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DISINVESTMENT IN HEALTHCARE: A SCOPING REVIEW OF SYSTEMATIC REVIEWS

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Abstract:	<p>Introduction Disinvestment from low value health technologies is growing globally. Diverse evidence gathering and assessment methods were used to implement disinvestment initiatives, however, less than half of the empirical studies report reduced use of the low-value services. This scoping review aimed to synthesise the information from available reviews on the concepts and purposes of disinvestment in healthcare, the approaches and methods used, the role of stakeholders and facilitators and barriers in its implementation.</p> <p>Methods This scoping review was guided by the JBI Manual for Evidence Synthesis and PRISMA statement for scoping review. Published reviews on disinvestment were identified from scientific databases including HTA websites using the terms "disinvestment", "health technology reassessment" and "healthcare". The data obtained was synthesised narratively to identify similarities and differences across the approaches based on the pre-specified categories.</p> <p>Results Seventeen reviews were included with 34 initiatives identified across 16 countries at various levels of implementation and responsible agencies for the activities. Two most used methods to facilitate disinvestment decisions are Programme Budgeting and Marginal Analysis (PBMA) and Health Technology Assessment (HTA). Stakeholder involvement are the most important aspect to be addressed, as it acts as both facilitator and</p>

	<p>barrier in disinvestment initiatives implementation.</p> <p>Conclusion Disinvestment programs have been implemented at multilevel, involving multi-stakeholders and using multiple methods such as PBMA and HTA. However, there is a lack of clarity on the additional dimensions of technical analysis related to these tools. Further research could focus on technology optimization in healthcare as part of overall health technology management.</p>



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DISINVESTMENT IN HEALTHCARE: A SCOPING REVIEW OF SYSTEMATIC
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ABSTRACT

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Introduction

Disinvestment from low value health technologies is growing globally. Diverse evidence gathering and assessment methods were used to implement disinvestment initiatives, however, less than half of the empirical studies report reduced use of the low-value services. This scoping review aimed to synthesise the information from available reviews on the concepts and purposes of disinvestment in healthcare, the approaches and methods used, the role of stakeholders and facilitators and barriers in its implementation.

Methods

This scoping review was guided by the JBI Manual for Evidence Synthesis and PRISMA statement for scoping review. Published reviews on disinvestment were identified from scientific databases including HTA websites using the terms “disinvestment”, “health technology reassessment” and “healthcare”. The data obtained was synthesised narratively to identify similarities and differences across the approaches based on the pre-specified categories.

Results

Seventeen reviews were included with 34 initiatives identified across 16 countries at various levels of implementation and responsible agencies for the activities. Two most used methods to facilitate disinvestment decisions are Programme Budgeting and Marginal Analysis (PBMA) and Health Technology Assessment (HTA). Stakeholder involvement are the most important aspect to be addressed, as it acts as both facilitator and barrier in disinvestment initiatives implementation.

76

77 **Conclusion**

78 Disinvestment programs have been implemented at multilevel, involving multi-
79 stakeholders and using multiple methods such as PBMA and HTA. However, there is
80 a lack of clarity on the additional dimensions of technical analysis related to these
81 tools. Further research could focus on technology optimization in healthcare as part of
82 overall health technology management.

83

84 **Keywords:** disinvestment, health technology reassessment, resource allocation,
85 value-based decision-making.

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AUTHORS' CONTRIBUTION STATEMENT.

We, the authors listed above, attest that (i) each author contributed to the conception and design or analysis and interpretation of data and the writing of the paper; (ii) each has approved the version being submitted; and (iii) the content has not been published nor is being considered for publication elsewhere.

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CONFLICTS OF INTEREST

None.

151 countries, mostly high-income economies, show that healthcare spending rose
152 significantly in 2020, more than in previous years. (4) Therefore, promoting active
153 disinvestment in this current climate is timely to help re-strategize value-based priority
154 setting and resource reallocation to aid economic recovery.

155

156 We undertook a scoping review of existing reviews to comprehensively synthesize the
157 large body of information from published studies on disinvestment in healthcare. The
158 aim of this scoping review was to describe the approaches and methods used in
159 disinvestment processes of health technologies. We also identified the facilitators and
160 barriers with regards to carrying out disinvestment and explore the role of stakeholders
161 particularly among clinicians who act as a bridge between policy-makers and patients.

162

163 **2. METHODS**

164 **2.1 *The scoping review protocol***

165 A priori protocol was developed following established scoping review frameworks from
166 the Joanna Briggs Institute (JBI) Manual for Evidence Synthesis (5). The reporting of
167 this study conforms to the PRISMA statement for scoping review standards or
168 PRISMA-ScR (6).

169

170 **2.2 Purpose statement of the scoping review**

171 The purpose of this scoping review is to clarify the concepts and definitions of
172 disinvestment in the published literature and identify key characteristics of existing
173 disinvestment initiatives that had been implemented. In achieving these, we intended
174 to map the data from the retrieved studies based on five categories: 1) concepts and
175 terms used in disinvestment in healthcare; 2) purpose of disinvestment; 3) methods

176 [and processes in disinvestment; 4\) stakeholder involvement in disinvestment; and 5\)](#)
177 [facilitators and challenges in disinvestment implementation.](#)

178

179 **2.3 Systematic search strategy**

180 **2.3.1 Identification**

181 The main electronic bibliographic databases used for evidence searching: MEDLINE
182 (Ovid), Embase, Web of Science and Scopus. Other sources used were NIHR
183 Journals Library, Centre for Reviews and Dissemination as well as HTA websites and
184 databases (INAHTA and HTAi). Based on a scoping review by Niven et al. (7) on de-
185 adoption in healthcare, 43 terms on “disinvestment” were identified, including “health
186 technology reassessment”, “de-listing”, and “de-implementation” (**Supplementary**
187 **Table 1**). Focusing on healthcare disinvestment, our search strategy was confined to
188 fourteen synonyms of “disinvestment” and combined with “healthcare” or “health care”
189 (see **Supplementary Table 2 and 3**). The initial search was conducted on 4th
190 February 2021 and repeated on the 3rd January 2022 to identify any additional
191 publications. Literature was also identified from the references of the retrieved articles
192 using citation tracking, snowballing method and recommendation by experts’ in
193 conferences or forums.

194

195 **2.3.2 Inclusion and exclusion criteria**

196 Specific inclusion and exclusion criteria were established to include all review types
197 containing terms and concepts, descriptions or methods relating to disinvestment in
198 healthcare (see **Supplementary Table 4**). These criteria were applied using automatic
199 sorting function in the databases and manually. A publication period was determined
200 to ensure that we included the papers that are contemporary and relevant to current

201 practice, without jeopardising the concept of ‘research field maturity’ (8). For
202 practicality, we only include articles published between year 2001 and 2021 which
203 considered as acceptable to perform a representative review on disinvestment in
204 healthcare. Additional automatic screening filters were applied for English only and
205 types of research (“review articles” or “reviews”).

206

207 **2.3.3 Screening and eligibility**

208 The titles and abstracts of the articles were checked to ensure that the studies
209 matched the pre-determined inclusion criteria. A paper was considered eligible if it was
210 secondary research on disinvestment initiatives, such as systematic reviews, scoping
211 reviews, pragmatic reviews, overviews, interpretative reviews, and critical
212 interpretative synthesis. An article was included when the study covered any of the
213 components outlined in the inclusion criteria. The lead author carried out the initial
214 screening and the results were presented to the co-authors for checking.

215

216 **2.4 Data extraction, synthesis, and analysis**

217 Data were extracted using a pre-designed data extraction table and synthesized
218 narratively to identify similarities and differences across the approaches. The general
219 description and findings from each article included in the review were summarized
220 according to the following characteristics: publication year, type of reviews, country,
221 organization or agency in charge of the program, scope of health technologies,
222 methods used and description on disinvestment initiatives including the process,
223 stakeholder involvement, as well as facilitators and barriers in its implementation.

224

225 Content analysis was employed to identify the pattern of data, and the findings were
226 organized into [the stated](#) categories using shared similarities or relationships of the
227 information (9). Descriptive data analyses were performed to report the frequencies
228 and quantitative findings from the included reviews.

229

230 3. RESULTS

231 Seventeen reviews on disinvestment initiatives were included for synthesis and
232 analysis, as shown in PRISMA flow diagram (**Figure 1**). Eight reviews described
233 international disinvestment initiatives with descriptions on countries that already
234 implemented disinvestment programs (3, 7, 10-15). Two of the included studies
235 discussed regional disinvestment initiatives, in European HTA agencies (16) and in
236 Latin American countries (17).

237

238 **Figure 1: PRISMA flow diagram of the scoping review (18)**

239

240 Whilst the majority (n=13) of the included reviews described disinvestment for health
241 technologies and services in general (3, 7, 11-14, 16, 17, 19-23), two reviews focused
242 on disinvestment strategies in pharmaceuticals (10, 24) and two studies on non-
243 pharmaceuticals (15, 25). Four of the reviews proposed methods or frameworks for
244 disinvestment or HTR (7, 12, 21, 22), mainly for identification and prioritization
245 processes. One review specifically explored the related terms and definitions in
246 disinvestment using 'de-adoption' as the key term (7), and one review focused solely
247 on stakeholders' involvement in disinvestment, specifically healthcare professionals
248 (25).

249

250 We identified 34 disinvestment initiatives across sixteen countries, operating at various
251 levels by different types of agencies responsible for carrying out the activities (**Figure**
252 **2**). Among the programs implemented internationally, the most quoted is the Choosing
253 Wisely campaign launched in 2012 by the American Board of Internal Medicine and
254 adapted by many countries and agencies. The majority of national level initiatives fall
255 under the responsibility of the HTA agencies in that country (11). Uniquely, Canada
256 and Spain initially started with regional-based disinvestment initiatives before
257 expanding to a national program (12).

258
259 There are several information gaps on some of the implemented programs. For
260 example, from the review in Latin American countries_(17), there are only few
261 documented records of disinvestment activities despite various programs that have
262 been carried out in the region based on survey responses conducted. Another
263 example is the Danish Centre for Health Technology Assessment's (DACEHTA) pilot
264 on disinvestment, in which the only source of information on this project was a 2005
265 conference abstract on the improper utilization of imaging technologies in Denmark
266 (15).

267
268 **Figure 2: Countries with identified disinvestment initiatives and the agencies**
269 **involved**

270
271 **Supplementary Table 5** summarized the details of the included studies and
272 description of disinvestment initiatives based on the pre-defined categories.

273
274

275 **3.1 Clarifying concepts and terms in disinvestment**

276 Six reviews highlighted the need to clarify the concepts and terms used in
277 disinvestment (7, 10, 13, 15, 20, 22). Among the reasons given are to provide a clearer
278 vision regarding managing existing technologies in the system (22), to enhance
279 communication (20) and to improve engagement among the stakeholders (10).

280

281 Due to overlapping concepts, stakeholders involved in managing healthcare resources
282 tend to use disinvestment interchangeably with the following terms; rationing (26),
283 HTR (12) and obsolete technologies (10, 13) (**Table 1**). The earliest definition of
284 disinvestment by Elshaug (27) focused on the withdrawal of resources in reducing
285 ineffective, harmful or low-value medical services with the aim of improving health of
286 patients. Rationing has, instead, the underlying premise of scarce resources; meaning
287 the prioritisation of resources will result in certain services being excluded from
288 funding, thus denying people from potentially beneficial services (20). Health
289 technology reassessment is the process of identifying low value practices that may or
290 may not lead to disinvestment decision. It is more acceptable to stakeholders as it
291 does not assume the removal of funding (10) and is not meant as a rationing tool.

292

293 **Table 1: Definitions of terms**

294

295 **3.2 Understanding the purpose of disinvestment**

296 Although disinvestment is frequently associated with budgetary concerns and
297 affordability, it can also be prompted to enhance efficiency and quality of care through
298 reformation of service provision (26). Based on our analysis ([see Supplementary](#)
299 [Table 5 and 6](#)), the purpose of disinvestment initiatives can be grouped into four

300 [themes](#) (**Figure 3**): (i) enhance value-based spending (12, 13, 15-17, 19, 25); (ii)
301 resource reallocation (3, 11, 13-17, 19-21, 24, 25); (iii) improving quality of health care
302 (3, 7, 10-13, 15, 19, 21, 22, 25); and (iv) informed policy-making (11, 16). Clarifying
303 the goals of disinvestment would help people understand that it is a tool for improving
304 access to effective solutions, not for eliminating technologies and withdrawing
305 resources on a large scale.

306

307 **Figure 3: Rationale and purpose of disinvestment**

308

309 **3.3 Methods and Processes in Disinvestment**

310 Most of the reviews (n=15) described processes and methods of disinvestment.
311 Generally, the disinvestment process includes identification, prioritization, assessment
312 or re-assessment, decision, and dissemination (**Table 2**). In some reviews,
313 implementation and monitoring of the decision were also included in the process.
314 Identification and prioritization were the least standardized in terms of methods, criteria
315 and evidence used across HTA agencies. In certain contexts, there is overlap in these
316 processes which potentially lead to some confusion in the roles and criteria.

317

318 **Table 2: Summary of disinvestment methods/processes, facilitators, and** 319 **challenges from the included reviews**

320

321 **3.3.1 Identification Process**

322 Three components related to identifying candidates for disinvestment were **triggers**
323 for identification, **source** of identification and **implementation** of the process
324 (**Supplementary Table 7**). Identification can be done through established methods

325 such as Horizon Scanning or based on the input from clinical experts and program
326 managers. It can also be linked with the HTA process that assumes a “one-in-one-out”
327 policy in which, for each new technology considered, the current technology is also
328 taken into consideration for reassessment (15).

329

330 Identifying candidates for disinvestment can be performed in two ways, “ad hoc
331 methods” and “embedded methods”. Ad hoc methods are specifically devised and
332 implemented to find suitable technologies for disinvestment and usually are not carried
333 out on a regular basis (21). For embedded methods, the identification process is
334 performed routinely alongside other organizational activities (21).

335

336 **3.3.2 Prioritization Process**

337 Eleven reviews outlined common prioritization criteria such as the evidence on
338 efficiency or effectiveness, cost-effectiveness and safety of the technology, existence
339 of available alternatives, the total cost, and disease burden. These criteria are usually
340 aligned with the purpose of disinvestment, for example, the rationale for inclusion of
341 ‘cost of inefficient drugs’ from a budgetary planning is to allow for investment in
342 technologies with higher value (10).

343

344 A specific tool for prioritization, the PriTec Prioritization Tool developed by Galician
345 Agency for Health Technology Assessment was mentioned in three included reviews
346 (10, 12, 16) (Supplementary Table 8). It is a three-domain weighted prioritization
347 exercise with a score system that allows for the ranking of health technologies
348 according to a set of specified criteria (16). Additional criteria for prioritization process

349 include evidence of futility (11, 12), strength of supporting evidence on lack of efficacy
350 (7, 24), cost (11-13) and opportunity cost (14).

351

352 **3.3.3 Assessment Process**

353 There is little information from the retrieved articles on technical assessment for
354 disinvestment. Twelve articles included methods similar to the [components](#) used in
355 HTA for investment: disease burden, safety, clinical and cost-effectiveness, and
356 overall value including ethical, legal, and social aspects (**Table 2**). It was highlighted
357 that an assessment should also evaluate the feasibility of implementation and analysis
358 of consequences, both intended and unintended (10).

359

360 We identified two commonly used frameworks to facilitate disinvestment decisions,
361 namely Program Budgeting and Marginal Analysis (PBMA) and HTA. It is argued that
362 PBMA is usually used to assess the distribution of resources for health services within
363 a fixed budget plan, while HTA is mainly focused on single technology appraisals for
364 public and social healthcare system and is not a framework specifically intended for
365 disinvestment (12). Other method is Accountability for Reasonableness (A4R) which
366 was applied in Sweden's healthcare priority setting to address the concepts of
367 rationing, rationalisation, ranking priority setting, and structured quality improvement
368 (14). However, the information on A4R as method for disinvestment is scarce and
369 limited to Swedish healthcare setting.

370

371 **3.3.4 Type of Disinvestment Decisions**

372 The outcomes of disinvestment decisions were mixed. Some reviews highlighted the
373 requirement of making decisions (i.e. binding judgments) (12, 13, 20), while some

374 outlined the resulting outcomes that may occur following the assessment (i.e. non-
375 binding information) (3, 10, 14, 17, 22, 24). According to Mayer and Nachtnebel (13),
376 the implementation of disinvestment decisions may result in one of these four
377 conditions: (i) a change in application or scope of use; (ii) full or partial resource
378 withdrawal; (iii) complete removal from practice, or (iv) no change to the practice.
379 However, the impact of these decisions on resource withdrawal must be judicially
380 evaluated for their influence on patients' health based on the clinical effectiveness and
381 on the availability of a suitable alternative (20).

382

383 **3.3.5 Dissemination Process**

384 Active dissemination through online or printed recommendation reminders, HTA
385 reports, commissioners' guides, clinical guidelines, and journal publications were the
386 most common means (10-13). It can also be done through conferences and
387 knowledge transfer programs (12), face-to-face communications with target groups
388 (13), and making direct changes to formulary or reimbursement listings (10). In Spain,
389 a software was embedded with the Guideline for Not Funding existing health
390 Technologies in the health system whereby progress and reports are emailed to the
391 stakeholders once the evaluation is completed (12, 16). More passive dissemination
392 include publishing the recommendation lists on websites such as "Do Not Do" and
393 Choosing Wisely, in online uncertainties databases and short reports (11).

394

395 **3.4 Stakeholders involvement in disinvestment initiative**

396 Only one systematic review by Mitchell et al. (25) focused on capturing healthcare staff
397 perspectives and reactions towards disinvestment initiatives. In other reviews, the

398 roles of stakeholders were described and discussed mainly in the context of the
399 processes, facilitators, and barriers of disinvestment programs (see **Table 2**).

400

401 Stakeholders usually involved are clinicians and other first-line responders in care
402 provision, clinical and political decision-makers, patients or their representatives,
403 researchers, health economists and academics, as well as citizens representing the
404 public (11). They may be involved as members of a special committee, for instance,
405 members of the Technology Appraisal Committee under NICE are drawn from the
406 National Health Service, patient organizations, academia, and pharmaceutical or
407 medical device industries (12).

408

409 **3.5 Facilitators and Challenges to Disinvestment Initiatives**

410 We identified several facilitating factors. First, the participation of a diverse range of
411 stakeholders with varying roles and expertise is a critical factor in increasing program
412 acceptance (3, 7, 12, 13, 20, 25). This, combined with an evidence-based strategy
413 and transparent process, further enhanced the acceptance (7, 10, 12, 13, 21, 22, 25).
414 Thirdly, the consideration on local context when evaluating the candidates for
415 disinvestment and in formulating recommendations facilitates implementation (7, 13,
416 17, 21). Various dissemination strategies were also customised to relevant target
417 groups, making the information more acceptable and comprehensible (10, 11, 13, 20).

418

419 Several main challenges and barriers were identified and grouped into three
420 categories, namely **perception barriers**, **technical or scientific barriers**, and
421 **organizational barriers**.

422

423 **3.5.1 Perception barriers**

424 Healthcare professionals often perceive that removing an existing health technology
425 is of greater disadvantage than refusing to embrace a new health technology of
426 comparable value (12). Removing or changing existing technology or practise may not
427 be favourable since trained doctors view technology as an integral element of their job
428 (3, 12, 25). For fear of being questioned by patients, some healthcare workers are
429 reluctant to discontinue legacy therapies, such as older drugs, which have never been
430 evaluated for cost effectiveness (25). The assumption that disinvestment reduces
431 prescriber and patient choice, and by reducing patient subsidies is also a main
432 motivation for refusal (24).

433

434 **3.5.2 Technical / Scientific barriers**

435 It is vital to convince stakeholders that withdrawing the technology would be harmless
436 and that keeping it would be counterproductive (12). In some circumstances, the
437 absence of robust evidence to support withdrawal decisions hinder the acceptance of
438 disinvestment (7). A joint NICE-Cochrane pilot project found that specific review
439 methods such as Cochrane systematic reviews were more likely to establish an
440 absence of evidence rather than evidence of a lack of efficacy or effectiveness (23).

441

442 Technical challenges include variation in selecting and prioritizing health technologies
443 for disinvestment (21). Failure to translate the suggested recommendations into
444 binding guidelines and link them to adjustment in coverage decisions may result in
445 stakeholder dissatisfaction (13).

446

447 **3.5.3 Organizational barriers**

448 Stakeholders frequently lack the political, administrative, and clinical will to support
449 disinvestment initiatives (10). Therefore, there is often a reluctance to devote
450 appropriate resources to disinvestment programmes, such as educating specialists
451 and HTA reviewers, providing incentives for implementation, and financing for related
452 research to cover information and data shortages (10, 15). Hence, having enough
453 resources to support disinvestment programs is critical to ensure its sustainability (3).

454

455 Among the solutions proposed are the provision of international platforms for
456 collaboration and development of transparent, adaptable disinvestment models which
457 can be achieved through multi-stakeholder engagement (10). Furthermore, the
458 presence of strong leadership may also expedite acceptance and facilitate
459 implementation by emphasizing the need of constructive disinvestment activities
460 through better resource allocation (13).

461

462 **4. DISCUSSION**

463

464 Disinvestment is a complex process of decision-making influenced by systemic
465 linkages between value-based spending, resource reallocation and quality of health
466 care delivery. Despite the favourable outcomes behind the ideas, in practice, the
467 process seems to be notoriously challenging in terms of scientific, political and ethical
468 aspects (2). Our scoping review aimed to summarise the findings of a growing body
469 of evidence on healthcare disinvestment. We undertook a comprehensive systematic
470 search of disinvestment initiatives globally using a broad lexicon of terms to identify all
471 relevant programs on disinvestment including HTR and assessment of low-value
472 technologies.

473

474 In England in the UK, disinvestment initiatives have been carried out implicitly through
475 NICE's current projects, with various outputs available on its website (28). The
476 established processes employed by NICE are conducted through technology
477 appraisals, recommendation reminders, and commissioning guidelines for clinical
478 practice. The procedures are comparable to those used in its HTA projects for
479 investment and reimbursement, in which a systematic and thorough approach to
480 evidence appraisal, as well as multistakeholder participation, is required to reach a
481 conclusion on technology disinvestment (29). Because HTR activities are carried out
482 alongside other existing initiatives, there is no specific disinvestment framework or
483 process formally created by NICE. Although frequently cited in the included reviews,
484 the "Do Not Do" database had been removed from the NICE website in November
485 2017 (NICE Communications Coordinator of Enquiries, personal communication,
486 August 16, 2021) and any recommendations that were potentially cost saving have
487 since been assessed using the cost saving and resource planning guidance under
488 NICE activities (30).

489

490 The current plethora of terms and concepts in describing this process creates
491 substantial confusion. Indirectly, it may influence stakeholders' engagement as well as
492 the acceptance of the initiative, hence, a more neutral term such as HTR has been
493 proposed to improve understanding (10, 15, 21). Whilst there are arguments raised by
494 researchers on making a distinction between disinvestment and HTR, we believe that
495 the differences are very subtle with some overlapping concepts, and it does not
496 change the rationale of disinvestment. However, it is noteworthy that this process does
497 not happen in a vacuum. Those involved in disinvestment are always aware of costs,

498 even if cost reduction or reallocation of funds is not the primary motivation. Although
499 they do not consider themselves to be rationing, HTR followed by disinvestment
500 coupled with resource reallocation can appear very similar to rationing.

501

502 Analysing the spectrum of disinvestment activities, stakeholder involvement would
503 appear to be one of the most important aspects that needs to be addressed, allowing
504 for higher acceptability, applicability, comprehension and political will. Early and
505 continued stakeholder participation throughout the HTR activity, transparency in
506 methodologies and processes, and ongoing knowledge transfer can all help to foster
507 meaningful engagement (22). This is pivotal given their involvement in the provision
508 of care and to avoid misperception in the purpose and process of disinvestment (25).

509

510 Barriers and challenges involving stakeholders' engagement are particularly profound
511 during the implementation phase. Disinvestment efforts that lack of support from top
512 level can lead to disengagement among frontline stakeholders tasked with
513 implementation, particularly when the program's resources are limited (22). Some
514 ideas for improving active engagement from these key stakeholders include
515 incentivizing them to conduct more research to fill data gaps and contextualize critical
516 data for reassessment purposes (10). In this instance, short-term resource allocation
517 for disinvestment efforts is almost always unavoidable in order to realize long-term
518 efficiency improvements (13).

519

520 Even though PBMA and standard HTA processes have been identified as the most
521 used methods from our findings, there are differing views on their use in the context
522 of disinvestment and resource reallocation. PBMA has had some difficulties in

523 achieving disinvestment choices, and the outcomes in terms of permitting resource
524 release are not always satisfactory (31). On the other hand, HTA was established with
525 reimbursement rather than disinvestment in mind, as it is a valuable instrument for
526 generating evidence in decision-making and not a specially designed framework for
527 disinvestment (32). There is a need to re-visit disinvestment methods to capture policy-
528 beneficial outputs beyond or within PBMA and HTA, particularly in terms of technical
529 analysis and what constitutes acceptable evidence. Common methods which can be
530 applied within both these frameworks include the use of economic evaluation and
531 multi-criteria decision analysis (MCDA). Furthermore, the growing importance of real-
532 world evidence in the context of disinvestment may be highlighted more explicitly to
533 accelerate and broaden its use in disinvestment.

534
535 A robust HTR, on the other hand, is part of the trajectory of health technology
536 management, which also includes continues reassessment of technologies for
537 improved health care. Future research could shift the emphasis away from
538 disinvesting, and more on the appropriateness and scope of technology utilisation,
539 including resource reallocation to technologies with higher value to the patients.

541 **4.1 Strengths and Limitations of this Scoping Review**

542 The comprehensive search strategy and thorough analysis of the literature on this
543 topic are the key strengths of this scoping review. Due to substantial number of
544 publications in this area, we focused on synthesizing the evidence from the existing
545 reviews to systematically summarize their findings in issues related to disinvestment.
546 We covered aspects on clarifying the concepts, the methods and processes of
547 disinvestment, the types of evidence used in the evaluations, and stakeholder

548 involvement in the implementation of disinvestment initiatives. Other studies have
549 tended to focus only on specific aspects of disinvestment in healthcare, such as the
550 identification and prioritization processes (21), initiatives in specific regions, countries
551 or within HTA agencies (12, 16, 17), and specific health technologies such as
552 pharmaceuticals (10, 24) or non-pharmaceuticals only (15, 25). This review also
553 highlighted the facilitators and barriers in disinvestment which we consider as critical
554 components in implementing the initiatives.

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556 We also acknowledge some limitations in this review. Most of the included publications
557 only discussed disinvestment initiatives in high-income countries. It is possible that we
558 overlooked unpublished, informal, or small-scale initiatives in low-and-middle-income
559 countries, which equally grapple with resource reallocation and value-based
560 healthcare spending. Furthermore, small studies on disinvestment from regional areas
561 may be classified or published as quality improvement and thus escape the scope of
562 this review. Another limitation in this review is the lack of details on additional
563 dimensions of using HTA in disinvestment process as it is not well-expanded in the
564 included articles. We also recognize that there is limited information on the impacts of
565 the proposed initiatives reported in the included articles. These can be improved by
566 focusing the research on a specific disinvestment program or agency that has already
567 implemented disinvestment initiatives, which could be conducted through case studies
568 on the evaluation and monitoring of related policy.

569

570 **5. CONCLUSION**

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572 With the growing emphasis for transparent and systematic processes of resource
573 allocation, disinvestment initiatives have been a priority in countries and agencies
574 worldwide despite the complexity of its implementation. There are plethora of terms
575 and concepts in disinvestment in healthcare, but the purposes are consistent –
576 towards value-based decision-making and wise spending of resources to achieve
577 maximum benefits for population health and improvement in the quality of care.
578 Disinvestment programs have been implemented at various level in many countries,
579 but the success of these initiatives has been mixed. This scoping review also highlights
580 the critical role of stakeholder involvement in disinvestment. The most used tools for
581 assessing candidates for disinvestment are PBMA and HTA; nevertheless, there is a
582 lack of clarity on the additional dimensions of technical analysis related to these tools.
583 Further research could focus on technology optimization in healthcare which include
584 continuous reassessment of health technologies as part of overall health technology
585 management and resource reallocation to higher value technologies.

586

587 **4,270 words**

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707 **Figure 2 (caption): Countries with identified disinvestment initiatives and the**
708 **agencies involved**

709 **Agencies acronyms:** Age.Na.S, Agency for Regional Healthcare; CADTH, Canadian
710 Agency for Drugs and Technologies in Health; CONITEC, Brazilian National
711 Committee for Technology Incorporation; DHB, District Health Board; HAS, Haute
712 Autorité de Santé Comprehensive Drug Review; HealthPACT, Health Policy Advisory
713 Committee for Technology; MSAC, Medical Services Advisory Committee; NECA,
714 National Evidence-based healthcare Collaborating Agency; NHC, National Health
715 Committee; NICE, National Institute for Health and Care Excellence; PBAC,
716 Pharmaceutical Benefits Advisory Committee; PCT, Primary Care Trusts
717 Programmes; PHARMAC, Pharmaceutical Management Agency; SHTG, Scottish
718 Health Technologies Group; SBU, The Swedish Council on Health Technology
719 Assessment; USPTF, US Preventive Services Task Force (grade D
720 recommendations); VHA, Veterans Health Administration Comprehensive Review
721 **General Health Committee agreed on eight types of drug exclusions. No information*
722 *was provided.*

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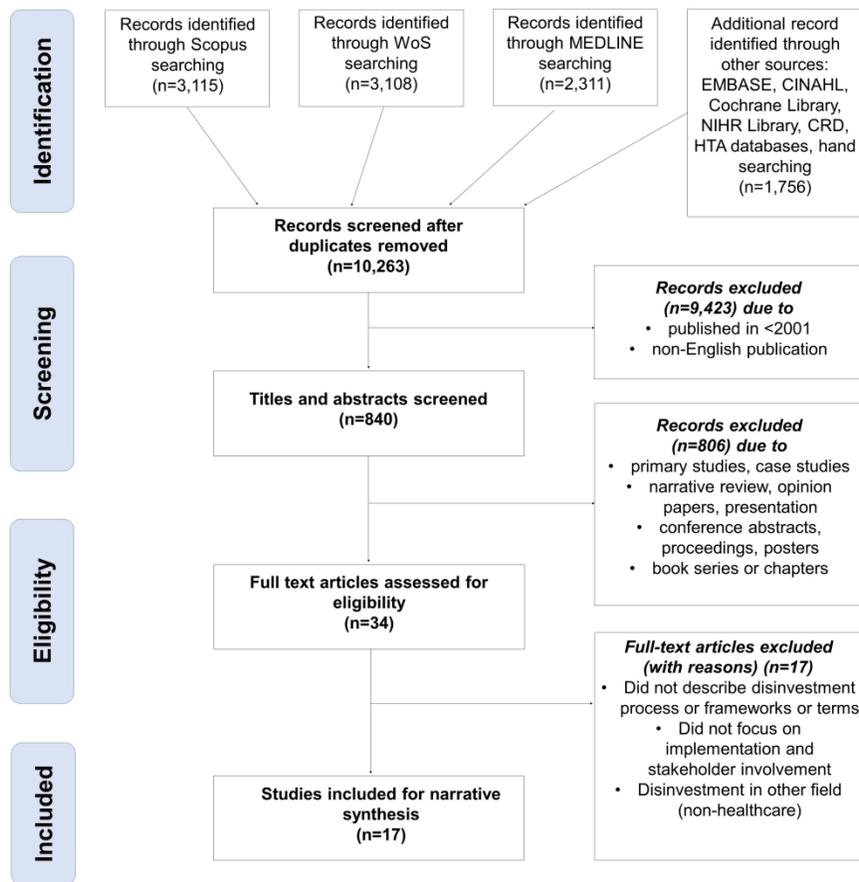


Figure 1: PRISMA flow diagram of the scoping review (18)

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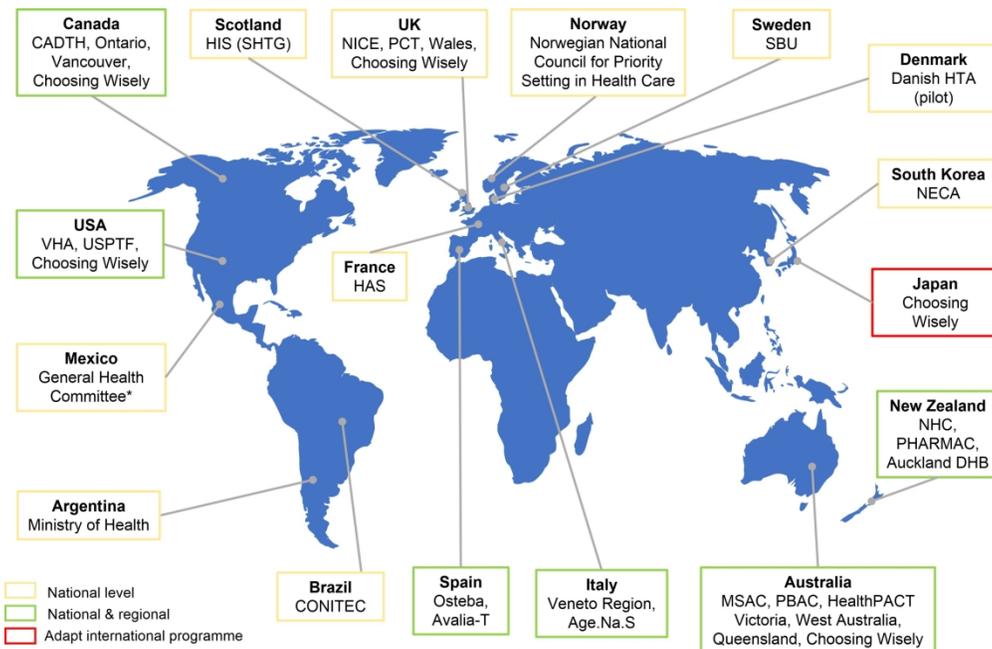


Figure 2: Countries with identified disinvestment initiatives and the agencies involved

Agencies acronyms: Age.Na.S, Agency for Regional Healthcare; CADTH, Canadian Agency for Drugs and Technologies in Health; CONITEC, Brazilian National Committee for Technology Incorporation; DHB, District Health Board; HAS, Haute Autorité de Santé Compréhensive Drug Review; HealthPACT, Health Policy Advisory Committee for Technology; MSAC, Medical Services Advisory Committee; NECA, National Evidence-based healthcare Collaborating Agency; NHC, National Health Committee; NICE, National Institute for Health and Care Excellence; PBAC, Pharmaceutical Benefits Advisory Committee; PCT, Primary Care Trusts Programmes; PHARMAC, Pharmaceutical Management Agency; SHTG, Scottish Health Technologies Group; SBU, The Swedish Council on Health Technology Assessment; USPTF, US Preventive Services Task Force (grade D recommendations); VHA, Veterans Health Administration Comprehensive Review

*General Health Committee agreed on eight types of drug exclusions. No information was provided.

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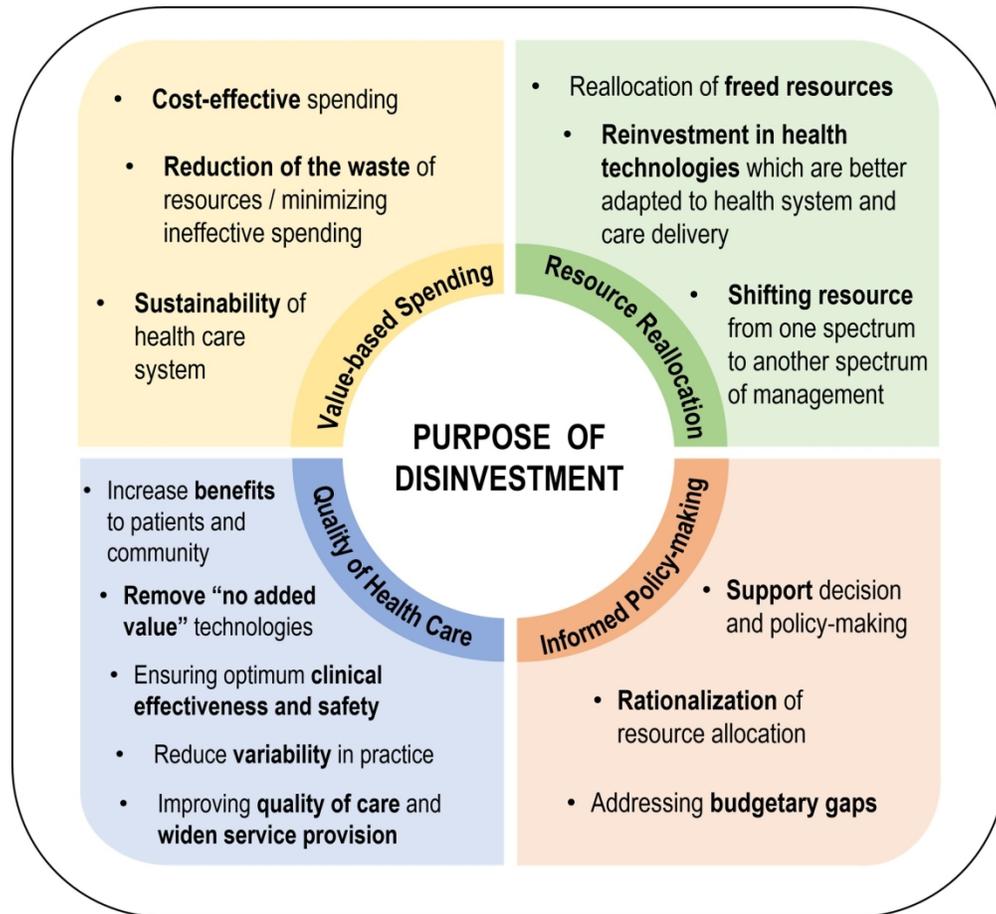


Figure 3: Rationale and purpose of disinvestment

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Table 1: Definitions of terms

Disinvestment	<ul style="list-style-type: none"> The process of (partially or completely) withdrawing health resources from any existing healthcare practices, procedures, technologies, or pharmaceuticals that are deemed to deliver little or no health gain for their cost, and thus are not efficient health resource allocations (25).
Rationing	<ul style="list-style-type: none"> The full or partial withdrawal of resources from a medical service that is clinically expected, on average, to result in a patient achieving diminished health benefits (23). It may result in exclusion of services from public funding, hence denying people from potentially beneficial technologies.
Health technology reassessment	<ul style="list-style-type: none"> A structured, evidence-based assessment of the clinical, social, ethical, and economic effects of a technology currently used in the healthcare system, to inform optimal use of that technology in comparison to its alternatives (15).
Obsolete technologies	<ul style="list-style-type: none"> Any health technology in use for one or more indications, whose clinical benefit, safety, and/or cost-effectiveness have been significantly superseded by other available alternatives or are not supported by evidence (10, 13).

Table 2: Summary of disinvestment methods / processes, facilitators, and challenges

Author, publication year	Description on disinvestment process / methods					Facilitators and Challenges in implementation	
	Identification	Prioritization	Assessment	Decision	Dissemination	Facilitators	Challenges
Walsh-Bailey et al., 2021	Not specified	i. clinical & cost ineffectiveness	i. PBMA ii. HTA / HTR	Based on action targets: i. Reduce ii. Replace iii. Restrict iv. Remove	Not specified	Stakeholder involvement (multicomponent interventions involving patients and providers)	Not specified
Mitchell et al., 2021	Not specified	Not specified	Not specified	Not specified	Not specified	i. Engaging clinical champions to lead change ii. Using rigorous patient outcome data iii. Transparent decision-making processes	Negative responses by health professionals: i. staff feel anxiety, disempowered, disrespected ii. distrust the process iii. dismiss the directive to disinvest iv. misperception on the purpose of disinvestment
Embrett et al., 2020	i. new evidence ii. introduction of a new technology iii. budget restrictions	i. clinical & cost effectiveness ii. value assessment iii. stakeholder consultation	i. HTA / HTR	Transparent decision-making on medical service withdrawal (policy option)	i. Guidelines ii. Education for public, training for providers iii. Monitoring of service use	Stakeholder involvement as a factor in the success of initiative.	Not specified.

Author, publication year	Description on disinvestment process / methods					Facilitators and Challenges in implementation	
	Identification	Prioritization	Assessment	Decision	Dissemination	Facilitators	Challenges
Esandi et al., 2020	3 different but related themes on methods for identifying candidates for disinvestment; approaches, triggers, and methods (ATM) - Ad hoc method - Embedded method	Not specified	Not specified	Not specified	Not specified	i. Transparent, systematic, evidence-based approach ii. Flexible method by HTA organisation / country according to suitability iii. Inclusion of stakeholders perceptions increases legitimacy in decision-making	i. Additional workload for HTA units ii. Variation in processes for selecting and prioritising candidates for disinvestment - causes dispute if the decision is to disinvest
Calabrò et al., 2018	Source: i. expert panel ii. literatures iii. new / rising technology databases iv. consultation with NHS, hospital	i. PriTec Tool - prespecified criteria based on 3 domains	i. HTA method (majority) ii. PBMA (Making Choices Spending Wisely, MaCS-Wise)	Not specified	i. NICE “Do not do” databases (passive) ii. GuNFT (active)	Regional and international platform for discussion	A complex process - requires inputs from all relevant stakeholders
Soril et al., 2018	Not specified	Not specified	Value assessment	Utilisation of technology (increased, unchanged, decrease, complete exit of technology from the healthcare system)	Not specified	i. The entire HTR process is a collective involvement of foundational stakeholders	i. Limited success due to insufficient engagement with and from stakeholders ii. Top-down initiatives without support from the top leads to disengagement among stakeholders tasked with implementation.

Author, publication year	Description on disinvestment process / methods					Facilitators and Challenges in implementation	
	Identification	Prioritization	Assessment	Decision	Dissemination	Facilitators	Challenges
Agirrezabal et al., 2017	Not mentioned	Not mentioned	i. Cost analysis ii. Retrospective study of adverse events notification	Mixed of disinvestment decisions, but not monitored	i. Publications ii. Technical reports	Not mentioned	Moving away from the public's understanding of "across the board cuts"
Chambers et al., 2017	Not specified. Programmes implemented: - Choosing Wisely - NICE Initiatives - US Preventive Services Task Force (grade D recommendation)	Not mentioned	Not specified. Programmes implemented: - Choosing Wisely - NICE Initiatives - US Preventive Services Task Force	The decisions and success of disinvestment initiatives has been mixed	i. NICE "Do not do" databases	Continuous promotion of the disinvestment initiative among practitioners is the key success	i. Gaining acceptance from the frontline service provider ii. Obtaining adequate resources to support disinvestment initiatives
Maloney et al., 2017	i. Search, monitoring, review of literature and databases ii. Fixed time or trigger for reassessment iii. Efficient and transparent processes	i. Stakeholder consultation and assessment of variation in technology use - methods for identification or prioritization or both ii. Fixed time or trigger for reassessment ii. Efficient and transparent processes	i. Stakeholder involvement in therapeutic review assessment ii. HTA method, including value assessment and opportunity cost	Disinvestment recommendation may result, but reinvestment in other drug technologies is also possible	i. Passive: publication on databases or websites ii. Active: incorporate in guidelines or decision support tools, changes to formulary and/or coverage reimbursement listings	i. Transparent process - promote acceptance among stakeholders ii. Using a more neutral term - "reassessment" instead of "disinvestment" iii. Adoption of fixed time HTRs or therapeutic reviews - increased engagement with stakeholders	i. Lack of political will and leadership ii. Hesitancy from stakeholders to allocate resources for disinvestment initiative iii. Variability in reimbursement and purchasing methods iv. Low engagement from stakeholders and decision-makers v. Resistant to losing access to a drug therapy that may still provide some benefit

Author, publication year	Description on disinvestment process / methods					Facilitators and Challenges in implementation	
	Identification	Prioritization	Assessment	Decision	Dissemination	Facilitators	Challenges
Orso et al., 2017	Depends on agencies / programme. - new evidence - temporal variation - conflicting with guidelines - public interest / controversy - effectiveness & safety issues - evidence-based consensus - utilization rate	i. cost of service ii. impact on health, equity iii. disease burden / population affected iv. Futility, obsolescence (age, type) v. access / capacity vi. sustainability vii. system integration	i. PBMA, HTA ii. scientific and colloquial data iv. macro-marginal analysis v. technology appraisal vi. CEA vii. critical appraisal of the evidence on uncertainties	Not mentioned	i. Printed / online ii. HTA reports, commissioners' guides (online) iii. Databases ("Do Not Do", Uncertainties database) iv. Short report and reviews (online)	The existence of HTA agency in the country is a strong predictor of the presence of disinvestment programs (p=0 .034)	Not mentioned
Seo et al., 2016	Similar criteria across countries: i. clinical guidelines ii. new evidence on safety and effectiveness iii. public interests iv. variation in practices v. leakage vi. legacy items Spain: use Guideline for Not Funding existing health Technologies	i. cost of services, ii. risk/benefit of technologies iii. disease burden iv. patient preferences v. evidence of futility Spain: use PriTec Tool which based on 3 domains	i. PBMA ii. HTR (not much different from HTA, but requires convincing evidence of at least no risk, or of a benefit, in removing the technology)	i. transparent, supported by robust evidence ii. appropriate knowledge transfer to all stakeholders - specific committee or council of experts and stakeholders involve at various level - 8 outcomes of HTR	i. Reports: technology appraisal, recommendation reminders, commissioning guidelines ii. Do Not Do database iii. knowledge transfer (conferences) iv. Email to stakeholders	i. Continuous knowledge transfer to educate stakeholders in PBMA ii. Stakeholder involvement (developing strategies for disinvestment) - from early phase to implementation iii. Spain - regulatory support at national level (Royal Decree 1030)	i. Lack of political motivation ii. Decentralised health system and evaluation iii. Technical difficulties of HTR processes iv. Reluctance in withdrawal (clinicians) v. Perception - removing an established intervention is harder than refusing new one of similar value vi. Absence of robust evidence to support disinvestment

Author, publication year	Description on disinvestment process / methods					Facilitators and Challenges in implementation	
	Identification	Prioritization	Assessment	Decision	Dissemination	Facilitators	Challenges
Mayer et al., 2015	<p>i. Literature-based and expert-related</p> <p>ii. Criteria: overlap between effectiveness, efficiency/cost/cost-effectiveness, available alternatives and benefit</p> <p>iii. Involvement of physician is crucial</p> <p>Programmes mentioned: Choosing Wisely, NICE initiatives, GuNFT, Australia PBAC and MBS, Cochrane Quality and Productivity topics</p>	<p>i. Spain (Osteba) standardised tool, PriTec Prioritization Tool</p> <p>ii. Criteria are identical in majority of the programs, with cost/efficiency most frequently mentioned</p>	<p>i. HTA</p> <p>ii. PBMA</p>	<p>i. Strategy for implementation: GuNFT and NICE program</p> <p>ii. Choosing Wisely: relies on physicians to implement recommendation and encourages patients/consumers to discuss involve in treatment options</p> <p>iii. PBAC, MBS: decisions are transferred into benefits schemes (direct)</p> <p>iv. PBMA: recommendation directed at specific organizations</p>	<p>i. HTA reports or concise lists summarizing the recommendation</p> <p>ii. Active (published online, print media, face-to-face communication with target groups or consumer organisations, commissioning guides)</p> <p>iii. Passive (database in website)</p>	<p>i. Broad involvement of stakeholders</p> <p>ii. Structured and evidence-based process, with transparent methods</p> <p>iii. Targeted group for dissemination strategy</p> <p>iv. Consideration of local contexts</p> <p>v. Encouragement of political discussion and raising awareness before and during program</p>	<p>i. Additional human and financial resources</p> <p>ii. Implementation strategy not well-planned</p> <p>iii. Lack of support from decision-makers and an absence of strong leadership</p>

Author, publication year	Description on disinvestment process / methods					Facilitators and Challenges in implementation	
	Identification	Prioritization	Assessment	Decision	Dissemination	Facilitators	Challenges
Niven et al., 2015	Review of available evidence combined with stakeholder engagement	i. Availability of evidence (harmful or ineffectiveness) ii. Safety issues iii. Potential health and cost impact of de-adoption iv. availability of alternative practices	i. PBMA ii. HTA / HTR	Not specified	Not specified	i. Early stakeholder engagement during identification and prioritisation allow implementation of de-adoption process and improve the probability of success	Not mentioned
Parkinson et al., 2015	i. Concerns on quality, cost and clinical effectiveness, higher than utilisation and/or international differences ii. Changes in evidence, regulatory status, or budget impact iii. Routine for all listed drugs (France) iv. Drugs with price competition v. Leakage: drug utilisation (NZ)	i. Evidence of insufficient safety, clinical- and cost-effectiveness after multiple technology assessment ii. SMR ratings (France): effectiveness, safety, disease severity, impact on individual health and public health alternatives iii. Not delivering value for money	Not mentioned	i. Drug delisting ii. Restricting treatment iii. Price or reimbursement rate reductions iv. Encourage generic prescribing v. Coverage with Evidence Development (CED)	Not mentioned	Stakeholder involvement: i. help diffuse any resulting politics ii. communicating with stakeholders upfront and throughout the process regarding what research is required and what level of evidence is needed for continuing funding the drug	i. Disinvestment removes subsidy to patient, restricts clinical autonomy, and reduces prescriber and patient choice ii. Resistance to change practice among clinicians iii. Insufficient information to patients leads to misunderstanding

Author, publication year	Description on disinvestment process / methods					Facilitators and Challenges in implementation	
	Identification	Prioritization	Assessment	Decision	Dissemination	Facilitators	Challenges
Garner et al., 2013	<ul style="list-style-type: none"> i. Potential productivity and cash- savings ii. Potential impact on quality of clinical care and outcomes iii. Potential impact on patient safety iv. Potential impact on patient and carer experience 	Not mentioned	Not mentioned	Not mentioned	Not mentioned	Not mentioned	<ul style="list-style-type: none"> i. Recommendation not applicable to local health care setting ii. Framework and recommendation not relevant to clinical practice iii. Specific review / assessment found an absence of evidence rather than evidence of a lack of efficacy and effectiveness - Cochrane using randomised trials
Polisena et al., 2013	Not mentioned	<ul style="list-style-type: none"> i. Disease burden ii. Clinical effectiveness and safety iii. Cost-effectiveness, opportunity cost iv. Health services impact (ethical, legal, psychosocial) v. Stakeholder and public engagement vii. Data sources 	<ul style="list-style-type: none"> i. PBMA (majority) ii. HTA iii. Accountability for Reasonableness (A4R) and quality improvement theory - Sweden 	<ul style="list-style-type: none"> i. reduce utilisation, interventions discontinued ii. changes in resource allocation ii. cost reduction in overall management of the specific condition ii. no change (adequate funding) 	Not mentioned	<ul style="list-style-type: none"> i. Interdisciplinary panel: executives, directors, managers, clinical leads, physicians, specialists, researchers and academics, health economists - robust decision-making ii. Patient/community representatives - improve acceptability iii. PBMA - transparent and structured framework 	<ul style="list-style-type: none"> i. PBMA - uncertainty on whether the correct decisions were made ii. PBMA - require training and sufficient time to be executed iii. Insufficient clinical effectiveness, safety studies, or cost data - difficult to make evidence-based recommendations iv. HTA - focused on specific technologies, principally in fee-for-service structures.

Author, publication year	Description on disinvestment process / methods					Facilitators and Challenges in implementation	
	Identification	Prioritization	Assessment	Decision	Dissemination	Facilitators	Challenges
Leggett et al., 2012	Depends on programmes / specific country (e.g., NICE initiative, Choosing Wisely, GuNFT, etc.)	<ul style="list-style-type: none"> i. Using existing tools for priority setting in resource allocation (similar with HTA) ii. PriTec Tool iii. "One in, one out" policy 	<ul style="list-style-type: none"> i. HTA (majority) ii. PBMA 	Not mentioned	<ul style="list-style-type: none"> i. HTA reports ii. "Do Not Do" databases iii. Choosing Wisely database iv. Technical reports and commissioning guides 	A standard and tested approach for HTR which include stakeholder engagement in addressing resource allocation - enable more countries to begin reassessing health technologies.	<ul style="list-style-type: none"> i. Resistance to change practice among clinicians ii. Obtaining buy-in from stakeholders is difficult iii. Additional cost for human and financial resources

SUPPLEMENTARY DOCUMENTS

Supplementary Table 1: Identified Unique Terms On De-Adoption Process

1. Disinvest*	23. Remov*
2. Decrease use	24. Replace
3. Discontinuu*	25. Refute
4. Abandon*	26. Overuse
5. Reassess*	27. Stop*
6. Obsole*	28. Inappropriate use
7. Medical reversal	29. Relinquish*
8. Contradict	30. Ineffective
9. Re-invest	31. Misuse
10. Withdraw*	32. Re-appraisal
11. Reduc*	33. Re-prioritization
12. Decline in use	34. Substitutional re-investment
13. Health technology reassessment	35. Evidence-based reassessment
14. Change in use	36. Clinical re-design
15. De-implement*	37. Disadoption
16. De-list	38. Defunding
17. Low value practice/intervention	39. Resource release
18. Change in practice	40. Withdrawing from a service and redeploying resources
19. De-adopt*	
20. De-commission	41. Redeploy
21. Do not do	42. Reversal
22. Reallocation	43. Drop in use

Source : Niven DJ, Mrklas KJ, Holodinsky JK, Straus SE, Hemmelgarn BR, Jeffs LP, et al. Towards understanding the de-adoption of low-value clinical practices: A scoping review. *BMC Med.* 2015;**13**:255.

Supplementary Table 2: The Search String Using Web of Science and Scopus (first round of search was done on 4 February 2021 and repeated on 3 January 2022)

Database	Search string
Web of Science	TS=((“disinvest*” OR “defund*” OR “health technology reassess*” OR “resource reallocation” OR “de-implement*” OR “de-list*” OR “obsolete technolog*” OR “obsolete practi*” OR “evidence-based reassess*” OR “de-commission*” OR “discontinue*” OR “low value practi*” OR “low value technolog*” OR “health technology assessment”) AND (“healthcare” OR “health care”))
Scopus	TITLE-ABS-KEY((“disinvest*” OR “defund*” OR “health technology reassess*” OR “resource reallocation” OR “de-implement*” OR “de-list*” OR “obsolete technolog*” OR “obsolete practi*” OR “evidence-based reassess*” OR “de-commission*” OR “discontinue*” OR “low value practi*” OR “low value technolog*” OR “health technology assessment”) AND (“healthcare” OR “health care”))

Supplementary Table 3: Search Strategy Using OVID Medline (using Boolean operator, phrase searching, truncation, wild card, and MeSH terms)

DATABASE: Ovid MEDLINE(R) and Epub Ahead of Print, In-Process & Other Non-Indexed Citations, Daily and Versions(R) <1990 to February 04, 2021>

-
- 1 Resource Allocation/
 - 2 (allocative adj1 efficiency).tw.
 - 3 (resource adj1 allocation*).tw.
 - 4 disinvest*.tw.
 - 5 discontinu*.tw.
 - 6 reassess*.tw.
 - 7 TECHNOLOGY ASSESSMENT, BIOMEDICAL/
 - 8 biomedical technolog* assessment*.tw.
 - 9 technology assessment*, biomedical.tw.
 - 10 health technolog* assessment*.tw.
 - 11 assessment*, health technolog*.tw.
 - 12 technology assessment*, health.tw.
 - 13 (obsolete adj1 technolog*).tw.
 - 14 (obsolete adj1 practice*).tw.
 - 15 medical reversal*.tw.
 - 16 re-invest*.tw.
 - 17 Health technology reassessment*.tw.
 - 18 De-implement*.tw.
 - 19 De-list*.tw.
 - 20 low value practice*.tw.
 - 21 low value intervention*.tw.
 - 22 de-commission*.tw.
 - 23 re-allocation*.tw.
 - 24 reallocation*.tw.
 - 25 Evidence-based reassessment*.tw.
 - 26 defund*.tw.
 - 27 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23 or 24 or 25 or 26
 - 28 DELIVERY OF HEALTH CARE/
 - 29 27 and 28
 - 30 limit 29 to (English language and last 20 years)
 - 31 limit 30 to "reviews (best balance of sensitivity and specificity)"
- *****

Supplementary Table 4: The Inclusion and Exclusion Criteria

Criterion	Eligibility	Exclusion
Research type	Review articles	Book series or chapter, primary study, case study, conference proceeding, abstract, poster, technical report (organisational or government policy document), opinion paper, commentary
Language	English	Non-English
Publication date	Between 2001 and February 2021	Published <2001
Review type	Systematic review, scoping review, pragmatic review, overview, interpretative review, critical interpretative synthesis	Narrative review
Components covered in the review	<ol style="list-style-type: none"> 1. Terms and concepts related to disinvestment 2. Description on disinvestment programme, tools or propose new framework 3. Description of “not to do” recommendations, no or low value technologies, practices, or services 4. Methods on decision-making related to disinvestment of health technologies 5. Stakeholder involvement in disinvestment process 	<ol style="list-style-type: none"> 1. Description of terms unrelated to disinvestment or health technology reassessment 2. Disinvestment in other field (not healthcare)

Supplementary Table 5: Summary of included reviews on type and number of articles, concepts and terms, purpose of disinvestment, implementation and areas of disinvestment, and new framework proposed for disinvestment or health technology reassessment

Author & publication year	Review type & number of articles included	Clarifying concepts and terms for disinvestment (Yes / No)	Purpose of disinvestment	Disinvestment implementation (Local / Country-level / Regional / International / Not specified)	Areas of disinvestment (general / pharmaceuticals / non-pharmaceuticals)	Propose framework for disinvestment / HTR
Walsh-Bailey et al., 2021	Scoping review of frameworks and models in healthcare, public policy, business fields (n=27)	No	Based on action targets for the interventions (reduce, replace, restrict, and remove)	Not specified	General	No
Mitchell et al., 2021	Systematic review of qualitative studies (n=12)	No	(i) Resource reallocation (ii) Cost-effective spending (iii) Benefits to patients and community	Not specified	Non-pharmaceuticals	No
Embrett et al., 2020	Systematic review of qualitative studies (n=106)	Yes - to provide clarity and enhance communication	Resource withdrawal	Not specified	General	No
Esandi et al., 2020	Interpretative review (n=17)	No	(i) Optimisation of care (ii) Resource reallocation	Not specified	General	Yes - ATM framework (to guide the strategies in identifying candidates for disinvestment)
Calabrò et al., 2018	Systematic review of deliverables from European HTA organisations (n=10)	No	(i) Sustainability of healthcare system (ii) Availability of new health technologies (iii) Resource constraints	Regional (European HTA agencies)	General	No
Soril et al., 2018	Overview of systematic reviews (n=not mentioned) followed by expert stakeholder consultation	Yes - to provide a clearer vision regarding managing existing technologies in the system	For optimal technology use	Not specified	General	Yes - a structured 6-questions approach to frame optimal technology use in guiding the HTR

Author & publication year	Review type & number of articles included	Clarifying concepts and terms for disinvestment (Yes / No)	Purpose of disinvestment	Disinvestment implementation (Local / Country-level / Regional / International / Not specified)	Areas of disinvestment (general / pharmaceuticals / non-pharmaceuticals)	Propose framework for disinvestment / HTR
Agirrezabal et al., 2017	Systematic review of published and unpublished articles (n=11) followed by online questionnaire	No	(i) Resource reallocation (ii) Re-investment in health technologies with better value (iii) Sustainability of healthcare system	Regional (Latin America countries)	General	No
Chambers et al., 2017	Systematic review of empirical evaluations of disinvestment initiatives (n=18) and identifying international programmes	No	(i) Invest in higher value care (ii) Increase health care efficiency	International	General	No
Maloney et al., 2017	Systematic literature review (n=40)	Yes - the use of more neutral terms, such as "reassessment," could improve stakeholder (clinicians, patients, industry) engagement.	(i) Optimizing the use of a drug technology (ii) