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Invitation to join the Healthcare AI Language Group: HeALgroup.AI Initiative

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The recent emergence of large language models (LLMs) has led to a revolution in information technology, with healthcare being at the forefront of this transformation. LLMs simulate and reproduce human language expression and understanding. When trained with appropriate data, they can accurately generate medical information.[1] The potential of LLM in the medical realm is vast, and many future applications of this technology remain yet to be discovered. Publications around this topic appear rapidly, and systematic reviews have sought to provide an oversight of the current body of knowledge.[2 3] As we look to the future, it is essential to understand the diverse roles LLM might play in healthcare and the enormous benefits it can bring while recognising its potential drawbacks and identifying factors relevant for safe application of this technology in the healthcare setting.[4] Even though initiatives surrounding the field of artificial intelligence (AI) and LLM in healthcare and medicine have previously been announced, there is a need for an open, low-threshold collaborative for clinicians, researchers and patient representatives alike (table 1).

The HeAL (Healthcare AI Language) Group—HeALgroup.AI was founded to better understand medicine-science applications of LLM and its implication on medical practice.[5] We aim to provide a community-based, low-threshold, open platform for healthcare providers, researchers and patient representatives. This contrasts with previously announced initiatives and research collaborations, which have a higher entry threshold due to their academic and institutional purpose or seek to provide collaboration between the healthcare industry and academia. Our initiative serves as a platform to connect individuals interested in LLM research within the medical context to exchange research ideas, bundle efforts and accomplish research goals. A low entry threshold allows individuals without previous academic track record or institutional affiliation to join. This initiative therefore is not competing with ongoing institutional research groups but aims to complement those efforts and create collaborations wherever possible. Research must be conducted within the ethical as well as quality standards previously defined.[6] Sought to be tackled with this initiative, the major challenge will be active contribution and steering of the development of LLM applications, rather than taking on the role of a bystander, faced with a *fait accompli*. Usage of human intelligence to identify applications for LLM in healthcare, defining rules of engagement and active exchange of ideas will stand at the core of HeAL Group's mission. Identification of gaps of knowledge, defining research aims, creation of an active community and laying groundwork for the safe implementation of LLM in healthcare will be the first targets of this collaboration.

With this letter, the authors would like to issue an invitation to all interested healthcare professionals, researchers, and patient representatives to join and contribute to the platform.

The future of healthcare is undoubtedly linked to the advancements in LLM. Its integration into medical research and practice holds a potential that might not yet be understood in its entirety. As we learn to use this technology to our advantage, it is pivotal to ensure that ethical considerations and patient safety remain

Table 1 Previously announced initiatives surrounding artificial intelligence (AI) and large language models (LLMs) in healthcare (not exhaustive)

Initiative	Participants	Scope
Alan Turing Institute	Academic collaboration	Research focused on understanding and advancing models, techniques and principles that underpin AI/LLM
Health Data Research UK	Academic and institutional collaboration	Clinical AI data analyses
HealTex.org	Academic, institutional and industrial collaboration	Healthcare-related text analysis
AI4Health	Academic	Research group
The Partnership on Artificial Intelligence for Health (PAIHealth)	Academic, civil society, media, industry	Not focused on medical applications
Allen institute for AI	Non-profit research institute	Development of AI applications, including medical
The Chan Zuckerberg Initiative	Philanthropic organisation	Development of AI applications, including medical
Digital Medicine and AI (DiMeAI)	Academic, clinical and industrial collaboration	Advancement of AI in healthcare

at the core of AI's healthcare journey, keeping the patient as our focus of attention.

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Codesign of health technology interventions to support best-practice perioperative care and surgical waitlist management

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ABSTRACT

Objectives This project aimed to determine where health technology can support best-practice perioperative care for patients waiting for surgery.

Methods An exploratory codesign process used personas and journey mapping in three interprofessional workshops to identify key challenges in perioperative care across four health districts in Sydney, Australia. Through participatory methodology, the research inquiry directly involved perioperative clinicians. In three facilitated workshops, clinician and patient participants codesigned potential digital interventions to support perioperative pathways. Workshop output was coded and thematically analysed, using design principles.

