1 Introduction

Overuse involves the oversupply of interventions beyond the needs of the population. It has become increasingly recognised as a problem of healthcare quality,[1–4] where quality refers to 'the degree of match between health products and services, on the one hand, and the needs they are intended to meet, on the other'.[5] In this Element, we explore how concepts related to overuse have been variously employed across research, policy-making, and clinical practice. We highlight that much work to date has focused on *identifying* overuse rather than examining potential solutions to combat it – but show that even identifying overuse is not straightforward. We describe how overuse is becoming seen as a new 'quality frontier'[5] and explain the challenges in designing and evaluating approaches to improvement. We discuss critiques highlighting the tension between standardised restrictive policies and individualised clinical care.

2 What Is Overuse?

Overuse has been defined as 'the provision of medical services that are more likely to cause harm than good'[6] and accordingly as a form of inappropriate care.[7] Since the adoption of the term by the Institute of Medicine National Roundtable on Health Care Quality in 1998,[8] overuse has increasingly encompassed a range of concepts, including overdiagnosis,[9] overtreatment,[10] and too much medicine.[11,12] It is also often linked with the concept of low-value care. However, overuse and low-value care have different origins and are traceable to different research literatures: research on overuse originated in the clinical community and has been focused on clinically orientated concerns;[8,13] research on low-value care originated with economists and has been focused on improving system-level value.[7,14] Concepts of low-value care in the literature are therefore often broader than those of overuse and based on priority-setting and the comparative cost-effectiveness of interventions – which may result in the classification of interventions that have significant clinical benefit as low-value due to their relative cost.[15,16]

In this Element we focus on overuse of healthcare interventions, broadly defined as diagnoses and treatment interventions that have negligible or no benefit to individuals and that have the potential to cause either direct harm (e.g. side effects) or other unwelcome consequences (e.g. financial or other burden of treatment) for patients, *as well as* wasting resources at a system or societal level.[17,18] We show that there are many challenges in identifying, defining, and measuring overuse, and highlight that all definitions of overuse incorporate both clinical *and* economic concerns to some extent.

3 Understanding Overuse

Overuse can be broadly understood as the provision of interventions that have negligible or no benefit (and may cause harm) to particular groups of patients. However, despite its apparent conceptual simplicity, the term has been used in different ways in different contexts, sometimes bringing together divergent and potentially competing ideas. Research, policy, and practice in this area have all suffered from a lack of consensus on conceptualisation, definition, and measurement, leading to challenges for stakeholders trying to strategically understand and address overuse.

Several conceptual frameworks for understanding overuse have been developed. For example, Lipitz-Snyderman and Bach[19] propose attention to: trade-offs between benefits and harms, and between benefits and costs; and patient preferences (i.e. where these may be inconsistent with evidence or clinical recommendations). Chan et al.[20] suggest that there should be differentiation between 'specific clinical situations or indications for which a service is considered inappropriate or of questionable clinical value' and 'services that may be appropriate for a specific population, such as a high-risk population, but [are] inappropriate or of negligible clinical benefit when applied to other, particularly lower-risk populations'.

Verkerk et al.[21] develop such ideas into a broad typology of low-value care, which reflects medical, system, and patient perspectives.

(1) **Ineffective care:** from a medical perspective, care that is ineffective (in terms of clinical benefit and/or cost) for a certain condition or subgroup of patients, according to scientific standards. Examples include antibiotics for a viral infection or routine echocardiography for asymptomatic patients.
(2) **Inefficient care:** from a societal (or system-level) perspective, care that involves 'inefficient provision or inappropriate high intensity or duration'. Examples include duplication of diagnostic tests and removing stitches in hospital instead of general practice. This form of care may be effective clinically but is also considered as overuse.
(3) **Unwanted care:** from a patient perspective, care that 'does not solve the individual patient's problem or does not fit the individual patient's preferences'. Examples include chemotherapy for a patient who prefers palliative care, or surgery for a patient who prefers conservative treatment.

3.1 Scientific Evidence of Clinical Ineffectiveness

Ineffective care can be considered as one key dimension of overuse. However, establishing unequivocal evidence of clinical ineffectiveness for particular

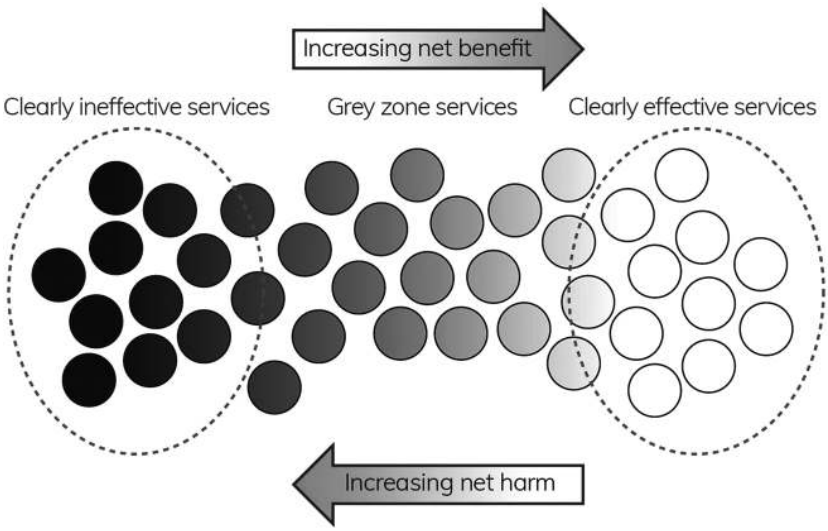

Figure 1 Grey zone services

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interventions and specific patient groups is rarely easy.[21] As Elshaug et al. point out in their report of 150 potentially low-value practices, 'services that are ineffective and/or unsafe across the entire patient population to which they are applied are probably quite rare'.[22] Instead, overuse occurs along a continuum, running from 'universal benefit' to 'entirely ineffective' (see Figure 1):

> *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. However, the majority of tests and treatments fall into a more ambiguous grey zone.*[6]

To date, a large proportion of the work to identify and address overuse has focused on the 'easy hits'[23] – that is, those interventions with a relatively uncontentious scientific evidence base to demonstrate that they are 'entirely ineffective' for all, or distinct groups of, patients. But as efforts to identify overuse have become more extensive (moving beyond unambiguous cases and into the grey zone), disagreement among experts and other stakeholders has increased, with definitions, underlying principles, and interests all being contested.[2,12,24]

In Brownlee et al.'s grey zone (Figure 1), a challenge for those seeking to identify overuse is absent or weak evidence relating to specific patient subgroups. For example, Garner et al. used Cochrane systematic reviews to identify low-value and potentially overused interventions.[25] But the interventions they identified were the result of 'a lack of randomised evidence of effectiveness, rather than robust evidence of a lack of effectiveness or evidence of harm'[25] – or as Altman and Bland memorably express it, an 'absence of evidence' rather than 'evidence of absence'.[26] In their systematic review of nursing guidelines, Verkerk et al. were similarly unable to distinguish between do-not-do recommendations with a strong or weak evidence base.[27] Although insufficient or weak scientific evidence is also a challenge in the development of clinical guidelines,[28,29] it is particularly problematic in the context of labelling interventions as overuse because such interventions may become targets for restriction or removal.

3.2 Approaches to Identifying Overuse

In addition to the challenges in establishing which interventions might be ineffective and thus vulnerable to overuse, methods for identifying when overuse is occurring in health systems are also diverse and lacking in consensus. One of the most widely used is the RAND Appropriateness Method, which was developed in the USA in the 1980s[8,13] in response to two main issues. First, a recognition of the limited specificity of clinical guidelines, which may recommend that an intervention is considered for a particular group of patients, but not address the conditions under which people within this group may derive limited benefit or experience harm.[30] Second, a new awareness of large geographical variations in the use of some interventions.[31] The RAND approach uses similar techniques to the guideline development process, integrating scientific evidence with the opinions of experts,[1,32] but it also incorporates detailed assessments about the 'appropriateness of performing the procedure for a comprehensive set of specific clinical circumstances or clinical scenarios'.[31]

Other approaches involve systematically reviewing the research evidence for individual conditions. In the UK, for instance, the National Institute for Health and Care Excellence (NICE) has developed do-not-do recommendations based on reviews of clinical guidelines.[33] Its do-not-do database stipulates, for example, that pharmacological intervention should not be employed to aid sleep 'unless sleep problems persist despite following a sleep plan'.[34] Researchers have also undertaken marginal analyses,[35] revisited previous systematic reviews (that were originally focused on intervention rather than potential for overuse),[25] and reassessed health technology assessments.[36–38]

Practice variation studies,[39,40] which seek to identify clinical practices that vary by country, region, or individual clinician, also have a role in assessing overuse. Such studies can provide insight into potential areas of overuse (or underuse) by identifying large geographical differences between and within countries to prioritise opportunities for disinvestment.[41,42] Their premise is that variation is not only due to different population characteristics, but also reflects 'professional uncertainty' – that is, variation in clinicians' beliefs about the outcomes of alternative treatments.[43] Findings can operate as 'tin-openers' – providing data from which to start the process of assessing and making decisions about overuse and underuse.[44] For example, an Australian report based on Organisation for Economic Co-operation and Development data aimed to 'stimulate a national discussion' about whether variation in several orthopaedic, obstetric, and cardiac procedures was warranted.[45] National and international surveillance programmes on antibiotic use are another important example of extensive infrastructure being put in place to enable variation modelling.[46,47] However, interventions with high levels of practice variation are often those for which the current evidence 'does not point clearly to a right answer'[6] on which practice is most effective, thereby creating space for different professional opinions and use of discretionary care.

Practical difficulties in trying to characterise overuse arise because of lack of data in relation to subgroups of patients,[20] problems separating data from routine data sources,[1] and a lack of relevant clinical data about symptoms and physical exam findings in electronic health records and administrative databases.[48] The incompleteness of data records has also created significant challenges with interpreting evidence of overuse from one healthcare setting to another.[25] As electronic records make data more accessible, and suites of local indicators are developed based on evidence of overuse from professional societies and campaigns,[49–52] some of these challenges are being addressed. Researchers are increasingly using new methods to identify overuse within healthcare systems – for example by using algorithms to interrogate administrative databases.[50] In line with the underpinning scientific evidence and focus of professional campaigns such as Choosing Wisely, such work has been orientated towards tests and procedures rather than, for instance, prescribing.[53]

3.3 Determining Overuse in the Context of Differing Perceptions of Value

The approaches for identifying overuse highlighted in Section 3.2 are typically based on research evidence of clinical and cost-effectiveness,[54,55] which is consistent with the argument that 'only evidence from clinical research has

secure standing as knowledge'.[56] But the methods for producing standardised evidence for application in clinical practice are, of course, open to challenge.[28,57–60] Increasingly, tensions are being recognised between standardised systems for assessing overuse and clinical judgements when applied in context. For policy-makers, determining the *value* of interventions requires more than scientific measures of effectiveness in the treatment of individual conditions: it also involves complex and context-dependent decisions about options, and allocative concepts of value – 'health outcomes achieved per dollar spent'.[14]

At this system and policy level, there is frequent tension between financial and quality imperatives.[61] Concepts of low value in this context include considerations of the *comparative value* of interventions given restricted budgets and allocative options, which may go beyond strictly clinical/scientific concepts. Healthcare commissioners may come under pressure, for reasons of cost, to restrict interventions and services that have been approved as clinically evidence-based.[62] By the same token, decisions about overuse may be influenced by the range of alternatives that are available and their associated costs and burdens. For example, surgery for minimally symptomatic inguinal hernia could be considered as overuse,[63] since this condition can be managed effectively with so-called watchful waiting. But this alternative strategy also requires clinical activity and resources, so the decision may not be straightforward. More generally, comparing surgical interventions with more conservative options (e.g. physiotherapy) is often more complex than it might initially appear, complicating assessments of overuse.

Determining value may also involve considering the (potentially conflicting) interests of different stakeholders. Antibiotic overuse is a particularly complex area: as well as debates about what constitutes appropriate use in clinical practice,[64] there is difficulty in balancing the value of antibiotics to individual patients in the short term against the longer-term risk to society of growing antimicrobial resistance. Controversies about managing antibiotic overuse point to the need for both responsible use in terms of optimising clinical outcomes, and broader stewardship programmes that protect the efficacy of antibiotics for wider society and patients of the future.[65]

Further complexity arises when the views of patients and the public are factored into thinking about what counts as overuse. An increasingly influential view is that identifying an intervention as low value should be based on the features of the individual encounter, rather than done in a general way outside of a specific situation.[66] This and similar arguments emphasise that individual patient needs and preferences should be core to decision-making about the value of interventions in practice.[59,67,68] In this individualised context, the most

important outcomes for some patients may diverge from those that are prioritised within the scientific frame of knowledge[69] (see Box 1). While patients may in many cases opt for more conservative options when informed about the likelihood of benefits and potential harms,[74] this approach can be problematic if patients seek interventions that are not deemed appropriate within the healthcare system. This can be seen in public calls for population-based screening programmes for conditions for which existing research evidence does not support screening, for example.

Ultimately, identifying what is deemed appropriate use cannot be seen as an entirely scientific or neutral enterprise. Instead, it is a social process with multiple political, economic, and relational dimensions[75,76] (see Box 2). Despite Porter's argument that a scientific and economically calculated 'value

Box 1 Balancing the possible benefits and harms of breast cancer screening

Screening for breast cancer with mammography is often discussed in the overdiagnosis and overtreatment literature. This is because of its tendency to identify anomalies that would not have gone on to cause a problem for the individual concerned, but are then subject to intervention.

A 2011 Cochrane review of breast screening suggested that for 2,000 women screened over a period of 10 years, one would have her life prolonged but an additional 10 would be treated unnecessarily.[70] In 2012, the Independent UK Panel on Breast Cancer Screening came to the view that while screening did reduce breast cancer mortality, there was an associated cost of overdiagnosis for other screening participants.[71] The review placed the figure at about three overdiagnosed cases identified and treated for every one breast cancer death prevented.

The balance between possible benefits and harms has led to calls for better information for those invited to take part in breast screening – in particular, for information clearly stating the potential for overdiagnosis and subsequent overtreatment. In Australia, a randomised controlled trial of a decision aid including information on overdiagnosis to support informed choice about breast cancer screening[72] suggested that the additional information increased the number of women making an informed choice about whether or not to have screening. It also indicated that being better informed *might* mean women were less likely to be screened. However, other work (by several of the same authors) on women's harm/benefit trade-offs has suggested that people have high tolerance for overdiagnosis, with around half of women reporting that they would always be screened, even at a 6:1 overdiagnosis-to-death-avoided ratio.[73]

Box 2 Controversies in defining appropriate use – an example from cardiovascular disease prevention

Controversies around defining and identifying overuse are particularly evident in debates around the use of preventative medications in healthy people. In recent years, medications targeting cardiovascular risk conditions (e.g. hypertension, type 2 diabetes mellitus) or calculations of overall risk have become a key feature of cardiovascular disease prevention.[77–79] The widespread prescription of these interventions for primary prevention (i.e. to people without history of cardiovascular disease) is intended to save both lives and money.[80] For example, the National Health Service (NHS) Health Check programme, which has operated in England since 2009, aims to address underuse of preventative medications by identifying people to whom they should be prescribed, and quality measures in general practice incentivise such prescribing.[81]

However, the widespread use of these preventative medications and apparently rigid adherence to guidelines in this area have been challenged.[82] Some clinical leaders claim that preventative medications may do more harm than good, with side effects outweighing potential predicted future benefits in many cases and broader harms (e.g. psychological, treatment burden) emerging from diagnostic labelling.[83,84] The widely publicised controversy over statin medications (coined the 'statin wars') illustrates such contentions,[85] with critics highlighting their widespread prescription as a case of overuse rather than underuse.[86,87] Others have disputed the value of the NHS Health Check programme, arguing that it diverts resources to population groups in least need.[88]

At the heart of the debate are competing framings of the benefits and harms of medications and ideas about how standardised knowledge from research and guidelines should be translated into practice.

for patients' should take precedence over the 'myriad, often conflicting goals' of stakeholders,[14] the practices involved in identifying overuse (and underuse) are inevitably complex and social. Overuse has been related to payment systems (e.g. fee for service), but also to interrelated patient, clinician, and healthcare system factors. Patterns of overuse can be surprising when, for example, system change shapes new behaviours.[89]

3.4 Recognising Overuse as a Quality Problem

Notwithstanding the debates about defining and measuring it, overuse is increasingly seen as a problem for health systems, populations, and patients.

Researchers have estimated that 'around 20% of mainstream clinical practice brings no benefit to the patient'.[90] Although such estimates are largely based on the US healthcare system, researchers working in other countries have reported similar findings. An international review of overuse estimates that 'approximately a third of all patients (between 20% and 33%, depending on the study), receive treatments or services that the evidence suggests are unnecessary, ineffective or potentially harmful'.[91] Individual studies suggest rates of overuse may be very much higher for some interventions, in some contexts – with one study in China finding that 57% of patients had been prescribed inappropriate antibiotics.[5]

Overuse has sometimes been identified as a particular problem in high-income countries,[6,32] but patterns of overuse – and underuse – are not always simple. In 2017, *The Lancet* published a series of articles on 'right care', based on studies of overuse around the world.[4–6,92–95] It highlighted that overuse and underuse (the latter defined as 'the failure to use effective and affordable medical interventions'[94]) were both widespread and should be understood and addressed in parallel.[92] Overuse and underuse may coexist within the same health economies, across the spectrum of different intervention types and/or for a single intervention across different patient groups. Overuse and underuse may be present in both high-income and low-income countries. Overuse has been (and continues to be) a persistent challenge even in low-income countries and in communities with limited access to healthcare services, where overuse may be a response to poor living conditions or limitations of available healthcare services.[5,96,97]

Concerns about overuse have become increasingly prominent in the healthcare community, particularly as increasing numbers of studies show that overuse has potentially major consequences for patients – including costs, emotional distress and anxiety, physical harms from side effects, or other adverse events[9,83,98–100] – and for the sustainability of healthcare systems.[3,101] Addressing overuse has recently been positioned as a new 'quality frontier' in international work to improve healthcare quality,[5] being linked with the Institute of Medicine's dimensions of quality.[102,103] Increasingly, it has been positioned as a patient safety ('harm') issue,[100] stretching the concept of safety to include psychological harm as well as physical injury.[104]

3.5 Recognising Systemic Influences on Overuse

To address overuse as a systemic quality issue, it is necessary to have an appreciation of its systemic drivers (Figure 2). For example, efforts to address problems of *underuse* may unintentionally result in *overuse*.[98,105] Clinical guidelines provide

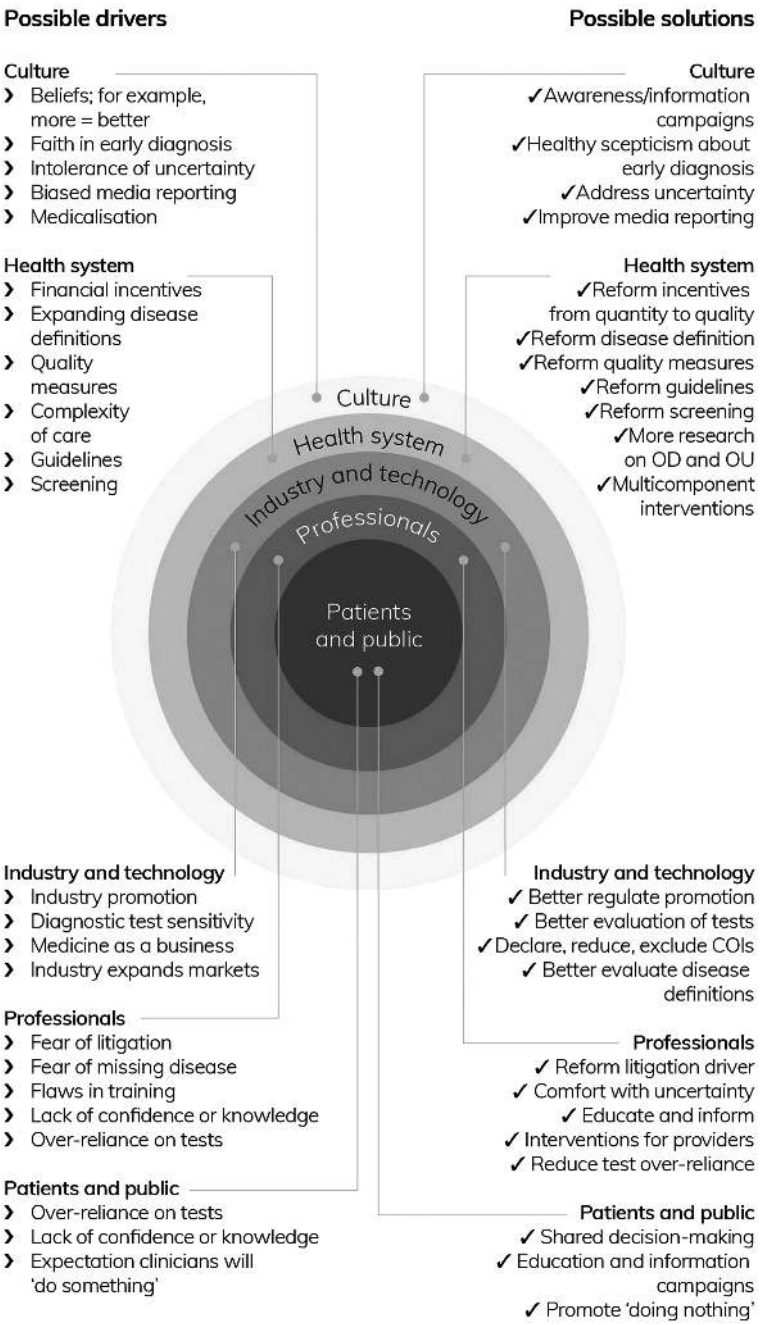

Figure 2 Overdiagnosis and related overuse: mapping possible drivers to potential solutions

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