

# Submission to Our Healthcare Future consultation paper

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This submission reflects my own personal views and does not represent any institutional or organisational policy.

## Introduction

The paper raises several important issues which must be addressed.

However, I would like to address a critical topic that has not been addressed by the paper: **the increasing problem of low value care**. This is an issue which is being increasingly addressed by clinicians and consumers alike in recent years, and in my view it is a fundamental problem. Without addressing low value care as a pervasive underlying problem throughout the entire health system, waste and harm will continue to compound, wiping out any gains made in other areas of the health system.

It is estimated that up to 40% of healthcare is wasteful and adds no value to the care of the patient. This has a number of serious consequences: it increases the risk of serious harm, it wastes scarce time and resources, and it denies others the opportunity to receive care in a timely fashion.

Consumers and the health professions have recognised this and implemented “ground up” initiatives to begin addressing the problem. Choosing Wisely ([www.choosingwisely.org.au](http://www.choosingwisely.org.au)) is one initiative which has taken hold internationally and in Australia. The Royal Hobart Hospital has been a Champion Health Service for over two years now and clinicians from most disciplines at the RHH are working to reduce delivery of low value care. Discussions are underway to embed these programs into broader Tasmanian Health Service operations with tangible project support.

However, the issue of low value care must be addressed at every opportunity – consumers and clinicians alike expect it.

I would like to comment on a selection of the consultation questions through the filter of addressing low value care at a systemic level. I will make my comments brief for this submission – I have spoken and written about low value care extensively at the RHH and to the THS and I am more than willing to expand on any or more of these points as required.

## Consultation questions:

**Reform Initiative 1 – Consultation questions: 1. How can we target better our current investment as well as future investments in health to ensure a sustainable and balanced mix of services is delivered across the whole of the health system to provide right care in the right place at the right time?**

- Acknowledgement that up to 40% of the healthcare that is delivered now is wasteful and harmful is an essential first step. Engagement with consumers and clinicians, with support from colleges, professional societies and researchers to identify which healthcare is of low value, will allow wasteful and harmful tests, procedures and investigations to be ceased, thereby improving the value of healthcare at all levels of the system.

**Reform Initiative 2 – Consultation questions: 2. What digitisation opportunities should be prioritised in a Health ICT Plan 2020- 2030 and why?**

- An integrated IT system which has built in capability to incorporate clinical decision aids and pathways supported by evidence is essential. This can allow the addition of “traffic light” ordering systems for pathology and radiology tests which will allow evidence-based tests to be ordered and low value tests to be denied. This is happening at an ad-hoc level at the moment, but given the rapid turnover of staff and the large volume of tests being ordered every day across our entire health system, an IT solution is the only practical way to deliver sustainable improvement in this area. Ideally these systems should incorporate the following:
  - Built in evidence-based clinical decision aids
  - Ability to deny the ordering of certain tests recognised to be of low-value in most clinical situation
  - Recognition of previous ordering of tests to avoid duplication (eg, links to outside systems to identify recent ordering of the same tests)
  - Built in systems to highlight critical results and to alert the clinician

**Reform Initiative 2 – Consultation questions: 4. What are the opportunities to develop a digital interface between hospitals and other care providers (such as GPs, aged care and the private system) to improve the timely sharing of patient information?**

- Sharing of data and test results reduces the risks of low value care through reducing duplication and encouraging continuity of care between health care providers. This has long been a challenge between public and private systems but a solution is clearly worth finding.

**Reform Initiative 3c – Consultation questions: 1 How could a Statewide Clinical Senate assist in providing advice to guide health planning in Tasmania.**

- The development of clinical senates in other jurisdictions has enabled consumers and clinicians to feed into policy development and to drive higher quality care. Embedding the principles of Choosing Wisely into the health system as a broad policy objective and

supported by all levels of the service, including a clinical senate, would go a long way to bringing about long lasting and sustainable change in this area.

**Reform Initiative 3c – Consultation questions: 2. How can we better engage meaningfully and effectively with consumers and other key stakeholders in health service planning, delivery and quality improvement?**

- Consumer engagement is critical in the design of better health systems with a clear patient-focus. The structures exist already – Health Consumers Tasmania and the Hospital CCEC groups – but these need to be adequately resourced so that meaningful input can be obtained and included at all stages of policy development and project design.

## **Summary**

Whilst this consultation paper is important and raises a number of worthy issues, unless the problem of low value care is identified and integrated as a core issue that needs to be addressed at every level of the system, then current problems will be compounded and the ideal of a sustainable healthcare system with equitable access for all will sadly never be realised.

OPINION

Open Access

# The three numbers you need to know about healthcare: the 60-30-10 Challenge



Jeffrey Braithwaite<sup>1\*</sup> , Paul Glasziou<sup>2</sup>  and Johanna Westbrook<sup>3</sup> 

## Abstract

**Background:** Healthcare represents a paradox. While change is everywhere, performance has flatlined: 60% of care on average is in line with evidence- or consensus-based guidelines, 30% is some form of waste or of low value, and 10% is harm. The 60-30-10 Challenge has persisted for three decades.

**Main body:** Current top-down or chain-logic strategies to address this problem, based essentially on linear models of change and relying on policies, hierarchies, and standardisation, have proven insufficient. Instead, we need to marry ideas drawn from complexity science and continuous improvement with proposals for creating a deep learning health system. This dynamic learning model has the potential to assemble relevant information including patients' histories, and clinical, patient, laboratory, and cost data for improved decision-making in real time, or close to real time. If we get it right, the learning health system will contribute to care being more evidence-based and less wasteful and harmful. It will need a purpose-designed digital backbone and infrastructure, apply artificial intelligence to support diagnosis and treatment options, harness genomic and other new data types, and create informed discussions of options between patients, families, and clinicians. While there will be many variants of the model, learning health systems will need to spread, and be encouraged to do so, principally through diffusion of innovation models and local adaptations.

**Conclusion:** Deep learning systems can enable us to better exploit expanding health datasets including traditional and newer forms of big and smaller-scale data, e.g. genomics and cost information, and incorporate patient preferences into decision-making. As we envisage it, a deep learning system will support healthcare's desire to continually improve, and make gains on the 60-30-10 dimensions. All modern health systems are awash with data, but it is only recently that we have been able to bring this together, operationalised, and turned into useful information by which to make more intelligent, timely decisions than in the past.

**Keywords:** Learning health system, Complexity, Complexity science, Change, Evidence-based care, Clinical networks, Quality of care, Patient safety, Policy, Healthcare systems

## A system in need of repair

Modern healthcare systems have a numbers problem: specifically, 60, 30, and 10. Despite all the resourcefulness and efforts of the past 30 years, the healthcare delivery cart remains stuck in a debilitating underperformance rut [1].

Care in-line with guidelines hovers at 60% as shown by large empirical studies of multiple conditions in adults and children in the USA, England, and Australia [2–6]. Some 30% of care is waste, duplication, or of low value, according to several authoritative sources including Berwick and the Organisation for Economic Co-operation and Development (OECD) [7–10], for which considerable expenditure cannot be justified. And many studies have documented how iatrogenic harm or adverse events befall at least 10% of patients globally [11–15].

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Consider for a moment, if civil aviation, car manufacturing, or the software design industry achieved 60% reliability of service delivery in commercial passenger journeys, new motor vehicles, and just-released software programs. Imagine further if these sectors had a 30% inefficiency rate when producing their outcomes, and they harmed 1 in 10 of their customers. This would not, surely, be tolerated. Healthcare is more complex than those industries, but spends less effort on improvement.

These headline healthcare numbers persist and may become worse when we consider everything that is coming down the health innovation pipeline. Advances in precision medicine, genomics, new generation drugs, AI, and brain sciences are all in various stages of development or take up in healthcare—with the potential to do both good and harm to the system. If the 60-30-10 Challenge represents a strong signal that the system is not fit for purpose now, how will it cope with an avalanche of these advanced technologies? This new evidence has the potential to deliver new cures and to save and extend lives, but if not adopted effectively, or across-the-board, then the proportion of evidence-based care could fall, not rise. New technologies also increase the complexity of care—and add more risk, and if they do not provide an adequate return on investment may add more waste. They could also introduce more potential for increased iatrogenic harm. The 60-30-10 Challenge is standing in the way of progress.

### Where we are now?

To meet the Challenge, there is an urgent need for a conceptual leap in our understanding of how healthcare systems respond to relentless demands, internal and external pressures, and naturally evolve. Stretched

clinicians and healthcare professionals see the symptoms of systems underperformance every day, so they are accustomed to frustrations, and, deft at work-arounds, mostly give of their best in a difficult system [16]. Managers, policymakers, ministers of health, and other politicians see it too, manifesting in the myriad of disparate matters (errors, human resource problems, politics, funding, and socio-economic issues) they have to grapple with, alongside weekly or daily media crises [17, 18]. It is not the workforce, any more than it is the patient, at fault. Today's episodic, fragmented, and hierarchical models of healthcare delivery and organisational governance are straining because they are built for the past [15, 19, 20]. And the pace of change is exhausting, with people struggling to keep up. Indeed, new research is making around 7% of 'best practice' obsolete each year [21], and an average of five new diseases are added to Medline every week [22].