Results Codesign workshops, involving 51 participants, were conducted October to November 2022. Participants designed seven patient personas, with consumer representatives confirming acceptability and diversity. Interprofessional team members and consumers mapped key clinical moments, feelings and barriers for each persona during a hypothetical perioperative journey. Six key themes were identified: 'preventative care', 'personalised care', 'integrated communication', 'shared decision-making', 'care transitions' and 'partnership'. Twenty potential solutions were proposed, with top priorities a digital dashboard and virtual care coordination.

Discussion Our findings emphasise the importance of interprofessional collaboration, patient and family engagement and supporting health technology infrastructure. Through user-based codesign, participants identified potential opportunities where health technology could improve system efficiencies and enhance care quality for patients waiting for surgical procedures. The codesign approach embedded users in the development of locally-driven, contextually oriented policies to address current perioperative service challenges, such as prolonged waiting times and care fragmentation.

Conclusion Health technology innovation provides opportunities to improve perioperative care and integrate clinical information. Future research will prototype priority solutions for further implementation and evaluation.

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Significant progress has been made in redesigning perioperative services, emphasising the importance of early risk assessment, improved communication and multidisciplinary care. However, it is unknown how health technology can effectively support surgical waitlist management and optimal models of perioperative care.

WHAT THIS STUDY ADDS

⇒ This study identified perioperative system challenges and potential opportunities where the user-based design of health technology can support the implementation of person-centric perioperative care pathways.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ This study provides a user-based foundation for future prototyping and innovation of digital tools and interfaces for perioperative care, supporting the need for integrated health technology solutions that address both clinical and administrative requirements.

INTRODUCTION

Perioperative surgical services are facing a global crisis characterised by long waiting lists, high rates of low-value surgery and increased health system costs.[1] Surgical services, already stretched servicing an ageing population with finite resources, were further strained by the COVID-19 pandemic.[2 3] The demand for surgery, coupled with resource and bed capacity limitations, has led to extensive waiting times for patients requiring surgical interventions.[4] Prolonged surgical waiting times are associated with serious complications, poor quality of life and higher risk of death, representing an important performance indicator for the quality of surgical services.[5–7] Operating theatres represent one of the most costly healthcare

commodities,[8 9] and efficient use requires avoiding futile or low-value procedures and unplanned cancellations.[10–12] These resource limitations and service challenges underscore the urgent need for innovative strategies to transform perioperative surgical services towards a more efficient, patient-centred and proactive models of care.[6 13]

Considerable progress has been made to define perioperative care as 'the multidisciplinary, individualised, integrated care of patients' from initial consideration of surgery to completing postoperative recovery.[14] New models of perioperative care, such as geriatric co-management,[15] Enhanced Recovery After Surgery[16] and prehabilitation,[17] are promising approaches to optimise patient outcomes. However, an ongoing unmet need is how healthcare systems can effectively identify patients on surgical waitlists who would benefit most from enhanced perioperative care models.[18]

Health technology solutions (such as electronic medical records, telehealth, digital applications and wearable technologies) are currently used by health services to improve perioperative patient safety, enhance data collection and monitoring, streamline management and share information between multiple care providers.[19–21] Health technology has the potential to improve how clinicians evaluate, communicate and plan the care of patients in the period between the initial decision for surgery and admission to the hospital. We, therefore, conducted a participatory research project to determine where health technology can support perioperative care for patients prior to hospital admission for surgery.

METHODS

Setting

Australia has universal government-funded healthcare in public hospitals, managed through local health districts (LHDs). The COVID-19 pandemic has exacerbated the challenge of providing timely surgery with finite resources, leading to increased waiting times for surgical procedures in Australian public hospitals.[22] This project was conducted in New South Wales, Australia, where median elective public surgical wait-times increased 28% between 2019–2020 and 2021–2022.[23] Funding and health policy can vary between LHDs, according to measures of clinical activity and nationally mandated priorities. Different electronic medical record platforms and systems hinder record integration between LHDs.[24] Participating LHDs were actively exploring strategies to enhance the efficiency and effectiveness of perioperative assessment and improve patient flow. This research is conducted by Sydney Health Partners Perioperative and Surgery Clinical Academic Group (CAG), a translational research centre including interprofessional members from four Sydney LHDs, funded by the National Health and Medical Research Council.[25]

