



# Barriers and facilitators to implementing priority setting and resource allocation tools in hospital decisions: A systematic review

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## ABSTRACT

Health care budgets in high-income countries are having issues coping with unsustainable growth in demand, particularly in the hospital setting. Despite this, implementing tools systematising priority setting and resource allocation decisions has been challenging. This study answers two questions: (1) what are the barriers and facilitators to implementing priority setting tools in the hospital setting of high-income countries? and (2) what is their fidelity? A systematic review using the Cochrane methods was conducted including studies of hospital-related priority setting tools reporting barriers or facilitators for implementation, published after the year 2000. Barriers and facilitators were classified using the Consolidated Framework for Implementation Research (CFIR). Fidelity was assessed using priority setting tool's standards. Out of thirty studies, ten reported program budgeting and marginal analysis (PBMA), twelve multi-criteria decision analysis (MCDA), six health technology assessment (HTA) related frameworks, and two, an ad hoc tool. Barriers and facilitators were outlined across all CFIR domains. Implementation factors not frequently observed, such as 'evidence of previous successful tool application', 'knowledge and beliefs about the intervention' or 'external policy and incentives' were reported. Conversely, some constructs did not yield any barrier or facilitator including 'intervention source' or 'peer pressure'. PBMA studies satisfied the fidelity criteria between 86% and 100%, for MCDA it varied between 36% and 100%, and for HTA it was between 27% and 80%. However, fidelity was not related to implementation. This study is the first to use an implementation science approach. Results represent the starting point for organisations wishing to use priority setting tools in the hospital setting by providing an overview of barriers and facilitators. These factors can be used to assess readiness for implementation or to serve as the foundation for process evaluations. Through our findings, we aim to improve the uptake of priority setting tools and support their sustainable use.

## 1. Introduction

High-income countries are grappling with how to maximise value within their healthcare systems. Spending as a proportion of gross domestic product is projected to grow from 10.8% to 13.1% between 2016 and 2050 (Network GBoDHFC, 2019). Hospital expenditure makes up the most significant proportion of healthcare expenditure, contributing between 27.6% and 37.6% and is the most substantial driver of healthcare expenditure growth (Schneider et al., 2021). There is concern over whether these trends are sustainable, considering healthcare resources are scarce (Fiscal, 2015) and there is substantial waste from the

overuse of medical services and technology (Speer et al., 2020; Braithwaite et al., 2020; OECD, 2017).

Healthcare systems can generate more value from their resource allocation by better comparing outcomes to costs for different stakeholders, better incorporating patient preferences, and better use of data through technology (Porter, 2009). Resource allocation decisions in health systems are mostly based on historical patterns or ad hoc processes (Seixas et al., 2021a). Decisions are often influenced by political views and may not be evidence-based, potentially leading to sub-optimal health outcomes and inefficient use of resources (Seixas et al., 2021a). Priority setting tools that assess multiple criteria seek to

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systematically organise the resource allocation decisions (Seixas et al., 2021a; Baltussen and Niessen, 2006; Peacock et al., 2009). The Organisation for Economic Co-operation and Development suggests that better use of priority setting within healthcare systems would improve their efficiency (OECD, 2010).

Priority setting is defined as ‘decisions about the allocation of resources between the competing claims of different services, different patient groups or different elements of care’ (Klein, 2010). A priority setting tool aims to systematise decision processes with two main components (Network GBoDHFC, 2019): a mechanism for assessing interventions’ value and (Schneider et al., 2021) a mechanism guiding prioritization (Seixas et al., 2021b). The most widely used priority setting tools in high-income countries are program budgeting and marginal analysis (PBMA), multi-criteria decision analysis (MCDA), and Health Technology Assessment (HTA) (Kapiriri and Razavi, 2017). However, using a systematic approach to setting priorities can be complex. It may require trading off resources and outcomes when deciding on which initiatives to prioritise, typically based on incomplete data and great uncertainty (O’Rourke et al., 2020). Organisations often have complex dynamic interactions among multiple stakeholders with competing interests, including patients (Damschroder et al., 2009). Health economists and other researchers are often required to provide technical analysis, which is difficult for other parties to fully comprehend without knowledge of fundamental economic concepts (Peacock et al., 2009). Priority setting decisions are further complicated by alternative investment options with differential benefits and costs to various groups, introducing ethical considerations to the decision (O’Rourke et al., 2020). Although all hospital related decisions use some form of priority setting process that could share some characteristics with PBMA, MCDA or HTA, these may not be formally constructed, not published, are context specific and be used with variable levels of technical rigour. A hypothesis for not observing more frequent use of formal priority setting tools could be how they have been implemented.

Researchers have sought to identify priority setting tools’ complexities to promote their use. Literature reviews with different objectives have explored priority setting frameworks. Some have searched for current priority setting and resource allocation frameworks in high-income countries (Seixas et al., 2021b). Others aimed to describe decision criteria used for priority setting (Cromwell et al., 2015), attributes the general public thinks should be included in priority setting (Gu et al., 2015), factors that influence HTA committees decisions (Ghijben et al., 2018), or focused on cases where disinvestment occurred (Polisena et al., 2013). Research has also been conducted on priority setting frameworks’ institutionalisation and decision-maker perspectives on its utility (Kapiriri and Razavi, 2017). Furthermore, there is literature aiming to provide ‘best practice’ steps to guide priority setting methods (Viergever et al., 2010), which has made recommendations for future practice focusing on characteristics of the priority setting process itself (Bryant et al., 2014). Other authors have proposed a framework for high performance priority setting and resource allocation (Smith et al., 2016a). PBMA, HTA, and MCDA could also coexist together, with PBMA as the overarching priority setting framework and using MCDA and HTA as inputs for decision making (Mitton et al., 2019). Additionally, priority setting processes have not been applied consistently. I.e., they have been applied with low fidelity. Fidelity is defined as the degree an intervention is implemented as intended initially when designed and tested (Carroll et al., 2007). This has been observed in process characteristics variation including different criteria to assess value, involvement of varied stakeholders, decisions not subject to external review, diverse types of data use, limited evaluation reporting, degree of political involvement, and deliberation process (Seixas et al., 2021b).

Although it seems reasonable to use priority setting tools, there are challenges to adopting them within healthcare systems, including hospital-related decisions where resource allocation decisions need to be made daily (Kapiriri and Razavi, 2017; Sabik and Lie, 2008). To address this, our study answers the following questions: (1) what are the barriers

and facilitators to implementing priority setting tools in hospital-related decisions of high-income countries? and (2) what is the fidelity to the application of these priority setting tools?

We were interested in hospital-related decisions in high income countries as hospitals represent the highest percentage of health spending in health systems (Schneider et al., 2021). Hospitals provide more specialised and resource-intensive services compared to the community or public health interventions. We focus on priority setting tools suitable for value-based healthcare decisions made in hospitals given payers in the US, Europe, Asia and Oceania are exploring how to extract greater value from their healthcare systems, with most value based interventions being implemented within the hospital setting (Schneider et al., 2021, van Staalduinen et al., 2022; Woolcock, 2019; Sarkies et al., 2020). The overarching purpose of our study was to enable hospital boards, committees, and system administrators to better align their priority setting approach around value. Many value-based experiences have been reported in the hospital setting, making this review relevant (Zanotto et al., 2021). We therefore restricted our study to priority setting tools with two components (Network GBoDHFC, 2019): a mechanism for assessing interventions’ value and (Schneider et al., 2021) a mechanism guiding prioritization (Seixas et al., 2021b). The priority setting tools could consider aspects such as equity, organisational aspects, community preferences, and disease severity, among other criteria (Baltussen and Niessen, 2006; O’Rourke et al., 2020; Mitton and Donaldson, 2004).

To answer the first research question, we employed the Consolidated Framework for Implementation Research (CFIR), which has been developed to describe implementation knowledge in a generalisable manner (Damschroder et al., 2009). The CFIR is based on 19 published implementation theories. It contains five domains and 39 constructs, all of which impact the effective implementation of interventions including priority setting tools. The CFIR is primarily used to guide data collection, measurement, coding, analysis and/or reporting on why a service or intervention was or was not adopted in practice by identifying factors that modulate its implementation (Kirk et al., 2016). Compared to other frameworks, it provides a taxonomy with descriptions of each construct (Breimaier et al., 2015). It has been extensively utilised to describe implementation factors across diverse disciplines in process redesign, quality improvement, health promotion and disease management (Holmes et al., 2020; Moecker et al., 2021; Xyrichis et al., 2021; Louie et al., 2021; Mutschler et al., 2021; Piat et al., 2021; Pereira et al., 2021; Michel et al., 2021; Cooper et al., 2021; Lowther et al., 2021; Tumma et al., 2022; Chan et al., 2021). The CFIR has also been used to assess the use of evidence from economic evaluations in priority setting (Merlo et al., 2019). Therefore, Using the CFIR benefits our assessment by applying a widely used framework and terminology, which will aid readers from different disciplines to understand the barriers and facilitators to the implementation of priority setting and resource allocation tools.

To answer the second question, we assessed whether fidelity is a potential implementation modulator for making priority setting tools ubiquitous within hospital-related decisions as the literature suggests priority setting processes have not been applied consistently (Seixas et al., 2021b). We compared priority setting tools case studies to best practice criteria identified within the literature.

This is the first literature review with a systematic design focused on barriers and facilitators of priority setting tools’ adoption and reports on their fidelity to the best of our knowledge. Our study employs the CFIR to evaluate the implementation of priority setting tools themselves, compared to other studies in the priority setting area where the use of evidence from economic evaluations was assessed (Merlo et al., 2019). Further, it is the first literature review focusing on priority setting tools for hospital-related value decisions, which currently represents the highest cost item on healthcare budgets (Schneider et al., 2021). Also, although PBMA, MCDA and HTA are the most frequently observed frameworks in high-income countries, our review is not limited to them

(Seixas et al., 2021b).

## 2. Methods

This study followed the Cochrane method of systematic reviews (Higgins et al., 2019). The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement was followed for reporting (Page et al., 2021). This systematic review protocol is registered in PROSPERO (CRD42022309857).

### 2.1. Search strategy

The following databases were searched: Medline (including PubMed) and Embase through Ovid, and Academic Search Premier, CINAHL and Econlit through EBSCOhost. The search strategy was built using general terms relating to the research questions, such as ‘priority setting’ or ‘resource allocation’ combined using Boolean operator ‘AND’ with terms related to decision tools such as PBMA, MCDA or HTA and related to healthcare. The search strategy was not limited only to these tools, but it acknowledges that they are the most frequently observed in high-income countries (Seixas et al., 2021b). The complete search strategy can be found in Appendix 1.

### 2.2. Study selection

Table 1 presents the inclusion and exclusion criteria used to select relevant studies. The inclusion criteria were published case studies that assessed real applications of priority setting decision tools for hospital-related decisions at any level, such as government, local authorities, or hospital management. These studies could potentially include authorities that also make decisions related to other levels of care. However, only those that presented hospital-related decisions and implementation outcomes were included. A study was included if the evaluated tool assessed attributes broader than costs and clinical effectiveness. Non-empirical studies, opinion articles, editorials, or conference abstracts were excluded. Studies published before the year 2000 were also excluded to reflect the latest practice.

Two reviewers (VJ and ES) independently screened the title and abstracts of studies identified by the search strategy. Potentially relevant studies were retrieved for full-text review and assessed for eligibility by the same reviewers. A third reviewer (AAC) was consulted if consensus was not reached on whether to include a study. The reference list of included studies and reference lists of relevant systematic reviews were checked. Forward citations of included studies were also checked.

### 2.3. Data extraction, analysis and synthesis

A data extraction form was designed to extract data from the included studies. This form was piloted with five studies to assess its

feasibility. Piloting was used to improve the form in terms of practicality but not for content. Three reviewers undertook data extraction independently (AAC, VJ, and AB). Appendix 2 presents a list of the data extraction form items.

Study characteristics were synthesised in a summary table and described in the text. Barriers and facilitators were classified according to the CFIR’s domains and constructs and were further characterised in the text (Damschroder et al., 2009). The CFIR comprises five interacting implementation domains, which are represented in Fig. 1. Within these domains, there are 39 constructs each domain containing concepts describing barriers or facilitators. This assessment was conducted independently and double checked by two reviewers (AAC and AB). Barriers and facilitators were identified by the reviewers’ judgement independently. Then, both reviewers agreed on what CFIR construct would suit each implementation factor better. If there was disagreement between reviewers, a consensus was sought, and if necessary, a third reviewer (VJ) was consulted for a final decision.

Each case study was compared against best practice criteria found in the literature to evaluate implementation fidelity. PBMA case studies were assessed against the criteria described by Peacock et al. (2006). That article described the stages for using PBMA. They include determining the aim and scope of the exercise, determining the program budget, forming an advisory panel, determining locally relevant criteria, identifying services for growth, release, or increased efficiencies, evaluating investments and disinvestments, and validation of results and resource reallocation (Peacock et al., 2006). For MCDA, the International Society for Pharmacoeconomics and Outcomes Research (ISPOR) MCDA emerging good practices report was used (Thokala et al., 2016; Marsh et al., 2016). The ISPOR good practices encompass selecting and structuring criteria, measuring performance, scoring alternatives, weighting criteria, calculating aggregate scores, dealing with uncertainty, and reporting and examining findings. For HTA, the recommendations of Drummond et al. were used, which broadly described four areas to improve HTA based decision making, including structure, methods, process, and implementation (Drummond et al., 2008). Each area had a different set of principles. This assessment was conducted independently by one reviewer (AAC).

## 3. Results

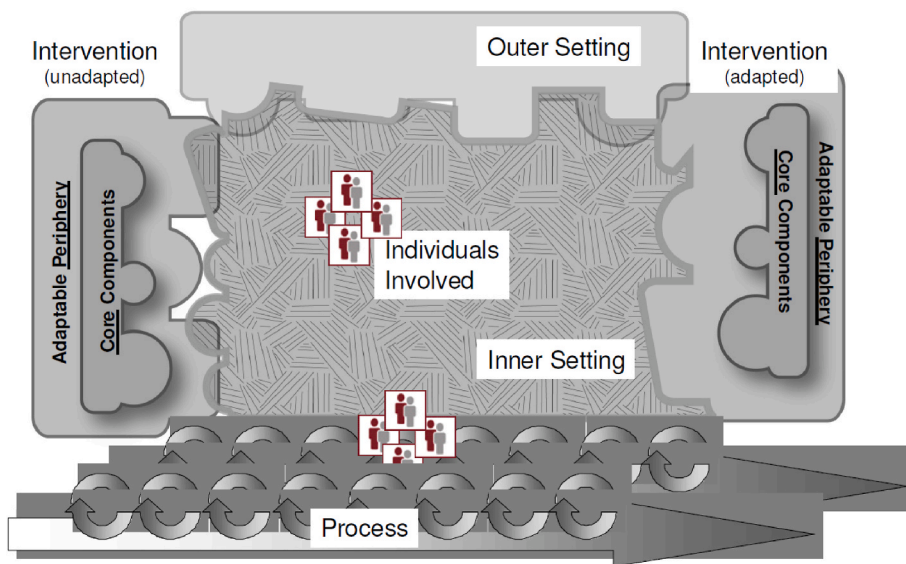
### 3.1. Study selection

Our initial search identified 4339 records. Of these, 1548 duplicates were removed, yielding 2791 reports for the title and abstract screening. We excluded a further 2543 articles leaving 248 papers for full-text review. After review, 30 studies in 38 papers were included for data extraction and analysis. Fig. 2 shows the PRISMA flowchart.

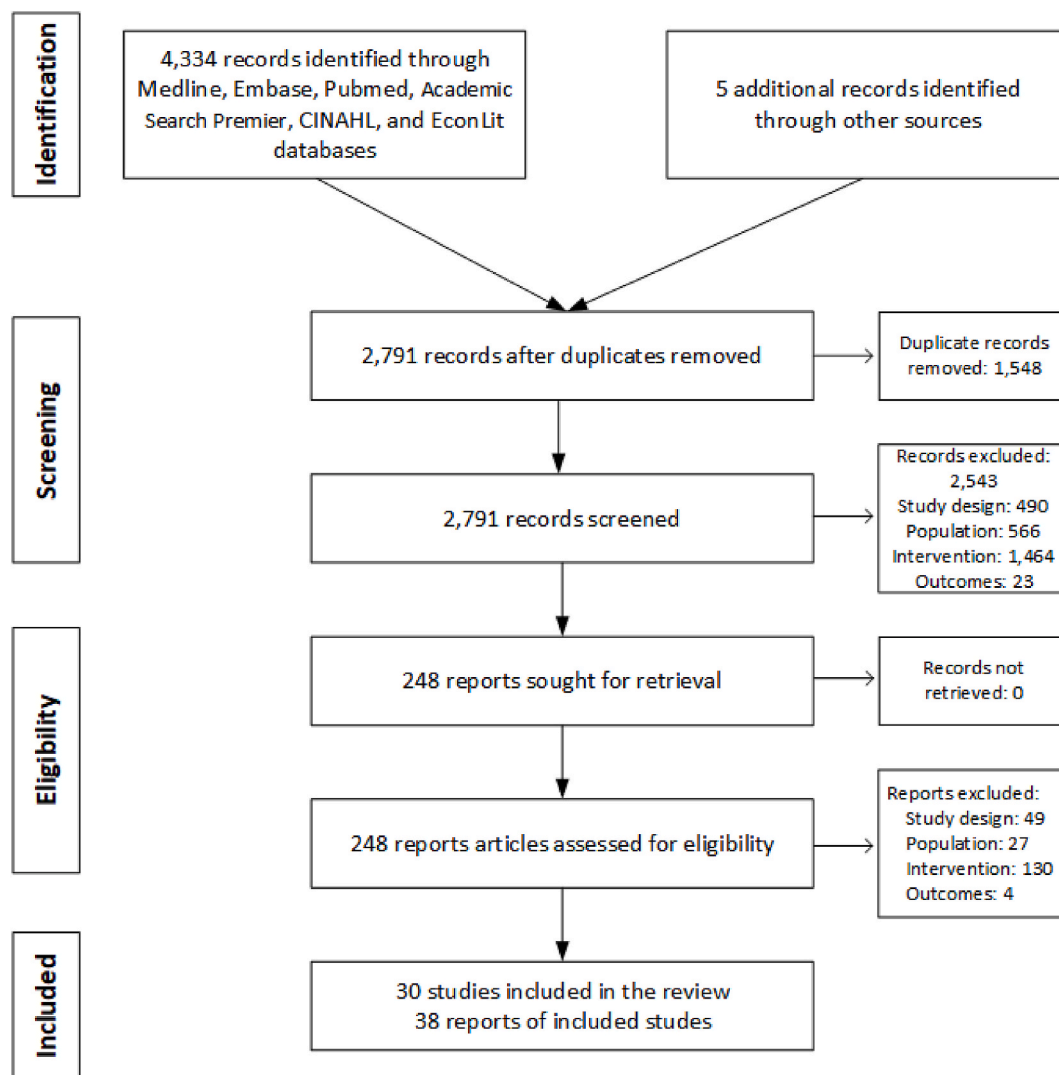
**Table 1**  
Inclusion and exclusion criteria.

	Inclusion criteria	Exclusion criteria
Study design	Real-world application case-studies	Non-empirical studies; hypothetical studies; literature review; conceptual/methods studies; conference abstracts; opinion, editorial
Population	Decision-makers related to the hospital setting; any high-income countries	Individual-level decision making; not hospital setting (e.g., primary care, community-based care); low- and middle-income countries; priority setting for non-clinical services
Intervention	Any priority setting tools, instruments or framework	Tools considering only costs and clinical effectiveness Tools not for priority setting purposes
Outcomes	Must report on the characteristics of the tool Must report on the characteristics of the setting within which the tool was used Must report on barriers or facilitators of the tool’s implementation	NA
Year of publication	Since 2000	None
Language	English	Non-English

NA: not applicable.



**Fig. 1.** Consolidated framework for implementation research (Damschroder et al., 2009). Domains interact with each other influencing implementation. The intervention has different components. Some of them are core to the intervention, whereas others can be adapted to facilitate implementation. Interventions sit within the inner setting and outer setting. The outer setting can influence the inner setting including factors such as socioeconomic and political context. Whereas the inner setting is determined by an organisation structure or culture. A fourth component are the individuals who are agents of change and can either facilitate or difficult an intervention implementation through their action, beliefs, cultures, among others. The fifth element is the implementation process that supports an intervention uptake.



**Fig. 2.** PRISMA flow diagram.

### 3.2. Studies characteristics

#### 3.2.1. Overview

Ten studies were conducted in Canada and published in 18 papers (Mitton and Patten, 2004; Mitton et al., 2002a, 2002b, 2003a, 2003b, 2004, 2005, 2006; Mitton and Donaldson, 2003a, 2003b; Patten et al., 2006; Smith et al., 2015, 2016b; Dionne et al., 2009; Gibson et al., 2011; Goetghebeur et al., 2012; Poder, 2017; Tadrous et al., 2020), six studies in Australia (Astley and Wake-Dyster, 2001; Haas et al., 2001; Blythe et al., 2019; Howard et al., 2019; Ju and Hewson, 2014; Vos et al., 2005), four in Italy (Foglia et al., 2017; Garau et al., 2018; Radaelli et al., 2014; Ritrovato et al., 2015), three in multiple countries (Angelis et al., 2020; Knies et al., 2013; Korge et al., 2017), three in the United Kingdom (Goodwin and Frew, 2013; Bowers et al., 2018; Anderson et al., 2017), two in Sweden (Waldau et al., 2010; Waldau, 2015), and one each in France (Martelli et al., 2016) and Denmark (Ehlers et al., 2006). Of the Canadian studies published in multiple papers, one assessed the implementation of PBMA in the Calgary Health Region publishing seven papers (Mitton and Patten, 2004; Mitton et al., 2002a, 2003a, 2004, 2005; Mitton and Donaldson, 2003a; Patten et al., 2006), another study describing the implementation of PBMA in individual services was reported in two papers (Mitton et al., 2002b; Mitton and Donaldson, 2003b), and an additional study describing the implementation of PBMA on a children and women's hospital was reported in two papers (Smith et al., 2015, 2016b).

Ten studies published in eighteen articles studied PBMA (Mitton and Patten, 2004; Mitton et al., 2002a, 2002b, 2003a, 2003b, 2004, 2005, 2006; Mitton and Donaldson, 2003a, 2003b; Patten et al., 2006; Smith et al., 2015, 2016b; Dionne et al., 2009; Gibson et al., 2011; Astley and Wake-Dyster, 2001; Haas et al., 2001; Goodwin and Frew, 2013), twelve studies assessed an application of MCDA (Goetghebeur et al., 2012; Poder, 2017; Blythe et al., 2019; Howard et al., 2019; Foglia et al., 2017; Garau et al., 2018; Radaelli et al., 2014; Ritrovato et al., 2015; Angelis et al., 2020; Bowers et al., 2018; Anderson et al., 2017; Martelli et al., 2016), six studies evaluated HTA related processes (Tadrous et al., 2020; Ju and Hewson, 2014; Vos et al., 2005; Knies et al., 2013; Korge et al., 2017; Ehlers et al., 2006). Two studies in Sweden considered a tool that could not be classified among the three categories (Waldau et al., 2010; Waldau, 2015). Studies characteristics such as interventions or health programs assessed by the tools, decision level, stakeholders involved, and decision criteria are summarised per tool below and are documented in Appendix Table 4.

#### 3.2.2. Program budgeting and marginal analysis

Most PBMA studies were conducted in Canada (Mitton and Patten, 2004; Mitton et al., 2002a, 2002b, 2003a, 2003b, 2004, 2005, 2006; Mitton and Donaldson, 2003a, 2003b; Patten et al., 2006; Smith et al., 2015, 2016b; Dionne et al., 2009; Gibson et al., 2011). Some studies assessed complete hospital budgets (Smith et al., 2015, 2016b), whereas others focused on individual units such as emergency departments or surgical departments (Gibson et al., 2011; Mitton et al., 2003b) or particular health problems including coronary heart disease (Haas et al., 2001). There were also reports of authorities responsible for broader publicly funded services in Canada (excluding physician fees) (Mitton and Patten, 2004; Mitton et al., 2002a, 2003a, 2004, 2005; Mitton and Donaldson, 2003a; Patten et al., 2006; Dionne et al., 2009) or primary care trusts in the UK (Goodwin and Frew, 2013). Four studies reported making decisions at some type of provincial or regional authority encompassing many services and programs allocated to a specific geographic region population including hospitals. These were conducted in Canada at the Calgary Health Region (Mitton and Patten, 2004; Mitton et al., 2002a, 2003a, 2004, 2005; Mitton and Donaldson, 2003a; Patten et al., 2006), Vancouver Island Health Authority (Dionne et al., 2009) and Provincial Health Services Authority of British Columbia (Mitton et al., 2006). Additionally, a Primary Care Trust in the UK was also described (Goodwin and Frew, 2013). Two studies reported

the application of PBMA at the individual hospital level (Smith et al., 2015, 2016b; Astley and Wake-Dyster, 2001). Four studies included specific areas such as infant cranial remodelling (Mitton et al., 2002b; Mitton and Donaldson, 2003b), neonatal and paediatric transport (Mitton et al., 2002b; Mitton and Donaldson, 2003b), arthroplasty (Mitton et al., 2002b; Mitton and Donaldson, 2003b), surgical services (Mitton et al., 2002b, 2003b; Mitton and Donaldson, 2003b), emergency department (Gibson et al., 2011), and coronary heart disease (Haas et al., 2001). Other studies assessed broader areas such as the whole institution (Smith et al., 2015, 2016b) or an allied health division of a women's and children's hospital. Different stakeholders were involved in the process, such as senior executives or managers (Mitton and Patten, 2004; Mitton et al., 2002a, 2002b, 2003a, 2003b, 2004, 2005, 2006; Mitton and Donaldson, 2003a; Patten et al., 2006; Smith et al., 2015, 2016b; Dionne et al., 2009; Gibson et al., 2011; Haas et al., 2001; Goodwin and Frew, 2013), health services providers (Mitton and Patten, 2004; Mitton et al., 2002a, 2002b, 2003a, 2003b, 2004, 2005, 2006; Mitton and Donaldson, 2003a, 2003b; Patten et al., 2006; Smith et al., 2015, 2016b; Dionne et al., 2009; Gibson et al., 2011; Haas et al., 2001; Goodwin and Frew, 2013), community representatives (Smith et al., 2015, 2016b; Gibson et al., 2011; Goodwin and Frew, 2013), or health economists (Mitton et al., 2003b; Haas et al., 2001). Studies reporting explicit decision criteria considered alignment with local priorities, efficiency, effectiveness, appropriateness, access, integration, prevalence, equity, severity, promotion and prevention, patient and family centred care, workplace environment, research, educational mandate, innovation, and implementation and health system impact (Mitton and Patten, 2004; Mitton et al., 2002a, 2003a, 2004, 2005, 2006; Mitton and Donaldson, 2003a; Patten et al., 2006; Smith et al., 2016b; Gibson et al., 2011). 'Gut feel' was also considered a criterion (Mitton et al., 2006). Three studies reported the adoption of PBMA for future use (Mitton and Patten, 2004; Mitton et al., 2002a, 2003a, 2004, 2005; Mitton and Donaldson, 2003a; Patten et al., 2006; Dionne et al., 2009; Gibson et al., 2011). One of them was a report on an already implemented tool (Dionne et al., 2009).

#### 3.2.3. Multi-criteria decision analysis

MCDA was presented in four Italian studies (Foglia et al., 2017; Garau et al., 2018; Radaelli et al., 2014; Ritrovato et al., 2015), two Australian studies (Blythe et al., 2019; Howard et al., 2019), two UK studies (Bowers et al., 2018; Anderson et al., 2017), one Canadian study (Goetghebeur et al., 2012), one French study (Martelli et al., 2016), and one study with multiple European countries (Angelis et al., 2020). A decision exercise combined MCDA with PBMA (Bowers et al., 2018), whereas most other studies were embedded in an HTA process, except for two (Blythe et al., 2019; Anderson et al., 2017). However, reports within an HTA process were focused on reporting the MCDA application rather than the HTA process (Goetghebeur et al., 2012; Poder, 2017; Howard et al., 2019; Foglia et al., 2017; Garau et al., 2018; Radaelli et al., 2014; Ritrovato et al., 2015; Angelis et al., 2020; Martelli et al., 2016). Therefore, reports within an HTA process were assessed for their MCDA component.

MCDA was applied to health services (Blythe et al., 2019; Bowers et al., 2018), medicines (Goetghebeur et al., 2012; Garau et al., 2018; Angelis et al., 2020), medical devices (Poder, 2017; Ritrovato et al., 2015; Martelli et al., 2016), or multiple technologies (Howard et al., 2019; Foglia et al., 2017; Radaelli et al., 2014; Standing et al., 2017). Some studies reported evaluating new technologies for assessment in general (Foglia et al., 2017; Anderson et al., 2017), others evaluated health areas such as postnatal care (Bowers et al., 2018), and some a particular intervention such as drugs for indolent non-Hodgkin lymphoma (Garau et al., 2018). Five studies assessed decisions at the hospital level (Poder, 2017; Blythe et al., 2019; Foglia et al., 2017; Ritrovato et al., 2015; Martelli et al., 2016), one at the UK NHS (Bowers et al., 2018; Anderson et al., 2017), two within HTA agencies (Garau et al., 2018; Angelis et al., 2020), and one at a national group of policy and

decision-makers, and researchers (Goetghebeur et al., 2012), one at an Australian state advisory committee (Howard et al., 2019), and one at an Italian region (Radaelli et al., 2014). Stakeholders from all levels were involved. These include central government decision-makers (Goetghebeur et al., 2012; Garau et al., 2018; Angelis et al., 2020; Anderson et al., 2017), local government decision-makers (Howard et al., 2019; Garau et al., 2018; Radaelli et al., 2014; Anderson et al., 2017), administrators and managers (Poder, 2017; Howard et al., 2019; Garau et al., 2018; Radaelli et al., 2014; Angelis et al., 2020; Bowers et al., 2018; Anderson et al., 2017), clinicians (Goetghebeur et al., 2012; Poder, 2017; Howard et al., 2019; Foglia et al., 2017; Garau et al., 2018; Radaelli et al., 2014; Angelis et al., 2020; Bowers et al., 2018; Anderson et al., 2017; Martelli et al., 2016), patients (Garau et al., 2018; Bowers et al., 2018; Anderson et al., 2017), or health economists or other health service specialists (Goetghebeur et al., 2012; Poder, 2017; Radaelli et al., 2014; Angelis et al., 2020; Anderson et al., 2017).

Different types of inputs were used within the MCDA process, such as literature reviews (Goetghebeur et al., 2012; Poder, 2017; Blythe et al., 2019; Howard et al., 2019; Foglia et al., 2017; Garau et al., 2018; Radaelli et al., 2014; Ritrovato et al., 2015; Angelis et al., 2020; Bowers et al., 2018; Anderson et al., 2017; Martelli et al., 2016), expert opinion (Poder, 2017; Blythe et al., 2019; Foglia et al., 2017; Radaelli et al., 2014; Ritrovato et al., 2015; Bowers et al., 2018), local cost data (Foglia et al., 2017; Bowers et al., 2018) other cost data (Angelis et al., 2020) HTA reports (Foglia et al., 2017; Radaelli et al., 2014; Anderson et al., 2017), and patient surveys (Bowers et al., 2018). Studies also reported different decision criteria including patient safety (Goetghebeur et al., 2012; Poder, 2017; Blythe et al., 2019; Howard et al., 2019; Foglia et al., 2017; Radaelli et al., 2014; Ritrovato et al., 2015; Angelis et al., 2020; Bowers et al., 2018; Martelli et al., 2016), clinical effectiveness (Goetghebeur et al., 2012; Poder, 2017; Howard et al., 2019; Foglia et al., 2017; Garau et al., 2018; Radaelli et al., 2014; Ritrovato et al., 2015; Angelis et al., 2020; Bowers et al., 2018; Anderson et al., 2017; Martelli et al., 2016), resources or costs (Goetghebeur et al., 2012; Howard et al., 2019; Foglia et al., 2017; Radaelli et al., 2014; Ritrovato et al., 2015; Bowers et al., 2018; Anderson et al., 2017; Martelli et al., 2016), economic evaluation (Goetghebeur et al., 2012; Howard et al., 2019; Foglia et al., 2017; Garau et al., 2018; Radaelli et al., 2014; Ritrovato et al., 2015; Anderson et al., 2017; Martelli et al., 2016), burden of disease (Goetghebeur et al., 2012; Howard et al., 2019; Foglia et al., 2017; Garau et al., 2018; Angelis et al., 2020; Anderson et al., 2017; Martelli et al., 2016), organisational impact (Blythe et al., 2019; Foglia et al., 2017; Ritrovato et al., 2015; Martelli et al., 2016), equity (Foglia et al., 2017; Radaelli et al., 2014; Angelis et al., 2020; Bowers et al., 2018; Anderson et al., 2017), quality of evidence (Goetghebeur et al., 2012; Foglia et al., 2017; Garau et al., 2018; Anderson et al., 2017; Martelli et al., 2016), legal, ethical or social issues (Howard et al., 2019; Foglia et al., 2017; Radaelli et al., 2014; Ritrovato et al., 2015; Anderson et al., 2017), patient-reported outcomes (Goetghebeur et al., 2012; Blythe et al., 2019; Martelli et al., 2016), research or innovation (Blythe et al., 2019; Angelis et al., 2020; Martelli et al., 2016), and prevention of future illness (Anderson et al., 2017). Five studies reported the adoption of MCDA for future use (Blythe et al., 2019; Howard et al., 2019; Radaelli et al., 2014; Ritrovato et al., 2015; Anderson et al., 2017). Three of them were reports of an already implemented tool (Howard et al., 2019; Radaelli et al., 2014; Ritrovato et al., 2015).

### 3.2.4. Health technology assessment

Two studies were conducted in Australia (Ju and Hewson, 2014; Vos et al., 2005), two in multiple countries (Knies et al., 2013; K rge et al., 2017), one in Denmark (Ehlers et al., 2006), and one in Canada (Tadrous et al., 2020). The case studies assessed interventions in different areas such as the production of radiopharmaceuticals and deep brain stimulation for cross-border hospitals (Knies et al., 2013), genetic counselling (K rge et al., 2017), mental health (Vos et al., 2005), or a range of different interventions (Tadrous et al., 2020; Ju and Hewson, 2014).

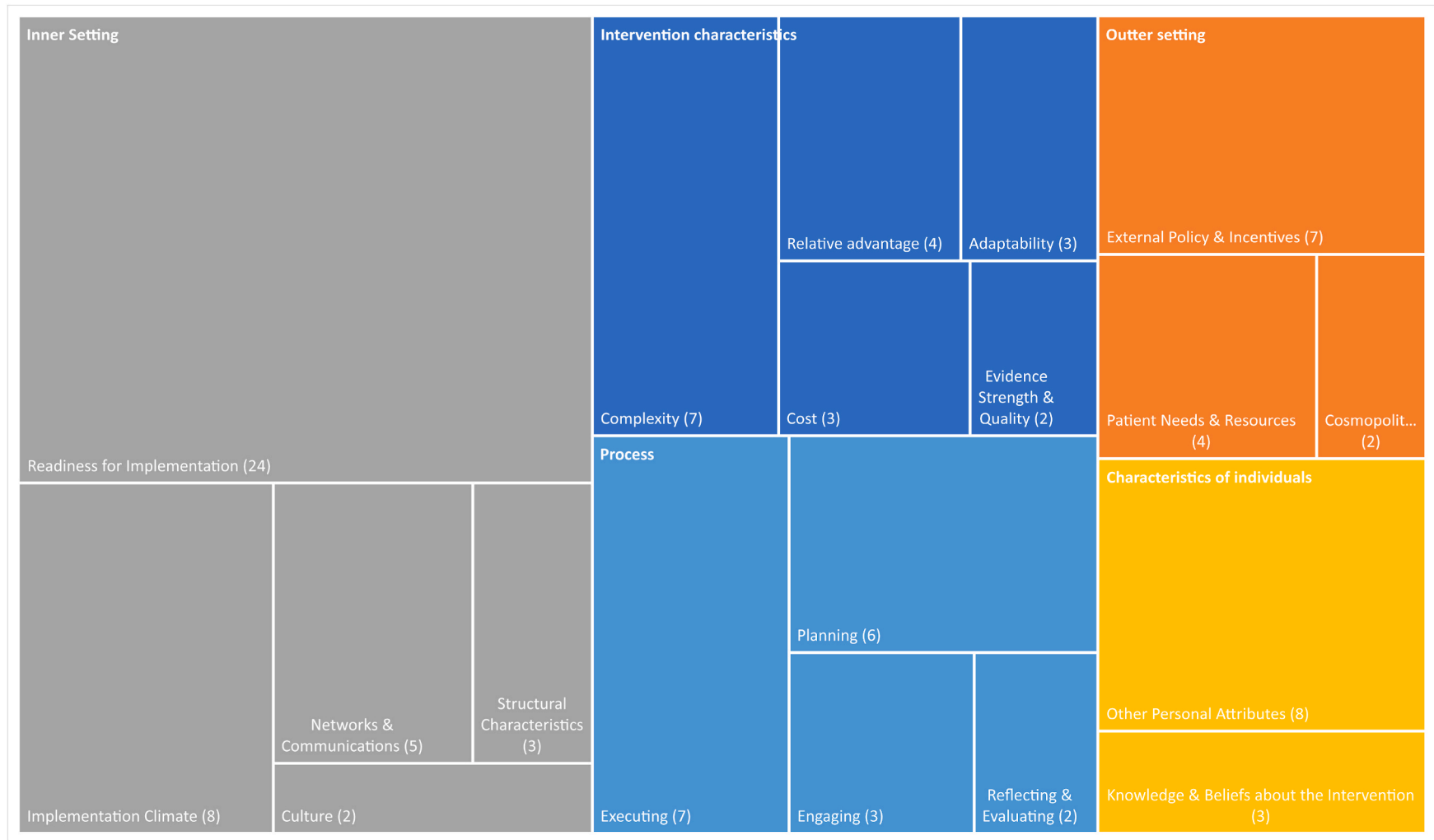
Decisions were made at the central government level (Vos et al., 2005; K rge et al., 2017) in two studies, one each at the local government level at the Ontario Ministry of Health and Long-Term Care in Canada (Tadrous et al., 2020) and the Queensland Department of Health in Australia (Ju and Hewson, 2014), and two at the hospital level (Knies et al., 2013; Ehlers et al., 2006). Clinicians were the predominantly reported stakeholders (Tadrous et al., 2020; Ju and Hewson, 2014; Vos et al., 2005; Knies et al., 2013), followed by policy-makers (Tadrous et al., 2020; Ju and Hewson, 2014; Vos et al., 2005), the community (Tadrous et al., 2020; Vos et al., 2005), manufacturers (Tadrous et al., 2020), managers (Knies et al., 2013), and technical advisors (Ju and Hewson, 2014). Several decision criteria were considered besides clinical and cost-effectiveness, such as societal and ethical considerations (Ju and Hewson, 2014; Knies et al., 2013; K rge et al., 2017), organisation (Ju and Hewson, 2014; Vos et al., 2005; Knies et al., 2013; K rge et al., 2014; Ehlers et al., 2006) and burden of disease (Ju and Hewson, 2014; K rge et al., 2017). Four studies reported adopting an HTA related tool for future use and were reports of already implemented applications (Tadrous et al., 2020; Ju and Hewson, 2014; K rge et al., 2017; Ehlers et al., 2006).

### 3.2.5. Others

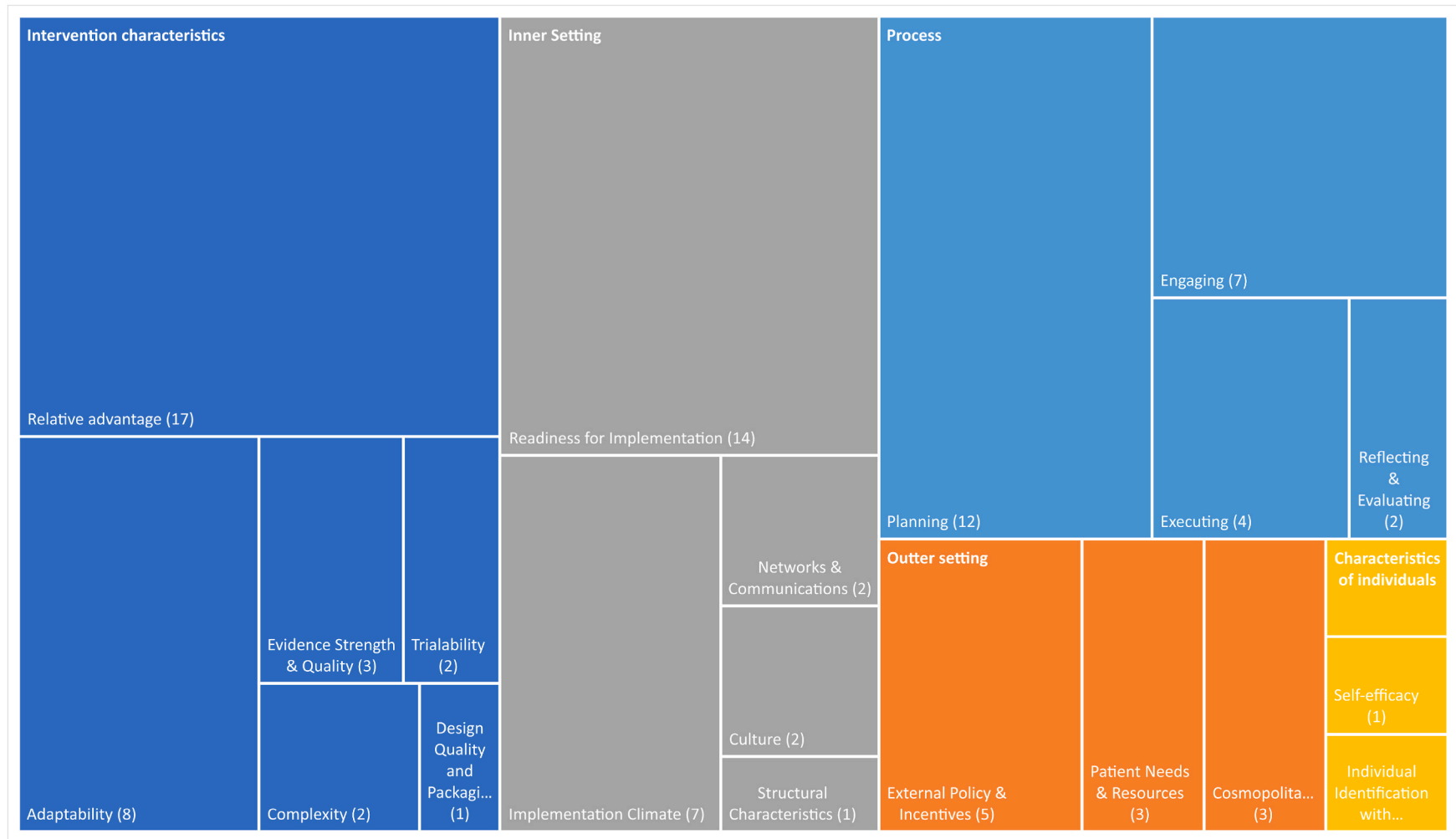
Two Swedish studies reported a bespoke decision tool at the V sterbotten County Council (Waldau et al., 2010; Waldau, 2015). It included stakeholders such as clinicians, administrators, management, and politicians. The process consisted of a within department identification of low priority activities, followed by an interdepartmental identification of low priority activities and final decision making. Decision criteria considered health condition, severity level, patient benefit, clinical effectiveness, cost per life-year/quality-adjusted life-year gained, and health economic evidence. After the second iteration, a national process moved forward to assess priority setting impacting the continuity of this tool (Waldau, 2015).

### 3.3. Barriers and facilitators

Barriers and facilitators were found across all domains and most constructs (Figs. 3 and 4). In the 'Intervention Characteristics' domain (Table 2) 14 studies reported barriers (Mitton and Patten, 2004; Mitton et al., 2002a, 2002b, 2003a, 2004, 2005, 2006; Mitton and Donaldson, 2003a, 2003b; Patten et al., 2006; Smith et al., 2015, 2016b; Gibson et al., 2011; Poder, 2017; Tadrous et al., 2020; Haas et al., 2001; Garau et al., 2018; Radaelli et al., 2014; Knies et al., 2013; K rge et al., 2017; Waldau et al., 2010; Waldau, 2015) and 20 reported facilitators (Mitton and Patten, 2004; Mitton et al., 2002a, 2002b, 2003a, 2004, 2005, 2006; Mitton and Donaldson, 2003a, 2003b; Patten et al., 2006; Smith et al., 2015, 2016b; Gibson et al., 2011; Goetghebeur et al., 2012; Blythe et al., 2019; Howard et al., 2019; Ju and Hewson, 2014; Foglia et al., 2017; Garau et al., 2018; Radaelli et al., 2014; Knies et al., 2013; K rge et al., 2017; Goodwin and Frew, 2013; Bowers et al., 2018; Anderson et al., 2017; Waldau et al., 2010; Martelli et al., 2016; Ehlers et al., 2006). No facilitator was reported for the 'Costs' construct, no barriers were reported in the 'Triability' and 'Design Quality and Packaging' constructs, and no barrier or facilitator was reported in the 'Intervention Source' construct. For the 'Outer Setting' domain (Table 3), 11 studies reported barriers (Mitton and Patten, 2004; Mitton et al., 2002a, 2002b, 2003a, 2004, 2005; Mitton and Donaldson, 2003a, 2003b; Patten et al., 2006; Smith et al., 2015, 2016b; Gibson et al., 2011; Tadrous et al., 2020; Astley and Wake-Dyster, 2001; Blythe et al., 2019; Vos et al., 2005; K rge et al., 2017; Goodwin and Frew, 2013; Anderson et al., 2017) and ten studies facilitators (Mitton and Patten, 2004; Mitton et al., 2002a, 2003a, 2004, 2005; Mitton and Donaldson, 2003a; Patten et al., 2006; Astley and Wake-Dyster, 2001; Garau et al., 2018; Angelis et al., 2020; Knies et al., 2013; K rge et al., 2017; Waldau et al., 2010; Waldau, 2015; Martelli et al., 2016; Ehlers et al., 2006) but none were reported for the 'peer pressure' construct. The 'Inner Setting' domain (Table 4)



**Fig. 3.** Barriers classified using the Consolidated Framework for Implementation Research.



**Fig. 4.** Facilitators classified using the Consolidated Framework for Implementation Research.



**Table 2**  
CFIR Domain 1: Intervention characteristics.

Construct	Description	Barriers	Facilitators
A Intervention Source	Perception of key stakeholders about whether the intervention is externally or internally developed.	NR	NR
B Evidence Strength & Quality	Stakeholders' perceptions of the quality and validity of evidence supporting the belief that the intervention will have desired outcomes.	Requirement of tangible proofs that the priority setting tool works (Smith et al., 2015, 2016b).	The priority setting tool is designed and adapted by a health economist using a comprehensive literature review (Goodwin and Frew, 2013). The priority setting tool has been used in the past (Smith et al., 2015, 2016b). There is an enhanced credibility, public defensibility, and a clear systematic approach within the priority setting process (Mitton et al., 2002b; Mitton and Donaldson, 2003b; Gibson et al., 2011).
C Relative advantage	Stakeholders' perception of the advantage of implementing the intervention versus an alternative solution.	Requires gender, ethnicity, and disability to be included in the priority setting process (Waldau et al., 2010). Interventions with little evidence are disadvantaged within the priority setting process (Waldau, 2015). The priority setting process does not assess cost per case (Mitton et al., 2006). There is no mechanism within the priority setting process to integrate new information on existing intervention proposals (Mitton et al., 2006). A detailed evaluation is required to track priority setting decision outcomes, and to assess fairness and utility of the priority setting process (Mitton and Patten, 2004; Mitton et al., 2002a, 2003a, 2004, 2005, 2006; Mitton and Donaldson, 2003a; Patten et al., 2006). There is perceived inequity between alternative resource allocation options within the priority setting process (Mitton and Patten, 2004; Mitton et al., 2002a, 2003a, 2004, 2005; Mitton and Donaldson, 2003a; Patten et al., 2006).	The priority setting process is structured and evidence-based, taking into consideration political, historical, and cultural contexts (Foglia et al., 2017; Garau et al., 2018; Radaelli et al., 2014; Goodwin and Frew, 2013). Participatory action research employed in the priority setting process (Mitton and Patten, 2004; Mitton et al., 2002a, 2003a, 2004, 2005; Mitton and Donaldson, 2003a; Patten et al., 2006). The priority setting process makes resource allocation decisions objective (Blythe et al., 2019; Anderson et al., 2017; Martelli et al., 2016). The priority setting process employs substantial quantitative data to help decision making (Bowers et al., 2018; Ehlers et al., 2006). The priority setting process uses multiple decision criteria (Mitton and Patten, 2004; Mitton et al., 2002a, 2003a, 2004, 2005; Mitton and Donaldson, 2003a; Patten et al., 2006; Goetghebeur et al., 2012; Howard et al., 2019) and considers patient priorities (Goetghebeur et al., 2012). The priority setting process considers organisational aspects and economic feasibility of alternative resource allocation decisions (Ju and Hewson, 2014). The priority setting process considers effectiveness and efficiency of alternative resource allocation decisions and the capacity of the organisation to invest (Radaelli et al., 2014; Knies et al., 2013). The priority setting process includes social and ethical impact (Radaelli et al., 2014). The priority setting tool has a practical and standardized layout (Ehlers et al., 2006). The priority setting process allows for flexibility, openness and timing in decision making (Ehlers et al., 2006). The priority setting process is considered fair and diligent (Mitton et al., 2006), and is clearly defined (Mitton and Patten, 2004; Mitton et al., 2002a, 2003a, 2004, 2005; Mitton and Donaldson, 2003a; Patten et al., 2006). There is less emphasis within the priority setting process on having all the data. Instead, the process can rely on expert opinions (Mitton et al., 2002b; Mitton and Donaldson, 2003b). The priority setting tool can be adapted to local needs (Blythe et al., 2019; Foglia et al., 2017; Knies et al., 2013; Korge et al., 2017; Waldau et al., 2010; Martelli et al., 2016). The priority setting tool was developed using an iterative design process (Bowers et al., 2018). The priority setting tool is first used within an 'easy-win' environment to garner support (Mitton et al., 2002b; Mitton and Donaldson, 2003b). The priority setting tool is piloted before considering implementation (Mitton and Patten, 2004; Mitton et al., 2002a, 2003a, 2004, 2005; Mitton and Donaldson, 2003a; Patten et al., 2006). The priority setting tool is easy to understand (Smith et al., 2015, 2016b). Use of the same criteria across decision processes allows a learning process to occur, thereby reducing the time required to use the priority setting tool (Martelli et al., 2016).
D Adaptability	The degree to which an intervention can be adapted, tailored, refined, or reinvented to meet local needs.	Evidence used within the priority setting process is not generalisable (Knies et al., 2013; Korge et al., 2017). The priority setting process does not appropriately refine criteria and weighting (Mitton and Patten, 2004; Mitton et al., 2002a, 2003a, 2004, 2005; Mitton and Donaldson, 2003a; Patten et al., 2006). The priority setting tool is used only for operational or clinical services decisions (Mitton and Patten, 2004; Mitton et al., 2002a, 2003a, 2004, 2005; Mitton and Donaldson, 2003a; Patten et al., 2006).	
E Trialability	The ability to test the intervention on a small scale in the organisation [8], and to be able to reverse course (undo implementation) if warranted.	NR	
F Complexity	Perceived difficulty of implementation, reflected by duration, scope, radicalness, disruptiveness, centrality, and intricacy and number of steps required to implement	It is difficult to compare outputs and outcomes between interventions within the priority setting process (Mitton and Patten, 2004; Mitton et al., 2002a, 2003a, 2004, 2005; Mitton and Donaldson, 2003a; Patten et al., 2006; Haas et al., 2001). There is a lack of guidance on how to use the priority setting tool (Garau et al., 2018).	

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Table 2 (continued)

Construct	Description	Barriers	Facilitators
G Design Quality and Packaging	Perceived excellence in how the intervention is bundled, presented, and assembled	Complexity might drive bureaucratic and political hurdles and limit flexibility, adaptability and timeliness (Radaelli et al., 2014). The assessment of a complex combination of resource allocation decisions (Tadrous et al., 2020). Comparing investment options across clinical departments, administrative and logistics and housing offices (Waldau, 2015). Business cases used in priority setting process take too much time to develop (Mitton et al., 2006). A scale for scoring benefits within the priority setting process is small (Mitton et al., 2006). Difficulty in identifying options for potentially releasing resources (Mitton and Patten, 2004; Mitton et al., 2002a, 2003a, 2004, 2005; Mitton and Donaldson, 2003a; Patten et al., 2006). NR	
H Cost	Costs of the intervention and costs associated with implementing that intervention including investment, supply, and opportunity costs.	Up-front resources are required to get the priority setting tool up and running (Mitton and Donaldson, 2003b; Gibson et al., 2011). The priority setting process creates additional cost to the organisation due to the need to undertake additional assessments (Poder, 2017). NR	The priority setting tool delivers standardized and comprehensive reports (Körge et al., 2017). NR

NR: not reported.

had 25 studies reporting barriers (Mitton and Patten, 2004; Mitton et al., 2002a, 2002b, 2003a, 2003b, 2004, 2005, 2006; Mitton and Donaldson, 2003a, 2003b; Patten et al., 2006; Smith et al., 2015, 2016b; Dionne et al., 2009; Gibson et al., 2011; Goetghebeur et al., 2012; Poder, 2017; Tadrous et al., 2020; Astley and Wake-Dyster, 2001; Haas et al., 2001; Howard et al., 2019; Vos et al., 2005; Foglia et al., 2017; Garau et al., 2018; Angelis et al., 2020; Körge et al., 2017; Goodwin and Frew, 2013; Bowers et al., 2018; Anderson et al., 2017; Waldau et al., 2010; Waldau, 2015; Martelli et al., 2016; Ehlers et al., 2006) and 16 facilitators (Mitton and Patten, 2004; Mitton et al., 2002a, 2002b, 2003a, 2004, 2005; Mitton and Donaldson, 2003a, 2003b; Patten et al., 2006; Smith et al., 2015, 2016b; Dionne et al., 2009; Gibson et al., 2011; Poder, 2017; Haas et al., 2001; Blythe et al., 2019; Ju and Hewson, 2014; Vos et al., 2005; Foglia et al., 2017; Knies et al., 2013; Goodwin and Frew, 2013; Waldau et al., 2010; Waldau, 2015; Ehlers et al., 2006). No barriers were reported in the 'Learning Climate' construct, and no facilitators were reported for the 'Relative Priority' and 'Goals and Feedback' constructs. The 'Characteristics of Individuals' domain (Table 5) had ten studies reporting barriers (Mitton et al., 2002b; Mitton and Donaldson, 2003b; Smith et al., 2015, 2016b; Astley and Wake-Dyster, 2001; Blythe et al., 2019; Garau et al., 2018; Radaelli et al., 2014; Angelis et al., 2020; Goodwin and Frew, 2013; Bowers et al., 2018; Waldau, 2015) and two facilitators (Mitton and Patten, 2004; Mitton et al., 2002a, 2003a, 2004, 2005; Mitton and Donaldson, 2003a; Patten et al., 2006; Waldau, 2015). No facilitators were reported for 'Individual Stage of Change' and 'Other Personal Attributes', no barriers were reported for 'Self-efficacy' and 'Individual Identification with Organisation', and neither was reported for 'Individual Stage of Change'. The 'Process' domain (Table 6) had 12 studies that reported barriers (Mitton and Patten, 2004; Mitton et al., 2002a, 2002b, 2003a, 2003b, 2004, 2005, 2006; Mitton and Donaldson, 2003a, 2003b; Patten et al., 2006; Smith et al., 2015, 2016b; Dionne et al., 2009; Gibson et al., 2011; Haas et al., 2001; Goodwin and Frew, 2013; Anderson et al., 2017; Waldau et al., 2010; Waldau, 2015) and 15 studies reported facilitators (Mitton and Patten, 2004; Mitton et al., 2002a, 2002b, 2003a, 2004, 2005, 2006; Mitton and Donaldson, 2003a, 2003b; Patten et al., 2006; Smith et al., 2015, 2016b; Gibson et al., 2011; Tadrous et al., 2020; Astley and Wake-Dyster, 2001; Haas et al., 2001; Blythe et al., 2019; Ju and Hewson, 2014; Angelis et al., 2020; Anderson et al., 2017; Waldau et al., 2010; Waldau, 2015; Ehlers et al., 2006). No barriers were reported at the 'Formally Appointed Internal Implementation Leaders', 'Champions', and 'External Change Agents' constructs.

### 3.4. Fidelity

Criteria were assessed for PBMA (Appendix Table 6), MCDA (Appendix Table 7) or HTA (Appendix Table 8) frameworks. The Swedish experiences classified in 'Others' were not evaluated as they did not fit any of the tools mentioned above (Waldau et al., 2010; Waldau, 2015). For PBMA, all but two studies fulfilled all the criteria scoring 86% (Mitton et al., 2002b, 2003b; Mitton and Donaldson, 2003b). These scores were mainly driven by not reporting if resource reallocation occurred. For MCDA, two studies were deemed satisfactory across all criteria (Angelis et al., 2020; Bowers et al., 2018), whereas one study achieved 36% (Foglia et al., 2017). Treatment of uncertainty was the lowest reported criteria with 25%. For HTA related studies, two studies reached 80% (Tadrous et al., 2020; Ju and Hewson, 2014), and the lowest-scoring study got 27% of satisfactory criteria (Knies et al., 2013). No study reported using the societal perspective, and 25% of studies reported including all relevant technologies, explicitly characterising uncertainty, and monitoring findings. Two HTA related studies were not evaluated due to insufficient information (Körge et al., 2017; Ehlers et al., 2006).

**Table 3**  
CFIR Domain 2: Outer setting.

Construct	Description	Barriers	Facilitators
A Patient Needs & Resources	The extent to which patient needs, as well as barriers and facilitators to meet those needs are accurately known and prioritised by the organisation.	Limited public engagement and participation in the priority setting process (Mitton and Patten, 2004; Mitton et al., 2002a, 2003a, 2004, 2005; Mitton and Donaldson, 2003a; Patten et al., 2006; Smith et al., 2015, 2016b; Blythe et al., 2019; Vos et al., 2005). Lack of public education on scarcity and trade-offs presents difficulties to the priority setting process (Mitton and Patten, 2004; Mitton et al., 2002a, 2003a, 2004, 2005; Mitton and Donaldson, 2003a; Patten et al., 2006).	Consumer and community involvement in the priority setting process (Astley and Wake-Dyster, 2001; Garau et al., 2018; Angelis et al., 2020).
B Cosmopolitanism	The degree to which an organisation is networked with other external organisations.	Integrating all levels of care is complex in the priority setting process (Goodwin and Frew, 2013). Limited consultation with parties outside of hospital executives in the priority setting process (Blythe et al., 2019).	For cross-border hospitals, considering differences such as different methods and levels of reimbursement of particular medical treatments, different laws, and legislation, and even differences in the expectations and preferences of patients between different countries (Knies et al., 2013). Developing collaboration with other organisations involved in priority setting (Körge et al., 2017). The priority setting process considers health information of other organisations (Mitton et al., 2002b; Mitton and Donaldson, 2003b). NR
C Peer Pressure	Mimetic or competitive pressure to implement an intervention; typically because most or other key peer or competing organisations have already implemented or in a bid for a competitive edge.	NR	NR
D External Policy & Incentives	A broad construct that includes external strategies to spread interventions including policy and regulations (governmental or other central entity), external mandates, recommendations and guidelines, pay-for-performance, collaboratives, and public or benchmark reporting.	The priority setting process lacks benchmarking data from other hospitals (Astley and Wake-Dyster, 2001). The priority setting process has externally imposed time constraints and changes in direction mid-process (Gibson et al., 2011). The priority setting process presents differences in incentives to resource constraints between local authorities and healthcare providers (Mitton et al., 2002b; Mitton and Donaldson, 2003b). The priority setting process is subject to political pressure (Blythe et al., 2019; Anderson et al., 2017). Variability of priority setting processes guidelines impact confidence on the priority setting process (Körge et al., 2017). The priority setting process produces non-transferable solutions between settings (Tadrous et al., 2020).	Autonomy of decision making organisations (Körge et al., 2017; Martelli et al., 2016). Political commitment to protect the priority setting process (Waldau et al., 2010; Waldau, 2015). Decision makers wishes to obtain high-quality assessment from the priority setting process (Ehlers et al., 2006).

NR: not reported.

**Table 4**  
CFIR Domain 3: Inner setting.

Construct	Description	Barriers	Facilitators
A Structural Characteristics	The social architecture, age, maturity, and size of an organisation.	<p>The priority setting process produced inefficient allocation of resources across departments (Mitton et al., 2002b; Mitton and Donaldson, 2003b).</p> <p>The priority setting process is challenged by discontinuity of personnel (Mitton et al., 2002b; Mitton and Donaldson, 2003b).</p> <p>The priority setting process does not translate into changes in resource allocation decisions (Mitton et al., 2002b; Mitton and Donaldson, 2003b).</p> <p>Non-integrated department budgets prevent the priority setting process of effective resource allocation (Mitton et al., 2002b; Mitton and Donaldson, 2003b).</p> <p>Upper authorities could use a 'veto' of certain disinvestment resource allocation decisions dismissing the recommendations of the priority setting process (Smith et al., 2015, 2016b).</p> <p>The priority setting process is limited to reallocating resources only within a program's scope, i.e., not touching other programs. (Mitton et al., 2003b).</p>	The priority setting process includes all organisational levels (Goodwin and Frew, 2013).
B Networks & Communications	The nature and quality of webs of social networks and the nature and quality of formal and informal communications within an organisation.	<p>Absence or lack of clarity communicating resource allocation decisions from the priority setting process (Smith et al., 2015, 2016b; Dionne et al., 2009).</p> <p>Insufficient internal communication strategy to promote the priority setting process (Gibson et al., 2011; Waldau, 2015).</p> <p>Distrust among stakeholders participating in the priority setting process (Mitton et al., 2002b; Mitton and Donaldson, 2003b).</p>	<p>The priority setting process allows the staff to think about linking resources to outcomes, and to discuss the issues with their counterparts in other sectors (Haas et al., 2001).</p> <p>Early integration of a communications strategy for the priority setting process (Waldau et al., 2010).</p>
C Culture	Norms, values, and basic assumptions of a given organisation.	<p>Priorities of clinical and corporate priorities might be different making the priority setting process difficult (Mitton and Patten, 2004; Mitton et al., 2002a, 2003a, 2004, 2005; Mitton and Donaldson, 2003a; Patten et al., 2006; Dionne et al., 2009).</p> <p>Challenges related to incorporating organisation's values to the priority setting process and translating it into actions (Mitton and Patten, 2004; Mitton et al., 2002a, 2003a, 2004, 2005; Mitton and Donaldson, 2003a; Patten et al., 2006).</p> <p>Stakeholders that participate in the priority setting process struggle with innovative thinking (Mitton and Patten, 2004; Mitton et al., 2002a, 2003a, 2004, 2005; Mitton and Donaldson, 2003a; Patten et al., 2006).</p>	<p>A learning culture and being open to resource allocation decisions by the priority setting process (Mitton et al., 2002b; Mitton and Donaldson, 2003b).</p> <p>Developing the culture of improvement (Smith et al., 2015, 2016b).</p>
D Implementation Climate	The absorptive capacity for change, shared receptivity of involved individuals to an intervention and the extent to which use of that intervention will be rewarded, supported, and expected within their organisation.	NA	NA
1 Tension for Change	The degree to which stakeholders perceive the current situation as intolerable or needing change.	Abundance of demands from stakeholders participating in the priority setting process (Mitton et al., 2002b; Mitton and Donaldson, 2003b).	<p>The priority setting process has stakeholders faced with actual decisions to be made (Mitton et al., 2002b; Mitton and Donaldson, 2003b; Foglia et al., 2017).</p> <p>The priority setting process was used to address a fiscal deficit (Mitton and Patten, 2004; Mitton et al., 2002a, 2003a, 2004, 2005; Mitton and Donaldson, 2003a; Patten et al., 2006).</p> <p>There was a desire in the organisation to implement a priority setting process (Waldau et al., 2010).</p>
2 Compatibility	The degree of tangible fit between meaning and values attached to the intervention by involved individuals, how those align with individuals' own norms, values, and perceived risks and needs, and how the intervention fits with existing workflows and systems.	<p>The priority setting process consumes time of other budget activities (Dionne et al., 2009).</p> <p>Priority setting tools to be implemented alongside other ongoing priority setting process (Martelli et al., 2016).</p>	<p>The priority setting process considers a strategic alignment of criteria (Gibson et al., 2011).</p> <p>The priority setting process consults with various clinical and care staff (Poder, 2017).</p>
3 Relative Priority	Individuals' shared perception of the importance of the implementation within the organisation.	Stakeholders participating in the priority setting process do not have genuine buy-in (Mitton et al., 2002b; Mitton and Donaldson, 2003b).	NR

(continued on next page)

Table 4 (continued)

Construct	Description	Barriers	Facilitators
4 Organizational Incentives & Rewards	Extrinsic incentives such as goal-sharing awards, performance reviews, promotions, and raises in salary and less tangible incentives such as increased stature or respect.	<p>Not all departments participate in the priority setting process (Waldau et al., 2010).</p> <p>Misalignment between payment systems difficult resource allocation (Mitton and Patten, 2004; Mitton et al., 2002a, 2003a, 2004, 2005; Mitton and Donaldson, 2003a; Patten et al., 2006).</p> <p>The priority setting process does not consider incentives to administrators (Mitton and Patten, 2004; Mitton et al., 2002a, 2003a, 2004, 2005; Mitton and Donaldson, 2003a; Patten et al., 2006).</p> <p>The priority setting process produced an improvement in efficiency but in a reduction of a program's budget making resource allocation decisions difficult to accept by the hospital staff (Mitton and Patten, 2004; Mitton et al., 2002a, 2003a, 2004, 2005; Mitton and Donaldson, 2003a; Patten et al., 2006).</p>	<p>The priority setting process incorporates incentives and rewards innovations and efficiencies (Mitton and Patten, 2004; Mitton et al., 2002a, 2003a, 2004, 2005; Mitton and Donaldson, 2003a; Patten et al., 2006).</p> <p>The priority setting process considers a percentage of the budget to keep running programs where disinvestment occurs (Mitton and Patten, 2004; Mitton et al., 2002a, 2003a, 2004, 2005; Mitton and Donaldson, 2003a; Patten et al., 2006).</p>
5 Goals and Feedback	The degree to which goals are clearly communicated, acted upon, and fed back to staff and alignment of that feedback with goals.	<p>The priority setting process lacks structured follow-up process of resource allocation decisions (Mitton et al., 2003b).</p> <p>The priority setting process considers a follow-up period too short to assess the resource allocation decisions (Smith et al., 2015, 2016b).</p> <p>The priority setting process has deficient goal orientation and leadership (Waldau, 2015).</p>	NR
6 Learning Climate	A climate in which: a) leaders express their own fallibility and need for team members' assistance and input; b) team members feel that they are essential, valued, and knowledgeable partners in the change process; c) individuals feel psychologically safe to try new methods; and d) there is sufficient time and space for reflective thinking and evaluation.	NR	The priority setting process considers that junior staff needs support by directors to propose resource allocation decisions without adverse consequences for them (Goodwin and Frew, 2013).
E Readiness for Implementation	Tangible and immediate indicators of organisational commitment to its decision to implement an intervention.	NA	NA
1 Leadership Engagement	Commitment, involvement, and accountability of leaders and managers with the implementation.	<p>The priority setting process can be circumvented by senior executives (Mitton and Patten, 2004; Mitton et al., 2002a, 2003a, 2004, 2005; Mitton and Donaldson, 2003a; Patten et al., 2006; Smith et al., 2015, 2016b; Dionne et al., 2009; Vos et al., 2005; Goodwin and Frew, 2013).</p> <p>Insufficient management support for the priority setting process (Mitton et al., 2002b; Mitton and Donaldson, 2003b; Korge et al., 2017).</p> <p>External influences prevent the priority setting process evaluating services provided (Mitton et al., 2002b; Mitton and Donaldson, 2003b).</p> <p>Insufficient political support to implement resource allocation decisions (Mitton et al., 2002b; Mitton and Donaldson, 2003b).</p> <p>Leadership change in the middle of the priority setting process (Waldau, 2015).</p>	<p>Sufficient management support for the priority setting process (Mitton et al., 2002b; Mitton and Donaldson, 2003b; Smith et al., 2015, 2016b; Haas et al., 2001).</p> <p>Resource allocation decisions consistent with managerial interests (Mitton and Patten, 2004; Mitton et al., 2002a, 2002b, 2003a, 2004, 2005; Mitton and Donaldson, 2003a, 2003b; Patten et al., 2006).</p> <p>Organisation is goal-oriented and has clear leadership (Waldau et al., 2010).</p> <p>Decision makers are involved in the priority setting process (Vos et al., 2005).</p>
2 Available Resources	The level of resources dedicated for implementation and on-going operations including money, training, education, physical space, and time.	<p>There are time constraints to conduct the priority setting process (Mitton and Patten, 2004; Mitton et al., 2002a, 2002b, 2003a, 2004, 2005; Mitton and Donaldson, 2003a, 2003b; Patten et al., 2006; Smith et al., 2015, 2016b; Goetghebeur et al., 2012; Tadrous et al., 2020; Astley and Wake-Dyster, 2001; Howard et al., 2019; Foglia et al., 2017; Garau et al., 2018; Waldau et al., 2010).</p> <p>Lack of resources for the priority setting process (Mitton and Patten, 2004; Mitton et al., 2002a, 2003a, 2004, 2005; Mitton and Donaldson, 2003a; Patten et al., 2006; Goetghebeur et al., 2012; Poder, 2017; Astley and Wake-Dyster, 2001; Howard et al., 2019; Garau et al., 2018; Waldau et al., 2010; Ehlers et al., 2006).</p> <p>Data availability, reliability or validity to use in the priority setting process is uncertain (Mitton and Patten, 2004; Mitton et al., 2002a,</p>	<p>Increasing the time allocated for the priority setting process for hospital departments (Waldau, 2015).</p> <p>The resource allocation decisions were based on a broad evidence base (Mitton et al., 2002b; Mitton and Donaldson, 2003b; Gibson et al., 2011; Haas et al., 2001; Blythe et al., 2019; Knies et al., 2013; Waldau, 2015).</p> <p>The priority setting process replaces other activities related to budget planning (Dionne et al., 2009).</p> <p>The priority setting process considers earmarking resources to implement resource allocation decisions (Mitton et al., 2002b; Mitton and Donaldson, 2003b).</p> <p>The priority setting process considers an investment/disinvestment list (Mitton and Patten, 2004; Mitton et al., 2002a, 2003a, 2004, 2005; Mitton and Donaldson, 2003a; Patten et al., 2006).</p>

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Table 4 (continued)

Construct	Description	Barriers	Facilitators
3 Access to knowledge and information	Ease of access to digestible information and knowledge about the intervention and how to incorporate it into work tasks.	<p>2003a, 2003b, 2004, 2005; Mitton and Donaldson, 2003a; Patten et al., 2006; Dionne et al., 2009; Gibson et al., 2011; Astley and Wake-Dyster, 2001; Haas et al., 2001; Vos et al., 2005; Angelis et al., 2020; Bowers et al., 2018; Anderson et al., 2017; Ehlers et al., 2006).</p> <p>Inputs local hospital metrics used in the priority setting process are heterogeneous across departments (Gibson et al., 2011).</p> <p>Insufficient resources (Mitton et al., 2002b; Mitton and Donaldson, 2003b) and infrastructure (Mitton and Patten, 2004; Mitton et al., 2002a, 2003a, 2004, 2005; Mitton and Donaldson, 2003a; Patten et al., 2006) to implement the resource allocation decisions.</p> <p>Staff using the priority setting tool have insufficient training for using it (Smith et al., 2015, 2016; Gibson et al., 2011; Garau et al., 2018; Waldau et al., 2010; Waldau, 2015).</p> <p>Lack of communication of the priority setting process principles (Mitton et al., 2006).</p>	<p>Having staff familiar with the priority setting process (Mitton and Patten, 2004; Mitton et al., 2002a, 2003a, 2004, 2005; Mitton and Donaldson, 2003a; Patten et al., 2006; Haas et al., 2001; Waldau, 2015; Ehlers et al., 2006).</p> <p>Implementing a priority setting process training (Mitton et al., 2002b; Mitton and Donaldson, 2003b; Ju and Hewson, 2014; Foglia et al., 2017).</p> <p>Having guidelines for using evidence in the priority setting process (Mitton and Patten, 2004; Mitton et al., 2002a, 2003a, 2004, 2005; Mitton and Donaldson, 2003a; Patten et al., 2006).</p>

NA: not applicable; NR: not reported.

#### 4. Discussion

Our review represents the first effort to identify the barriers and facilitators to implementing priority setting tools in hospital-related decisions of high-income countries and to assess the fidelity to the application of these priority setting tools. To do this, we applied the CFIR framework increasing our findings generalizability by using a widely applied implementation science tool. Thirty studies yielded many barriers and facilitators across domains and constructs of the CFIR framework. Challenges with implementing priority setting tools have been previously reported concluding that even though they are valuable and can improve processes, their implementation in standard practice is not straightforward (Kapiriri and Razavi, 2017). Our implementation science approach to assessing priority setting tools may help decision makers involved in hospital-related decisions prepare their implementation aiming for sustainability. Following this approach, sustainability has been defined with an implementation science focus as: *'after a defined period of time, the program, clinical intervention, and/or implementation strategies continue to be delivered and/or individual behaviour change (i.e., clinician, patient) is maintained; the program and individual behaviour change may evolve or adapt while continuing to produce benefits for individuals/systems'* (Moore et al., 2017).

##### 4.1. Barriers and facilitators

Other reviews have described barriers and facilitators to using priority setting tools, but none have explicitly set out to describe barriers or facilitators to implementation, focused on hospital-related decisions, nor have they used an implementation science framework. For example, one study reported that decision-makers agreed that PBMA was a useful evidence-based tool, although they noted difficulties understanding the tool and allocating the time required to make the decision (Kapiriri and Razavi, 2017). It was also recognised that MCDA improved transparency and provided a systematic, structured approach to decision making, but some stakeholders found the tool technically challenging, requiring training before application (Kapiriri and Razavi, 2017). Another study stated that the PBMA process was transparent and structured and noted the advantages of using set decision criteria and identifying programs' budgets to meet objectives (Polisena et al., 2013). However, freeing up resources from disinvesting interventions already implemented was seen as problematic (Polisena et al., 2013). Training was required to apply the tool, insufficient evidence sometimes hinders the process, and follow-up on the validity of resource allocation decisions would help establish PBMA credibility and uptake (Polisena et al., 2013). In addition, research suggests that broad stakeholder engagement, empowerment, decisions review, transparency, relevant decision criteria and good quality evidence are best practice priority setting procedures (Barasa et al., 2015).

Our study findings extend this knowledge. Many constructs across domains presented implementation factors that were not observed previously. In the 'Intervention Characteristics' domain, it was observed that having evidence of previous successful tool applications, a tool's adaptability, trialability, and costs modulated uptake. The 'Outer Setting' domain showed that patient needs & resources, organisations' networking, and external policy & incentives influenced implementation. The 'Inner Setting' domain showed relevant implementation factors regarding structural characteristics, internal communication, compatibility with the organisation, and feedback. In the 'Characteristics of Individuals' domain, knowledge and beliefs about the intervention and personal attributes proved to impact implementation. The 'Process' domain overwhelmingly revealed the critical nature of planning and executing, where most barriers and facilitators were observed.

Interestingly, some constructs did not report any barriers or facilitators. In the 'Intervention Characteristics' domain, no implementation factors were found in the 'Intervention Source' construct showing that whether the intervention was developed locally or externally did not

**Table 5**  
CFIR Domain 4: Characteristics of individuals.

Construct	Description	Barriers	Facilitators
A Knowledge & Beliefs about the Intervention	Individuals' attitudes toward and value placed on the intervention as well as familiarity with facts, truths, and principles related to the intervention.	Hospital staff has aversion for resource allocation decisions considering disinvestment following years of increasing budget (Goodwin and Frew, 2013). Stakeholders being reluctant, unaccustomed, or unaware of the priority setting process (Radaelli et al., 2014). The priority setting process presents difficulty in defining low priority services (Waldau, 2015).	Individuals knowing that information gathered in the priority setting process would be used for external comparison (Mitton and Patten, 2004; Mitton et al., 2002a, 2003a, 2004, 2005; Mitton and Donaldson, 2003a; Patten et al., 2006).
B Self-efficacy	Individual belief in their own capabilities to execute courses of action to achieve implementation goals.	NR	Stakeholder participating in the priority setting process have high personal self-confidence (Waldau, 2015).
C Individual Stage of Change	Characterisation of the phase an individual is in, as he or she progresses toward skilled, enthusiastic, and sustained use of the intervention.	NR	NR
D Individual Identification with Organization	A broad construct related to how individuals perceive the organisation and their relationship and degree of commitment with that organisation.	NR	The priority setting process recognises needs across departments (Mitton and Patten, 2004; Mitton et al., 2002a, 2003a, 2004, 2005; Mitton and Donaldson, 2003a; Patten et al., 2006).
E Other Personal Attributes	A broad construct to include other personal traits such as tolerance of ambiguity, intellectual ability, motivation, values, competence, capacity, and learning style.	The priority setting process allows for stakeholders' subjectivity in resource allocation decisions (Blythe et al., 2019; Garau et al., 2018; Angelis et al., 2020; Bowers et al., 2018). Stakeholders participating in the priority setting process struggle to understand the priority setting process (Smith et al., 2015, 2016b; Goodwin and Frew, 2013). Stakeholder participating in the priority setting process have inconsistent opinions (Astley and Wake-Dyster, 2001). Stakeholders participating in the priority setting process lack of capacity for developing business cases (Goodwin and Frew, 2013). The priority setting process does not consider innovative interventions (Goodwin and Frew, 2013). Stakeholders do not have experience in priority setting processes (Mitton et al., 2002b; Mitton and Donaldson, 2003b).	NR

NR: not reported.

**Table 6**  
CFIR domain 5: Process.

Construct	Description	Barriers	Facilitators
A Planning	The degree to which a scheme or method of behaviour and tasks for implementing an intervention are developed in advance and the quality of those schemes or methods.	<p>Service areas are underrepresented in the priority setting process (Mitton et al., 2003b, 2006; Waldau et al., 2010).</p> <p>Leadership of clinical departments participating in the priority setting process is not clear (Smith et al., 2015, 2016b; Waldau, 2015).</p> <p>Short timelines and uncertainty around the priority setting process (Goodwin and Frew, 2013).</p> <p>The priority setting process did not consider strategies to increase stakeholder involvement (Goodwin and Frew, 2013).</p> <p>The priority setting process is not aligned with other planning hospital activities (Goodwin and Frew, 2013).</p> <p>The priority setting process does not consider a mechanism to implement the resource allocation decisions (Haas et al., 2001).</p> <p>The priority setting process does not assess all interventions together (Waldau et al., 2010).</p> <p>Not allowing for enough time between priority setting processes (Waldau, 2015).</p> <p>The priority setting process needs to integrate financial personnel early in the process (Mitton et al., 2006).</p>	<p>The priority setting process considers an expert panel representing major stakeholders but small enough to reach consensus (Mitton and Patten, 2004; Mitton et al., 2002a, 2002b, 2003a, 2004, 2005; Mitton and Donaldson, 2003a, 2003b; Patten et al., 2006; Waldau, 2015).</p> <p>Ensuring stakeholders provide input on criteria used in the priority setting process (Gibson et al., 2011; Ehlers et al., 2006).</p> <p>Conducting the priority setting process for programs directly related to clinical staff at the beginning of the procedure (Haas et al., 2001).</p> <p>The priority setting process has advocates in management (Mitton and Patten, 2004; Mitton et al., 2002a, 2003a, 2004, 2005; Mitton and Donaldson, 2003a; Patten et al., 2006).</p> <p>Strategic planning is used in the priority setting process (Smith et al., 2015, 2016b).</p> <p>The priority setting process considers an impartial party for administering criteria scoring (Blythe et al., 2019).</p> <p>The priority setting process considers criteria weights agreed collaboratively ahead of time (Blythe et al., 2019).</p> <p>The priority setting process ensures user-friendly protocols available (Angelis et al., 2020).</p> <p>The priority setting process considers consultation with other local stakeholders not directly involved in the process (Ju and Hewson, 2014).</p> <p>The priority setting process considers staff for quality revision (Waldau, 2015).</p> <p>The priority setting process considers an increased resource reallocation goal compared to previous processes as the goal was not previously achieved (Waldau, 2015).</p> <p>The priority setting process considers interventions for different diseases and subpopulations separately (Anderson et al., 2017).</p> <p>The priority setting process uses one-page summaries with interventions' information (Mitton et al., 2006).</p> <p>NA</p>
B Engaging	Attracting and involving appropriate individuals in the implementation and use of the intervention through a combined strategy of social marketing, education, role modelling, training, and other similar activities.	NA	NA
1 Opinion Leaders	Individuals in an organisation who have formal or informal influence on the attitudes and beliefs of their colleagues with respect to implementing the intervention	<p>There is lack of staff engagement in the priority setting process (Mitton and Patten, 2004; Mitton et al., 2002a, 2003a, 2004, 2005; Mitton and Donaldson, 2003a; Patten et al., 2006; Waldau, 2015).</p> <p>The priority setting process presents difficulty retaining stakeholders and public (Anderson et al., 2017).</p>	<p>The priority setting process engaged clinicians in different fields (Mitton and Patten, 2004; Mitton et al., 2002a, 2003a, 2004, 2005; Mitton and Donaldson, 2003a; Patten et al., 2006; Tadrous et al., 2020).</p>
2 Formally appointed internal implementation leaders	Individuals from within the organisation who have been formally appointed with responsibility for implementing an intervention as coordinator, project manager, team leader, or other similar role.	NR	<p>The priority setting process lacks project managers or they have inadequate support (Gibson et al., 2011; Tadrous et al., 2020).</p>
3 Champions	"Individuals who dedicate themselves to supporting, marketing, and 'driving through' an [implementation]" [101] (p.182), overcoming indifference or resistance that the intervention may provoke in an organisation.	NR	<p>The priority setting process has an internal champion (Mitton and Patten, 2004; Mitton et al., 2002a, 2002b, 2003a, 2004, 2005; Mitton and Donaldson, 2003a, 2003b; Patten et al., 2006; Smith et al., 2015, 2016b).</p>
4 External Change Agents	Individuals who are affiliated with an outside entity who formally influence or facilitate intervention decisions in a desirable direction.	NR	<p>Expert academic group supports the priority setting process (Mitton and Patten, 2004; Mitton et al., 2002a, 2002b, 2003a, 2004, 2005; Mitton and Donaldson, 2003a, 2003b; Patten et al., 2006; Haas et al., 2001).</p>
C Executing	Carrying out or accomplishing the implementation according to plan.	<p>Stakeholders participating in the priority setting process submit unrealistic or low-quality proposals (Smith et al., 2015, 2016b; Waldau, 2015).</p> <p>Resource allocation proposals are inappropriately organised (Waldau, 2015).</p>	<p>The priority setting process disclose the evaluation criteria (Gibson et al., 2011).</p> <p>The priority setting process allows for iterative internal dialogue (Gibson et al., 2011).</p> <p>The priority setting process is resilient to variable health service</p>

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Table 6 (continued)

Construct	Description	Barriers	Facilitators
D Reflecting & Evaluating	Quantitative and qualitative feedback about the progress and quality of implementation accompanied with regular personal and team debriefing about progress and experience.	<p>The financial team does not support appropriately the priority setting process (Goodwin and Frew, 2013).</p> <p>Stakeholders participating in the priority setting process are reluctant to criticise or reject proposals to avoid demotivating staff (Goodwin and Frew, 2013).</p> <p>Unequal participation of stakeholders in the priority setting process (Haas et al., 2001).</p> <p>Stakeholders participating in the priority setting process are unable to prioritise across sub-programmes (Haas et al., 2001).</p> <p>The priority setting process does not clarify how resource allocation decisions will be implemented (Mitton et al., 2002b; Mitton and Donaldson, 2003b).</p> <p>The priority setting process produces unclear resource allocation decisions (Anderson et al., 2017).</p> <p>Decision criteria used in the priority setting process is not comprehensive enough or is subject to individual interpretation (Mitton et al., 2006).</p> <p>The priority setting process does not filter adequately intervention proposals (Mitton et al., 2006).</p> <p>The priority setting process does not have a formal feedback mechanism (Dionne et al., 2009; Gibson et al., 2011).</p>	<p>provider capacity (Gibson et al., 2011).</p> <p>The priority setting process approaches resource allocation decisions considering the impact in the whole hospital (Smith et al., 2015, 2016b).</p> <p>The priority setting process maintains consistent weights across resource allocation decisions (Blythe et al., 2019).</p> <p>Reports produced by the priority setting process are timely and appropriately written (Ehlers et al., 2006).</p>
			<p>The priority setting process has a formal feedback mechanism (Astley and Wake-Dyster, 2001; Waldau et al., 2010).</p>

NA: not applicable; NR: not reported.

shift stakeholders' opinion of a tool. No barriers were reported in the 'Triability' construct, which might be explained by the fact that many of the studies were applied at hospital-related decisions, i.e., it is an already small organisation compared to organisations that administer many hospitals and other healthcare centres. A similar situation was observed in the 'Design Quality and Packaging' construct, where no barriers were found. On the other hand, no facilitators were observed at the 'Costs' construct. This can probably be explained by the usual lack of consideration for resources attached to the tool's implementation even if there is a political will to implement it. This is also supported by the fact that many barriers were observed in the available resources in the 'Inner Setting' domain, which can result from not anticipating costs beforehand. No implementation factors were found at the 'Peer Pressure' construct in the 'Outer Setting' domain. This can be interpreted to mean that these tools are not widely used, and organisations such as hospitals do not feel the need to compete in this area. It would be expected that as the implementation of priority setting tools becomes more widespread, this construct would become more relevant. For the 'Inner Setting' domain, no facilitators were reported in the 'Relative Priority' construct, which is in line with the lack of utilisation of these tools. A similar trend was observed in the 'Goals and Feedback' construct stressing there is room for improvement in communicating them and reassessing the process against set goals. The 'Characteristics of Individuals' domain has no implementation factors at the 'Individual Stage of Change', no barriers at the 'Self-efficacy' and 'Individual Identification with organization', and no facilitators at the 'Other Personal Attributes' constructs were reported. Case studies included in this review focused on the process rather than individuals experiencing the process probably explaining this. No barriers were reported in the 'Process' domain under the 'Formally Appointed Internal Implementation Leaders', 'Champions', and 'External Change Agents' constructs.

Next, we summarise and discuss the implications of the most frequently observed barriers and facilitators for implementing a priority setting framework for hospital-related decisions. The case studies did not assess the comparative importance between the barriers and facilitators. Therefore, the following order is not intended to represent importance.

#### 4.1.1. Planning

Planning is a critical aspect of the successful implementation of a tool. This area can be relevant to any part of the implementation process and needs to be carefully considered. Failure to plan accordingly can result in underrepresentation of service areas (Mitton et al., 2003b; Waldau et al., 2010), not defining leadership roles clearly (Smith et al., 2015, 2016b; Waldau, 2015), short timelines (Goodwin and Frew, 2013), and lack of a mechanism to implement the chosen interventions (Haas et al., 2001), among others. Conversely, effectively planning facilitates the implementation process as the tool can be used as intended. Some strategies previously used in conducting the priority setting exercise were selecting a representative panel but one small enough to reach consensus (Mitton and Patten, 2004; Mitton et al., 2002a, 2002b, 2003a, 2004, 2005; Mitton and Donaldson, 2003a, 2003b; Patten et al., 2006; Waldau, 2015), ensuring participating stakeholders provide inputs to the process (Gibson et al., 2011), using impartial parties to administer scoring exercises or agreeing on criteria weights beforehand (Blythe et al., 2019).

#### 4.1.2. Executing

Even if the implementation of a decision tool is planned by considering possible scenarios that might act as barriers and promoting others that can enhance uptake, the tool's implementation execution may underperform. Barriers such as unrealistic proposals to undermine the process (Smith et al., 2015, 2016b; Waldau, 2015), unwillingness to criticise to avoid hospital staff demotivation (Goodwin and Frew, 2013), and the inability of the group to prioritise across hospital programmes (Haas et al., 2001) warrant the need to keep stakeholders engaged with

the process to ensure successful execution.

#### 4.1.3. Adaptability

A priority setting tool that can be adapted to the local hospital context was a significant facilitator across several studies (Blythe et al., 2019; Foglia et al., 2017; Knies et al., 2013; Korge et al., 2017; Martelli et al., 2016). Each priority setting approach should be tailored to the local hospital context as countries, settings, and hospital decision structures vary significantly. A transferability assessment could be planned if a tool is used for the first time in a specific setting, similar to what has been done for economic evaluations in healthcare (Drummond et al., 2009).

#### 4.1.4. Training

Stakeholders participating in a priority setting process must be appropriately trained, as a lack of training can be a significant barrier to implementation (Smith et al., 2015, 2016b; Gibson et al., 2011; Garau et al., 2018; Waldau et al., 2010; Waldau, 2015). The uptake of priority setting tools has been facilitated by providing courses to those participating in the priority setting approach (Mitton and Patten, 2004; Mitton et al., 2002a, 2003a, 2004, 2005; Mitton and Donaldson, 2003a; Patten et al., 2006; Haas et al., 2001; Waldau, 2015), providing physical guidelines (Mitton and Patten, 2004; Mitton et al., 2002a, 2003a, 2004, 2005; Mitton and Donaldson, 2003a; Patten et al., 2006), and using staff that has already used a priority setting tool or has participated in a similar process (Mitton and Patten, 2004; Mitton et al., 2002a, 2003a, 2004, 2005; Mitton and Donaldson, 2003a; Patten et al., 2006; Haas et al., 2001; Waldau, 2015).

#### 4.1.5. Leadership

A priority setting approach must be supported from the top down. Hospital management support (Mitton and Patten, 2004; Mitton et al., 2002a, 2003a, 2004, 2005; Mitton and Donaldson, 2003a; Patten et al., 2006; Goetghebeur et al., 2012; Poder, 2017; Astley and Wake-Dyster, 2001; Howard et al., 2019; Garau et al., 2018; Waldau et al., 2010) or lack thereof (Mitton et al., 2002b; Mitton and Donaldson, 2003b; Smith et al., 2015, 2016b; Haas et al., 2001) has shown to moderate a tool's uptake. Leadership support can also be affected by the way a tool is implemented. For example, decision-makers arbitrarily circumventing the tool's recommendation may hinder the implementation process (Smith et al., 2015, 2016b; Dionne et al., 2009; Vos et al., 2005; Goodwin and Frew, 2013).

#### 4.1.6. Available resources

Having appropriate resources to implement a tool was a fundamental construct showing that attention needs to be given to ensuring necessary resources are available for appropriate implementation, such as enough skilled staff and reliable access to quality data. Reports of time constraints (Mitton et al., 2002b; Mitton and Donaldson, 2003b; Smith et al., 2016b; Goetghebeur et al., 2012; Tadrous et al., 2020; Astley and Wake-Dyster, 2001; Howard et al., 2019; Foglia et al., 2017; Garau et al., 2018; Waldau et al., 2010) and lack of skilled professionals to apply the tool (Mitton and Patten, 2004; Mitton et al., 2002a, 2003a, 2004, 2005; Mitton and Donaldson, 2003a; Patten et al., 2006; Goetghebeur et al., 2012; Poder, 2017; Astley and Wake-Dyster, 2001; Howard et al., 2019; Garau et al., 2018; Waldau et al., 2010) stress the importance of having the necessary resources to complete the process within the pre-determined deadlines (Waldau, 2015). Also, activities carried out to apply a decision tool often replace other activities related to budget planning, giving participants more time to work on this (Dionne et al., 2009). Data availability, reliability and validity also moderated implementation success, acting as a facilitator (Mitton et al., 2002b; Mitton and Donaldson, 2003b; Gibson et al., 2011; Haas et al., 2001; Blythe et al., 2019; Knies et al., 2013; Waldau, 2015) or a barrier (Dionne et al., 2009; Gibson et al., 2011; Mitton et al., 2003b; Astley and Wake-Dyster, 2001; Haas et al., 2001; Vos et al., 2005; Angelis et al., 2020; Bowers

et al., 2018). This underlines that despite being in the evidence-based medicine era, there is still lack of data for many policymaking questions, which can include specific subgroups, innovative technologies, or new uses of current interventions, among others. It also calls attention to the reliability and validity of current data emphasising the importance of assessing aspects other than the results, such as the risk of bias or transferability to different settings.

#### 4.1.7. Complexity

Complexity within the decision making process can act as a barrier to implementation. This was observed in different ways, such as that complexity can result in bureaucratic and political issues (Radaelli et al., 2014), combining different policies to carry out the process (Tadrous et al., 2020), or complex criteria requiring cut-off values (Garau et al., 2018). Reducing complexity can be addressed by using a tool that is easy to understand or building on complex tasks that can be used in future processes, such as developing decision criteria or weights (Smith et al., 2015, 2016b; Martelli et al., 2016).

Champions; opinion leaders; change agents; implementation leaders.

Individuals within a hospital supporting a decision framework's implementation facilitated its uptake. Engaging with experts (Tadrous et al., 2020), project managers (Gibson et al., 2011), or an internal champion (an individual that advocates to support, market and drive through the implementation of an intervention (Damschroder et al., 2009)) were deemed as facilitators. Additionally, having external or internal researchers supporting the process also improved uptake (Mitton and Patten, 2004; Mitton et al., 2002a, 2002b, 2003a, 2004, 2005; Mitton and Donaldson, 2003a, 2003b; Patten et al., 2006; Haas et al., 2001).

#### 4.1.8. Personal attributes

An integral part of priority setting tools is having multiple stakeholders participate in increasing its credibility. However, there is a potential negative impact from increased subjectivity when reaching consensus (Blythe et al., 2019; Garau et al., 2018; Angelis et al., 2020; Bowers et al., 2018), and some individuals can struggle to understand priority setting concepts (Smith et al., 2015, 2016b; Goodwin and Frew, 2013). The selection of participants needs to be carefully carried out to facilitate implementation.

#### 4.1.9. Costs

Although the essence of a priority setting exercise is resource allocation for health interventions, a minimum set of hospital resources need to be allocated to the exercise itself. Studies reported insufficient funding to implement the priority setting tool (Mitton et al., 2002b; Mitton and Donaldson, 2003b; Gibson et al., 2011) or the inability to cover extra costs arising from the process (Poder, 2017). It is critical to consider the priority setting tool in the hospital's budget, anticipating some extra implementation costs that might arise.

#### 4.1.10. External policy & incentives

Priority setting processes are bound to be political as they usually entail use of public funding. Externally imposed deadlines (Gibson et al., 2011), change of government authorities mid-process (Gibson et al., 2011), and political pressure can hinder the tool's uptake (Blythe et al., 2019). Conversely, political support to protect the process has been reported as a facilitator (Waldau et al., 2010; Waldau, 2015), similarly to autonomous HTA bodies (Korge et al., 2017; Martelli et al., 2016). Ensuring political support or process independence within the hospital appears relevant to a priority setting tool implementation.

#### 4.1.11. Communication

As a complex intervention with multiple stakeholders working towards reallocating resources efficiently, communication is of utmost importance to achieve success. Some studies have reported that lack of communication (Smith et al., 2015, 2016b; Dionne et al., 2009) or an

insufficient internal communication strategy (Gibson et al., 2011; Wal-dau, 2015) results in impaired implementation. A clear internal communication strategy should be set out from the beginning so the priority setting exercise can be conducted appropriately.

#### 4.1.12. Relative advantage

The 'Relative Advantage' construct refers to the comparative superiority of using a priority setting decision tool versus the current decision making process. An evidence-based process that considers political, historical and cultural context is a clear advantage compared to ad hoc processes (Foglia et al., 2017; Garau et al., 2018; Radaelli et al., 2014; Goodwin and Frew, 2013). Using a systematic approach to resource allocation improves credibility and public defensibility (Mitton et al., 2002b; Mitton and Donaldson, 2003b; Gibson et al., 2011), whereas others may appreciate the improvement in objective decision making (Blythe et al., 2019; Martelli et al., 2016). Using multiple criteria (Mitton and Donaldson, 2003b; Poder, 2017), including patient priorities (Mitton and Donaldson, 2003b), is also an advantage of using these tools. Consideration of ethical impact (Radaelli et al., 2014), effectiveness, efficiency and capacity to invest (Radaelli et al., 2014; Knies et al., 2013), and organisational aspects are also superior to having no systematic decision process (Ju and Hewson, 2014). Including these advantages within a business case that outlines the use of a priority setting tool can benefit their uptake and successful implementation.

These results could aid decision-makers in the readiness to implement the assessment of a priority setting tool in hospital-related decisions. They could also potentially outline areas of improvement to prepare different hospital teams such as management and clinical teams. Ideally, they will set the implementation for future success aiming to achieve a sustainable decision making process.

#### 4.2. Fidelity

We assessed fidelity for PBMA, MCDA and HTA studies. PBMA studies mostly achieved 100% across criteria, and two reached 86% of them (Mitton et al., 2002b, 2003b; Mitton and Donaldson, 2003b). The lowest-scoring criteria did not report if resource reallocation occurred, which is directly related to implementation. Additionally, three studies reported adoption for future use (Mitton and Patten, 2004; Mitton et al., 2002a, 2003a, 2004, 2005; Mitton and Donaldson, 2003a; Patten et al., 2006; Dionne et al., 2009; Gibson et al., 2011). This finding is consistent with other reviews, which described that implementing these initiatives for future adoption was challenging (Peacock et al., 2009; Kipiriri and Razavi, 2017). Interestingly, most of the PBMA studies were authored by those that also designed the methodology, which might be a factor contributing to the high fidelity observed. That research group also proposed strategies to achieve long-standing success (Peacock et al., 2009): combining PBMA with MCDA to make explicit trade-offs between different criteria; using the accountability for reasonableness (A4R) framework, which sets the conditions for processes to be fair (Daniels and Sabin, 2008); and the use of participatory action research (PAR) using qualitative methods. We observed one study that combined PBMA successfully with MCDA (Bowers et al., 2018). Regarding A4R, previous reviews have considered this a priority setting tool (Kipiriri and Razavi, 2017), and it has also been used with PBMA (Gibson et al., 2006). However, we did not consider A4R as a priority setting tool for this review as it focuses on process fairness rather than assessing the value of different interventions. PAR guides the research process to develop and advance a decision tool through various iterations of reflection until achieving a successful result (Baum et al., 2006). PAR was mentioned as a facilitator in one study found in our review (Patten et al., 2006). Ten guidelines for successful study design and implementation of PBMA have also been proposed, which included: establish the organisational objectives, ensure there is organisational 'readiness', establish an appropriate advisory panel structure, ensure that implementation is feasible, define the study question, choose the most appropriate

program structure, choose an appropriate level of detail for a program budget, use appropriate methods to identify options for investment and disinvestment, identify measure and value costs and benefits of investments and disinvestment, and ensure that resource reallocation recommendations are valid and robust (Peacock et al., 2010). This suggests that even if PBMA is applied as intended and combined with strategies such as MCDA, A4R and PAR, it does not ensure implementation in practice.

For MCDA, uncertainty treatment was the lowest-scored attribute across studies with 25%. One study described examining and reporting uncertainty as 'hallmarks of good practice' (Marsh et al., 2016). Uncertainty can manifest as imprecise or incomplete model inputs, variability in these inputs, quality of evidence or structural uncertainty. This can be handled broadly with two methods (Network GBoDHFC, 2019): including uncertainty as a criterion and (Schneider et al., 2021) conducting a sensitivity analysis (Thokala et al., 2016; Kevin Marsh et al., 2017). Considering uncertainty can potentially improve these tools' uptake by improving decision-makers confidence in their decisions. There is no clear association between fidelity and the future application of MCDA. The two studies having satisfied every criterion were not reported to implement the tool for future use (Angelis et al., 2020; Bowers et al., 2018). Whereas other studies with 55% or 64% were implemented (Radaelli et al., 2014; Ritrovato et al., 2015; Anderson et al., 2017).

For HTA based tools, no study reported using the societal perspective and only 25% considered all available alternatives. A societal perspective has traditionally been recommended to capture all relevant costs and consequences to society (Drummond et al., 2008; Sanders et al., 2016). If the societal perspective is used, other perspectives can be derived to suit stakeholders' preferences, such as health payers, hospitals, or individuals. All relevant alternatives must be considered to ensure the most valuable intervention is chosen (Drummond et al., 2008; Sanders et al., 2016). Regarding future use applications, four studies reported achieving this (Tadrous et al., 2020; Ju and Hewson, 2014; Körge et al., 2017; Ehlers et al., 2006). However, they were already implemented before the studies commenced reflecting HTA's widespread use.

Considering the studies observed in this review, it is difficult to conclude that fidelity is strictly related to implementation. This highlights that considering barriers and facilitators mentioned in our review, other than fidelity, could be critical to achieving the implementation of priority setting tools. However, the relationship between fidelity and implementation requires further research as timelines of reporting can confound this finding. It is plausible that priority setting tools applications that could not be confirmed to be implemented within this review, were actually continued but not published.

#### 4.3. Limitations

Reporting barriers and facilitators to implementation was not the main objective of the studies presented in this review. Although this limits the ability to extract all relevant information from these studies, it also highlights that further research needs to be conducted in this area.

Our study was based on high-income countries, omitting possibly relevant results from low- and middle-income countries (LMICs). Both settings have different challenges. High-income countries are fighting an unsustainable increase in health care demand due to population ageing and the adoption of innovative and more expensive healthcare technologies. LMICs struggle to fund health problems due to more limited budgets compared to high-income countries, as well as other system and contextual issues (Hipgrave et al., 2014). For example, a study comparing priority setting processes in Norway, Canada, and Uganda reported a total health expenditure per capita 44 times higher in Norway than in Uganda (Kipiriri et al., 2007). However, LMICs have also been reported to implement priority setting tools such as PBMA and MCDA (Hipgrave et al., 2014; Wiseman et al., 2016). This includes reporting similar implementation barriers such as rigid budgets, lack of

acknowledgment of agreed priorities, absence of budgeting experience, or lack of local data (Higgrave et al., 2014). Implementation factors for priority setting tools in LMICs remain a gap in the literature that needs to be systematically addressed.

This review only considered priority setting tools implementation finding many examples in hospital-related decisions. This could potentially exclude valuable insights from community or public health settings. However, hospital-related resource allocation decisions present unique challenges compared to community or public health settings. Hospital decisions often require assessing multiple competing specialised services, decision makers have a unique information set, care is typically episodic rather than chronic, and decision making can be heavily influenced by power imbalances. Differences in the decision making context could impact the generalizability of our results to specific decision making contexts if the scope includes both hospital and community or public health settings. Researching barriers and facilitators to implementing community and public health interventions represent an area of further research.

Our study only assessed peer-reviewed evidence, which may miss real-world applications of other priority setting tools in government reports or those published elsewhere in the grey literature. This could be particularly relevant for hospital-based HTA, which is used in many countries but with limited publications on the implementation experience (Galazka-Sobotka et al., 2020). Identifying and assessing real-world applications could also be important for MCDA, as observed in a systematic review that found 15 MCDA applications included in grey literature, and overall differences in MCDA applications (Gongora-Salazar et al., 2022). Despite this limitation, having a comprehensive approach by including HTA and other tools provides valuable information about the implementation of priority setting tools for hospital-related decision making and makes our study more generalisable.

The application of the CFIR framework requires subjective assessment. Potential bias from this subjectivity was addressed by applying the framework by two independent researchers and reaching a consensus on disagreements.

The fidelity assessment results are subject to the best practice criteria chosen. For example, the PBMA and MCDA criteria did not include monitoring of findings as part of their criteria, whereas HTA did. This might overestimate PBMA and MCDA study scores compared to HTA as the timelines to evaluate whether a tool reassessed its recommendations might not be included within a publication scope. Further, PBMA has also been proposed as the backbone of priority setting processes, with arguments that MCDA and HTA usually focus on assessing value (Mitton et al., 2019). Although, the three frameworks might differ in their implementation and output produced, analysing all of them provides a more complete picture of priority setting tools implementation.

The review was limited to the English language, which opens the possibility of missing relevant applications of the already described tools or new tools not described here.

## 5. Conclusion

Our study sheds light on what factors decision makers should consider to successfully implement a priority setting tool for hospital-related decisions. Barriers and facilitators across all CFIR domains were observed. Strategies to look actively for barriers' causes and implementation interventions should be used to overcome them, while facilitators reported here need to be encouraged and sought after. Results from our study could help assess the readiness to implement a priority setting tool in a local context. As scarcity of resources will remain an issue for the foreseeable future, implementing evidence-based, transparent decision processes to promote value-based care is worthwhile. The findings of this review could be used as a starting point to aim for implementation in usual practice and eventually sustainably applying priority setting tools.

## Author contributions

Antonio Ahumada-Canale: Conceptualization; Data curation; Formal analysis; Investigation; Methodology; Project administration; Validation; Writing - original draft. Varinder Jeet: Conceptualization; Data curation; Methodology; Validation; Writing - review & editing. Anam Bilgrami: Conceptualization; Data curation; Validation; Writing - review & editing. Elizabeth Seil: Conceptualization; Data curation; Validation; Writing - review & editing. Yuanyuan Gu: Conceptualization; Investigation; Methodology; Supervision; Validation; Writing - review & editing. Henry Cutler: Funding acquisition; Resources; Conceptualization; Investigation; Methodology; Supervision; Validation; Writing - review & editing.

## Declaration of interest statement

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

## Data availability

No data was used for the research described in the article.

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## Appendix A. Supplementary data

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