Meanwhile, research on healthcare systems, using increasingly sophisticated methods and approaches, and drawing on the same complexity science and network theories used to understand biological processes, is beginning to reveal deep insights into how things really work [23–26] (for definitions of terms, see Table 1). The answer is not the introduction of yet more rigid policies or re-arrangement of organisational charts in the vain attempt to restructure once again. That type of approach is based on linear thinking—to which humans all-too-often default. Such simplistic, if-then logic serves us well when making straightforward decisions, but it is insufficient for the wicked problems that now present to us in healthcare settings [29–31].

Complexity science is making breakthroughs in understanding the dynamic webs of virtually infinite

**Table 1** Glossary of terms

Term	Definitions
Complex adaptive system	A dynamic, self-similar collectivity of interacting agents and their artefacts with emergent behaviours and characterised by nonlinearity, e.g. a large hospital.
Complexity	The behaviour embedded in highly composite systems or models of systems with large numbers of interacting components (e.g. agents, artefacts and groups); their ongoing, repeated interactions create local rules and rich, collective behaviours.
Complexity science	A discipline drawing on the study of systems sciences, accounting for and describing the core features and behaviours of different kinds of complex adaptive systems.
Emergence	Behaviours that are built from smaller or simpler entities, the characteristics or properties of which arise through the interactions of those smaller or simpler entities; the larger entities are one level up in scale and manifest as structures, patterns, properties, or collective behaviours.
Learning health system	A system at the crossroads of people and information systems—i.e. one that is 'sociotechnical'—and that enables virtuous learning cycles through an underlying information infrastructure. Through the implementation of virtuous learning cycles, a learning system is informed by evidence and actionable data in 'real-time' and creates the foundations of a system capable of meeting systems-wide, clinically oriented, and patient-relevant delivery targets.
Network	An interlocking web of relationships or connections at varying levels of scale in a system; the agents or artefacts are the nodes and the relationships between them are lines or vectors, which together describe the structure of the interactions of the network's membership.

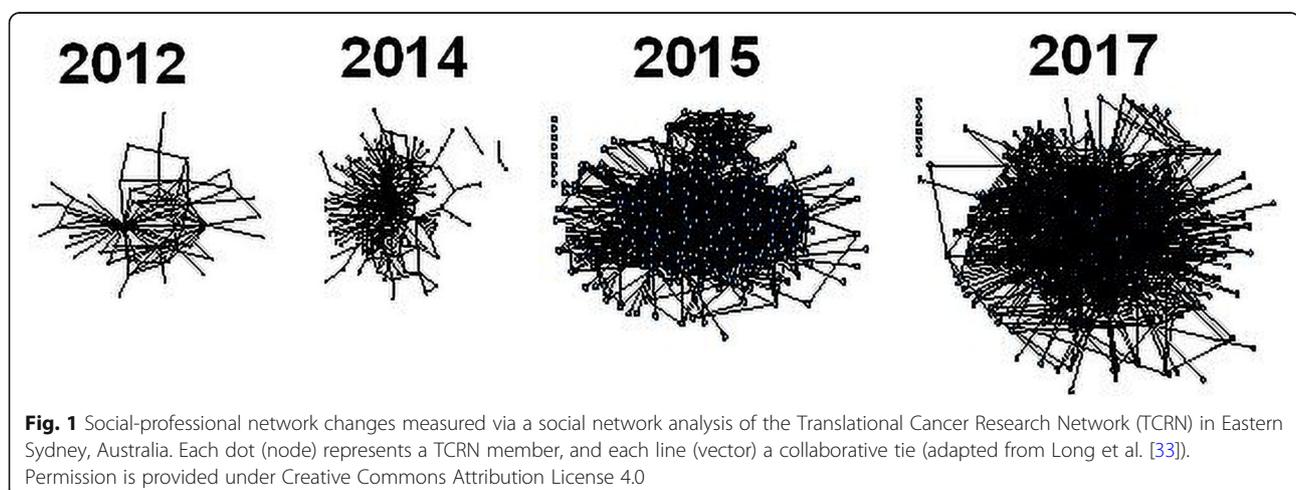
Sources: Boeing [27]; Braithwaite et al. [24, 28]

combinations of interactions required to deliver effective care. These complex healthcare ecosystems resist standardisation, and inevitably flex and adapt in the face of constant change and shifting pressures [32]. We can only improve them if we understand them as such. An example of how organic change across clinical practice can be induced is a network of clinicians, researchers, clinician-researchers, and patients in eastern Sydney, Australia, which nurtured their collaboration over a 6-year period, and achieved substantial growth in individuals involved in the collective strength of the network (Fig. 1). Network expansion was made possible through the allocation of research funding, so the partnership was strengthened diachronically. This included supporting the activities of opinion leaders and collaborators conducting and funding joint projects. An ethos of promoting inclusivity and teamwork was inculcated, and participation in educational and other events encouraged.

Managers might persist with hierarchical accountability charts and more policy pronouncements as solutions, but seeking to drive improvements to clinical practice via top-down edicts has rarely worked satisfactorily for those on the front lines of care. Complex healthcare systems do not respond in a linear way to what the high-level architects of change intend [28, 34]. But they do respond if provided with incentives, resources, encouragement, data, feedback, tools, and fewer constraints, as exhibited by the social network study. Across the 6 years, 2012 to 2017, network members could apply for funding together (incentives), a biobank was established (resources), members were supported by an administrative team to underpin progress and collaboration (encouragement, fewer constraints), and biostatistical support (data) and implementation science expertise (tools, feedback) were made widely available. Although direct attribution of the TCRN's collaborative

growth to downstream outcomes is difficult when so many variables in health systems are changing, there are some key accomplishments. The collaboration was funded by a modest research award of AUD\$6.5 million in 2012 and again in 2017. In this time, the network published 1513 articles, leveraged a further \$170,898,488 of funding, led or enabled over 50 research projects, and supported over 50 PhD students, and by February 2017, there were 2130 biobank participants. The TCRN initiated clinical improvement projects, including those to enhance quality of care in surgical oncology and multidisciplinary care. In a 2015 survey of the network, a subsample of 122 respondents answering an open question indicated that changes in practice as a result of TCRN activities included enhanced engagement with consumers (42 respondents, 34%), the biobank (35, 29%), and diagnostic improvements around hereditary breast, ovarian, or colorectal cancer (5, 4%). By 2017, approximately two thirds of all respondents had been involved in new translational projects not funded by the TCRN but coming about as a result of TCRN involvement.

As well as beginning to understand the strengths of these kinds of networked collaborative structures, researchers have gradually realised that healthcare systems are non-deterministic and behaviours are emergent—that is, it is not possible to confidently predict the future by generalising from the past [28]. For example, medical errors have long been scrutinised using 'root cause analysis' that promises to identify and 'fix' the pathways to sometimes tragic failures. It is, of course, critical to establish how failures occur. But the answers may not effectively inform future safety protocols or avert further harm because few errors follow the same pathways within those complex webs of interactions that healthcare delivery entails. Initiating more rigid policies and procedures following such analyses in the expectation that the same confluence of events will arise in the



future can have adverse effects by restricting the system and hampering the ability of teams to adapt in response to dynamic situations.

### A way forward

How then, can we use this knowledge and evidence from other examples [35–37] to break the impasse to achieve better, more cost-effective, and safer care? The 60-30-10 Challenge is ample warning against trudging along the same well-worn tracks to disappointment. Today's popular 'solutions' such as restructuring [38], constantly fiddling with policy settings [39], adding more and more bureaucracy [40, 41], and introducing a new election manifesto or imposing fresh targets on the system every time a government changes [42] keep lots of people busy implementing 'change' but beyond superficialities; these measures conspire to constrain systems and contribute much inertia. In the end, all this top-down activity is not genuine improvement and just adds up to the same 60-30-10 gridlock.

Accumulating research across healthcare systems is reinforcing the view that we need to take the different approach that the network model signifies. We need to study, design, and test new integrated, interdisciplinary, and evidence-based models that can keep pace with inevitable changes in our knowledge, narrowing the gulf between research and clinical practice. These will be models that induce collaboration and transcend specialty silos; that link hospitals, primary care, aged care, and community services; and that can guide well-informed patients along clearer, evidence-based healthcare pathways, for their immediate health needs, and across their lifespan, from birth through paediatric to adult and aged care [23, 43, 44]. Such an approach requires multi-pronged strategies, from exploiting information and decision-support technologies to new health financing models that reward good care, de-fund futile or marginal care, and provide incentives to excel. That is just the first step.

We have been focusing intently on errors and waste while largely ignoring the majority of care that is delivered effectively, despite considerable pressures at the clinical coalface. Flip the question that way and we can ask how, in a system this complex, does so much care go well in everyday practice? [45] And, within the landscape of good care that is well delivered, where are the best examples of exemplary practice? Therein lie many of the secrets of success [26]. Learning from what goes right could help shift the dial on those headline numbers. In every healthcare system, we can dig a little deeper into each of those three figures to find useful variability. There are always stand out performers providing better care, creating less waste, or making fewer

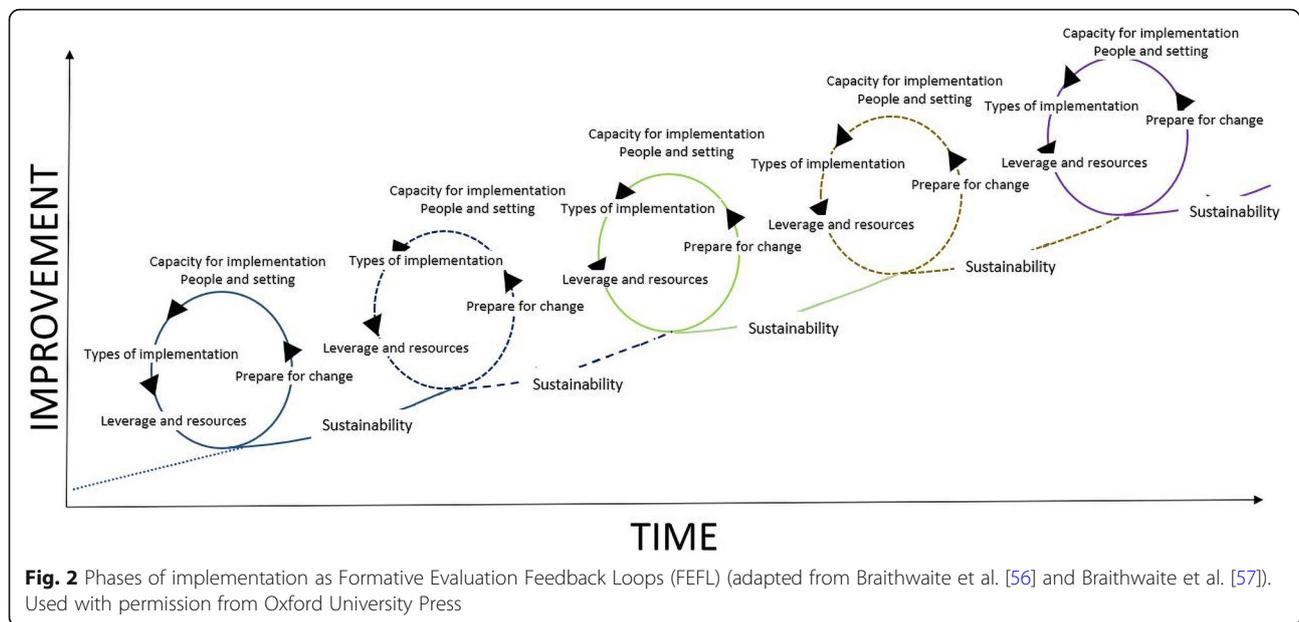
errors. They have much to offer other parts of the system operating under similar conditions.

Yet we are not very accomplished at spreading good practices across entire health systems, so islands of excellence can be found, but amongst oceans of poorer or even mediocre care, and the lessons are not shared, nor the better practices widely adopted. Those scattered exemplars already exist—such as the research networks for undiagnosed diseases [46] or the clinical improvement networks for cystic fibrosis [47], or more generally that better mortality and quality is correlated with clinical research, particularly the number of patients enrolled in interventional studies [48]—but they are not the norm, and even these examples can and must continue to reform and improve. In short, to understand health systems and systems performance, we need to focus not only on the problems (e.g. that harm or adverse events occur in 10% of admissions and GP encounters) but also on where things go well (e.g. where patients are kept safe in 90% of cases). For example, the WHO's five moments for medication safety (starting, taking, adding, reviewing, and stopping a medication) [49] is an evidence-informed way of tackling errors (in the 10% camp), and Hollnagel's resilience analysis grid (four resilience potentials: monitoring, learning, anticipating, and responding) [50] is a way of promoting more care going right (in the 90% camp).

Going further, there is potential to recalibrate static healthcare models so that organisations, clinical teams, and patients can learn for themselves, effectively improving processes on the go [51]. This is not fanciful and, in complex systems, is in reality the only way to proceed, because we simply cannot expect professionals on the front lines of care to respond to command and control management models rooted in the past. We have, or are assembling, the data mining tools, the ubiquitous digital connectivity, the mobile devices, and the burgeoning data banks and research registries to support coalface decision-making at virtually every step—and to constantly feed lessons back into care processes for continuous optimisation. This means harvesting big data, aggregated and configured as the engine of knowledge generation and application. It also means developing the next generation of clinicians such that they are adept with managing information and sure-footed with continuous improvement methods and systems-based approaches to practice [52]. Bring this together, and it is a learning system [53–55].

### The deep learning health system

Schematically, the constantly improving system might behave something like the model in Fig. 2—where feedback is provided in close to real time to clinical teams, patients, managers, and policymakers, and efforts to

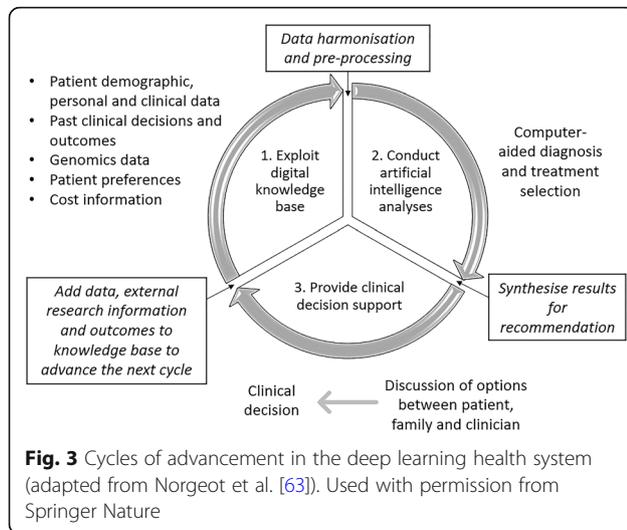


improve care are much better aligned than today. The overarching idea is to measure progress with improvement over time in a learning environment [58] with a culture of respect and trust [59]. The drivers are as follows: being committed to improvement, a readiness and preparedness for change, recognising the capacities for and barriers to progress, an understanding of the types of implementation strategies available, and building sufficient leverage and allocating resources to the fast paced learning needed in today's busy clinical world. While some medical school, nursing, and allied health programs have begun to emphasise the kinds of knowledge, competencies, and skills which will enable clinicians to be systems thinkers and change agents, working in adaptive learning systems and changing those systems as they go along, many do not—or they have not yet gone far enough. The US National Academies of Sciences, Engineering, and Medicine have argued recently that more people in healthcare need to be trained in systems thinking [15], underscoring our point.

If we make progress in building rapid-learning systems predicated on ongoing improvement, regular feedback to stakeholders, and incorporating patients' perspectives and choices into decisions [60], we can expect a variety of new models aligned with local conditions and workplace cultures to emerge, most likely centred on the clinical microsystem [61]. This is the defined, organised group of care staff and associated personnel looking after a targeted population of patients; a far cry from the outmoded concepts of care centred on the individual clinician on the one hand, or the top-down view of a highly structured and hierarchical system beloved of policy-makers on the other. Our notion of a clinical-

microsystem-as-learning-system is one that is adaptable and fluid rather than rigid and static—in other words, its features are much more closely aligned with the complex adaptive system of which it is an integral part. With such characteristics, the learning health system may be able to bring together and manage data from multiple sources, including information on health status, patients' expectations and preferences, clinical and biological information, genomic data, cost and benefit schedules, and lifestyle and history profiles. All these data will, in the model we hope the system can aspire to, be brought together in useable forms for the benefit of both patients' and clinicians' decision-making [62]. If we get this right, such flexible and information-rich deep learning systems will replace today's forgetting systems, with their entrenched, standardised, brittle organisational structures. Figure 3 shows how the cycles of advancement in the deep learning health system would work [63]. It is a high-level sketch outline of what might help us re-energise clinicians to provide more appropriate care, less waste, and safer, higher quality care—underpinned by the data needed to make good decisions, and adjust them over time.

Examples of such learning systems, or those attempting to emulate the characteristics of a learning health system, are emerging at a rapid pace. Cases in point are studies redesigning the care of lung cancer patients (The Ottawa Health Transformation Model) [64], the changing roles of researchers in different US settings using learning health system principles to reduce diagnostic errors and near misses [65], UK policy initiatives to build the infrastructure and data backbone on which the progress of learning health



systems will be based [66], and data collaborations to reduce mortality associated with sepsis amongst 21 hospitals of the Kaiser Permanente North California system [67] following earlier Kaiser Permanente examples, such as the work on Vioxx, and the early detection of its long-term side effects [68].

### If we fail to make the transition

Despite being a relatively new idea, bringing together much that seems to be emerging and in-train in any case, such comprehensive systems models are not optional. We are acutely aware of the continued human and financial cost of current systems underperformance. All that poor care, waste, and iatrogenic harm cost billions of futile healthcare pounds, euros, and dollars. The very healthcare professionals we depend on to deliver quality care and to implement next-generation medical advances are labouring under unsustainable pressures and as a result, too often, feel they are failing their patients, or are burning out [69]. They need to know that the support mechanisms on which they rely are modernising, they have the tools to address the 60-30-10 Challenge, and they can deliver better care in a system that is daily becoming more complex.

Although the learning model is appealing, it is not guaranteed. In healthcare, some things are quickly accepted and embedded (e.g. laparoscopic techniques, immunisation of infants, day only surgery) and others have been slow in adoption (e.g. patient involvement in decision-making, various kinds of level 1 evidence, and adherence to guidelines such as for alcohol dependence, antibiotic use, and obesity) [5]. While there will be many variants on the theme, learning health systems will need to spread, principally through diffusion of innovation

models and local adaptations [70]. Nevertheless, the combined thrust of thinking from the embryonic learning health systems literature [53–55], our TCRN case study and others we have pointed to, is attractive and does seem to represent a paradigm shift in re-conceptualising care.

### Conclusion

The learning health system model represents our best option at the moment for shifting the dial on these truculent numbers and rising to the Challenge. All-in-all, worldwide, we are investing heavily in biomedical and technological advances that promise safer, affordable, more effective healthcare. But without commensurate attention to fit-for-purpose, responsive, evidence-based delivery models that are built to learn and are commensurate with a complex systems view of healthcare rather than an inflexible, top-heavy, hierarchically laden command model, we will remain trapped in an Einsteinian Groundhog Day—doing the same thing over and over to achieve the same unsustainable results.

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### Authors' contributions

JB conceptualised and drafted the article based on work on a series of books he edits on health reform across 152 countries and regions and other recent studies in health systems improvement. PG and JW contributed expertise in waste, appropriateness of care, and patient safety. The authors read and approved the final manuscript.

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### Competing interests

The authors declare that they have no competing interests.

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# Choosing Wisely Australia: changing behaviour in health care

## Challenging the notion that “more is better” in our health care system

**T**he key to addressing low value care in Australia’s health care system is reducing unnecessary tests, treatment and procedures. With consumer demand reported as a main driver of unnecessary tests and treatments,<sup>1</sup> Choosing Wisely Australia encourages health care providers to have conversations with patients around the necessity for and risks of certain health care practices.

### A growing international movement

Launched in the United States in 2012, Choosing Wisely is a global social movement working to improve the quality and safety of health care. Australia — where NPS MedicineWise implemented it in April 2015 — is one of 20 countries that have adopted the initiative.

Choosing Wisely is a clinician-led initiative that engages medical colleges, societies and associations to identify tests, treatments and procedures that, according to the available evidence, may be unnecessary or harmful. It also provides consumers with trustworthy information to raise awareness of unnecessary interventions and encourage better conversations with their health professionals. Thirty-two organisations, including 80% of medical colleges, have joined Choosing Wisely Australia, with 158 published recommendations that cover themes such as imaging, medicines, pathology, and end-of-life care.

### Bridging the great divide

While Australians say they understand the importance of reducing unnecessary medical testing, the *Choosing Wisely in Australia, 2017 report*<sup>1</sup> revealed contradictory attitudes among consumers around tests and the need for better conversations between consumers and health care professionals around their options. Sixty-one per cent of people agreed they should play role in reducing unnecessary care; however, 61% indicated that if they were sick, their doctor should conduct all available medical tests related to their condition.<sup>1</sup>

Health professionals need to play a leading role to reduce unnecessary health care, with ineffective interventions accounting for a considerable proportion of health care costs.<sup>2</sup> There is a disconnect around unnecessary testing: according to the report, 62% of general practitioners and 42% of specialists cite patient expectations as a driver of unnecessary tests, treatments and procedures, whereas 84% of consumers said they had tests at their health care provider’s recommendation.<sup>1</sup>

Surveys with Australian GPs and medical specialists expose the drivers of low value care. Patient expectations were the most common reason for GPs to use unnecessary tests, and the third most commonly cited reason for specialists (Box 1). In general, patients overestimate the benefits of medical interventions

### 1 Four most common drivers of unnecessary care\*

Reasons	GPs	Specialists
Patient expectations	62%	42%
Potential for medical litigation	54%	34%
Uncertainty regarding the diagnosis	49%	48%
Difficulties in accessing information from doctors in other settings, including results	52%	64%

GPs = general practitioners. \* Online surveys were conducted in December 2016. There were responses from 264 randomly selected GPs, giving a 7% response rate, and from 160 randomly selected medical specialists, with a response rate of 7%. ♦

and underestimate the harms. Without accurate expectations of benefits and harms by clinicians, patients may not have the right assistance to make informed decisions.<sup>3</sup>

A recent study on the cognitive biases that may influence a clinician’s decision towards a low value intervention highlighted shared decision making between clinicians and patients as a good countermeasure.<sup>4</sup> It suggested familiarising patients with the available options to manage their condition, including advantages and disadvantages, and exploring their preferences to inform final decisions. This approach provides a means for declining patients’ requests for low value interventions without losing their trust.

### Supporting implementation

Choosing Wisely is reaching clinicians through the work of medical colleges, societies and associations, for example:

- the Royal Australian and New Zealand College of Radiologists has developed clinical decision rules and online modules to assist in determining when imaging is truly needed;
- the Royal Australian College of General Practitioners promotes its recommendations through member newsletters and its Red Book Guidelines for preventive activities; and
- the Royal Australasian College of Physicians, in conjunction with specialty societies, has released “top five” lists through Choosing Wisely and the EVOLVE program (<https://evolve.edu.au>), which are promoted among its membership. The Royal Australasian College of Physicians Congress 2017 discussed techniques to manage the concerns patients might have about not having a procedure or not receiving a prescription. It also modelled the ways clinicians may promote the delivery of high value care and improve interactions between junior and senior doctors.

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## 2 Multifaceted approach to evaluating the Choosing Wisely Australia initiative

Process evaluation	Short and intermediate impacts	Long term outcomes
Key performance indicators	Baseline surveys of awareness, attitudes and practice	Influence on policy and systems
Participation and reach	Annual surveys (health professionals, consumers, pharmacists etc) to assess changes to awareness, attitudes and practice	PBS and MBS drug utilisation using interrupted time series analysis will assess changes in prescribing and test ordering related to selected recommendations
Website, media and social media	Partnership evaluation to assess implementation and satisfaction	
Difficulties in accessing information from doctors in other settings, including results		

MBS = Medicare Benefits Schedule. PBS = Pharmaceutical Benefits Scheme. ◆

### Growing movement among health services

The 2017 Choosing Wisely Australia National Meeting showcased health service programs to reduce patient exposure to unnecessary tests. For example, Gold Coast Health has developed demand-management strategies to improve pathology ordering patterns — an online dashboard is supporting clinical monitoring and auditing of pathology-ordering practices, with the ultimate goal of improving patient safety and experience while providing high quality care. Over 15 months,

early results highlighting the potential of this initiative to significantly change the mindsets and behaviours of health professionals and consumers to successfully challenge the notion that “more is better” in managing health.

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References are available online at [www.mja.com.au](http://www.mja.com.au).

a multidisciplinary collaboration saw a 2% drop in the number of unnecessary pathology tests ordered — from an average of 96 000 a month to 93 500 — despite a 10% increase in patient activity. The health service reported that clinicians were making wiser choices as a result of seeing the data on pathology orders first-hand.<sup>5</sup>

### Measuring impact and outcomes

An evaluation of the initiative requires a multifaceted approach, including process indicators, short and intermediate term impacts and long term outcomes (Box 2). Choosing Wisely Australia’s first 2 years have shown significant engagement by health professionals, organisations and services, with

- 1 NPS MedicineWise. Choosing Wisely Australia, 2017 report. Sydney: NPS MedicineWise; 2017. <http://www.choosingwisely.org.au/getmedia/042fedfe-6bdd-4a76-ae20-682f051eb791/Choosing-Wisely-in-Australia-2017-Report.aspx> (accessed Dec 2017).
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- 3 Hoffmann TC, Del Mar C. Clinicians' expectations of the benefits and harms of treatments, screening and tests: a systematic review. *JAMA Intern Med* 2017; 177: 407-419.
- 4 Scott IA, Soon J, Elshaug AG, Lindner R. Countering cognitive biases in minimising low value care. *Med J Aust* 2017; 206: 407-411. <https://www.mja.com.au/journal/2017/206/9/countering-cognitive-biases-minimising-low-value-care>
- 5 Kelly T. Managing the demand and improving the quality use of pathology testing at Gold Coast Health [unpublished presentation]. Choosing Wisely Australia National Meeting; Melbourne (Australia), 4 May 2017. ■



## Right care 1

## Evidence for overuse of medical services around the world

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This is the first in a Series of four papers about right care

See [Comment](#) pages 101, 102, and 105

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Overuse, which is defined as the provision of medical services that are more likely to cause harm than good, is a pervasive problem. Direct measurement of overuse through documentation of delivery of inappropriate services is challenging given the difficulty of defining appropriate care for patients with individual preferences and needs; overuse can also be measured indirectly through examination of unwarranted geographical variations in prevalence of procedures and care intensity. Despite the challenges, the high prevalence of overuse is well documented in high-income countries across a wide range of services and is increasingly recognised in low-income countries. Overuse of unneeded services can harm patients physically and psychologically, and can harm health systems by wasting resources and deflecting investments in both public health and social spending, which is known to contribute to health. Although harms from overuse have not been well quantified and trends have not been well described, overuse is likely to be increasing worldwide.

### Introduction

Overuse, which Chassin and Galvin defined as ‘the provision of medical services for which the potential for harm exceeds the potential for benefit’,<sup>1</sup> is increasingly recognised around the world. Directly measuring overuse requires a definition of appropriate care, which is often challenging. In the USA, estimates of spending on overuse vary widely: conservative estimates based on the direct measurement of individual services range from 6% to 8% of total health-care spending;<sup>2</sup> whereas studies of geographical variation (an indirect measure) indicate that the proportion of Medicare spending on overuse is closer to 29%.<sup>3</sup> Worldwide, overuse of individual services can be as high as 89% in certain populations.<sup>4</sup> Although overuse has mainly been documented in high-income countries (HICs), low- and middle-income countries (LMICs) are not immune. Evidence suggests widespread overuse is occurring in countries as diverse as Australia,<sup>5</sup> Brazil,<sup>6</sup> Iran,<sup>7</sup> Israel,<sup>8</sup> and Spain.<sup>9</sup> Overuse can coexist with unmet health-care needs, particularly in LMICs.

We aimed to highlight the significance of the problem of overuse and explore what is known regarding the scope and consequences of such, around the world. We have

drawn on five systematic reviews (one unpublished)<sup>4,10–12</sup> of overuse to help inform this paper, supplemented with reference tracking and additional structured searches of scientific and grey literature. Subsequent papers in this Series<sup>13–15</sup> examine the underuse of medical services worldwide, the causes of overuse and underuse, and potential solutions for both.

### What is overuse?

“Though the doctors treated him, let his blood, and gave him medications to drink, he nevertheless recovered.”

Leo Tolstoy, War and Peace

Although Chassin and Galvin’s definition of overuse is succinct, and may have broad intuitive appeal, it is difficult to address. To directly measure overuse, a definition for the appropriateness of a service is required, based on evidence that considers the balance between benefits and harms for a population or individuals. However, quantifying benefits and harms is often problematic, because evidence regarding benefits is often incomplete, and for many services harms are poorly documented.<sup>16</sup> Furthermore, the threshold between appropriate and inappropriate care can vary among patients or patient groups. Additionally, the role of cost in defining low-value services varies in different settings (panel).

Ultimately, overuse can be considered to occur along a continuum. At one end of the continuum lie tests and treatments that are universally beneficial when used on the appropriate patient, such as blood cultures in a young, otherwise healthy patient with sepsis, and insulin for patients with type 1 diabetes. At the other end of the continuum are services that are entirely ineffective, futile, or pose such a high risk of harm to all patients that they should never be delivered, such as the drug combination fenfluramine-phentermine for obesity.<sup>22</sup> However, the majority of tests and treatments

### Key messages

- Overuse is difficult to measure and has not been well characterised
- Most studies of overuse have been done in high-income countries, but there is growing evidence that overuse is a global problem
- Overuse is likely to cause physical, psychological and financial harm to patients
- Overuse deflects resources from public health and other social spending in both low-income and high-income countries
- Overuse occurs across a wide range of medical specialties

fall into a more ambiguous grey zone,<sup>23,24</sup> which includes: services that offer little benefit to most patients (eg, glucosamine for osteoarthritis of the knee); those for which the balance between benefits and harms varies substantially among patients (eg, opioids for chronic pain, antidepressant medications for adolescents); and the many services that are backed by little evidence to help decide which patients, if any, might benefit and by how much (eg, routine blood testing in patients with hypertension) (see figure 1: Grey zone services). Even when robust consensus has established criteria defining the appropriateness of tests and treatments (such as those developed for cardiological services in the USA), appropriateness can remain uncertain in many individual cases.<sup>25</sup>

Chassin and Galvin's simple definition is further complicated by the question of whose values and preferences should determine the balance between potential benefits and acceptable harms. Certainly different patients faced with a choice of potentially beneficial treatments will vary in their views regarding the tradeoffs of each.<sup>26</sup> Thus, individual patient values and preferences are critical for defining appropriate care for many conditions that lie within the grey zone. Unfortunately, clinicians often have a poor understanding of patient values, incorrectly assuming in some cases that a patient would prefer to avoid aggressive or invasive intervention, and in other cases that the patient would favour more rather than less care. This so-called preference misdiagnosis contributes to overuse (and underuse) when clinicians deliver a service that is wrong for that individual patient.

### Measurement of overuse

Overuse can be measured in various ways. Overuse of a specific service can be measured directly within a population by use of patient registries or medical records. This approach requires a reliable definition of appropriateness for a given service, generally using an evidence-based or consensus-based guideline, or a multidisciplinary iterative panel process (eg, the RAND Appropriateness Method<sup>27</sup>) to define necessary and unnecessary use. Rates of overuse are then calculated as either the proportion of delivered services that are inappropriate or as the proportion of patients who receive the service inappropriately. This direct measure, which is the most reliable indicator of overuse, has been used in a growing body of literature, including several systematic reviews (see figure 2: Overuse of selected services in four countries).<sup>10-12</sup> However, several challenges inherent in this approach exist when applied to many health-care interventions.<sup>4</sup> First, as discussed above, evidence for defining appropriate care is scarce in many clinical situations, precluding the direct measurement of overuse for those services. Second, even if evidence is available, necessary details for defining the appropriateness of care in individual

#### Panel: The role of cost in defining overuse and low-value services

The elimination of clearly ineffective services would reduce both potential harm to patients and excess costs. However, clearly ineffective services are greatly outnumbered by grey zone interventions. Many grey zone interventions benefit very few patients or provide only small benefit relative to costs, and thus are not cost effective. Funding such low-value services poses an opportunity cost; less money is available to address unmet health needs, which subsequently reduces the funds available to improve the socio-economic determinants of health. Whereas cost-effectiveness analysis, which can quantify these tradeoffs, is formally considered in coverage decisions in HICs, such as Australia, Canada, and the UK,<sup>17-19</sup> and an increasing number of LMICs,<sup>20</sup> it is not included in appropriateness determinations in the USA.<sup>21</sup>

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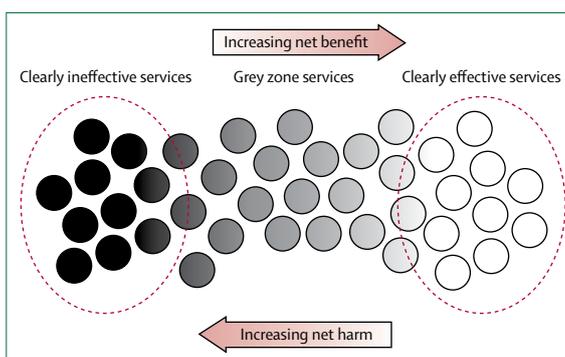
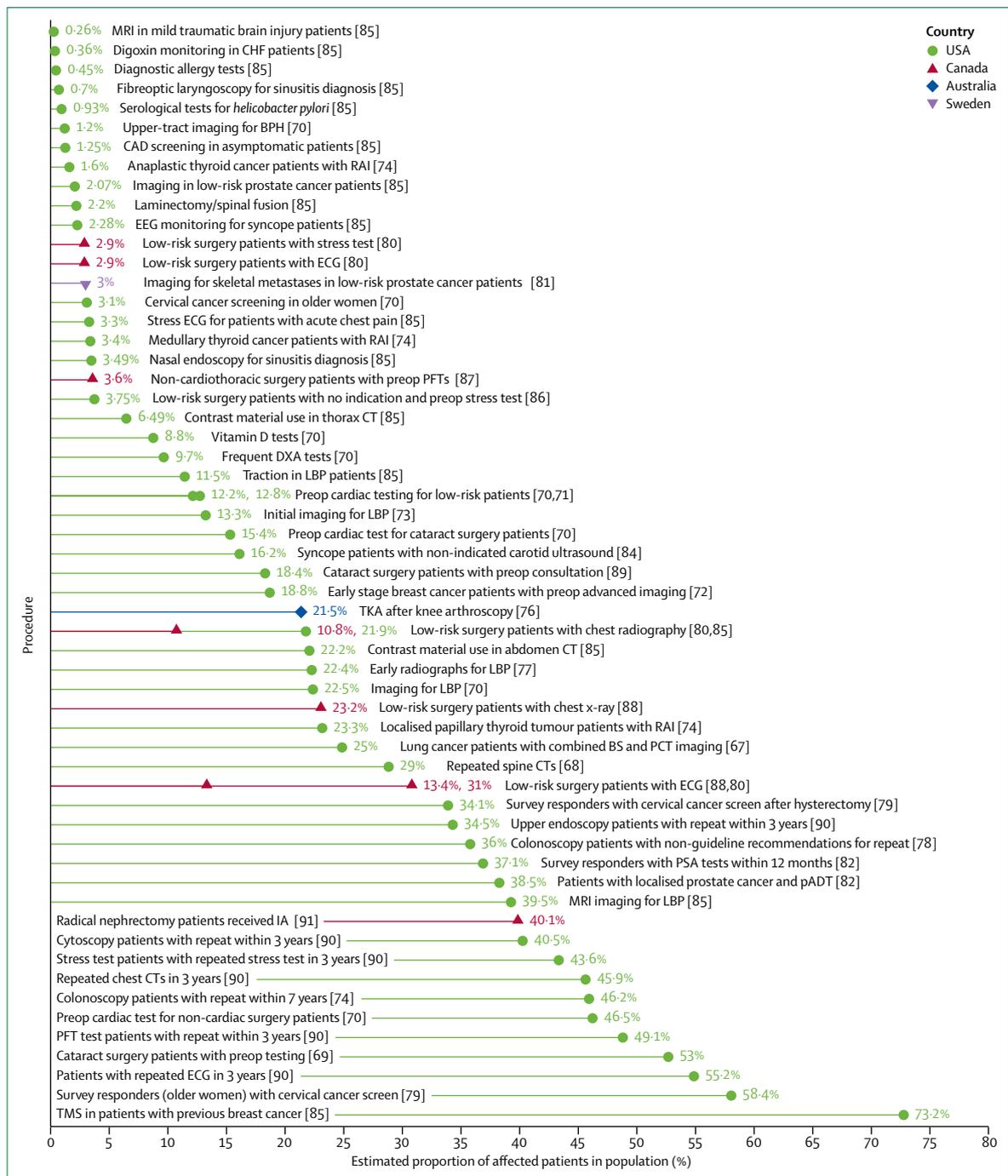