Study design

This participatory research project used codesign to gain a deeper understanding of how clinicians deliver perioperative care and identify gaps, inefficiencies and opportunities for improvement in healthcare systems.[26–28] Participatory research uses a process of systematic inquiry in collaboration with the people or 'users' who are most impacted by the issue being studied.[28] In this study, the users are the perioperative clinicians who, along with patients, are using the existing or future health technology interventions. The codesign steps in figure 1 are modified from the 'Double Diamond' design process of the UK Design Council.[29] In the first Discover phase, participants begin with an open, divergent approach to identify a set of opportunities and service gaps. These insights help support and guide the Define process, refining ideas into a nuanced 'design brief' that consolidates initial ideas into robust concepts for generating potential technology solutions in the Develop phase. In this paper, we describe the implementation and findings of the Discover, Define and Develop phases. The final Deliver stage, where proposed priority solutions are prototyped, delivered and implemented into practice, is planned for future research.

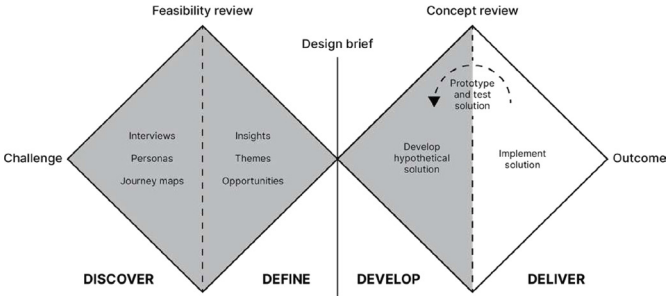

Figure 1 'The double diamond of design'*: applied methodology for the codesign processes *modified from UK Design Council.[16]

The codesign workshops were conducted over a 3-month period between October and December 2022. The need for change and project scope was established through one-on-one interviews with key members of the research team and senior perioperative clinician stakeholders. Three rounds of participatory codesign workshops involving interprofessional clinicians were conducted that aimed to identify current system needs and key opportunities for change, focusing the design direction toward potential technology solutions to support perioperative service delivery.

We employed personas (workshops 1 and 2) and journey maps (workshop 3) as interactive tools to take participants through a process of contextual inquiry and solution ideation. Personas are research-based characters that participants create to represent the diversity of different patient profiles and allow stakeholders to empathise with user needs, concerns and preferences throughout the perioperative journey.[30 31] Coupled with personas, journey maps provided a visual representation of user experiences, highlighting the various touchpoints and interactions with the healthcare system. From these workshops, hypothetical solutions were generated for future prototyping and testing.

Participants

For the purpose of this research, users were defined as the clinicians and healthcare staff who frequently use the clinical systems supporting perioperative assessment pathways (including resident doctors, anaesthetists, intensive care specialists, internal medicine specialists, surgeons, nurses and allied health clinicians) and healthcare managers.[28]

Participants were recruited via an email invitation extended to perioperative CAG members, and clinicians in perioperative and surgical services at participating LHDs. Purposeful sampling was used to ensure a broad representation of relevant stakeholders. Consumer representatives were directly approached and invited to attend as co-creators, to provide their perspectives on patient experiences and relevance.

All 51 participants provided informed consent. Clinician participants volunteered their time; however, consumer representatives were renumerated according to guidelines from Health Consumers NSW.[32] The workshops were facilitated by an external, paid codesign consultant (RD).

Data collection

All clinician participants completed an electronic pre-workshop questionnaire on their current perioperative practices and methods of risk assessment, with de-identified results collated to guide the workshop discussions. Pre-workshop contextual inquiry also involved interviewing key CAG representatives. Field notes from pre-workshop interviews and questionnaires were collated to inform the scope for the subsequent codesign activities.

Three participatory codesign workshops were conducted—two via video conferencing and one face-to-face. Data collected included pre-workshop surveys, field notes on discussion points and workshop documents (persona templates, participant notes, journey map posters, mind-maps and other output from interactive activities). Workshop outputs were photographed for data analysis and record retention.

Data analysis

The principal investigator (SJA) and codesign consultant (RD) independently and systematically coded the output from the codesign workshops using an iterative constant comparative method. The preliminary report was provided to the full research team and workshop participants for comments and validation. Themes were then collated and revised, guided by the principles of human-centred design.

Reflexivity statement

The researchers involved in the project have different perspectives and lived experiences, as both clinicians and consumers within the healthcare system. The research group has a range of career stages, and clinical and academic specialties, many with concurrent clinical, governance and administrative roles. The principal investigator (SJA) is a vascular surgeon interested in patient-focused healthcare systems, with personal experiences of disability and surgery. The consumer representatives involved in the project, and many of the clinician participants, were encouraged to ask questions about each other and share their own lived experiences of surgery or as carers for people having surgery with differing degrees of health sector engagement. These experiences helped develop collective knowledge and insights that shaped and guided the codesign discussions for subsequent analysis.

Table 1 Distribution of primary professional roles of participants in the codesign workshops

Virtual workshops 1 and 2 'Persona Development'		Face-to-face workshop 3 'Journey-mapping'	
	Total, n=22		Total, n=29
Surgeon	5	Surgeon	3
Anaesthetist	4	Anaesthetist	4
Physician (geriatric medicine)	2	Physician (geriatric medicine)	1
Emergency medicine	1	Nursing	6
Nursing	3	Primary care physician	1
Primary care physician	2	Allied health	2
Resident doctor	4	Administrator	2
Consumer	1	Intensive care specialist	3
		Resident doctor	3
		Consumers	3
		Other	1

Ethics approval

Approval was obtained from the Sydney Local Health District Concord Human Research Ethics Committee and informed consent was obtained from all participants (HREC 2022/ETH01436).

RESULTS

Across the three workshops, 51 clinicians from multiple professions and three consumer representatives participated in the codesign process (table 1). After the initial contextual inquiry, the project scope was limited to where health technology can support perioperative care occurring between the initial decision for surgery and admission to the hospital. Improving clinical decisions and practices within this time frame were considered the most important to providing high-quality care to patients waiting for surgery.

Workshop 1 and 2 participants worked as a group to iteratively develop seven patient-modelled user personas across a range of perioperative risk profiles.[27] Persona descriptions were sufficiently detailed to adequately support clinical decision-making, including personal characteristics (name,

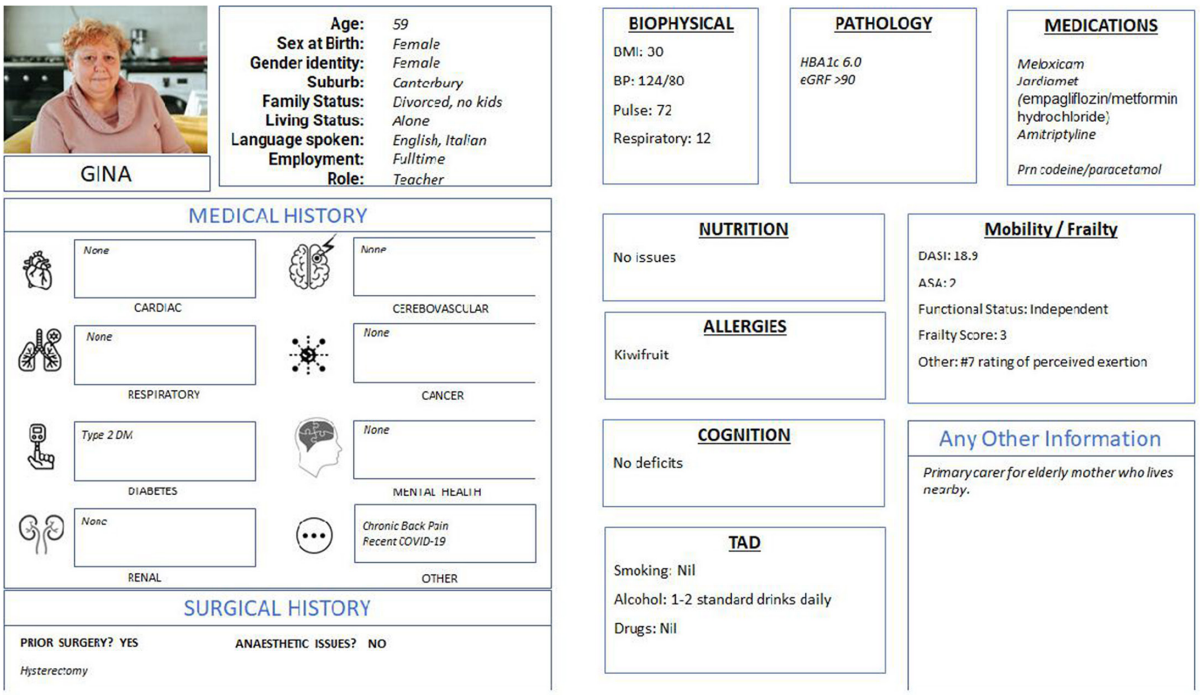

Figure 2 Example of a patient persona. BMI, body mass index. Example of a patient personaa. ASA, American Society of Anesthesiologists Score. BMI, body mass index. BP, blood pressure. DASI, Duke Activity Status Index. eGFR, estimated glomerular filtration rate; HbA1c, haemaglobin A1c; TAD, tobacco, alcohol and drugs.

photo, gender, social situation and supports, financial status, personal needs and treatment goals), clinical context (contact with healthcare systems, symptoms, pain scores, function, medications, comorbid illnesses) and baseline investigations (blood tests, relevant imaging or investigations). Researchers and participants ensured that the personal and social attributes of the personas were representative of the populations serviced by the participating LHDs. Figure 2 shows an example of persona. Summaries of the persona development exercise were further refined based on consensus feedback from the wider research group. Online supplemental table S1 summarises each persona's characteristics.

In the final workshop, participants mapped anticipated perioperative experiences for elective anterior resection for colon cancer or hip arthroplasty, according to each persona. During the initial inquiry and scoping process, these two surgical procedures were chosen as representing different levels of procedural magnitude, clinical urgency and perioperative risk associated with elective surgical procedures. In this workshop, participants worked in small interprofessional groups of five to six people to generate a visual depiction of the perioperative journey for their allocated patient persona, shown in online supplemental figure S1. Journey mapping included reference to key perioperative decisions, person-centred care elements,[33] emotions (both patient and clinician), location and access to required clinical information and potential system pitfalls. After reflecting on the journey maps and group summaries, an interactive exercise had participants propose and rank potential solutions where health technology could address identified needs and opportunities (table 2). In this exercise, participants each allocated a limited sum of hypothetical money to their preferred solutions.

Thematic analysis of the project output identified six key design challenges, which were reframed as opportunities to improve current perioperative health systems.

Proactive and preventative perioperative care requires a shift in care processes towards earlier assessment

Currently, most perioperative planning occurs towards the end of the preoperative period, often within weeks of the anticipated surgery date. This gives limited opportunity to implement preventative treatments such as rehabilitation or nutritional therapy.

> We currently have a highly labour-intensive process and system. Tasks are often done at the last minute. It's not optimised.

Improving digital health record integration could provide critical clinical information required for triage and risk assessment at the time of surgical listing and facilitate streamlined preparation, monitoring of clinical status while on the waitlist and planning for hospital services such as intensive care beds.

Clinical records need to support clinicians to make evidence-based yet individualised care decisions

Clinician participants desired autonomy to individualise treatment plans to patient needs and priorities. While participants valued clinical risk scores and algorithms, they wanted flexibility to tailor their preferred tools and avoid over-protocolisation. Some participants

Table 2 Proposed solutions to perioperative challenges, ranked according to participant preferences

