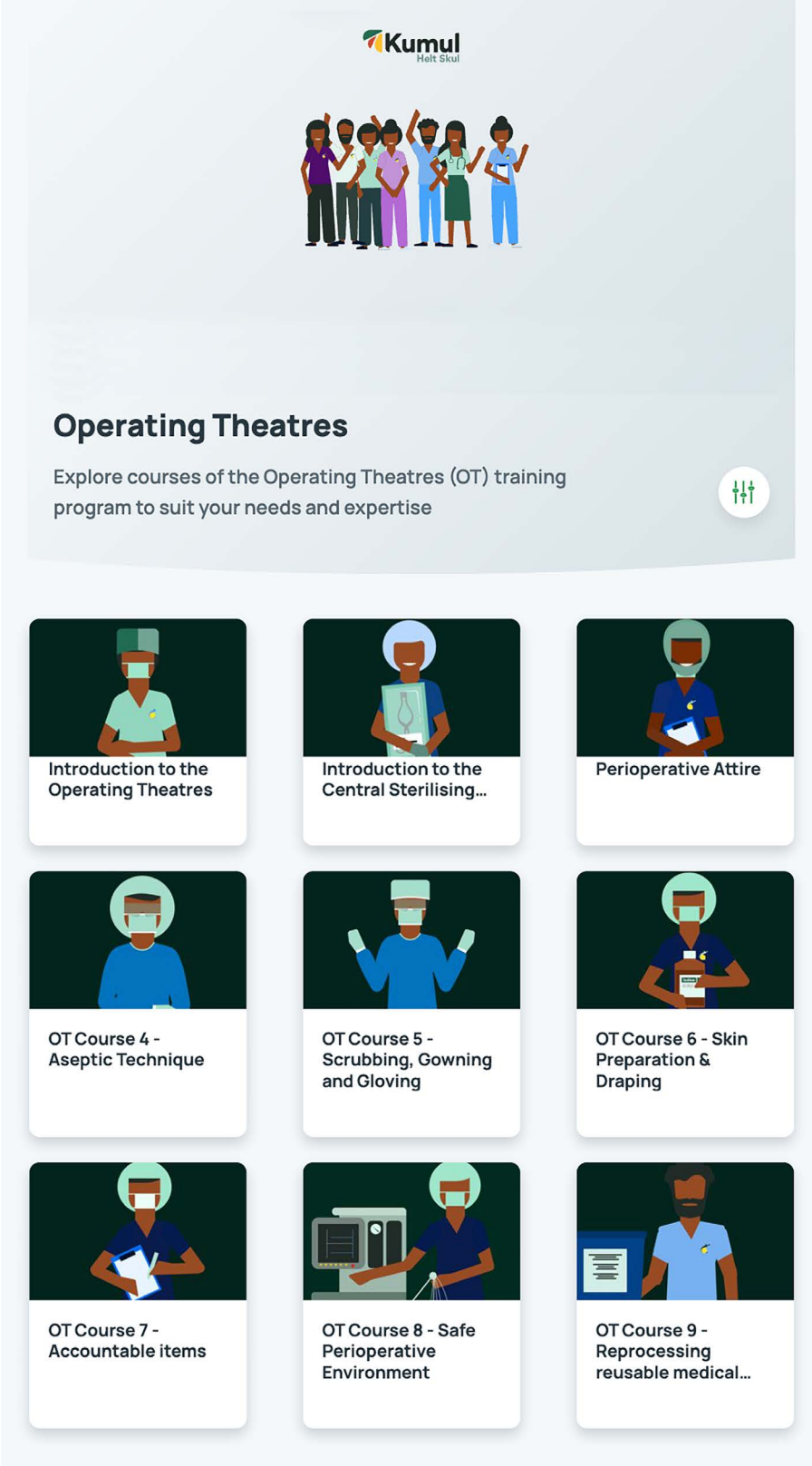
The PNGPSP was endorsed by the AMH Board of Management Safety and Quality Committee and the PNGPNS. Endorsement is now being sought from the PNG National Department of Health.

Education and training program

The education and training program comprised three components:

1. an online learning program
2. interactive workshops delivered virtually or face to face
3. mentoring and support for staff during an in-country visit.

The online learning program is complete. It was developed in collaboration with Catlapa, an international design and technology organisation that uses technology to make information accessible in low-resource countries. In PNG they have implemented micro learning via a mobile phone app at two major hospitals including AMH.



Kumul Helt Skul introductory screen

Kumul Helt Skul (PNG Health School) is the app that provides professional development training for hospital staff to improve quality of care. The app's visual language was designed to represent PNG heritage and culture.

Nine courses were developed for Kumul Helt Skul for ORS and CSU staff. Two introductory courses, one for ORS and one for and CSU, and seven courses relating to the seven standards in the PNGPSP. Courses contain a series of lessons with an ungraded multi-choice question at the end of each lesson. The courses relating to the standards also have a graded exam at the end of the course. The courses contain a discussion forum called 'talk to the team' where questions are posed and learners can discuss the topic with other learners.

Enrolments to the app and the use of the technology were logistically problematic for staff with low technology literacy skills. The aim was for all staff to complete the online learning program before commencing the interactive workshops where the standards would be further expanded upon. The workshops have commenced and are being delivered virtually. The workshops encourage discussion of practices and problem solving of issues relating to practice.

Central Sterilising Unit Standard Operating Procedures (CSUSOP)

The staff survey revealed that the current CSU accepted instrumentation already cleaned and wrapped from other areas of the hospital for sterilising. Therefore, CSU staff were not completing the entire process for reprocessing RMDs, which is best practice, and thus not meeting infection control

AMH staff undertaking Kumul Helt Skul courses. From left: Sr Julienne Pauliet, Community Health Worker David Waesa, Sr Elaine Kuresu

best practices. ORS staff were cleaning instrumentation in a corridor before taking it to CSU for processing. CSU staff also identified a lack of education and training in reprocessing RMDs as a significant gap for their practice. The AMH CSU nursing workforce data indicated a total of six staff for the CSU, including a nurse manager. The move to a larger, newly equipped CSU will mean an increase in staffing to undertake the multistep process that includes process control and monitoring to ensure the devices are safe for re-use. A recommendation has been made to implement significant training and support during commissioning of the new CSU and to explore ongoing access to education in sterilisation practices.

Standard 7: Re-usable medical devices is based on best practice according to the Standards Australia and Standards New Zealand AS/NZS 4187:2014 Reprocessing of re-usable medical devices in health service organisations. Information was also included from the WHO's *Decontamination and reprocessing of medical devices for health care facilities*, and the PNG *National Infection Prevention and Control Guidelines for Health Services*.

The standard for RMDs required a companion operating procedure document with step-by-step details of the work-related tasks. This document will assist staff to understand what tasks need to be done, how to do the tasks and which tools and equipment are needed for doing the tasks. The operating procedures in the CSUSOP are designed to enhance performance, improve efficiency and ensure quality by enabling consistent practice. The CSUSOP includes detailed operating procedures for:

1. cleaning
2. packaging
3. sterilising
4. sterile storage
5. process control and monitoring, including validation.

These operating procedures are designed to be applied in CSUs across PNG.

The operating procedures were developed and based on Queensland Health, Oral Health Sterilising Practices that were referenced to AS/NZS 4187:2014 Reprocessing of re-usable medical devices in health service organisations and the National Health and Medical Research Council (NHMRC) *Australian Guidelines for the Prevention and Control of Infection in Healthcare*.

Continutation of the project

The next phase of the project is to oversee the completion of the Kumul Helt Skul courses and conclude the series of interactive online workshops that are already underway. There are two sets of workshops:

1. to further clarify the perioperative standards for practice and CSU operating procedures
2. to conduct question-and-answer sessions about the new equipment for the new ORS.

The final phase of the project is to conduct in-country visits to mentor and advise staff about the relocation to the new ORS and CSU. This will include supporting nursing management and leadership with workflows, emergency responses, staffing, data management and ORS activity indicators.

This article has described ACORN's role in the project's scoping design, the development of a set of standards and operating procedures and the development and implementation of education and training. A second article will report on the completion of the project and the evaluation data.

Peer-reviewed article

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Prevention of post-operative nausea and vomiting with honey as a pre-operative oral carbohydrate: A randomised controlled pilot trial

Abstract

Background: Post-operative nausea and vomiting (PONV) is the second-most common post-operative complication. Prolonged pre-operative fasting is common in Australia despite guidelines recommending reduced fasting to improve patient outcomes, such as PONV. Commercially prepared pre-operative oral carbohydrate (OC) drinks may be used to reduce fasting time. In this study commercial products were replaced with honey, an inexpensive and common food item.

Design: Partially blinded, four parallel arms randomised controlled non-inferiority trial compared pre-operative OC loading with overnight fasting.

Methods: Adult elective laparoscopic cholecystectomy and thyroidectomy patients having two or more risk factors for PONV were allocated into intervention and control groups by simple randomisation. The intervention group ingested 60g of honey in 100 ml of water at least two hours before surgery as pre-operative OC loading to reduce PONV. Participants and assessors to the group assignment were blinded to the study outcomes. Early PONV (0–6 hours) was measured with Rhodes index of nausea, vomiting and retching (R-INVR) and a numeric rating scale (NRS).

Results: The four groups (N = 142) were control and intervention groups of thyroidectomy patients (n = 72: C = 37, I = 35), and control and intervention groups of laparoscopic cholecystectomy patients (n = 70: C = 37, I = 33) and had similar distributions of variables. The estimated effect size was 140 with a 95 percent confidence interval. The PONV incidence (Pearson $\chi^2 = 4.54$; df = 1; p = 0.03) and severity were significantly lower in the laparoscopic cholecystectomy intervention group (R-INVR: Mann–Whitney U = 446.5; p = 0.01; NRS: Mann–Whitney U = 444.5; p = 0.01) and results were not conclusive in the thyroidectomy group (NRS: Mann–Whitney U = 629.5; p = 0.95; R-INVR: Mann–Whitney U = 629.5; p = 0.76).

Conclusion: Honey could be recommended as an inexpensive pre-operative OC to reduce PONV in adult patients receiving general anaesthesia.

Keywords: pre-operative, carbohydrate loading, honey, post-operative nausea and vomiting, prevention, randomised controlled trial

Introduction

Overnight fasting of patients before surgery (no oral intake from midnight until surgery) is an outdated and harmful practice; however, it remains common in Australia. The fasting period is frequently prolonged – greater than 12 hours and up to 24 hours. Guidelines recommend reduced fasting and early post-operative oral intake to improve patient outcomes such as post-operative nausea and vomiting (PONV) and glycaemic balance. One strategy to reduce the fasting period is providing patients with oral carbohydrate (OC) drinks up to two hours before surgery. However, evidence-based guidelines on pre-operative fasting are poorly implemented and research is not being translated into reduced fasting times.[1,2]

Despite the improvement in anaesthesiology and surgical methods, PONV is the second-most common post-operative complication, experienced by approximately one third of all perioperative patients.[3–5] The aetiology and pathophysiology of PONV is multidimensional and not fully understood. The nausea and vomiting centre, located in the medulla oblongata of the brain, is thought to respond to chemoreceptor inputs from blood circulation, toxins or other stimulants received from the gastrointestinal tract, and other inputs from the cerebral cortex, thalamus and vestibular region.[5] PONV is considered to be a consequence of physiological stress, prolonged fasting time and anaesthetic agents.[6,7] Increased length of hospital stay and subsequent increased cost, discomfort, anxiety, incisional tension and pain can occur due to PONV.[8–10]

Recommendations for the prevention of PONV include reduced pre-operative fasting, early post-operative oral intake, determination of the risk groups and prophylactic interventions for those at high risk of developing PONV.[1,7] However, the best way to manage PONV has not yet been determined, although 5-HT3 receptor antagonists, glucocorticoids or a combination of these are used with limited efficacy.[1,11,12] Many studies have investigated the best practice for pharmacological PONV management; however, many had suboptimal methodology resulting in a weak to moderate level of evidence for prevention.[13–15] The recommended approach for managing PONV is to determine patients at higher risk of developing PONV and focus on prevention for this population rather than the current practice of polypharmacological interventions for all surgery patients. Polypharmacological intervention for PONV poses a risk of adverse effects, such as drowsiness and hypotension, and increases the cost of care. Non-pharmacological interventions for PONV include reducing the fasting time and pre-operative OC loading.[7,15,16]

Current recommendations regarding non-pharmacological interventions for managing PONV include oral pre-operative carbohydrate.[6,17,18] The evidence remains moderate as PONV is a multifaceted issue and previous studies lack inclusion of all relevant variables. For instance, some reports did not present an anaesthesia protocol, some were unclear regarding the medical management of PONV and very few included data regarding PONV risk factors; thus, making comparisons to results in future studies is difficult.[6,19,20] We have not found any studies that used honey as an oral pre-operative carbohydrate for PONV or any other type of nausea prevention.

The evidence for the effectiveness of pre-operative OC loading in reducing PONV has not been conclusive; however, it was recommended as a simple and safe intervention to reduce fasting time (gastric emptying time for clear fluids was determined between 60 to 90 min).[21–24] OC loading is described as ingestion of 400–800 ml of OC the night before surgery and 200–400 ml up to two hours before elective surgery.[1,6]

Studies indicate that reducing pre-operative fasting time improves patients' comfort, insulin resistance and stress responses in the post-operative period.[21,23] Moreover, the pre-operative OC loading improved post-operative insulin resistance and return of bowel function,[6,17] and did not increase the risk of aspiration.[22,25,26] The recommendations from anaesthesiology professionals resulted in commercial pre-operative drinks emerging in the market and being promoted to health care institutions with an additional cost. The content of these commercial pre-operative drinks varies but is usually a hypo-osmolar solution including around 50 grams of complex glucose, sometimes with vitamins and minerals.[22,27,28] The economic and environmental impact of manufacturing, packaging, storing and distributing is assumed to be a significant consideration when developing a commercial OC preparation, whereas using honey, a common pantry item that can be ingested by patients as preferred, avoids these impacts. Honey has been used for gastric mucosal protection and healing, and its consumption has been shown to be just as effective as sucralfate or allopurinol[29–31] in reducing glycated hemoglobin, LDL cholesterol, and fasting triglycerides.[32]

Previous studies measured PONV as a gastric complication, as described in the design section. Therefore, the current study was planned as a pilot superiority randomised controlled trial to support or refute our hypothesis that a natural nutrient source, honey, would be beneficial to prevent or reduce PONV.

Pre-operative OC has been beneficial for reducing PONV in a number of studies[6,33,34] and was recommended in the Enhanced Recovery After Surgery (ERAS) guidelines.[6] As a natural carbohydrate source, honey has an antioxidant effect with tocopherol, ascorbic acid, flavonoids and other phenolic-enzyme compounds in its structure.[35–37] To date, there are no published studies investigating the effect of honey consumption on PONV or any other type of nausea, to our knowledge.

Perioperative nurses are patient advocates for improving surgical outcomes and reducing the cost of health care. This study presents evidence and recommendations for reducing the pre-operative fasting period by replacing commercial carbohydrate products with a common food item, informing practice regarding non-pharmacological interventions and introducing a new method for managing PONV.

Aim

The aim of this randomised control trial (RCT) was to evaluate whether pre-operative oral honey and water intake is associated with a lower incidence and severity of PONV in adult participants, compared to overnight fasting.

Hypotheses

Hypothesis 1: Pre-operative oral intake of 60 g of honey in 100 ml of water is associated with a lower incidence and severity of early PONV for laparoscopic cholecystectomy patients, compared with standard pre-operative overnight fasting.

Hypothesis 2: Pre-operative oral intake of 60 g of honey in 100 ml of water is associated with a lower incidence and severity of early PONV for thyroidectomy patients, compared with standard pre-operative overnight fasting.

Methods

Study design

The study was designed as a single-centred, open-label randomised control non-inferiority trial with a 1:1 allocation ratio. The impact on PONV incidence and severity of oral administration of honey in water as oral carbohydrate loading to reduce fasting time was compared with overnight fasting.

PONV risk factors and the participants selection

The factors that affect incidence of PONV are: female gender, history of PONV or motion sickness, not smoking, younger age, general anaesthesia, use of volatile anaesthetics and nitrous oxide, use of post-operative opioids, longer duration of anaesthesia and type of surgery (cholecystectomy, laparoscopic, gynaecological).[1,5] We considered Koivuranta's five risk factors (female, age <50, non-smoking, duration of anaesthesia >60 min, history of PONV or motion sickness[38]) as they were indicated to be superior to Apfel's risk factors[39] (female, non-smoking, history of PONV or motion sickness, use of post-operative opioids[5]). To obtain more robust results in smaller samples, we aimed to include patients with two or more of Koivuranta's risk factors.

Elective laparoscopic cholecystectomy and thyroidectomy surgeries were targeted, to obtain consistent results with previous studies[24] and to reach a robust sample size for comparison, as these surgeries were frequent in the study setting.

Patients aged 18 to 79, having two or more Koivuranta risk factors for PONV[38] were approached between May 2017 and January 2018. Patients with diabetes, oral restrictions other than fasting, or pollen allergy were excluded (Figure 1).

Intervention (description of study procedures and methods)

The intervention in this study was the oral intake of a honey and water mixture as a pre-operative carbohydrate source. We compared the impact on PONV incidence and severity of oral honey intake with overnight fasting. Previous studies used 50 g (200 kilocalories) of carbohydrate in 400 ml of water two hours pre-operatively. The anaesthesiology department where the study was conducted limited the oral fluid to 100 ml. Therefore, our intervention was 60 grams of honey (200 kilocalories approx.) in 100 ml of spring water at room temperature. The mixture was ingested by participants up to two hours pre-operatively.

The honey used in the study was purchased from a single producer, collected in the same season and in the same region for consistency of chemical and glycaemic properties. The honey samples were tested for quality and confirmed to meet the quality standards of international consumable honey.[40]

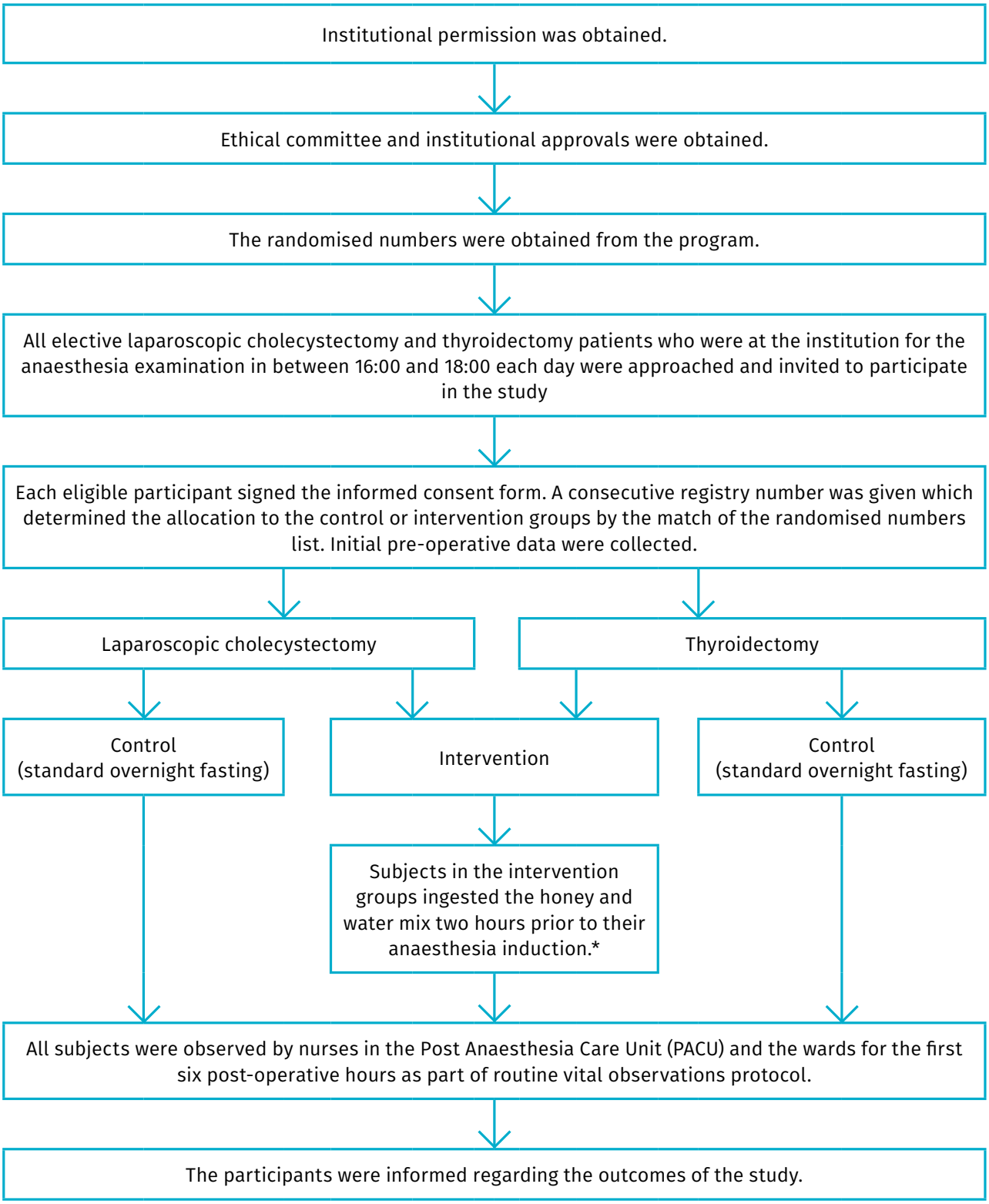

Figure 1: Research process diagram

*Subjects whose surgery was planned as second, third and fourth cases of the day were given the honey and water mixture an estimated two hours before surgery.

The primary investigator prepared a food-grade jar with 60 g of honey, marked each jar to the top-up point of 100 ml for water to be added and mixed before consuming. The hospital where the study was conducted admits perioperative patients at 7.00 am, and the first case of each operating room commences at 8.00 am. Therefore, the first patients of each operating room list were instructed to consume the mixture at 6.00 am before coming to the hospital and two hours before the anaesthesia induction. The primary investigator phoned the participants a day before the operation and repeated the instructions. Confirmation of drinking the mixture was sought on hospital admission by the primary investigator. The same investigator observed the participants' intake at the hospital for the remainder of the cases on each operating room list of the day from 8.00 am onwards. Patients who did not follow these instructions were excluded from the study.

All participants received the same protocol (as follows) for a general inhalation (inh.) and intravenous (IV) anaesthesia: propofol 1-1.5 mg/kg (IV), midazolam 0.03-0.05 mg/kg (IV), fentanyl 0.5-1 mg/kg (IV), rocuronium bromide 0.3-0.6 mg/kg (inh.), sevoflurane %2-3/L (inh.), prophylactic antibiotic 1 g (IV), paracetamol 1 g (IV), atropine sulphate 1 mg (IV), neostigmine methyl sulphate 2 mg (IV), famotidine 20 mg (IV).

Outcomes

There were two primary outcomes for this study:

1. the incidence of PONV per group over the early post-operative period (0–6 hours)
2. the severity of PONV per group over the early post-operative period (0–6 hours).

Data collection

The data collection form consisted of three sections:

1. participant characteristics – age, gender, education, height, weight, BMI, general health condition and planned type of surgery
2. PONV risk factors – gender, age, smoking status, anaesthesia medications, duration of anaesthesia and history of PONV or motion sickness[5,38]
3. post-operative complications – pain, bleeding, antiemetic use, PONV incidence and severity (measured by the Rhodes index of nausea, vomiting and retching (R-INVR) and the numeric rating scale (NRS) at each routine post-operative assessment for the first six hours post-operatively.

The first part of the data collection form was completed by the primary investigator during the pre-operative anaesthesia examination of patients. Data for the second section was pulled from the institutional patient data, and data for the third section was collected by nurses who were trained by the primary investigator prior to data collection. The nurses in the Post Anaesthesia Care Unit (PACU) and general surgery departments collected the post-operative data by observation and patient reporting in the first post-operative hour, and by patient reporting in the next five post-operative hours.

The R-INVR and NRS were used for PONV measurement along with routine post-operative observations which were conducted, according to hospital protocol, every 15 minutes in the first hour, every 30 minutes in the second hour and hourly thereafter. PONV incidence and severity were measured by R-INVR scores (eight items, 0–4 points; total of 0–32 points) and NRS (0 to 10 patient expression) in the early post-operative period, zero to six hours after surgery. The highest recorded scores of PONV within the observation period were used for the analysis; the intervention group was compared to the control group for each type of surgery.

Description of instruments, including measurement reliability and validity evidence

The R-INR and NRS are validated scales and have been used in previous studies of PONV. The R-INVR was developed by Rhodes and McDaniel in 1999, validated for PONV in adult patients by Kim et al. in 2007 and Genc and Tan proved language validity of the scale in 2010. It is widely used in the literature for PONV.[39,41–44] Responses are recorded using a scale ranging from '0' for no discomfort to '4' for the highest discomfort, with a total of 32 points for eight scale items. The internal consistency coefficient of the scale was 0.91; sub-dimensions alpha internal consistency coefficients were 0.81 and 0.89 for 'symptom development' and 'symptom discomfort' respectively in this study.

The NRS is a widely used tool and has been used in several studies to measure PONV in similar populations, including adult laparoscopic cholecystectomy patients. Patients were asked by nurses to rate their discomfort, nausea, vomiting/retching and pain on an NRS ranging from '0' for no complaints to 10 for worst imaginable complaint, during the routine post-operative care intervals. The highest score of the repeated assessments was recorded.

Both scales were approved by a panel of experts.

Sample size

The literature indicated the average incidence for PONV is around 30 per cent of patients. We aimed to reduce this by 50 per cent. For the power analysis, alpha was set at 0.05 and estimated power at 0.8. Estimated effect size of two independent groups was calculated at an average of 0.5 (d=0.50).[24] In consideration of any data loss and non-parametric analysis, the power analysis determined the sample size at a minimum of 140 participants – 70 laparoscopic cholecystectomy participants (35 in each of the intervention and control groups) and 70 thyroidectomy participants (35 in each of the intervention and control groups).

Simple stratified randomisation

The patients were assigned to the four groups – laparoscopic cholecystectomy control and intervention and thyroidectomy control and intervention – by simple randomisation using an online number randomisation service.[45] The primary investigator gave consecutive registration numbers to volunteering participants; these registration numbers were randomised and used to assign participants to a group (intervention or control). Allocation was marked only on the data collection forms, the patient records did not include any allocation information.

Partial blinding

This study was an open-label RCT. The outcome measures of the intervention were not disclosed to participants – information provided to participants included the general statement 'gastrointestinal system and other post-operative outcomes will be observed after surgery'. The nurses who collected the post-operative data were blinded to the group allocation of participants. The external expert who supervised the statistical analysis was not blinded to the group allocations.

Statistical analysis

Statistical analyses were performed with SPSS 21.0 (IBM Corp. released 2012, Armonk, NY, USA) package program. Descriptive statistics were mean, standard deviation, median, minimum–maximum, frequency, percentile and regression analysis.

We used Pearson's chi-squared test and Fisher's exact test in the comparison of discrete variables regarding the incidence of PONV. We performed Mann Whitney U test for comparisons between groups of continuous variables related to the severity of PONV with mean scores of the R-INVR and the NRS. $P < 0.05$ value was accepted for statistical significance with a 95 per cent confidence interval.

Ethical considerations

Following the institutional permits and ethical approval from Istanbul University, Cerrahpaşa Medical Faculty Ethical Board (03/05/2017-166977), health professionals in the relevant departments were informed. The primary investigator approached the patients at their pre-operative anaesthesia examination a few days before their surgery, provided verbal and written information about the study, and obtained written consent from voluntary participants.

We censored the patient identification information in the data set prior to the analyses, archived all patient data collection forms safely, and stored and protected the electronic data in an offline device.

Results

The study was conducted with a total of 142 participants in four groups; 72 of the participants underwent thyroidectomy – 37 were randomly assigned to the control group (T-control) and 35 to the intervention group (T-intervention); 70 patients underwent laparoscopic cholecystectomy – 37 were randomly assigned to the control group (LC-control) and 33 to the intervention group (LC-intervention). Table 1 shows the distribution of variables of the four groups.

The intervention and control groups were comparable in terms of type of surgery, age, gender, smoking status, PONV or motion sickness history and obesity. On the other hand, more participants in the intervention group had a history of gastric morbidity (presence of ulcer, gastritis, reflux, hiatus hernia, pain or gastric cancer), In addition, more patients received tramadol hydrochloride in the intervention groups of both types of surgery, and more patients in the thyroidectomy control group received dexamethasone compared to the intervention group.

Four of Koivuranta's five PONV risk factors[38] – being female, being younger than 50, being a non-smoker (tobacco) and having a history of PONV and/or motion sickness were included in the data collection to facilitate comparisons to results in future studies. Other PONV risk factors indicated in the literature, including opioid, antiemetic, or tramadol hydrochloride administration (opioid analgesic), and body mass index[1] (recorded as obesity) were included for the same reasons.

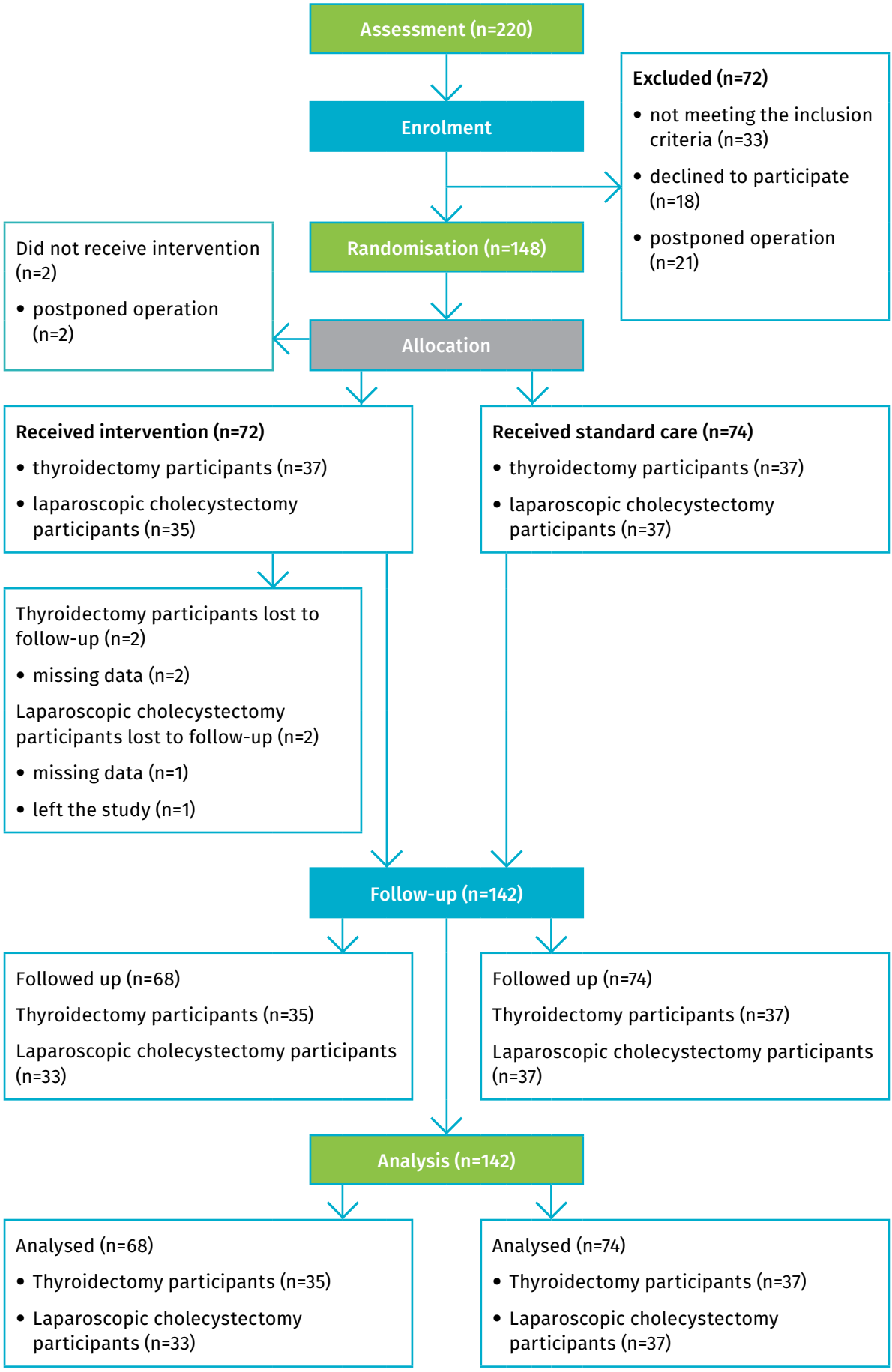

Figure 2: Modified Consolidated Standards of Reporting Trials (CONSORT) flow diagram for individual randomised controlled trials of nonpharmacologic treatments

Table 1: Distribution of variables between groups (N=142)

Variable		Control (n=74)	Intervention (n=68)
Operation	Thyroidectomy	37 (50.0%)	35 (51.5%)
	Laparoscopic cholecystectomy	37 (50.0%)	33 (48.5%)
Gender∝	Female	63 (85.1%)	52 (76.5%)
	Male	11 (14.9%)	16 (23.5%)
Age∝	Mean ± standard deviation	47.1±14.4	45.7±12.3
	Median (min–max)	50.5 (19–79)	45 (22–79)
Smoking status∝	Smoking	16 (21.6%)	19 (27.9%)
	Non-smoking	58 (78.4%)	49 (72.1%)
History of PONV and motion sickness∝*	No	60 (81.1%)	53 (77.9%)
	Yes	14 (18.9%)	15 (22.1%)
Obesity	No	47 (63.5%)	52 (76.5%)
	Yes	27 (36.5%)	16 (23.5%)
Gastric morbidity	No	47 (63.5%)	32 (47.1%)
	Yes	27 (36.5%)	36 (52.9%)
Use of tramadol hydrochloride	No	67 (90.5%)	48 (70.6%)
	Yes	7 (9.5%)	20 (29.4%)
Use of dexamethasone	Thyroidectomy	16 (43.2%)	6 (17.1%)
	Laparoscopic cholecystectomy	1 (2.7%)	3 (9.1%)

PONV = Post-operative nausea and vomiting; ∝ = Koivuranta risk factor; Gastric morbidity = presence of ulcer, gastritis, reflux, hiatus hernia, pain or gastric cancer

* All participants who had a history of PONV also had a history of motion sickness.

The time between the intervention (ingestion of honey and water mixture) and anaesthesia induction varied from two to five hours, as the daily operation lists were frequently updated; however, the difference in incidence of PONV was not significant (Spearmen's correlation -0.085, P=0.49).

Table 2 shows the incidence of PONV in the four groups. There was no significant difference in incidence of PONV in the R-INVR mean score comparison between the thyroidectomy groups (Pearson $\chi 2$ =0.038; p=0.84; df=1). However, a statistically significant lower severity of PONV was determined in the laparoscopic cholecystectomy intervention group than in the control group (Pearson $\chi 2$ =4.54; p=0.03; df=1).

Table 3 shows the mean R-INVR and NRS scores for each group. The R-INVR and NRS scores were statistically lower in the laparoscopic cholecystectomy intervention group than in the control group; no statistical significance was calculated between thyroidectomy intervention and control groups (Table 3).

Discussion

The intervention and control groups in the present study had a similar distribution of characteristics, including the PONV risk factors (gender, age, smoking status and

Table 2: Incidence of PONV by R-INVR (N=142)

Operation	R-INVR Score	Control n	Intervention n	Pearson $\chi 2$ / df	P *
Thyroidectomy	0	30 (81.1%)	29 (82.9%)	0.038 / 1	0.84
	>0	7 (18.9%)	6 (17.1%)		
Laparoscopic cholecystectomy	0	23 (62.2%)	28 (84.8%)	4.54 / 1	0.03
	>0	14 (37.8%)	5 (15.2%)		

R-INVR = Rhodes index of nausea, vomiting and retching (8 items of 0–4 points, total of 0–32 points); df = degrees of freedom

Table 3: Mean R-INVR and NRS scores (N=142)

Score	Operation	Group	n	Mean±SD	Median (min–max)	Mann-Whitney U	P
R-INVR	Thyroidectomy	Control	37	1.8±4.3	0 (0-17)	629.5	0.76
		Intervention	35	1.6±5.4	0 (0-30)		
	Laparoscopic cholecystectomy	Control	37	3.0±5.1	0 (0-23)	446.5	0.01
		Intervention	33	0.5±1.4	0 (0-6)		
NRS	Thyroidectomy	Control	37	1.1±2.5	0 (0-8)	629.5	0.95
		Intervention	35	1.1±2.4	0 (0-10)		
	Laparoscopic cholecystectomy	Control	37	2.0±2.7	0 (0-7)	444.5	0.01
		Intervention	33	0.4±1.4	0 (0-5)		

R-INVR = Rhodes index of nausea, vomiting and retching (8 items of 0–4 points, total of 0–32 points);
NRS = numeric rating scale (0–10)

history of PONV or motion sickness). The time between the intervention (ingestion of honey and water mixture) and anaesthesia induction varied from two to five hours, as the daily operation lists were frequently updated; however, the difference between PONV incidence and mean R_INVR was not significant. The incidence of PONV was significantly lower in the laparoscopic cholecystectomy intervention group; there was no significant difference between the thyroidectomy groups.

In line with the literature,[5,38,46,47] we believe the balanced distribution of factors affecting PONV among the groups strengthens the results of our study. Gastric morbidity can make a patient more prone to PONV[48] and history of gastric morbidity was more frequent in the intervention groups for both surgeries. Therefore, we considered the lower incidence of PONV to be another strength for the validity of the results.

Oral pre-operative carbohydrate solutions have been shown to be effective in reducing PONV in some studies. Yilmaz et al.[34] and Ayoğlu et al.[24] showed in their research that 200 kilocalories of carbohydrate and 400 ml of fluid administered to participants two hours before laparoscopic cholecystectomy surgery reduced early PONV, Weledji et al.[35] showed positive effects of pre-operative oral carbohydrate intake on metabolic and endocrine surgical stress response and an RCT by Hausel et al.[21] showed that pre-operative carbohydrate solutions could reduce PONV.[16] In contrast, Poyraz[49] examined the effects of pre-operative oral carbohydrate solutions on surgical stress response and did not find any significant difference. A number of systematic reviews and guidelines stated the need for more robust RCTs that include an anaesthesia protocol, antiemetic treatment and rescue treatment.[2,50,51]

We observed a significantly lower occurrence of PONV in the intervention group compared to the control group of laparoscopic cholecystectomy participants. In thyroidectomy participants, significantly more patients received dexamethasone in the control group to prevent vocal cord oedema. The lack of significant differences between the thyroidectomy groups may be associated with the antiemetic effect of dexamethasone.[52,53] Lauwick et al.[54] also reported no difference in PONV with oral carbohydrate administration with thyroidectomy participants. They indicated that factors such as pharynx and vagal nerve stimulation may have affected their results and that a more detailed examination was necessary to draw conclusions.[54]

Post-operative nausea and vomiting is one of the most common perioperative complications, and pre-operative oral carbohydrate administration is recommended for its prevention. Honey is a natural and available source of carbohydrate. Pre-operative oral honey and water administration can reduce the incidence and severity of PONV.

In-service or postgraduate education programs for perioperative health professionals could include up-to-date recommendations for improved patient care, such as ERAS protocols which involve reducing pre-operative fasting time and providing pre-operative oral carbohydrates.

Anaesthetists, surgeons and perioperative nurses should be informed of the consequences of prolonged fasting practices and recent evidence regarding the safety of pre-operative oral intake. Studies have shown no changes in gastric emptying time between individuals (including patients with obesity or diabetes, unless gastric reflux was present) or any risk of aspiration for fluids ingested up until two hours prior to surgery. These findings from oral carbohydrate loading were equal to overnight fasting.[1,55] The recommendations for all solid and liquid dietary intake have been present for quite some years; however, today's routine surgical practices still do not reflect those recommendations.

Despite the fact that general anaesthesia practices have been trending towards the reduction of volatile anaesthetics to reduce PONV, the issue seems to remain pertinent. Therefore, further studies to modify risk factors and reduce the incidence of PONV are recommended. Considering that the results for thyroidectomy participants in our study were not significant, covariate-adaptive randomisation is recommended in future studies to obtain definitive evidence for this type of surgery and the relation between the use of dexamethasone and PONV.

Strengths and limitations

The R-INVR and NRS scales used in this study to measure outcomes and to define risk for PONV were previously validated, and the sample size was sufficient. Data was presented regarding the type and total dose of medications that impact emesis, such as anaesthetics, antiemetics, tramadol-HCl and dexamethasone. This will assist with replication of the study and applicability of the results. However, PONV incidence in total intravenous anaesthesia should be further investigated as our study included combined inhalation and intravenous anaesthesia protocols.

Identified limitations are that the study was conducted in a single centre, and the primary investigator registered the participants and conducted randomised allocation. A potential bias could exist during the study's introduction; however, we prevented this by providing the same information to all participants and blinding the nurses collecting the data to the group allocation. The interrater reliability for the nurses' collection of the data was not analysed and this could present another limitation.

The use of dexamethasone and antiemetic treatment, tramadol hydrochloride, could not be standardised across groups. The total doses of each medication administered were analysed, and no influence on the primary outcomes was determined. The time between intervention (participants ingesting the honey and water mix) and anaesthesia induction also varied between participants, as the operation list of the day was frequently updated. The amount of time from the intervention to anaesthesia induction varied from two hours to five hours, and this was analysed against PONV outcomes using regression analysis; however, the difference appeared not to be statistically significant.

Conclusion

In this RCT, it was discovered that honey could be recommended as a simple and inexpensive pre-operative oral carbohydrate to prevent or reduce PONV in adult participants receiving general anaesthesia (combined inhalation and intravenous administration) undergoing laparoscopic cholecystectomy. Honey, which is a common and economical nutrient, is available as an effective intervention for PONV prevention and is an alternative to commercially prepared, processed carbohydrate which is less economical.

Knowledge translation

- PONV is presently one of the most common perioperative complications. Pre-operative oral carbohydrate administration is recommended for PONV prevention.
- Honey is a natural, economical and readily available source of carbohydrate. Pre-operative oral honey and water administration can reduce the incidence and the severity of PONV in laparoscopic cholecystectomy.

Conflict of interest and funding statement

The authors have declared no competing interests. No funding was used.

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Improving perioperative communication: Can labelled theatre caps play a role?

Abstract

Studies have shown that approximately one third of operating room communications fail. This has a negative impact on patient safety, with half of all adverse events being attributed to communication failures. However, human factors have the capacity to protect patients. Aviation's human factors strategies provide guidance for staff and are beneficial in the operating room. Currently, no intervention is universally applied to improve operating room communication and team performance. Closed loop communication, though poorly utilised, has been demonstrated to counteract communication errors, therefore protecting patient safety. In 2018, calls were made to take advantage of theatre caps to display staff member's name and/or aid staff identification and communication. Further research into this initiative with larger participant numbers in a variety of specialities, especially emergency situations, and with greater scrutiny of infection prevention and control guidelines should be considered.

Keywords: communication, patient safety, human factors, staff identification, mental recall

Introduction

In 1995, a retrospective study of Australian hospital admissions (n = 14 000) by Wilson et al.[1] revealed that adverse events were associated with 16.6 per cent of hospital admissions, and half (51%) were considered preventable. Communication was identified as one area requiring improvement to prevent these events reoccurring (11.1%, preventability 81%).[1] Today, preventable adverse events continue to occur globally, with communication still negatively impacting patient safety.[2–4]

Gillespie and Davies[5 p.39] defined human factors 'as the interrelationships between people and their environment and each other' and communication failure has been identified as the most significant human factor influencing adverse events.[4,6] Within Australia, this continues despite the National Safety and Quality Health Service standard 'Communication for safety'.[7] The operating room (OR) is a complex and dynamic environment providing many barriers to effective communication; however, high performing perioperative teams communicate effectively and have better patient outcomes.[6,8]

In 2004, Lingard et al.[9] concluded that approximately a third (30.6%) of OR procedural communication failed, with similar results (32.7%) noted by Garosi et al.[3] in 2020, indicating that communication is still ineffective, despite calls for improvement. Several interventions have been suggested to improve OR communication and staff identification including, among others, eliminating non-procedural conversations, simulation, colour-coded stickers or theatre caps, writing names on a whiteboard and, recently, displaying name and/or role on the theatre cap.[3,4,10–13]

In 2018, English midwifery student, Alison Brindle, devised the #TheatreCapChallenge which Rob Hackett, an Australian anaesthetist, then championed.[14] They both labelled their disposable theatre cap by writing their name and role on it to aid communication and prevent misidentification.[15] This discussion paper will examine the elements required for effective communication, and the role labelled theatre caps may play in staff identification and communication within the perioperative environment. Thematic analysis of reviewed literature will be presented under the following three themes: 'effective communication', 'staff and role identification' and 'labelled theatre caps'.

Discussion

Health care's adverse event numbers have remained relatively unchanged while aviation's error rate has significantly reduced.[16] Aviation's human factors training, or crew resource management, was developed to combat complications arising from human factors, such as communication between team members.[16,17] Aviation recognised that human factors rather than equipment or technical skills were responsible for accidents.[16] Similarly, OR adverse events have predominately been attributed to human factors or nontechnical skills – particularly communication but also teamwork, situational awareness and leadership.[18,19] Communication failure impedes teamwork and approximately half of all adverse events are attributed to it.[4,6] Studies indicate that communication failure occurs in almost all operations, with ineffective communication noted in every observed procedure and occurring every seven to eight minutes.[3,6] Interprofessional communication is more susceptible to failure due to differing education, roles, perspectives and priorities.[6,20] Kenway and Schwaltz's[16] survey (n=67) explained that staff strongly agreed that communication is important (p = 0.52) but acknowledged that its quality is not of a high standard. A qualitative study by Paige et al.[21] indicated that staff (n = 15) consider that effective communication is a vital component of efficient teamwork and assists situational awareness. Adverse events are predominately attributed to communication failures but these small studies indicate that OR personnel recognise the importance of communication.[16,21]

Adam-McGavin et al.[18] in a cross-sectional study analysing data from an OR black box, a data capturing device, noted that while poor human factors predominately contribute to adverse events, well executed human factors have the capacity to protect patient safety. Three quarters of the observed strategies that protected patient safety were attributed to human factors, as humans can adapt to change.[18] Interventions directed at improving human factors will target the source of the greatest threat to patient safety.[18] Jackson[19] suggests that as clinical complexities are increasing, communication skills must improve; and aviation strategies, such as checklists, clear messaging, read back and names are applicable.[4,6] Etherington et al.[6] propose identifying creative solutions to counteract communication barriers and call for further research to improve communication within the operating room.

Effective communication

Communication is the process of transferring information, by verbal or nonverbal methods, between individuals.[22] Information is not only transferred between sender/s and receiver/s, it must also be recognised and interpreted by the receiver/s, who rely upon verbal, paraverbal (for example, tone and pitch) and nonverbal cues.[6] OR staff must focus upon effective verbal cues as the communication process is compromised in the OR environment[6,20], which is complex with numerous simultaneous senders and receivers, multitasking, masks and reduced nonverbal cues. For the process to be successful, there needs to be more than an impression that communication has occurred and information must be interpreted exactly as intended by the sender.[23] Therefore, verbal communication must be audible, concise and use universally recognised vocabulary rather than jargon.[20] Structured formats and checklists enhance communication but closed loop communication, with read back, provides an opportunity to counteract communication failures.[23,24]

Closed loop communication originates from military radio communications and comprises three phases.[23] Flemming and Carpini[23] describe these phases as:

1. the sender transmitting information to an intended receiver
2. the receiver acknowledging and reading back their interpretation of the received information
3. the sender confirming that the interpretation is correct, thus closing the loop.

This communication loop eliminates ambiguity, permits questioning and has the potential to protect patient safety; however, it is poorly utilised in health care.[23] Objective analysis of an operative emergency simulation concluded that approximately half of the messages were non-

directed.[25] Etherington et al.[6] indicate that this may be attributed to limited research assessing closed loop communication within ORs; however, trauma research highlights closed loop communication's effectiveness.[23] In a retrospective observation study of paediatric trauma, El-Shafy et al.[25] illustrated that closed loop communication significantly reduced time to complete tasks. Tasks were completed 3.6 times faster (95% CI (confidence interval) [2.5–5.3], p<0.0001).

Closed loop communication relies on targeting the intended receiver/s using an individual's name; therefore, not knowing the name of other team members contributes to poor communication and potential adverse events.[4,13] Using names is comparable to aviation's use of callsigns.[4] Hardie et al.[4] indicate that in circumstances where names are unknown, using role titles is superior to making the request generalised with 'you' or 'someone'. Generalised requests result in no-one responding, the 'bystander effect', as everyone thinks that someone else will respond.[3] In noisy environments, humans can recognise familiar words such as their name, the 'cocktail party effect'; therefore, using names draws attention faster than a generalised request.[26] Name usage promotes positive action, or feedback, and good team performance.[3,27]

Staff and role identification

The Garling Report, a New South Wales public hospitals' Special Commission of Inquiry 2008 report, made recommendations to assist health care communication.[28] Colour-coding uniforms, according to professional role, with name badges displaying name and role in large print, was one recommendation.[28] Similarly, in 2009 the World Health Organization (WHO) released guidelines regarding safety in surgery.[29] The WHO's evidence-based surgical safety checklist was introduced, as an intervention to reduce medical errors and improve patient safety, by addressing interprofessional communication weaknesses.[30] The first requirement of 'time out', or 'surgical pause', is an introduction of everyone's name and role.[30] These introductions acknowledge that OR staff allocation is fluid and identifying everyone is vital to effectively manage high risk circumstances.[30]

Both the OR environment and human nature present barriers to these recommendations.[6] Colour-coding uniforms enables 'object communication', a form of non-verbal communication; however, within the OR environment attire overwhelmingly is a universal colour, while name badges are frequently covered by surgical attire and difficult to read from afar.[10,29] A small survey (n = 15) of OR staff at a single centre noted that introductions are an opportunity to commence communication, reducing obstacles.[21] However, introductions during time out are frequently poorly executed.[14] Ethnographic observations, in a single centre and surgical speciality, noted that only the initial procedure included staff introductions during time out.[31] This was attributed to the Hawthorne effect – when normal behaviour is not displayed because there is an awareness of being observed – as eye contact was made with researchers.[31] Time out frequently occurs with some team members absent for a variety of reasons.[11,31] Surgeons and radiographers are frequently not present due to conflicting obligations and availability, while additional staff arrive during a procedure as a substitute or due to an emergency.[11,31,32]

Bahrick, Bahrick and Wittlinger's[33] salient research, illustrated that humans are able to remember faces but remembering names is problematic. Introductions during time out, therefore, may not be enough. Birnbach et al.[34] objectively concluded that, on the whole, team members could not name their colleagues at the conclusion of procedures that used the WHO's surgical safety checklist. Of the 150 participants, the anaesthetic resident was the least known (28%); however, Birnbach et al.[34] acknowledge that results may be determined by the size of a facility, thus limiting generalisability. Attitudes towards knowing names and having names known was different between professional groups. Surgeons believed it was more important that everyone knew them than that they knew other's names, anaesthetists believed it was more important that they knew others than that others knew them, and nurses rated knowing and being known of roughly equal importance.[34] Similarly, Bodor, Nguyen and Broder's[35] research (n = 50) found that accuracy rates for identifying team members were highest within disciplines (surgeons 84%, anaesthetists 83%, nurses 100%). However, outside their own professional discipline comparative accuracy rates were lower and the differences between disciplines were statistically significant (p<0.0001).[35] While nurses demonstrated the best accuracy, their average accuracy of identification was only 54 per cent when identifying surgeons and 65 per cent when identifying anaesthetists.[35] Anaesthetic trainees remained the least known with some not known at all, especially by surgeons.[35] However, it was not known if introductions were conducted during time out in Bodor, Nguyen and Broder's research.

Labelled theatre caps

Through social media platforms, #TheatreCapChallenge has gained momentum; however, research assessing its impact is minimal.[29,36] Four quality improvement studies were located.[14,27,29,36] All four studies indicated that knowledge and usage of names improved but the study sample sizes were small (n = 100,[14] n = 236,[27] n = 84,[29] n = 78[36]) so caution is required when generalising the results. Douglas et al.[27] conducted a before-and-after study (n = 236, 107 responses) and reported a statistically significant decrease ($p<0.001$) in staff not knowing names of team members (before M (mean) = 3, after M = 2). Midwives were the only group to have a statistically significant ($p<0.001$) improvement in teamwork (before M = 3, after M = 4), suggesting labelled caps were beneficial for transient staff members such as midwives.[27] Only one randomised study, underpowered and unblinded, was located, it assessed the effect of labelled caps on communication during elective caesarean sections (n = 20).[8] Brodzinsky et al.[8] found a statistically significant difference regarding staff's knowledge of names ($p<0.011$, 95% CI [64.4% – 88.0% labelled versus 41.6% – 67.9% unlabelled]). Four observed miscommunications were corrected when a name was used.[8] The impact of using labelled theatre caps during emergencies remains unclear as the number of emergency cases in these studies was limited.[8,27,29]

Three quarters of patients indicated that they liked the labelled caps, mirroring support provided by a patient collaborative committee.[8,36] In addition, labelling theatre caps is viewed as low cost and study results appear favourable; however, barriers were identified.[14,27,29,32,36] Some participants were concerned the caps appear unprofessional, others felt they are irrelevant because they know everyone, while some had difficulty containing their hair within the style of cap used for the trial.[14,27,32] The most significant barrier identified is that disposable caps, as suggested originally by Alison Brindle,[13] have evolved into cloth hats. There are issues associated with cloth hats due to specific infection control standards for the manufacture and laundering of cloth hats and the types of fabric they are made from.[37] Proposed solutions include labelling the disposable theatre cap or covering a cloth cap labelled with a dark font with a disposable theatre cap.[38]

Conclusion

The incidence of adverse events in health care has remained relatively unchanged despite almost half of the events being considered preventable. In 1995, communication failures were highlighted as significantly contributing to patient adverse events, with calls for improvement. However, recent studies have indicated that OR communication has not improved. Aviation has successfully demonstrated the effectiveness of human factors training which may pave the way for perioperative safety. Closed loop communication and name usage are examples of two strategies intended to improve communication and reduce adverse events.

Care is required to ensure that staff introductions take place as part of team time out before each case. Labelling theatre caps may provide one solution to improve OR communication and this could be achieved by labelling disposable theatre caps or labelling cloth caps that have been manufactured according to appropriate standards and laundering them after each surgical session.

Further research with larger participant numbers in a variety of specialities and circumstances, especially emergency situations, is required. Solutions that meet infection prevention and control standards must be sought and transient staff, such as radiographers, midwives, student doctors and nurses and company representatives, must be considered if implementing this intervention.

Having team members' names and/or roles displayed on their theatre caps appears, in principle, beneficial for promoting closed loop communication and a safety culture within the perioperative environment. This must be balanced with adhering to infection prevention and control standards and guidelines.

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Peer-reviewed article

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Measuring surgical patient engagement: A scoping review

Abstract

Background

Patient engagement is a patient's capacity and willingness to participate and collaborate in their own health care. This scoping review aimed to identify tools used to measure engagement among surgical patients, the levels of engagement and the association between engagement and surgical outcomes. We hypothesise that highly engaged patients are more likely to achieve better surgical outcomes.

Review methods

MEDLINE/PubMed, CINAHL, SCOPUS and Embase were searched for studies that assessed adult perioperative patients for engagement. Analysis from charting the data identified the measurement tools, levels of capacity to engage and relationships between engagement and surgical outcomes.

Results

Twelve studies were selected out of 3975 identified; three valid and reliable tools to measure surgical patient engagement – Patient activation measure (PAM®), Patient health engagement scale (PHE-s) and Hopkins rehabilitation engagement rating scale (HRERS) – were identified, as well as levels of engagement. The capacity to engage was categorised into two, three or four levels. High levels of engagement were associated with enhanced patient satisfaction, better adherence to physical therapy, and decreased pain and disability.

Conclusion

There are valid and reliable tools to measure the capacity of surgical patients to engage in their post-operative recovery; PAM® is the most frequently used tool. Patients with higher engagement are more likely to report better physical health and greater satisfaction with their surgery. Using these tools could assist health care providers in the early identification of patients at risk of poor recovery and provide tailored support.

Keywords: patient engagement, levels of engagement, patient activation measure, surgery, scoping review

Background

Surgery is a major component of the health care system with 2.7 million[1] surgeries performed annually in Australia. While a patient's surgery may be successful, the success of their recovery is not guaranteed. In Australia and New Zealand, 30 complications occur in every 100 patients.[2] Encouraging patients to engage in perioperative care education shapes effective collaboration between patient and provider, prevents complications and promotes patient recovery.[3] Also, importantly, those who experience fewer post-operative complications are more likely to express higher satisfaction.[4]

In the current health care system, patients are motivated to participate[5] and hospitals are adopting patient-centred approaches to promote patient engagement[6]; however, patients feel there is limited opportunity to do so due to the power imbalance between health care providers and themselves.[5,6] Studies have shown that behaviours of health care providers, including nursing staff, such as ignoring patient knowledge[6,7] and providing insufficient information,[7–9] prevents patient participation[6] and leads patients to adopt a passive role in their care.[7–9] As such, there is a recognised urgency to empower patients to engage in their health care. Despite this, when encouraging patients to participate in their health care, health care providers often disregard a patient's ability to engage[6] and often presume the level of a patient's understanding of their surgical journey.[7] This frequently results in a 'one size fits all' approach to educating patients.

Tailored education is important to promote patient engagement, as it provides patients with the appropriate knowledge and skills to take ownership of their health and make informed decisions. It also promotes effective communication between patient and provider. It is therefore essential for health care providers to understand their patients' levels of engagement so they can provide effective, tailored support[8] to minimise the impact of post-surgical complications on patients' physical and mental health.[9]

Patient engagement

Patient engagement consists of behaviours that are shaped by degree of participation, according to patients' desires and capabilities, and influenced by partnership with providers and institutions.

Patient engagement involves four developmental phases:

1. blackout – disengaged and overwhelmed
2. arousal – gaining awareness but lacking knowledge
3. adhesion – taking action
4. eudaimonic – accepts the 'patient identity' and integrates and maintains health care behaviours.[10]

Patient engagement shifts the patient role from a passive participant in the health care system to an active member of the health team. Engaged patients are able to access and process information, participate in decision-making and act in their health care. They are more likely to manage their condition by adhering to treatment plans, take preventative health measures and ask questions when confused. These behaviours are important because they can facilitate patient recovery. Compared to less engaged patients, more engaged surgical patients report better post-operative surgical results, reduced pain and greater adherence to physical therapy (PT).[11–13]

Current interventions (e.g. health behaviour change counselling,[14] decision aids and health information technology[15,16]) have been designed to include patients in their ecosystem of care; however, before interventions can be implemented it is essential to first understand a patient's capacity to engage. This knowledge is vital to identifying barriers to patient engagement and determining areas where patients need more support.

We conducted a scoping review which aimed to provide an overview of current patient engagement measures, the levels of engagement measured among surgical patients and the associations between engagement levels and surgical outcomes. Our findings will assist health care professionals involved in caring for surgical patients to choose the appropriate tools to understand their patients' capacity to engage.

Methods and analysis

Protocol design

A scoping review is appropriate as we aimed to explore the available tools to measure patient engagement and identify key characteristics of and factors that influence surgical patient engagement.[17] This scoping review was written in accordance with the framework proposed by Arksey and O'Malley[18] which has been further enhanced by Levac et al.[19] and The Joanna Briggs Institute (JBI).[20] This framework organises the review process into a minimum of five stages:

1. identifying the research questions
2. identifying relevant studies
3. selecting studies
4. charting the data
5. collating, summarising and reporting the results.

Stage 1: Identifying the research questions

The following research questions were identified based on an initial exploratory study of the literature on patient engagement in surgery and discussions with members of the research team:

1. What are the tools used to measure levels of engagement among surgical patients?
2. What are the levels of engagement measured among surgical patients?

3. Are levels of engagement associated with surgical outcomes?

The following assumptions were made to further clarify the definitions of common terms used when formulating research questions:

1. 'patient engagement' involves increasing or promoting patient knowledge, skills, ability and willingness to manage their own health and care, or meaningful and active patient–provider collaboration (i.e. shared decision-making and asking questions related to their care)
2. 'surgical patients' are individuals in their perioperative phase (from the time the patient goes into surgery until the time the patient goes home
3. 'surgical outcomes' include results of surgery, pain levels, rate of hospital readmission and adherence to PT sessions.

Stage 2: Identifying the relevant studies

The four selected databases were MEDLINE/PubMed, CINAHL, SCOPUS and Embase. An initial search was conducted using key concepts within our research questions: 'patient engagement', 'surgery', 'outcomes', 'measure' and 'levels of engagement'. To elicit more relevant articles, search terms were reviewed to include: 'consumer', 'client', 'perioperative care', 'questionnaire', 'scale' and 'survey'. Producing irrelevant search results, 'consumer' was excluded. Upon discussion with the research team, the search terms were finalised as follows: AB (measure OR questionnaire OR survey OR scale) AND AB (surgery OR surgical patients OR perioperative care) AND AB (patients OR perioperative care) AND AB (patient engagement OR patient activation OR patient participation OR patient experience OR patient involvement). See supplement 1 for an example search history.

Stage 3: Selecting studies

Search results were combined, with duplicates removed. Articles were screened for their title, abstract and index terms, to ensure all eligibility criteria were met, and categorised into the following groups: 'exclude', 'include' and 'maybe'. The full text of the articles in the 'maybe' and 'include' groups were screened then checked by another researcher to ensure consistent application of the eligibility criteria. 'Maybe' group articles were found to explore aspects of patient engagement (e.g. decision-marking, health literacy and empowerment), but not patient engagement in its totality. As such, these papers were excluded.

The inclusion criteria were subjects being adults ≥ 18 years old, subjects being surgical patients during the perioperative period, the study assessed patient engagement and the report was published in English. Being a scoping review, all publication types were included (i.e. guidelines, theses, etc.). Qualitative studies and studies not assessing levels or measures of engagement were excluded and no timeframe was included due to the potential of limited search results.

Stage 4: Charting the data

In scoping reviews, data extraction is referred to as charting the results. Data was entered in an Excel spreadsheet and collected on the following information: year of publication, author, country of origin, title, aim, study type, selection criteria, study population and sample size, type of patient engagement measure used, levels of engagement measured, results and conclusion.

Stage 5: Collating, summarising, and reporting the results

Analysis of the data provided information about the levels of engagement among surgical patients and the associated surgical outcomes. This identified the actions and behaviours of surgical patients associated with each level, highlighting the potential surgical outcome benefits and the impact of enhanced patient engagement. Furthermore, it determined gaps in the literature and under-researched areas that require further investigation. Findings are presented in tables and charts where appropriate.

Results

The literature search yielded a total of 3973 articles with two articles identified through hand searching. 339 duplicates were removed. After the initial screening of article titles and abstracts, 95 full-text papers were screened, of which 12 were included in the final review. The detailed process of articles identified, screened, excluded, selected and reviewed is depicted in Figure 1.

Characteristics of the selected articles

Articles were primarily published as of 2011 and from the United States of America (USA). Over one third were longitudinal studies and spine surgical populations were primarily assessed (8 of 12 articles). Table 1 provides a summary of the studies and supplement 2 is the complete data extraction of the study characteristics.

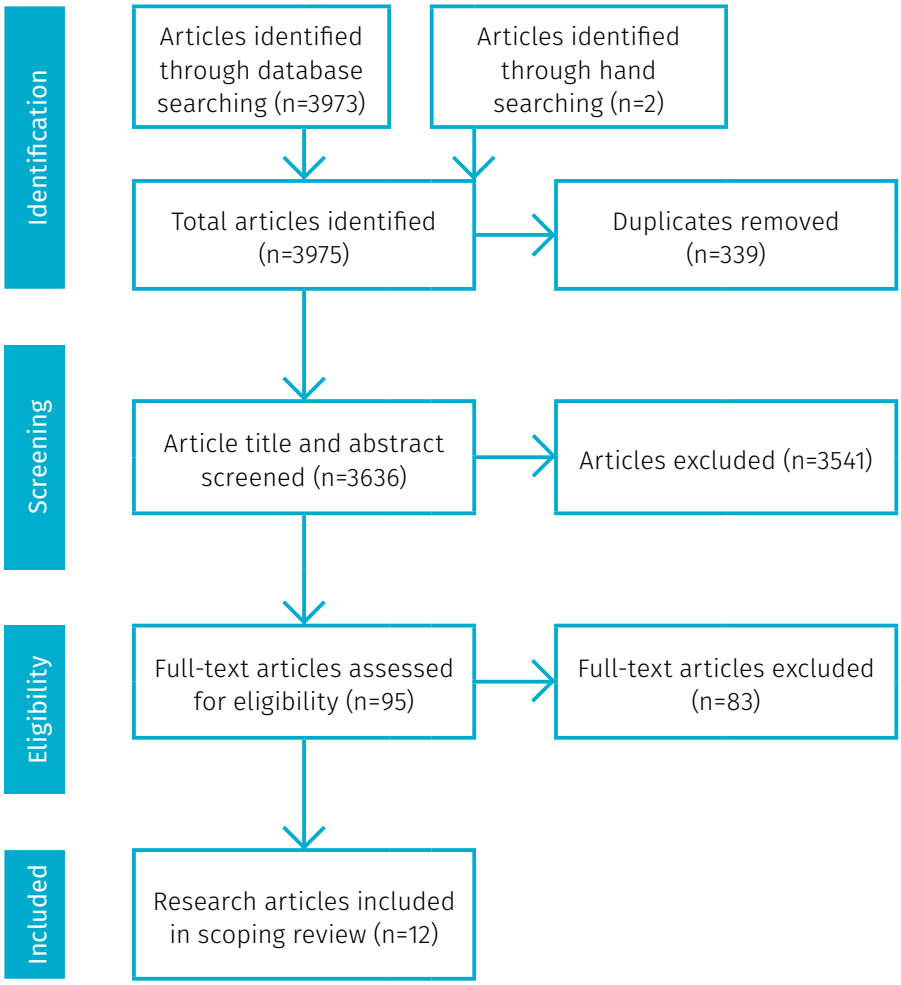

Figure 1: Study selection process

Measures of patient engagement

Three tools were identified: Patient activation measure (PAM®), Patient health engagement scale (PHE-s) and Hopkins rehabilitation engagement rating scale (HRERS). All tools are validated and reliable measures of patient engagement, designed to be short and feasible for a wide audience with different comprehension skills. PAM® was the most commonly used scale (10 of 12 articles) and is available in over 35 validated translations.[21]

Table 2 compares features of the patient engagement measures.

The self-reported PAM® and PHE-s are used across a variety of health conditions and disease prevention efforts. PAM® captures the six dimensions of patient activation in 10 or 13 items to assess patient willingness, knowledge, skill and confidence to manage their health care. PHE-s is a five-item psychometric questionnaire that describes patient's experience along a continuum of the four phases of engagement.[10] In contrast, the five-item clinician-rated HRERS specifically quantifies patient rehabilitation engagement through behavioural observations.[14] Unlike PAM® and PHE-s, HRERS cannot capture engagement throughout the entire perioperative process.

PAM® uses a five-point Likert scale where patients rate their level of agreement with each item to produce an activation score between 0 and 100. PHE-s uses a seven-point Likert scale, allowing patients to rate themselves between engagement positions to facilitate more accurate responses. PHE-s scores are calculated as the median of item scores, ranging from 1 to 4, which corresponds to an engagement phase. HRERS uses a five-point scale, ranging from 'never' to 'always'. Scores are calculated by summing ratings minus the score of item 2, to produce an overall score ranging from 5 to 30. For all measures, the higher the score, the greater the engagement.

Levels of patient engagement

Patient engagement is a developmental process that involves levels or phases. In the literature, engagement was categorised into two to four levels – two levels (low and high),[12–14,26–28] three levels,[29] four levels[10,30–34] – with two and four being the most common. While PAM® and PHE-s identify four levels of engagement, PAM® determines the levels based on patient perception of participation in their care process – passive and overwhelmed (score ≤ 47.0), lack of knowledge and confidence (score 47.1–55.1), taking action but lacking confidence and skills (score 55.2–67.0) and adopting new behaviours but unable to maintain them under stress (score ≥ 67.1).[31,32–34] PHE-s describes them according to the emotional and psychodynamic components throughout the engagement experience – blackout = 1, arousal = 2, adhesion = 3 and eudaimonic = 4.[10]

Table 1: Summary of studies included in this scoping review assessing patient engagement among surgical patients

		Number of articles (n= 12)	Percentage of articles
Year of publication	2006–2010	1	8%
	2011–2015	5	42%
	2016–2020	6	50%
Country	USA	11	92%
	Italy	1	8%
Type of article	conference abstract	1	8%
	longitudinal study	4	33%
	clinical trial	2	17%
	observational study	1	8%
	prospective cohort study	1	8%
	qualitative study	1	8%
	retrospective study	1	8%
	review	1	8%
Surgical population studied	adult spinal deformity (ASD) surgery	1	8%
	lumbar and cervical spine disorders	6	50%
	spine surgery and spinal cord stimulation	1	8%
	hand and upper extremity surgery	1	8%
	primary hip or knee arthroplasty (THA/TKA)	1	8%
	thoracic surgery	1	8%
	thyroidectomy, colectomy or proctectomy	1	8%
Patient engagement measure used	PAM®-10	2	17%
	PAM®-13	8	67%
	PHE-s	1	8%
	HRERS	1	8%
Number of levels of engagement measured	2	6	50%
	3	1	8%
	4	5	42%

THA = total hip arthroplasty, TKA = total knee arthroplasty, PAM®-10 = 10-item Patient activation measure, PAM®-13 = 13-item Patient activation measure, PHE-s = Patient health engagement scale, HRERS = Hopkins rehabilitation engagement rating scale

Table 2: Comparison of patient engagement measures

	Patient activation measure (PAM®)	Patient health engagement scale (PHE-s)	Hopkins rehabilitation engagement rating scale (HRERS)
Person who rates	patient	patient	clinician
Purpose and dimensions	To assess patient activation: • self-management of symptoms • engagement in treatment plan • shared decision-making • collaboration with health care providers • informed choices of provider based on quality • navigating the health care system.	To assess patient engagement: • blackout – disengaged and overwhelmed • arousal – gaining awareness but lacking knowledge • adhesion – taking action • eudaimonic – accepts the 'patient identity' and integrates and maintains health care behaviours.[10]	Assess patient engagement during rehabilitation: • therapy attendance • attitude toward therapy • need for verbal or physical prompts to facilitate initiation or maintenance of therapy engagement • recognition of the need for therapy • level of active participation in the therapy.
Number of questions	10 or 13	5	5
Time to complete*	<10 minutes	<5 minutes	<5 minutes
Number of languages available in	51	5 (Chinese, English, Italian, Spanish and Turkish)	1 (English)
Score range	0–100	1–4	5–30
Levels of engagement**	1. passive and overwhelmed 2. lack of knowledge and confidence 3. taking action but lacking confidence and skills 4. adopting new behaviours but unable to maintain them under stress	1. blackout 2. arousal 3. adhesion 4. eudaimonic	1. low 2. high
Reliability and validity	Internal consistency (Cronbach α= 0.81).[22] Validity: higher proportion of participants with low activation in unplanned admission group for both oncology and cardiology service lines (p = 0. 007, and p = 0. 047, respectively).[22]	Internal consistency (ordinal alpha via empirical copula= 0.85).[23] Reliability (PSI= 0.884).[23] Correlations between PHE-s and PAM® (r = 0.431, p < 0.001).[23] Test-rest reliability (ICC = 0.95; CI = 0.90–0.97).[23]	Internal consistency (Cronbach α.91).[24] Interrater reliability (intraclass correlation coefficient, 0.73).[24]
Responsiveness and sensitivity	For every +1 PAM® score, hospitalisation decreases, and medication adherence increases by 2% each.[25]	–	–

*This has been estimated by the author as there were no details found.

**Of the ten studies that used PAM®, five articles reported only two levels of engagement – low or high; one article, three levels – low, medium or high; four articles reported the four levels listed.

Correlations with patient engagement

Eleven articles examined correlations between factors influencing patient engagement and/or behaviour and health outcomes (see Table 3 and Figure 2). See supplement 3 for the complete data extraction of study aims and results.

Influencing factors

Two articles identified a correlation between patient engagement and patient characteristics. Among spine surgery patients, non-white individuals were more likely to score lower PAM® scores (P= 0.042) and individuals with higher household income were more likely to be in the upper quartiles of patient activation (P= 0.048)(13). Higher PAM® scores of patients with hand and upper extremity conditions were correlated with higher education (r= -0.055, P < 0.1), both assessed prior to surgery.[28]

Outcomes

Fourteen health and behaviour outcomes were identified. The outcome most commonly correlated with patient engagement was satisfaction. Four articles reported that patients with higher PAM® scores were more likely to be

satisfied[12,26,28,32] and a study of spine surgery patients found that highly activated patients were three times more likely to be satisfied with their treatment at one year post-surgery (OR 3.23, 95% CI 1.8–5.8).[32] Similarly, another study found that satisfaction was more likely for patients in PAM® levels 3 and 4 at one year post-surgery than at three or six months post-surgery ($p < 0.05$).[34] This suggests that the engagement is important for longer-term post-operative recovery.

Several psychological correlations were identified. Patients with higher engagement were more likely to report high self-efficacy.[13,28,31] Among spine surgery patients undergoing PT, increased engagement was significantly associated with increased self-efficacy ($P < 0.001$), increased hopefulness ($P = 0.003$), increased confidence to participate in PT (79% vs 53%), decreased depressive symptoms ($P < 0.001$) and decreased externalised control (powerful others, $P<0.001$; physicians, $P=0.003$; other people, $P=0.002$).[13] One study found that for every one-point increase in PAM® score, mental health scores improved by 0.26.[12] Furthermore, patients with higher PAM® scores did not show the same psychological risk factors (i.e. demoralisation, negative emotions and self-doubt) compared to patients with lower scores.[26] This suggests increased engagement protects against psychological risk factors that impact surgical outcomes.

Higher engagement was correlated with decreased disability[14,28,30] and pain intensity.[12,28,30] On average, pain intensity decreased by 3.15 ± 1.91 points for level 4 patients compared to 2.01 ± 2.24 points for level 1 ($p = 0.029$).[30] Among anterior cervical discectomy and fusion patients there was no difference in immediate post-operative pain and narcotic consumption between PAM® levels.[29] As such, pre-operative PAM® scores may not predict post-operative outcomes for all surgery types.

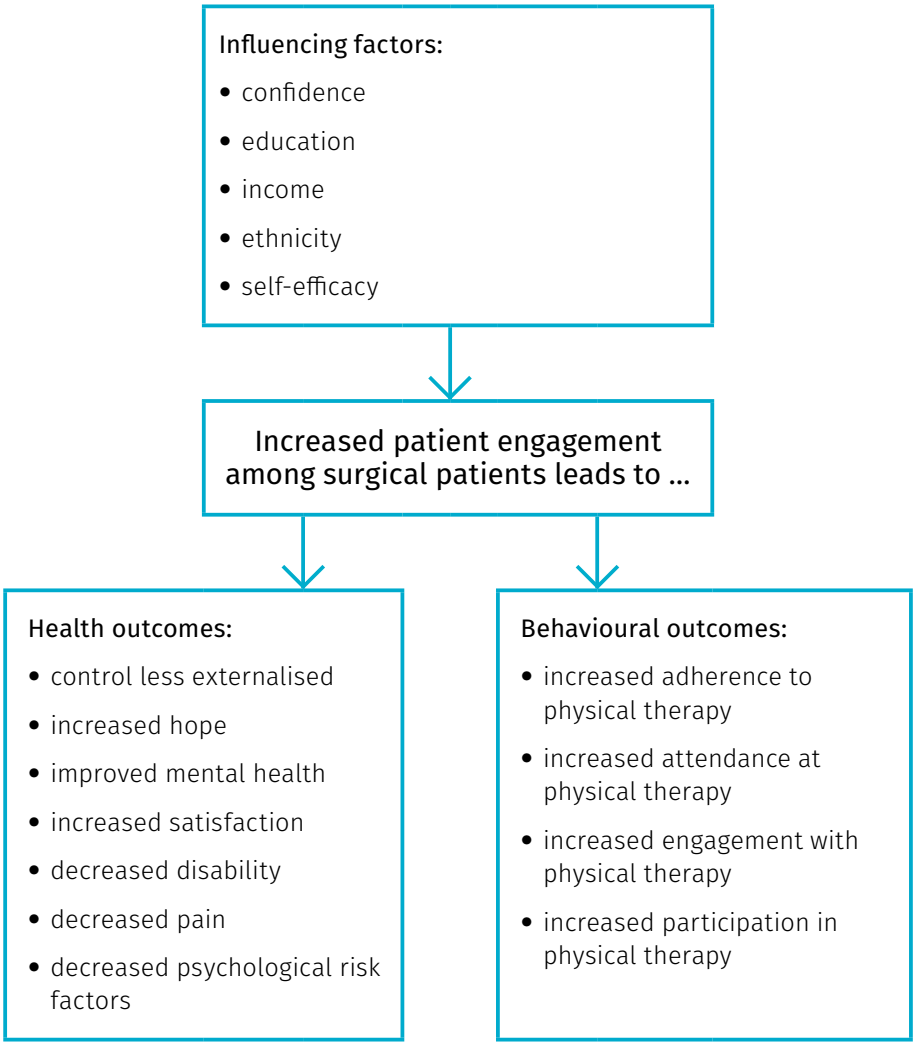

Figure 2: Correlations with patient engagement

Three articles investigated correlation between patient engagement and PT.[13,14,27] Increased PAM® scores were associated with improved adherence to PT, and positively correlated with participation in PT ($r = 0.53$, $P<0.001$) and engagement with PT ($r = 0.75$).[13] Patients who participated in health behaviour change counselling (patient engagement intervention) had significantly higher rehabilitation engagement than the control group (who did not receive health behaviour change counselling) (21.20±4.56 vs 23.57±2.71)[14]; however, one-third still reported low rehabilitation engagement compared to the control group.[27] This highlights the need to address barriers that inhibit greater improvements in rehabilitation engagement.

Discussion

This scoping review identifies valid and reliable measurement tools that are easy to use and can provide perioperative nurses and other health care professionals with information about the level of patient engagement. Knowing this

Table 3: Correlations with patient engagement

	Patient engagement		Health outcomes										Behavioural outcomes				Influencing factors				
Author (year)	Measure used	No. of levels identified	Depressive symptoms	Disability	Control less externalised	Hope	Mental health	Narcotic consumption	Pain	Physical health	Psychosocial risk factors	Satisfaction	Adherence to PT	Attendance at PT	Engagement with PT	Participation in PT	Confidence	Education	Ethnicity	Income	Self-efficacy
Skolasky (2008)[13]	PAM®-13	2	–		+	+							+	+	+	+	+		•	+	+
Skolasky (2011)[30]	PAM®-13	4		–			X		–	+											
Gruber (2014)[28]	PAM®-13	2		–					–			+						+			+
Andrawis (2015)[12]	PAM®-13	2					+		–			+									
Skolasky (2015, Pt 1)[14]	HRERS	2		–									+	+	+						
Skolasky (2015, Pt 2)[27]	PAM®-13	2													+						
Block (2019)[26]	PAM®-13	2									–										
Harris (2019)[34]	PAM®-13	4										+									
Patel (2019)[29]	PAM®-10	3						X	X												
Harris (2020)[32]	PAM®-13	4										+									
Yun (2020)[31]	PAM®-10	4																			+

Key: PT= physical therapy, + = positive correlation, - = negative correlation, • = correlation, x = no correlation.

can help health care practitioners improve patient-centred care and promote positive clinical outcomes.

The three tools identified are user-friendly and may be used as diagnostic tools to assess a patient's capacity to be an active participant in their care. PAM® is the most widely used measure. It captures a wide range of contributors to engagement, to provide a more comprehensive assessment of patient engagement, and caters to patients from culturally diverse backgrounds, having been translated into over 35 languages.

Patients with higher levels of engagement were more likely to report greater satisfaction, better adherence to and engagement with PT, and decreased pain and disability.

Comparison with existing literature

Consistent with studies on non-surgical populations, patient engagement was associated with psychological factors (i.e. self-efficacy, hope, locus of control, confidence and satisfaction)[13] and psychological risk factors (i.e. demoralisation, negative emotions and self-doubt).[26] Increased self-efficacy and confidence was associated with increased engagement. Patients with a high level of engagement were more likely to report more internalised control, hope, satisfaction and improved mental health, reflecting that psychological factors may affect a patient's willingness, confidence and ability to engage. Furthermore, those factors identified pre-operatively have been reported to effect post-operative physiological and psychological outcomes.[35,36]

As health care systems transition from disease-centred to patient-centred care, the need to assess a patient's capacity to engage is paramount, as it will not only capture patients at risk of low engagement pre-operatively, but also enable health care providers to gain an insight into psychological morbidity of their patients and identify patients who might have potentially poor surgical outcomes. These findings will provide an opportunity for health care providers or health care organisations to deliver individualised interventions to better support patients and prevent poor surgical outcomes.

This review identified some contradictory findings about correlation between patient engagement and mental health or pain, with one study identifying no association,[29], while others did.[12,28] One study[30] found an association between patient engagement and pain but not mental health. These conflicting findings may be a result of different sample sizes (no association, N = 65[30] vs association, N = 125[12]) and surgery types (lumbar spine surgery[30] vs total hip and knee arthroplasty[12]).

Interpretation of the findings

Patient engagement and the surgical journey are both processes which involve phases. Depending on surgery type, the surgical journey has an acute phase and a long-term recovery phase for those that require rehabilitation. Through this process, a patient's capability to engage will change over time. Reported satisfaction increased with higher levels of pre-operative engagement one-year after surgery, but not at three or six months post-operatively.[34] This suggests that patients with high capacity to engage are more likely to have better engagement further into their health care journey. This continuous and sustained effort to engage will in turn have long-term effects.

However, it is unclear whether the level of patient engagement measured here during the long-term recovery phase reflects the immediate post-operative journey. One third of the reviewed studies were longitudinal but only one assessed patient engagement before and after surgery, finding that satisfaction increased with higher levels of pre-operative engagement one year after surgery.[34] Due to this gap in the literature, it is unknown how surgical patient engagement evolves.

Existing research focuses on the patient characteristics that influence patient engagement, and the outcomes associated with it, but not on the 'why' behind non-engaged patients or the 'what' that hinders their ability to engage. One study, in which health behaviour change counselling was administered to improve patient activation, reiterated the importance of these findings; however, one third of patients still reported low rehabilitation engagement due to a lack of knowledge and support, resulting in low self-efficacy which health behaviour change counselling was not designed to address.[27] While measurement tools do not tell us why patients do not engage, they may be used to identify barriers which may reflect why patients cannot engage. Early identification of these barriers allows health care provider intervention, creating an opportunity to minimise these barriers to engagement.

Considerations for clinical practice and future research

Patient engagement is important to patient-centred care. PAM® stood out as the preferred evaluation tool due to its ease of use, wide application and ability to provide quantifiable measures to determine

the level of engagement as well as capture a wide range of components involved in engagement. PAM®'s broad and inclusive nature allows it to be used across different disease groups, cultural backgrounds and stages of the health care journey. In order to integrate PAM® into the clinical setting, it is important to consider the facilitators and barriers to its implementation.

Facilitators

The implementation of PAM® requires organisational, leadership and provider support for patient engagement. Organisational leaders recognise the importance of patient activation and communicate this to staff.[37] Similarly, health care providers perceived PAM® as a valuable and acceptable tool to demonstrate the efficacy of the person-centred approaches they use.[38] At the patient level, patients found PAM® easy to complete as it only takes five minutes to fill out. On average, 90 per cent of respondents provide reliable PAM® responses.[39]

Previous studies showed that organisations and health care providers who have used PAM® found PAM® aligns well with person-centred care.[38] PAM® appealed as a way of quantifying qualitative constructs[38]; in addition, when using a more flexible administrative approach (e.g. mediate completion, deviate and elaborate on questions to assist patient understanding), PAM® opened discussion on patient engagement and re-aligned patient–provider understanding to improve patient-centred care.

Barriers

To successfully implement PAM®, organisational resources are required. It is important to provide appropriate training, infrastructure and personnel to support staff and patients. In addition, organisations should consider the time and funds needed to train staff and fully adopt PAM®. To support staff, organisations may consider redesigning workflow and revising staff roles. Other qualified members, such as front desk staff, can administer PAM® and take greater responsibility for patient engagement and care[40]. Re-allocating work that does not require medical or nursing skills will relieve extra workload and allow more efficient workflow. This is particularly important in smaller organisations or individual practices (e.g. family practices) to overcome staffing challenges that can affect implementation.[40]

At the health care provider level, a well-defined but flexible and time efficient administration process to appropriately inform patient care is important for PAM® implementation.[41] It is important to note that when a patient needs assistance to complete PAM® longer than the five minutes indicated by developers may be needed to establish common understanding and goals.

Future research

Future research should explore patient engagement among surgical patients beyond those undergoing orthopaedic surgery. In addition, it is necessary to investigate how patient engagement develops during the perioperative process and identify why patients are not engaged.

Limitations

As health care systems transition from disease-centred to patient-centred care, the term 'patient engagement' has become increasingly popular. Throughout the rise of the term, patient engagement has assumed many definitions; however, there is no widely accepted definition or criteria for patient engagement. Various terms for patient engagement were included in the search; however, broader search terms (e.g. 'education', 'coaching', 'literacy' and 'teaching') were not included. Adding these terms would have broadened the search but might have retrieved many irrelevant papers. As such, search terms and findings from this review are based on our chosen definition of patient engagement.

The studies included in this scoping review were primarily conducted in the USA, where health care delivery differs from other parts of the world. Therefore, these findings may not apply to surgery patients elsewhere. Furthermore, the number of studies produced is limited, and most articles are about orthopaedic surgery patients. As such, the results of this scoping review may not be applicable to other surgical populations or align with the results of studies conducted in other populations.

Conclusion

There are valid and reliable tools to measure the level of engagement among surgical patients, and engagement levels correlate with some health and behavioural outcomes. Consistent with patient-centred care, these tools can be used to help early identification of patients at risk of poor recovery and to provide personalised perioperative support. Future research should be extended to non-orthopaedic surgery patients and explore the evolution of patient engagement throughout the surgical journey.

Competing interests and funding declaration

The authors have declared no competing interests.

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All authors contributed to the study's conception and design, data analysis and interpretations, and critical revisions. RL, ZZ and DWLW contributed to literature search strategies. RL contributed to literature search, data extraction and initial draft. ZZ and DWLW contributed to the literature search and data extraction verification. RL and ZZ contributed to the study selection.

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Supplement 1: Example search history

EBSCO host

Search conducted on 25 August 2020

Search	Query	Limiters/expanders	Last run via	Results
S1	AB (measure or questionnaire or survey or scale) AND AB (surgery or surgical patients or perioperative care) AND AB (patient engagement or patient activation or patient participation or patient experience or client engagement or consumer engagement) AND AB (outcomes or treatment outcomes or patient reported outcomes)	Expanders – Apply equivalent subjects Search modes – Boolean/Phrase	Interface – EBSCOhost Research Databases Search Screen – Advanced Search Database – CINAHL with Full Text	688
S2	AB (patient engagement or patient activation or patient participation or patient experience or patient involvement) AND AB (surgery or surgical patients or perioperative care or operative or operation) AND AB (measure or questionnaire or survey or scale)	Expanders – Apply equivalent subjects Search modes – Boolean/Phrase	Interface – EBSCOhost Research Databases Search Screen – Advanced Search Database – CINAHL with Full Text	1769
S3	AB (patient engagement or patient participation or patient experience) AND AB (surgery or surgical patients) AND AB (outcomes or treatment outcomes or patient- reported outcomes) AND (survey or questionnaire or measure)	Expanders – Apply equivalent subjects Search modes – Boolean/Phrase	Interface – EBSCOhost Research Databases Search Screen – Advanced Search Database – CINAHL with Full Text	647
S4	AB (measure or scale or questionnaire or survey) AND AB (surgery or surgical patients) AND AB (patient engagement or patient activation or patient participation or patient experience or patient involvement)	Expanders – Apply equivalent subjects Search modes – Boolean/Phrase	Interface – EBSCOhost Research Databases Search Screen – Advanced Search Database – CINAHL with Full Text	1559
S5	AB (patient engagement or patient activation or patient participation or patient experience or patient involvement) AND AB (surgery or surgical patients or perioperative care) AND AB (measure or scale or questionnaire or survey) AND (levels of engagement or types of engagement)	Expanders – Apply equivalent subjects Search modes – Boolean/Phrase	Interface – EBSCOhost Research Databases Search Screen – Advanced Search Database – CINAHL with Full Text	3

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Supplement 2: Data extraction of study characteristics

Author (year) Country of origin	Title	Study type	Selection criteria	Population	Engagement measurement tool (levels of engagement measured)	Intervention	When were outcome measures assessed?
Andrawis (2015)[12] USA	Higher pre-operative patient activation associated with better patient-reported outcomes after total joint arthroplasty	Longitudinal study	Inclusion criteria: • all patients scheduled to undergo a primary THA/TKA at UCSF Medical Centre from January 2013 to July 2013 and Harbor-UCLA Medical Centre from March 2013 to January 2014 • 18+ • advanced arthritis refractory to conservative management. Language: N/A Informed consent: N/A Exclusion criteria: N/A	N = 125 Mean age 64 ± 10 60% female 30.4% postgraduate degree 64% unemployed/retired 56% TKA 96% active smoker Ethnicity: N/A Marital status: N/A Income: NA	PAM-13 (0-100 PAM score)	N/A	Pre-op: • PAM • HOOS or KOOS (hip disability and osteoarthritis outcome score or knee injury and osteoarthritis outcome score) • UCLA activity scores • physical and mental health (SF12v2). 6 or 12 months post-op: • HOOS or KOOS • UCLA activity scores • physical and mental health (SF12v2) • HKSS (hip and knee satisfaction scale).
Block (2019)[26] USA	Patient activation mediates the association between psychosocial risk factors and spine surgery results	Longitudinal study	Inclusion criteria: • 1574 consecutive patients who presented for spine surgery or a spinal cord stimulator • capable of providing informed consent. Age: N/A Language: N/A Exclusion criteria: N/A	Pre-operative sample: • N = 1254 • mean age 50.41 ± 13.11 • 56.3% female • mean years of education 13.45 ± 2.88 • 61.7% underwent various conventional spine surgeries • 66.5% obtained fusion Ethnicity: N/A Marital status: N/A Income: N/A Employment: N/A Smoking: N/A Post-operative sample: • mean age 50.2 ± 13.03 • 59.4% female • mean years of education 13.53 ± 2.82 • 70.7% underwent various conventional spine surgeries • 29.3% obtained SCS Ethnicity: N/A Marital status: N/A Income: N/A Employment: N/A Smoking: N/A	PAM-13 (2 levels: low and high)	N/A	Pre-op: • PAM • MMPI-2-RF (Minnesota multiphasic personality inventory-2-restructured form). 3 months, 1 and 2 years post-op: • ODI (Oswestry disability index) • pain and spine surgery evaluation survey.

Author (year) Country of origin	Title	Study type	Selection criteria	Population	Engagement measurement tool (levels of engagement measured)	Intervention	When were outcome measures assessed?
Graffigna (2018)[10] Italy	Patient health engagement (PHE) model in enhanced recovery after surgery (ERAS): monitoring patients' engagement and psychological resilience in minimally invasive thoracic surgery	Review	Inclusion criteria: N/A Exclusion criteria: NA	N/A	PHE-s (4 stages: 1. blackout 2. arousal 3. adhesion 4. eudaimonic)	N/A	N/A
Gruber (2014)[28] USA	Patient activation and disability in upper extremity illness	Observational study	Inclusion criteria: • patient visiting the office of one of three orthopaedic hand and upper extremity surgeons • 18+ • English speaking. Informed consent: N/A Exclusion criteria: N/A	N= 112 mean age 46 ± 17 (18-88) 51% male 50% married 58% working full time 52% acute injuries 12% smoking Ethnicity: N/A Household income: N/A Education: N/A	PAM-13 (0-100 PAM score)	N/A	Pre-meeting with surgeon: • PAM • demographic questionnaire • quick disabilities of arm, shoulder and hand • patient health questionnaire-2 • pain self- efficacy questionnaire • pain intensity. Second evaluation: (1 or 2 months) • PAM • quick disabilities of arm, shoulder and hand • pain intensity • satisfaction.
Harris (2019)[24] USA	Engaged patients are more likely to be satisfied at one year following adult spinal deformity (ASD) surgery	Conference abstract	Inclusion criteria: • ASD patients (> 5 levels fused) at a multi-provider, single academic institution. Age: N/A Language: N/A Informed consent: N/A Exclusion criteria: N/A	N= 90 mean age 61 ± 11 71% female Median of nine levels fused Ethnicity: N/A Marital status: N/A Income: N/A Education: N/A Employment: N/A Smoking: N/A	PAM-13 (4 levels: Stages I–IV*)	N/A	Pre-op: • PAM 1 year post-op: • North American Spine Society patient satisfaction index
Harris (2020)[32] USA	The engaged patient: Patient activation can predict satisfaction with surgical treatment of lumbar and cervical spine disorders	Longitudinal study	Inclusion criteria: • patients presenting to a multi-provider, academic spine centre between 2014 and 2017 who received elective surgical treatment of lumbar/ cervical spinal disorders. Age: N/A Language: N/A Informed consent: N/A Exclusion criteria: N/A	N= 257 mean age 60 ± 12.2. 59 % female 82% white 5.5% active smokers Marital status: N/A Income: N/A Education: N/A Employment: N/A	PAM-13 (4 levels: Stages I–IV*)	N/A	Pre-op: • PAM • PROMIS (patient reported outcomes measurement information system) health domains 6 weeks and 3, 6, and 12 months post-op: • PAM • PROMIS • patient satisfaction index

Author (year) Country of origin	Title	Study type	Selection criteria	Population	Engagement measurement tool (levels of engagement measured)	Intervention	When were outcome measures assessed?
Patel (2019)[29] USA	Patient activation is not associated with post-operative outcomes following anterior cervical discectomy and fusion	Retrospective study	Inclusion criteria: • patients who had undergone a primary, 1–3 anterior cervical discectomy and fusion (ACDF) for degenerative pathology Age: N/A Language: N/A Informed consent: N/A Exclusion criteria: N/A	N=64 mean age: 52.3 59.4% male 11% smokers Ethnicity: N/A Marital status: N/A Income: N/A Education: N/A Employment: N/A	PAM-10 (3 levels: 1. low PAM (bottom quartile) 2. moderate PAM (2nd and 3rd quartile) 3. high (top quartile)).	N/A	Pre-op: • PAM • demographic questionnaire • Charlson comorbidity Index 6 weeks, 3 and 6 months and 1 year post-op: • NDI (neck disability index) • SF-12 PCS (12-item short-form physical component score) • visual analogue scale neck and arm pain.
Skolasky (2008)[13] USA	Patient activation and adherence to physical therapy in persons undergoing spine surgery	Prospective longitudinal study	Inclusion criteria: • academic spine centre patients for degenerative lumbar spinal stenosis surgery between August 2005 and May 2006 • 18+ • English speaking • capable of providing informed consent (determined by a mini-mental status examination score of >18 of 30 points). Exclusion criteria: • previous spine surgery.	N=65 mean age: 58 ± 15 58% female 89% non-Hispanic white 80% married 43.1% $30–50k household income 44.6% < college education Employment status: N/A Smoking: N/A	PAM-13 (2 levels: low and high)	N/A	Pre-op: • PAM • demographic, health and social characteristics • Charlson comorbidity Index Post-op: • attendance: collected weekly through week 6 • engagement during PT (HRERS): collected at week 6
Skolasky (2011)[30] USA	Patient activation and functional recovery in persons undergoing spine surgery	Prospective cohort study	Inclusion criteria: • patients presenting to their academic spine centre from August 2005 to May 2006 undergoing surgical treatment of degenerative lumbar spinal stenosis • 18+ • English speaking • capable of providing informed consent (determined by a mini-mental status examination score of >18 of 30 points). Exclusion criteria: • previous spine surgery.	N=65 mean age: 58 ± 15 59% female 89% non-Hispanic 80% married 43.1% $30-50k household income 44.6% < college education 80% diagnosed with lumbar spine stenosis 20% diagnosed with lumbar spine stenosis associated with spondylolisthesis Employment status: N/A Smoking: N/A	PAM-13 (4 levels: Stages I–IV*)	N/A	Pre-op: • PAM • demographic, health and social characteristics • Charlson comorbidity Index • pain intensity • ODI (Oswestry disability index) • SF-12v2 for physical and mental health. 12 and 24 months post-op: • pain intensity • ODI (Oswestry disability index) • SF-12v2 for physical and mental health.

Author (year) Country of origin	Title	Study type	Selection criteria	Population	Engagement measurement tool (levels of engagement measured)	Intervention	When were outcome measures assessed?
Skolasky (2015, Pt 1)[14] USA	Health behaviour change counselling in surgery for degenerative lumbar spinal stenosis. Part I: Improvement in rehabilitation engagement and functional outcomes	Prospective clinical trial	Inclusion criteria: • presented at an academic medical centre from December 2009 to August 2012 for surgical treatment of degenerative lumbar spinal stenosis (i.e. instability or deformity) • 18+ • English speaking • capable of providing informed consent. Exclusion criteria: • previous spine surgery	N= 122 mean age: 59 ± 13.3 63% female 77% non-Hispanic white 47.5% LS (lumbar stenosis) 59 control 63 HBCC intervention group Marital status: N/A Income: N/A Education: N/A Employment: N/A Smoking: N/A	HRERS (N/A)	Brief motivational interview-based HBCC versus control	6 weeks post-op: • rehabilitation participation (HRERS) 3 or 6 months post-op: • ODI (Oswestry disability index) • SF-12v2. Therapists assessed engagement in and patients reported attendance at post-operative rehabilitation (physical therapy and/or home exercise program).
Skolasky (2015, Pt 2)[27] USA	Health behaviour change counselling in surgery for degenerative lumbar spinal stenosis. Part II: Patient activation mediates the effects of health behaviour change counselling on rehabilitation engagement	Prospective clinical trial	Inclusion criteria: Presented at an academic medical centre from December 2009 to August 2012 for surgical treatment of degenerative lumbar spinal stenosis (i.e., instability or deformity) 18+ English speaking Capable of providing informed consent Exclusion criteria: Previous spine surgery	N= 122 mean age: 59 ± 13.3 63% female 77% non-Hispanic white 47.5% LS (lumbar stenosis) 59 control 63 HBCC intervention group Marital status: N/A Income: N/A Education: N/A Employment: N/A Smoking: N/A	PAM-13 (2 levels: low and high)	Brief motivational interview-based HBCC versus control	Pre-intervention: • PAM. Post-intervention: • PAM. After 6 weeks of PT: • rehabilitation engagement (HRERS) • self-reported attendance in physical therapy and home exercise program.
Yun (2020)[31] USA	A novel surgical patient engagement model: A qualitative study of patients	Qualitative study	Inclusion criteria: • patients from either a safety net or private hospital in the Houston area for surgery for thyroid, parathyroid, colon or rectal cancer, Crohn's disease, ulcerative colitis and diverticulitis • between 18 and 70 years old • English or Spanish as primary language Informed consent: N/A Exclusion criteria: • pregnant • incarcerated • having post-operative complications; secondary active malignancy, a pre-existing vocal cord paralysis, chronic neurological condition affecting voice or swallow, or a need for multivisceral resection • interview time frames greater than four weeks post-operatively..	N= 38 post-operative patients Age: N/A Gender: N/A Ethnicity: N/A Marital status: N/A Income: N/A Education: N/A Employment: N/A Smoking: N/A	PAM-10 (4 levels: Stages I–IV*)	N/A	4 weeks post-op: • open ended qualitative interview • PAM-10.

UCSF = University of California San Francisco, UCLA = University of California Los Angeles, SF-12v2 = medical outcomes study short form-12, version two, HBCC = health behaviour change counselling

* Stage I = persons not taking an active role in their health, Stage II = persons lacking confidence for self-management, Stage III = persons beginning to take action, Stage IV = persons adopting behaviours of health support.

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Supplement 3: Data extraction of study aims and results

Author (year) Country of origin	Title	Aim	Health outcomes	Behaviour outcomes	Factors of patient engagement	Conclusion
Andrawis (2015)[12] USA	Higher pre-operative patient activation associated with better patient-reported outcomes after total joint arthroplasty	To determine whether patients with higher activation scores would experience: 1. greater resolution of pain and improved activity 2. greater improvements in post-operative physical and mental health 3. greater satisfaction after primary total hip arthroplasty (THA) or total knee arthroplasty (TKA).	• Higher baseline PAM score experienced better pain relief using the HOOS/KOOS (hip/knee injury and osteoarthritis outcome score) pain scores (R2 = 0.311, p = 0.048) and symptoms using the HOOS/KOOS symptom scores (R^2 = 0.272, p = 0.021). • Higher PAM scores were associated with better post-operative mental health using the SF12v21 (R^2 = 0.057, p<0.001). • Higher PAM scores were associated with having greater post-operative satisfaction after surgery using the HKSS questionnaire (R2 = 0.048, p = 0.023).	N/A	N/A	• Higher pre-operative patient activation was associated with better pain relief, decreased symptoms, improved mental health, and greater satisfaction after total joint arthroplasty.
Block (2019)[26] USA	Patient activation mediates the association between psychosocial risk factors and spine surgery results	To determine whether patient activation mediates some of the psychosocial factors previously found to be associated with reduced outcome of spine surgery (SS) and spinal cord stimulation (SCS).	• Higher pre-surgical levels of patient activation assessed by the PAM are associated with improved surgery results. • PAM scores measured prior to surgery negatively correlated with the MMPI-2-RF scales, implying that patients who tend to be more active in their health care also evidence lower psychosocial risk factors. • Patient activation mediates the association between psychosocial risk factors and surgery results, such that more activated patients did not show the same detriment in outcome associated with the psychological risk factors as did those patients who were not as positively activated. • PAM scores did not mediate the relationship between higher pre-surgical MLS scores and patients reporting that surgical results were not meeting their expectations. • Pre-surgical PAM scores were not associated with pre-operative pain levels when assessed at the same time prior to surgery. • All pre-surgical MMPI-2-RF scores were modestly to substantially negatively associated pre-surgical PAM scores. • Pre-surgical PAM scores were modestly associated with lower post-operative ODI scores and higher expectation and satisfaction scores.	N/A	N/A	• Patient activation mediates numerous associations between psychosocial risk factors and suboptimal outcomes --> patients' involvement in obtaining information, decision-making, and their resilience can explain why some patients do not experience adverse surgical results when pre-surgical psychosocial risk factors are present. • Patient activation –patient's involvement in obtaining information, decision-making and resilience during times of stress – mediates such adverse effects.

Author (year) Country of origin	Title	Aim	Health outcomes	Behaviour outcomes	Factors of patient engagement	Conclusion
Graffigna (2018)[10] Italy	Patient health engagement (PHE) model in enhanced recovery after surgery (ERAS): monitoring patients' engagement and psychological resilience in minimally invasive thoracic surgery	To discuss the implication of the adoption of these scientific tools in the enhanced recovery after surgery (ERAS) experience and their potentialities for health care professionals working in thoracic surgery settings.	N/A	N/A	N/A	• PHE allows clinicians to easily assess patients' level of engagement, and thus their needs and expectations in terms of doctor–patient communication, health literacy and therapeutic education. • The introduction of the PHE-s along the patient journey, thus, would allow tracking of the evolution of patient engagement, to identify critical cases and even to verify the effectiveness of patient support programs in sustaining patients' psychological resilience and participation in health care.
Gruber (2014)[28] USA	Patient activation and disability in upper extremity illness	To determine if higher patient activation correlates with fewer symptoms and less disability in patients with hand and upper extremity illness.	• Patient activation at enrolment correlated with disability (QuickDASH r = -0.31, P < 0.01), pain intensity and satisfaction with treatment but was only retained in the multivariable model for pain intensity. • Decreased disability between enrolment and re-evaluation correlated with > symptoms of depression, higher PAM at follow up and lower self-efficacy. • Significant predictors of pain at follow up included PAM at enrolment (r = -0.055, P < 0.1). • Satisfaction with treatment was weakly, but significantly, correlated with PAM at enrolment, and PAM at follow up.	N/A	• PAM at enrolment was positively correlated with education and negatively correlated with patient health questionnaire-2, QuickDASH at enrolment and pain intensity.	• Given the consistent relationship between effective coping strategies (e.g. pain self-efficacy) and symptoms and disability and the independent influence of patient activation on pain intensity in this study, future research should address the ability of interventions. • Patients who were more engaged in their health care had better health outcomes (correlation between PAM and DASH). • PAM correlated with self-efficacy and self-efficacy is the strongest correlate of disability, even stronger than symptoms of depression.
Harris (2019)[34] USA	Engaged patients are more likely to be satisfied at one year following adult spinal deformity (ASD) surgery	To identify the association between levels of pre-operative patient engagement and post-operative satisfaction among ASD patients.	• Pre-surgery PAM level: 1 = 8.9%, 2 = 14%, 3 = 22%, 4 = 54%. • 86% were satisfied at 1 year. • Greater odds of satisfaction with PAM stage 3 (OR 16.2, 95% CI: 1.02 – 258.8) or 4 (OR 11.7, 95% CI: 1.4 – 97.1). • No significant odds of being satisfied with higher levels of pre-operative activation at 3 or 6 months post-surgery (p < 0.05).	N/A	N/A	• Patients with higher PAM scores have significantly greater odds of satisfaction at 1 year, while the PAM does not predict satisfaction at 6 months, suggesting that engagement becomes important in longer-term post-operative recovery. Clinicians may consider implementing previously proven techniques to increase patient activation in ASD patients for whom surgery is being considered.
Harris (2020)[32] USA	The engaged patient: Patient activation can predict satisfaction with surgical treatment of lumbar and cervical spine disorders	1. To determine whether activated patients are more likely to be satisfied with the results of their surgical treatment following elective spine surgery. 2. To examine the relationship between patient activation and other validated outcome measures in patients undergoing spine surgery in order to better understand how this construct is related to known health-related quality of life domains in this patient population.	• Pre-operative patient activation was weakly correlated (r ≤ 0.2) with PROMIS health domains. • The most activated patients were three times more likely to be satisfied with their treatment at one year (OR 3.23, 95% CI 1.8–5.8). • Similarly, patients in the second-highest stage of activation also demonstrated significantly greater odds of being satisfied (OR 2.8, 95% CI 1.5–5.3).	N/A	N/A	• Patients who are more engaged in their health care prior to elective spine surgery are significantly more likely to be satisfied with their post-operative outcome. Clinicians may want to implement previously proven techniques to increase patient activation in order to improve patient satisfaction following elective spine surgery. • While a majority of patients endorsed the highest level of activation (56%), 51 (20%) endorsed the lower two stages (neither believing that taking an active role was important nor having the knowledge and skills to manage their condition).

Author (year) Country of origin	Title	Aim	Health outcomes	Behaviour outcomes	Factors of patient engagement	Conclusion
Patel (2019)[29] USA	Patient activation is not associated with post-operative outcomes following anterior cervical discectomy and fusion	To determine whether an association exists between pre-operative patient activation, as measured by the 10-Item Patient Activation Measure (PAM-10), and post-operative outcomes following anterior cervical discectomy and fusion (ACDF).	• Patients were stratified by their PAM scores as follows: – 25 had a low PAM score – 19 had a moderate PAM score – 20 had a high PAM score. • There was no difference in inpatient visual analogue scale (VAS) pain scores or narcotic consumption. • No difference in improvement in VAS neck pain, VAS arm pain, neck disability index, and SF-12 PCS among subgroups at all post-operative follow-ups. • No difference in immediate post-operative pain and narcotic consumption among PAM subgroups.	N/A	N/A	• Although PAM has been associated with better post-operative recovery in lumbar spine patients and other orthopaedic surgeries, our investigation suggests that pre-operative PAM assessments are not an effective method to predict post-operative outcomes following an ACDF.
Skolasky (2008)[13] USA	Patient activation and adherence to physical therapy in persons undergoing spine surgery	To determine: • the association between baseline patient activation and participation in post-operative physical therapy (PT) in a cohort of individuals after lumbar spine surgery • the influence of baseline PAM to predict PT attendance and engagement.	• Low activated patients were more likely to report low hope, and external locus of control compared to high activated individuals. • Increased activation significantly associated with increased hopefulness (P=0.032) and decreased externalised control (powerful others, P<0.001; physicians, P=0.003; other people, P=0.002).	• Scores on PAM were positively correlated with participation (r = 0.53, P<0.001) and engagement (r = 0.75) in PT. • PAM a significant predictor of PT adherence. • PAM accounted for ~25% of variation of attendance. • PAM accounted for ~56% of variation of engagement score. • PAM significantly increased amount of variance explained in these models indicating that PAM provided additional information in the predication of adherence to PT.	• Low activated patients were more likely to report low PT self-efficacy, low hope and external locus of control compared high activated individuals. • Low activation endorsed lower confidence to participate in PT than those with high activation (53% vs 79%). • Non-white individuals were more likely to score < PAM scores (P=0.042). • High household income more likely to have > PAM score (P=0.048). • Increased activation significantly associated with increasing self-efficacy (P<0.001), increased hopefulness (P=0.032) and decreased externalised control (powerful others, P<0.001; physicians, P=0.003; other people, P=0.002).	• Increased patient activation is associated with improved adherence to physical therapy as reflected in attendance and engagement. • A health care provider may be able to quickly assess an individual's propensity to engage in adaptive health behaviour using PAM.

Author (year) Country of origin	Title	Aim	Health outcomes	Behaviour outcomes	Factors of patient engagement	Conclusion
Skolasky (2011)[30] USA	Patient activation and functional recovery in persons undergoing spine surgery	To determine whether there was an association between pre-operative patient activation and functional recovery after lumbar spine surgery.	• Stage IV had significantly better decrease in pain (P=0.049) and disability (P=0.035) than Stage I.* • Pain intensity decreased by an average of 3.15 ± 1.91 points for Stage IV individuals, which was significantly greater than the average decrease of 2.01 ± 2.24 points for Stage I individuals (p = 0.029). • Highest stage of patient activation experienced a significantly greater reduction in disability than did those in the lowest stage (mean difference, 27.40 ± 3.20 points; p = 0.035). • Significantly lower pain at baseline for Stage III and IV patients than Stage I. • No association between PAM and change in mental health (P=0.081). • Highest stage of patient activation experienced a significantly greater improvement in physical health than those in the lowest stage (mean difference, 4.6 ± 2.28 points; p = 0.044).	N/A	N/A	• High patient activation was associated with better recovery after surgery. • Increased patient activation may lead to improved functional recovery through increased physical therapy adherence after spine surgery in adults.
Skolasky (2015, Pt 1)[14] USA	Health behaviour change counselling in surgery for degenerative lumbar spinal stenosis. Part I: Improvement in rehabilitation engagement and functional outcomes	To examine whether a brief motivational interview-based health behaviour change counselling (HBCC) intervention increased patient participation in physical therapy (PT) and/or home exercise programs (HEPs), reduced disability and improved health status after surgery for degenerative lumbar spinal stenosis.	• Effect of the HBCC intervention on disability was mediated through rehabilitation engagement HRERS (indirect effect calculated as a1*b1, 7.35). Rehabilitation engagement measured by HRERS accounted for 41.5% of the effect of the HBCC intervention on disability. • The effect of the HBCC intervention on physical health status was mediated through rehabilitation engagement HRERS (indirect effect: 4.39, 44.6%).	• HBCC patients had significantly higher rehabilitation engagement (21.204.56 vs 23.572.71, respectively). • HBCC intervention on disability was mediated through rehabilitation engagement HRERS (indirect effect: 4.50, 23.1%), attendance in PT (indirect effect: 2.16, 11.1%), and attendance in HEP (indirect effect: 1.04, 5.3%). The effect of the HBCC intervention on physical health status was mediated through rehabilitation engagement HRERS (indirect effect: 2.12, 18.3%), attendance in PT (indirect effect: 1.12, 9.7%), and attendance in HEP (indirect effect: .37, 3.2%).	N/A	• HBCC can improve outcomes after spine surgery through improved rehabilitation participation.

Author (year) Country of origin	Title	Aim	Health outcomes	Behaviour outcomes	Factors of patient engagement	Conclusion
Skolasky (2015, Pt 2)[27] USA	Health behaviour change counselling in surgery for degenerative lumbar spinal stenosis. Part II: Patient activation mediates the effects of health behaviour change counselling on rehabilitation engagement	To determine the effect of health behaviour change counselling (HBCC) on patient activation and the influence of patient activation on rehabilitation engagement, and to identify common barriers to engagement among individuals undergoing surgery for degenerative lumbar spinal stenosis.	• The effect of HBCC on rehabilitation engagement was mediated by patient activation (standardised regression weight, .079; PZ.395).	• Patient activation predicted engagement (standardised regression weight, .682; P<.001). Post-intervention patient activation was predicted by baseline patient activation (standardised regression weight, .808; P<.001) and receipt of HBCC (standardised regression weight, .444; P<.001).	N/A	• The influence of HBCC on rehabilitation engagement was mediated by patient activation. Despite improvements in patient activation, one-third of patients reported low rehabilitation engagement. Addressing these barriers should lead to greater improvements in rehabilitation engagement. • Thematic analysis identified three common barriers to engagement: 1. low self-efficacy because of lack of knowledge and support (62%) 2. anxiety related to fear of movement (57%) 3. concern about pain management (48%).
Yun (2020)[31] USA	A novel surgical patient engagement model: A qualitative study of patients	To define a new model specifically for surgical patient engagement to guide future work to improve patient outcomes.	• Only 2%, or 1 patient, scored a patient activation level of 2, indicating that this patient is disengaged and easily overwhelmed.	N/A	• Of patients completing PAM, 98% obtained a score of 3 or 4, indicating optimal levels of activation despite differences in socio-economic status. • Patients with high self-efficacy also show significant patient engagement, actively participating in their own post-operative care, leading to better outcomes. • Patients displaying a higher level of self-efficacy; patient 2 without the self-efficacy driver displayed a higher level of anxiety regarding his ability to accomplish required self-care tasks such as assessing his health post-operatively at home and properly receiving standardised discharge precautions. Consequently, this patient returned to the emergency department after discharge despite having a normal exam.	• A novel model of patient engagement specific to surgical patients is necessary because of the unique recovery track they endure. Our new model can be used to develop interventions for these patients to improve their engagement and thereby their outcomes.

SF-12v2 = medical outcomes study short form-12, version two, HKSS = hip and knee satisfaction scale, MMPI-2-RF = Minnesota multiphasic personality inventory-2-restructured form, ODI = Oswestry disability index), QuickDASH = shortened version of the disabilities of arm, shoulder and hand (DASH) outcome measure, SF-12 PCS = 12-item short-form physical component score

* Stage I = persons not taking an active role in their health, Stage II = persons lacking confidence for self-management, Stage III = persons beginning to take action, Stage IV = persons adopting behaviours of health support.