Figure 1: Grey zone services

patients are often absent from guidelines, while iterative panel processes, which incorporate more nuance, are costly and time consuming. Third, few measures have been developed to assess the prevalence of overuse that occurs because patient preferences are not elicited. Electronic health records (EHR) and the development of large datasets, informed by clinical information from EHRs, have facilitated the measurement of overuse in some contexts (eg, the USA Veteran's Affairs system<sup>28,29</sup>) and could have broader applicability in the future. However, EHRs alone are not likely to enable widespread measurement of overuse directly.

A growing literature seeks to expand knowledge of overuse through an indirect measure: identifying unexpected variations in health-care implementation. Variations in utilisation that are not attributable to differences in patient or population characteristics have been documented both within and among countries and health-care systems.<sup>1-3,5,6,30,31</sup> Although these variations are often not related to overuse (or underuse) per se, but rather to different rates of discretionary care (or services for which the evidence does not point clearly to a right answer,<sup>23</sup> such as revisit interval for patients with diabetes), unexpectedly high



**Figure 2: Overuse of selected services in four countries**

Estimates from the literature of the proportion of patients that received various low-value services, out of the relevant patient population. The populations are based in four locations. preop=preoperative. TKA=total knee arthroplasty. LBP=lower back pain. BPH=benign prostate hyperplasia. pADT=primary androgen deprivation therapy. BS=bone scintigraphy. PET=positron emission tomography. TMS=tumour marking studies. DXA=dual-energy x-ray absorptiometry. EEG=electroencephalogram. ECG=echocardiography. PSA=prostate specific antigen. PFT=pulmonary function test. IA=ipsilateral adrenalectomy. RAI=radioactive iodine treatment. CAD=carotid artery disease. CHF=congestive heart failure. Adapted and updated from Chalmers, Pearson and Elshaug (unpublished data).

rates of use of a particular service can reflect overuse.<sup>8,9</sup> In more recent years, investigators have used large databases to explore variations in the use of specific services as a method of identifying probable overuse.<sup>32,33</sup>

Examples of both direct and indirect evidence documenting overuse of specific services around the world have been noted (table). Some investigators have moved beyond individual services to evaluate rates of

	Direct evidence of inappropriate care	Indirect evidence of inappropriate care
Musculoskeletal procedures	Spain: Rates of inappropriate total knee replacement 26% and total hip replacement 25%; <sup>34</sup> USA: Rate of inappropriate total knee replacement 34% <sup>35</sup>	International: 4-fold variation across countries and 2–3 fold variation within countries in rates of knee replacement; <sup>36</sup> England: 13-fold regional variation in rates of arthroscopic knee lavage; <sup>37</sup> USA: 5-fold regional variation in adjusted rates of total hip and knee replacement <sup>38</sup>
Cardiovascular procedures	Italy: Rate of inappropriate PCI 22% and inappropriate coronary angiography 30%; <sup>39</sup> USA: Rate of inappropriate PCI 1.1% for acute indications and 11.6% for non-acute indications with variation across hospitals (6.0–16.7%); <sup>40</sup> Brazil: Rate of inappropriate coronary angiography 20% <sup>41</sup>	International: 9-fold variation in use of PCI and 5-fold variation in use of coronary artery bypass grafting across OECD countries; <sup>30</sup> USA: Rates of elective PCIs vary 10-fold within the state of California; <sup>42</sup> India: A second opinion centre reported recommending against cardiac interventions in 55% of patients in whom intervention was initially recommended <sup>43</sup>
Hysterectomy	Taiwan: 20% of hysterectomies inappropriate; <sup>44</sup> Switzerland: 13% of hysterectomies inappropriate; <sup>45</sup> USA: Rates of inappropriate hysterectomies between 16 and 70% across studies <sup>46</sup>	Canada: 2.7-fold variation in rates of hysterectomy across regions within Ontario; <sup>47</sup> Netherlands: 2.2-fold regional variation in rates of hysterectomy for bleeding disorders; 2.3-fold regional variation in rates for pelvic organ prolapse; <sup>48</sup> India: Prevalence of up to 9.8% overall, with one third of hysterectomies performed in women under the age of 35 (probably inappropriate in this age group) <sup>49</sup>
Antibiotics for acute diarrhea	Italy: Among children hospitalised for acute diarrhea, 9% received antibiotics inappropriately; <sup>50</sup> China: 57% of patients received antibiotics inappropriately; among those with an indication for antibiotics, 21% were not treated (adults); <sup>51</sup> Thailand: 55% of children with acute diarrhea received antibiotics inappropriately <sup>52</sup>	USA: 10.4% of patients with diarrhea received antibiotics (often likely inappropriate); <sup>53</sup> India: 71% of children with acute diarrhea received antibiotics (despite recommendations against routine use); <sup>54</sup> India: Rates of antibiotic use for acute diarrhea 43% in public facilities and 69% in private facilities (despite recommendations against routine use) <sup>55</sup>

PCI=percutaneous coronary intervention. OECD=Organisation for Economic Co-operation and Development.

**Table: Direct and indirect evidence of global overuse in different clinical categories**

general overuse in health-care systems by evaluating variations in groups of possibly overused services,<sup>5,56–58</sup> but these methods are not yet well established.

### Related concepts

We use the term “overuse” to refer to any services that are unnecessary in any way. The related terms, overtreatment and overtesting, indicate the inappropriate delivery of particular types of services.

Another related term, overdiagnosis, is commonly defined as the diagnostic labelling of abnormalities or symptoms that are indolent, non-progressive or regressive, and that if left untreated will not cause considerable distress or shorten the person’s life.<sup>59</sup> This definition can be complicated by the varying natural history of specific diseases, and does not entirely encompass the various settings in which overdiagnosis occurs or the role that it has in overuse.<sup>60</sup> Overdiagnosis can occur as a consequence of screening (including recommended screening). For some screening tests, such as cervical cancer screening,<sup>61</sup> the small risk of overdiagnosis and subsequent overtreatment are outweighed by the reduction in risk of death. For other screening tests, however, the balance is less clear<sup>62</sup> and overdiagnosis may be an important driver of overuse in the form of aggressive overtreatment of clinically insignificant findings.<sup>5,63</sup> (The third paper in this Series<sup>14</sup> discusses overdiagnosis in greater detail and other drivers of overuse, including defensive medicine, which

has been associated with aggressive diagnostic testing in the USA<sup>64</sup> and has been identified by physicians in several countries<sup>65–67</sup> as an important reason for overusing tests and treatments.)

Overdiagnosis can also occur when the definition of disease or abnormality is broadened, leading to populations that were previously considered “normal” or healthy being labelled as diseased. This phenomenon is referred to as overmedicalisation and can result in the treatment of essentially healthy patients in whom potential benefit is small and likely to be outweighed by harms. A review of recent USA guidelines showed that for ten of the 16 guidelines studied, disease definition had been widened, potentially leading to overuse.<sup>68</sup> For example, lowering risk thresholds for treating cholesterol has led to a growing proportion of populations in many countries being prescribed lipid-lowering drugs with unclear benefits.<sup>69,70</sup> Furthermore, a broadened definition of chronic kidney disease that is used in many countries, although potentially beneficial for ensuring safe drug dosing, has led to large numbers of asymptomatic older people being labelled as ill; as many as 30% of older adults diagnosed with moderately advanced kidney disease (stage 3A) have no urine markers of kidney damage.<sup>71</sup> In children, overdiagnosis can occur in frequently diagnosed conditions, such as Attention Deficit Hyperactivity Disorder (ADHD), food allergies, gastroesophageal reflux, obstructive sleep apnea, and urinary tract infections.<sup>72</sup>

### Worldwide prevalence of overuse

Overuse is gaining increasing recognition as a worldwide problem; however, the significance of it has not yet been defined. A 2012 systematic review of the prevalence of service overuse in the USA noted that the majority of studies that directly measured overuse were focused on a relatively small number of services.<sup>4</sup> However, indirect evidence, such as studies of geographical variation, suggests that overuse is not limited to these services in the USA.<sup>73</sup> A more recent systematic review (unpublished) of global overuse categorised 83 overused or low-value services from studies including large sample sizes (more than 800 patients).<sup>30,74–97</sup> These authors identified studies from four countries (with USA studies predominating) and found that the rates of overuse of various services ranged from about 1% to 80% (see figure 2). For LMICs and many HICs, the evidence of overuse is more scarce and largely indirect, although it appears to be increasing (see for example, a 2014 report<sup>36</sup> on geographical variation in health care in 13 countries). In this section, we describe worldwide rates of overuse for a selection of clinical services. We focused our attention on the services most commonly described in systematic reviews and other literature, and services in which overuse has the potential to substantially affect patients or health-care systems.

#### Overuse of medication

One of the best-documented examples of medication overuse in both HICs and LMICs is the inappropriate use of antibiotics, which represents a worldwide problem that has important consequences for antimicrobial resistance. Many studies have addressed inappropriate antibiotic use in patients with upper respiratory viral infections. A 2012 systematic review of overuse in the US health-care system found 59 studies documenting widely variable rates of overuse of antibiotics for upper respiratory infections.<sup>4</sup> In Europe, rates of antibiotic prescribing for viral upper respiratory infections are high in Poland, Sweden, and the UK, with half of patients receiving unnecessary antibiotics.<sup>98–100</sup> Additionally, across the continent, studies have documented variable rates of antibiotic prescribing for patients with acute cough, with no associated differences in rates of recovery,<sup>101</sup> suggesting overuse.

Evidence of antibiotic overuse in LMICs is largely indirect. Global consumption of antibiotic drugs has risen by 36% between 2000 and 2010, with growing economies such as Brazil, China, India, Russia, and South Africa accounting for 76% of this increase.<sup>102</sup> The extent to which this increase represents overuse is not known, however, a 2015 systematic review<sup>12</sup> of medication use in China and Vietnam found evidence for antibiotic overuse in both countries. Furthermore, a 2005 systematic review<sup>11</sup> of patterns of antibiotic use, which included studies from around the globe, found high rates

of inappropriate administration, including substantial patient consumption of so-called leftover antibiotics. Similarly, a 2013 Cochrane review<sup>103</sup> of the effect of interventions to improve antibiotic prescribing in patients admitted to hospital included studies from both HICs and LMICs, suggesting wide recognition of the problem of inappropriate antibiotic use, however, the review did not directly quantify prescribing rates.

In other clinical specialties, unexpectedly high prescribing rates for specific drugs in individual health systems suggests overuse. Bevacizumab, an expensive and generally ineffective treatment for breast cancer, is not recommended by the National Institute for Health and Care Excellence (NICE) in the UK, and its US Food and Drug Administration marketing authorisation for breast cancer was withdrawn. However, the drug is reimbursed by health insurers in Colombia for all (licensed and unlicensed) cancer indications at great expense to the country's health-care system.<sup>104</sup> Similarly, erythropoiesis stimulating drugs, epoetin alfa and beta and darbapoetin alfa, have been widely and inappropriately used in Romania to treat ribavirin-induced anaemia in patients with Hepatitis C and organ transplantations, in the absence of supporting evidence.<sup>105</sup>

#### Overuse of screening tests

High rates of inappropriate use of screening tests have been documented, often in the context of concurrent underuse in appropriate populations. In the USA, where there is widespread public support for cancer screening,<sup>106</sup> overuse of screening for cervical cancer<sup>107,108</sup> in women at very low-risk, and overuse of mammography in women with short life expectancy, who are unlikely to benefit from diagnosis and treatment,<sup>109</sup> has been documented. Furthermore, inappropriate use of colonoscopy screening has been found in both the USA and Canada.<sup>110–12</sup>

Few studies have evaluated rates of inappropriate cancer screening outside of North America. A notable exception is South Korea's aggressive use of ultrasound screening, which has led to a 15-fold increase in incidence of papillary thyroid cancer. The death rate from this cancer has remained unchanged throughout the period of increased screening, and it is estimated that 99.7–99.9% of screen-detected thyroid cancers in Korea represent overdiagnosis.<sup>113</sup> Patients subjected to unnecessary thyroidectomy face an 11% risk of hypoparathyroidism and a 2% risk of vocal cord paralysis, demonstrating clear downstream harms of inappropriate screening. Despite low levels of appropriate mammography screening and widespread doubts regarding the cost-effectiveness of mammograms,<sup>114</sup> there are reports of touring mammography vans in India that provide indiscriminate breast cancer screening in women as young as 18 years old,<sup>115</sup> much of which represents clear overuse.

### Overuse of diagnostic tests

Overuse of testing appears to be common, driven by availability, apparent objectiveness, and the increasing sensitivity of tests to detect disease. Although few systematic analyses of inappropriate use of diagnostic tests have been performed in general, some specific diagnostic services have been evaluated around the world. For example, overuse of endoscopy seems to be common globally. In primary care practices in Switzerland, 14% of colonoscopy referrals and 49% of referrals for upper endoscopy represented overuse.<sup>116,117</sup> Elsewhere in Europe, appropriateness rates for endoscopy have been reported in Portugal, Spain, Italy, and Norway; overuse accounted for between 13% and 33% of tests,<sup>118–21</sup> and at an Israeli centre 16% of endoscopies were unnecessary.<sup>122</sup> Studies in the USA have reported overuse rates as high as 60%.<sup>123</sup> In Saudi Arabia, which has open access to endoscopy, nearly half of procedures were deemed inappropriate.<sup>124</sup> A Dutch study<sup>125</sup> found that approximately a quarter of patients received appropriate colonoscopy after removal of colorectal adenomas, with both overuse and underuse of surveillance observed.

### Overuse of therapeutic procedures

Surgery and other invasive procedures are likely to be commonly overused in high-income countries. Although prevalence of directly-measured overuse were not reported, Elshaug and colleagues<sup>5</sup> identified more than 150 low-value services in use in Australia, and in the USA, up to 42% of Medicare beneficiaries had received at least one of 26 low-value treatments, with these interventions accounting for as much as 2.7% of overall Medicare spending.<sup>56</sup> Such findings are suggestive of widespread overuse of these services.

There are ample global data regarding the overuse of several cardiovascular procedures, despite clear and broadly accepted appropriateness criteria.<sup>126</sup> Inappropriate percutaneous coronary intervention has been documented in many countries, with a prevalence of 4–12% in the USA;<sup>40,127</sup> 10–14% in Germany,<sup>128,129</sup> 16% in Italy;<sup>130</sup> 22% in Israel;<sup>8</sup> 20% in Spain;<sup>9</sup> and 4% in Korea.<sup>131</sup> In one second-opinion centre in India, 55% of recommended cardiac stents or surgery were deemed inappropriate.<sup>43</sup>

### Site of care delivery

The site of care delivery and the intensity of care provided are relevant to overuse since more intense care carries a greater risk of complications, and is more costly. If more intense care does not improve outcomes for a condition when compared with less invasive or intensive care, it represents overuse. Hospital care overuse has been documented in both HICs and LMICs. A 2000 systematic review<sup>10</sup> found widely varying rates of inappropriate hospital admissions around the world, ranging from 1% to 54% of hospital admissions. Rates of hospital care

overuse in specific countries measured using established criteria to determine appropriateness, were 18–25% in France,<sup>132</sup> 33% in Germany,<sup>133</sup> 19% among internal medicine admissions in Portugal,<sup>134</sup> 7% at a referral centre in Spain,<sup>135</sup> 27% in rural hospitals in China,<sup>136</sup> and widely variable across three Egyptian hospitals, with rates ranging between 0% and 79%.<sup>137</sup> Additionally, studies have shown broad variations in rates of hospital use both within and among countries,<sup>138,139</sup> suggesting possible overuse, as well as underuse, of hospital care in different locations. Many of these variations are particularly striking with regard to “ambulatory care-sensitive” conditions, or conditions for which high-quality primary care is likely to prevent the need for hospital admission.<sup>140</sup> Overuse of hospital care for ambulatory care-sensitive conditions demonstrates that overuse of one (usually more aggressive) service can result from underuse of another, often less aggressive service.

### End-of-life care

In many countries, evidence exists for the overuse of aggressive care for dying patients and simultaneous underuse of appropriate palliative care. Despite evidence that the majority of people around the world would prefer to die at home,<sup>141–46</sup> about half die in hospital worldwide, with considerable variation among countries.<sup>147</sup> Inappropriately aggressive cancer care near the end of life has been identified as a common problem in Canada,<sup>148</sup> the USA,<sup>149</sup> and the UK,<sup>150</sup> with regional variations observed.<sup>151</sup> Overuse of aggressive end-of-life care in the UK, for example, includes futile insertion of percutaneous endoscopic gastrostomy tubes<sup>151</sup> and administration of chemotherapy that hastens death.<sup>152</sup> Furthermore, ineffective intensive care unit treatment at the end of life has been reported in Canada,<sup>153</sup> the USA,<sup>154</sup> and Brazil.<sup>155</sup> A study from Korea found that the majority of terminal cancer patients received futile intravenous nutrition during the last week of life, with discussions of palliation in only 7% of cases.<sup>156</sup>

Although few systematic assessments of end-of-life care have been performed in LMICs, it is likely that futile care at the end of life is not limited to HICs. In one study in India, nearly half of patients with cancer were diagnosed late and received ineffective radiotherapy.<sup>157</sup> In Brazil, one in five patients with cancer were administered useless medication, most often a statin.<sup>158</sup> Overall, it is likely that overuse of aggressive care and underuse of palliative care at the end of life is commonplace in both HICs and LMICs.

### Harms to patients and health-care systems

Overuse is likely to harm patients physically, psychologically, and financially, and could threaten the viability of health-care systems by increasing costs and diverting resources. However, our ability to collect strong evidence that describes the direct consequences of overuse on patients and health systems has been impeded by the same factors that challenge our ability to document

overuse itself, including an incomplete evidence base for effectiveness and limited reporting of treatment harms.<sup>159</sup> Much of what we know regarding the harms of overuse is derived from estimates and extrapolations.

### Harms to patients

Few studies have directly documented patient harms from overuse, however, estimates of physical harm to patients from overuse can be inferred from data on adverse events and studies regarding overuse of specific treatments. For example, Cushner and colleagues<sup>160</sup> used outcomes from a global orthopaedic registry for total knee and hip arthroplasty to estimate a rate of 7–8% for serious adverse events, which included severe infection, revision, cardiovascular events, and death. Other researchers estimate that more than 20% of total knee replacements in Spain and 30% in the USA are inappropriate.<sup>35,161</sup> Thus we can estimate that 2–3% of patients undergoing arthroplastic surgery in those two countries are unnecessarily harmed by an inappropriate procedure, with approximately 14000 patients suffering harm from unnecessary knee and hip arthroplasty per year in the USA alone. Other examples of documented harm from overuse include high rates of overuse of implantable vena cava filters and low rates of appropriate removal,<sup>162</sup> with known excess venous thrombotic complications in 10% of patients who receive them,<sup>163</sup> and continued overuse of tight glycemic control in intensive care units, despite evidence of higher rates of hypoglycemic complications without reductions in mortality.<sup>164</sup>

Psychological harms from overuse have only been documented for few clinical situations but may be common. Several authors have noted that treatment in hospital may lead to unnecessary physical isolation of patients,<sup>165</sup> with negative consequences including loneliness, feelings of stigmatisation, and depression.<sup>166</sup> Furthermore, screening for breast cancer is known to lead to the diagnosis of precancerous lesions, such as ductal carcinoma in situ,<sup>167</sup> which has been associated with anxiety for several years after diagnosis and patient overestimation of future cancer risk.<sup>168–70</sup>

Patients can also suffer from being inappropriately labelled as “ill” as a result of unnecessary testing. As early as 1967, Bergman and Stamm found that among adolescents with heart murmurs, which had been previously (and possibly unnecessarily) evaluated and deemed ‘innocent’, 40% continued to experience restricted activity and 63% had parents who continued to believe their child was unhealthy.<sup>171</sup> Harm from labelling can also occur in the context of mental illness. For example, it is widely acknowledged that ADHD is overdiagnosed and overtreated in the USA and other HICs. ADHD is also overtreated in some LMICs,<sup>172</sup> although some children with ADHD fail to receive appropriate treatment. There is scant research on the effect of an ADHD diagnosis on a child’s sense of self-esteem and ability to modulate their own behaviour,

but the label has been shown to affect teacher’s expectations and peer interactions, which can substantially influence a child’s self-perceptions.<sup>173–75</sup>

Financial costs represent a potentially important but poorly documented source of harm from overuse to patients. In the USA, cost has been identified as a known consequence of all medical care<sup>176</sup> and of cancer treatment in particular,<sup>177</sup> with medical bills contributing to over half of personal bankruptcies,<sup>178</sup> although the contribution of overuse is not known. Similarly, in Australia, parents of children with cancer reported high out-of-pocket expenses,<sup>179</sup> and WHO has documented medical indebtedness across the globe. Health care is a major source of impoverishment and indebtedness among the poor of India,<sup>180,181</sup> and 15% of rural Vietnamese families with one member with a chronic illness experience financial catastrophe.<sup>182</sup> Determining the financial burden of overuse on patients requires active investigation in the future.

### Harms to health-care systems

Although there are few direct measurements of the proportion of health-care spending attributable to overuse, evidence is emerging that suggests the cost might be considerable. A study<sup>183</sup> regarding the inappropriate use of bone scans for US Medicare beneficiaries with prostate cancer found that 21% of patients at low risk and 48% of patients at moderate risk of bone metastases underwent at least one scan, despite recommendations against scanning in these groups, at an annual cost of US\$11 300 000. Experts estimate that prevalence of overuse contributes substantially to health-care spending in the USA.<sup>184</sup> Based on a conservative estimate,<sup>2</sup> the USA spent at least \$270 billion on care that could be defined as overuse in 2013, despite the fact that millions of Americans do not have adequate access to basic health care. Overuse might also strain health-care budgets in other countries.<sup>185</sup> In Australia, where many common services are believed to be overused,<sup>5</sup> the growth in health care expenditure from the rising volume of medical services has been identified as the greatest threat to the financial position of the government, and a bigger cause of health-care cost increases than population growth or ageing.<sup>186</sup>

Of particular concern is the potential financial effect of overuse on LMICs. The use of expensive advanced technology in HICs, such as new cancer biologics, imaging devices, and multi-focal cataract replacement lenses, spreads through globalised markets to LMICs, potentially crowding out less technological (and potentially higher value) means of promoting population health.<sup>187</sup> In India, private health insurance and formal sector employees’ insurance programmes cover expensive cancer drugs for a tenth of the country’s population, although the general population does not have access to many basic health-care interventions.<sup>180</sup> Although the extent to which the use of expensive

services represents true overuse as opposed to lower-value care from a public health perspective is not clear, overuse is a potential threat to both the viability of public budgets and to population health in LMICs.

### Worldwide trends in overuse

Is overuse getting better or worse? This is a difficult question to answer for several reasons. First, we are only beginning to conceptualise overuse as a general system problem and to develop system-level metrics.<sup>188</sup> Second, there are no measures in general use and providers in most countries have few incentives to report overuse. Third, health-care systems are complex and dynamic;<sup>189</sup> reducing or eliminating overuse of one service or in one site of care could encourage overuse in another, particularly in systems whereby providers are paid a fee-for-service and expect to maintain revenue.

We do know that there has been increased attention among health ministers, clinicians, policy makers and the public, with respect to overuse during the past 5–10 years, particularly in HICs but also in some LMICs. However, awareness of the problem has not automatically led to clinicians delivering the right care. In the USA, for example, concerns about excessive caesarean delivery have existed for decades, however, incidence has continued to rise (from 21% in 1996 to 31% in 2006).<sup>190</sup> Furthermore, despite longstanding concerns regarding the overuse of imaging with CT and MRI, their use increased between 8% and 10% annually from 1996 to 2010.<sup>191</sup>

In LMICs, overuse appears to be increasing, at least for certain services. In Tanzania, rates of caesarean delivery rose from 19% in 2000 to 49% in 2011 among low-risk deliveries,<sup>192</sup> with similar increases over time in India, Nepal, and Bangladesh.<sup>193</sup> Financial incentives and government policies can contribute to increased overuse. In China, government cuts in subsidies led hospitals to charge patients for care,<sup>194,195</sup> potentially contributing to notably high rates of caesarean delivery (46% in one study in a rural area).<sup>196</sup> Amid allegations of physician corruption and kickbacks from the pharmaceutical industry and diagnostic centres, there are reports from India of inappropriate use of drugs, diagnostic tests, and procedures,<sup>197</sup> including strikingly high rates of hysterectomies.<sup>198</sup> These trends appear to be novel and probably reflect increases in overuse over the past decade, but there are few data documenting longitudinal changes.

HICs are experimenting with specific initiatives to address overuse, such as NICE's "do not do" list,<sup>199</sup> attention to low-value practices in Australia,<sup>5</sup> and the Choosing Wisely campaign (<http://www.choosingwisely.org/>).<sup>200</sup> However, there are few studies in either HICs or LMICs addressing the impact of such initiatives. Additionally, EHRs, which have been used as a tool to reduce overuse locally,<sup>201</sup> could be used more broadly in the future. The fourth paper in this Series<sup>15</sup> reviews efforts around the world to reduce overuse.

### Conclusion

There is strong evidence for the widespread overuse of several specific medical services in many countries, suggesting that overuse is common around the world and might be increasing. However, this paper highlights a key challenge: measuring overuse and developing robust evidence for its prevalence in health services and patient populations. There is a clear need for a research agenda to develop such evidence.<sup>13</sup> Overuse is likely to cause harm to both patients and health-care systems and thus, physicians, politicians and policy makers in both HICs and LMICs must understand overuse and act to reduce it.

#### Contributors

All authors participated in the development of the report, including conception, provision of data and references, writing of the manuscript, revision of the draft, and approval of the final version. SB and DK wrote drafts, which were improved and revised by all other authors. KeC developed figure 2.

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