Ranking	Proposed solution	Key opportunities addressed	Hypothetical monetary sum assigned*
1	Develop a digital perioperative dashboard that has the ability to send alerts and notifications and links the various information and data created by different actors involved in the care, coordination and treatment decisions for the patient. Provide a high-level overview with visual design to show different specialties involved, what they are currently doing for that patient, and the ability to drill down and then link to other systems with detailed information. Map the patient's progress through the pathway. Make available to the care team, general practice and patients.	1, 2, 3, 4, 5, 6	$A920
2	Digitise the request for admission surgical booking and patient survey forms.	2, 3, 4, 6	$A570
3	Integrate care coordination and virtual MDT for rural/remote or isolated patients to provide support with systems navigation, compliance with preoperative indications and recommendations and coordination of diverse perioperative activities and consultations, as well as leveraging requirements for in-person consultation.	1, 2, 3, 4, 5, 6	$A440
4	Virtual care coordinator support for patients with complex care to assist with system navigation, collate and disseminate information, streamline processes for pre-admission clinics, patient liaison and coordination of early referrals to other services and maintain continuity of care. Follow-up on existing NSW Health trials outcomes around care coordinators for complex care patients.	1, 2, 3, 4, 5, 6	$A370
5	Establishment of surgical MDT virtual mega clinical available for complex patients and not just for cancer patients.	1, 3, 4, 5	$A230
6	Standardisation and digitisation of Health Questionnaires, making them available in other languages and accessible to general practitioners and patients. Ensure data quality and completion prior to the booking date.	2, 3, 6	$A220
7	Implement automated electronic medical record system alerts for pre-admission clinical patients when they require insulin/time-sensitive medications for high-risk medicines reconciliation, early identification and inclusion on patients' charts.	1, 2, 6	$A120
8	Virtual MDT/case coordination, focused on information sharing, streamlining transitions and earlier assessment.	1, 3, 5, 6	$A100
9	Decrease last-minute pre-admission clinics' requests to general practices for patient information/test results by automating electronic medical record sharing, triggering 'data missing/request' eMR workflow activities days in advance and consolidating information with existing electronic medical health records. Decrease and avoid duplication of investigations by integrating imaging and pathology activities/requests into the patient pathway dashboard with real-time progress (eg, done, booked, to be scheduled) and system alerts of pending/next steps stages.	1, 2, 3, 4	$A40
10	Develop and integrate into eMR a tool for risk score and fitness for life-saving surgery in the emergency department and emergency surgery, with the ability to liaise with MDT for advice and recommendations on the futility.	1, 2, 5	$A40
11	Automated high-risk patient identification at the point of procedure booking by incorporating validated scoring onto e-health systems.	1, 2	$A20
12	Integrated coordination of care for patients with multiple interventions through real-time digital patient pathway tracker available to patients and carers.	1, 3, 4	
13	Perioperative process information booklet, pathway and wait times transparency through a real-time digital tracker available to patients and carers.	3	

Continued

Table 2 Continued

Ranking	Proposed solution	Key opportunities addressed	Hypothetical monetary sum assigned*
14	Increase and improve communications regarding patient needs and status between parties involved in the perioperative journey (health providers, urban/rural hospital, community health services, patient and carer).	3, 4	
15	Set advanced care planning and subsidising confirmation, where community services are required for disability or aged care, from the early stages of the pathway.	1, 2, 3, 6	
16	Increase awareness and education around 'It's ok to say No to surgery', including realistic and achievable management plans and surgery vs no-surgery outcomes.	1, 4, 5	
17	Cost-benefit analysis and opportunities around burden and expenses of receiving non-hospitalised clinical services such as allied health at prehabilitation or rehabilitation.	2, 3	
18	Comprehensive support for and early identification of the non-compliant patient and how to address patients not following preoperative instructions.	1, 3, 4	
19	For non-surgical patients (eg, highly complex aged care or disability) who are referred for surgical consult/specialist referral/opinion, integrate systems and existing electronic patient data from care facilities and electronic health records to inform risk assessment and outcomes onto patient dashboard. Share this with care teams for transparency and integration of care.	2, 3, 5	
20	Increase awareness and education of senior policymakers and non-hospital advisories on real-life operationalisation and patients' struggles, promoting empathy and understanding how to help them, so these learning can be considered when policymaking for real-life impacts.	3, 4, 6	

*Participants were allocated fictional money counters equating to $A100 per participant, to distribute to their preferred solutions as part of an interactive ranking exercise: 'Put your money on your solution'.

were apprehensive about policymakers promoting specific risk scores in clinical algorithms, replacing the role of experienced clinicians in decision-making. All clinicians advocated that better visualisation of clinical parameters in electronic health records could improve decision-making.

> A dashboard is an opportunity to get away from manual time-consuming paper-based processes. This gives us an opportunity to identify and triage patients more effectively.

Opportunities for health technology solutions included summarising key perioperative clinical and social variables into visually appealing ways, that provided sufficient data for clinicians to calculate their preferred risk scores.

Communication can be integrated by improving access to clinical information across different healthcare settings

Participants were frustrated by difficulties locating clinical information in electronic medical records, spending considerable time obtaining documentation from private facilities and primary care providers. Different healthcare staff prioritised different aspects of the clinical record, and current processes duplicate information gathering.

> Data is buried; different clinical groups use the system in different ways, and there are opportunities for assessments to be done in an interdisciplinary way.

Primary care clinicians wanted access to electronic hospital records to advise patients of waitlist times, and support preventative care and monitoring. Participants also proposed that patients should have input into their perioperative records and information-sharing. There are opportunities to improve access to digital clinical records across different healthcare jurisdictions, between hospital and community and between different members of the perioperative team.

Key transitions in clinical care need to be more streamlined to help with patient and clinician experiences

Transitions in care to different providers and services in the perioperative journey represented potential care fragmentation and uncertainty.

> We need better flow systems for how patients come to the surgery and how we optimise and prepare them for that operation.

Participants proposed that the experience of patients and clinicians could be significantly improved through

virtual care coordination, especially for high-risk or vulnerable patients or those with additional barriers to care such as rural and remote residence or limited English-language proficiency.

Perioperative organisational structures need to provide an opportunity for shared decision-making and options to pursue non-operative management

Participants reported limited opportunities to redirect patients towards non-operative pathways if surgery is deemed to be of limited benefit, or if treatment goals change. The current demand for complex decision-making support is unknown and proactive referrals are ad hoc. Digital health summaries present opportunities to monitor and stratify subgroups of patients on the surgical waitlist with different perioperative needs and plan health services based on projected requirements.

Partnerships between administrative and clinical staff are required for safe and timely perioperative care

Current systems separate waitlist administration and demand management from clinical services. Participants desired greater partnership between clinicians and administrative staff to manage the waitlist and align clinical needs with efficiency indicators. Participants saw an opportunity to integrate administrative and electronic health records, with the aim of supporting perioperative review and operating theatre demand management and reducing unplanned cancellations.

Twenty digital solutions were suggested, shown in table 2. The highest ranked were a digital clinical support dashboard, virtual care coordination and digitisation of core clinical documents. These three potential solutions also address all six of the key opportunities to improve care.

DISCUSSION

We have shown how health technology-based solutions can be used to improve the perioperative phase of care occurring between the initial decision for surgery until hospital admission. By engaging diverse stakeholders, including clinicians and patients, in a participatory design process, we identified key design challenges and locally relevant solutions for further evaluation. Interprofessional teamwork, perioperative health system transformation and health technology infrastructure investment are required to address these design challenges. By co-creating this research with clinician end-users and other key stakeholders, the opportunities and interventions proposed have the potential to create meaningful solutions to real-world problems. This collaborative approach has been shown to foster a shared sense of ownership and responsibility for creating meaningful changes.[27 28 30 34] Our findings emphasise the surgical waitlist period is an opportunistic time to implement preventative care that promotes proactive and patient-centred perioperative management. Digitisation of key documents and improved integration of clinical information across healthcare jurisdictions were seen as solutions to overcome existing communication barriers and streamline patient progress through transitional phases of care. Participants strongly supported integrating digital tools into existing clinical services, to monitor service provision and support patient pathways.

The identified knowledge gaps and perioperative service needs are not unique to our local context. Similar health system strains are reported globally, indicating the need for a comprehensive redesign of perioperative pathways.[1 13] Building health system capacity to support patient self-management before and after surgery is essential to improving system efficiencies and supporting patient-centred care. Our study reinforces the value of the recently published Australian and New Zealand College of Anaesthetists (ANZCA) Perioperative Framework, which emphasises the importance of non-operative care and early perioperative optimisation.[14] This includes ensuring that all patients who need surgery receive high-quality care, with their health managed to ensure optimal surgical outcomes. For patients in whom surgery may have minimal value, the perioperative pathway should include options for non-surgical care that aligns with their treatment goals and preferences. The ANZCA perioperative model, along with our findings, advocates for moments in the perioperative journey where the surgical team and patient can review perioperative risks and benefits, deciding collaboratively whether to pursue surgical intervention.[14] We, along with others, identified that informed and collaborative discussions on surgical risk are often delayed until anaesthetic review immediately before surgery, with delays in obtaining sufficient clinical information, reducing the time for contemplation and decision support.[4 6 7 35 36] Digital support tools, such as a perioperative dashboard that summarises and presents pertinent clinical information, are potential mechanisms to improve the quality of shared decision-making and proactive care coordination.[13]

The quality and ease of access to clinical data are important mechanisms to inform perioperative health system design, improve patient safety and support decision-making. Patient portals, perioperative dashboards and virtual coordination were some solutions raised during the codesign process to improve information sharing, build partnerships between stakeholders and engage patients in their perioperative care. Improving the visual comprehensibility of complex clinical data can improve communication between patients and clinicians.[37] An example of innovative health technology supporting perioperative care is the UK National Health Service 'perioperative digital playbook', which has improved communication between health services and patients.[38] This intervention supports in-depth clinical decision-making, preoperative assessment and waitlist coordination and provides patient education about surgery.[39] Similar programmes in the USA focus on reducing last-minute surgery cancellations through computerised modelling of key predictors in electronic health records,[40 41] using machine-learning algorithms to streamline perioperative services[42] and improving patient access to information through personal health record portals.(42) Participants in our study also saw opportunities for clinical information to link with administrative and waitlist management, improving system

efficiencies by ensuring all patients scheduled for surgery are fit to proceed. The solutions our participants ranked highest were also those that addressed all of the key opportunities identified in our thematic analysis, and solutions that addressed only one or two opportunities had less support. This suggests that clinicians prioritise whole-system solutions over more targeted interventions focused on efficiency.

Our study is strengthened by the participatory design process, which included multiple clinician and administrative stakeholders from various career stages and specialties, minimising selection bias through comprehensive representation. The involvement of consumer representatives in the codesign process lends weight to our findings. However, as the focus of this research was on how clinicians interact with perioperative systems, this bias towards clinical professions may under-represent the perspectives of non-clinicians and consumers. While many of the findings are comparable to experiences of the wider perioperative care community, the project focused on perioperative services in Sydney, Australia and there are generalisability limitations. Despite trying to balance the need for both specificity and generality in the personas and journey maps, it was not possible to fully represent the nuances of perioperative care for individual diseases or surgical procedures. Differences in electronic health record systems and local practices meant that detailed prototyping and location-specific solutions were not feasible during these workshops, and future work on the delivery design phase will address these implementation challenges.

CONCLUSION

This research provides valuable insights for future policy and practice by identifying key challenges in perioperative care and generating potential solutions through codesign. The findings highlight the need for a comprehensive redesign of perioperative care and the integration of health technologies to support information sharing, care coordination and decision-making. There is potential to transform perioperative systems, improve patient outcomes and enhance the experiences of both patients and healthcare providers through effective implementation of well-designed, user-oriented health technology solutions. Clinician support for system change was higher when their priorities were addressed with multifaceted interventions, compared with targeted, specific cost-saving measures. Future research should focus on the implementation and evaluation of proposed solutions to ensure their effectiveness and maximise value to perioperative care.

Strengths and limitations

- Strengthened by the participatory study design with broad interprofessional representation to support the validity of study findings and reduce selection bias.
- Relevance to person-centred care is strengthened by consumer participation at all stages of the project.
- Codesigned resources (personas and journey maps) can be reused in future projects, strengthening sustainability and reach of the research.
- Generalisability has some limitations due to regional variations in e-health platforms and local policies.
- Findings are limited to general principles of perioperative care, not specific surgical procedures or diseases.

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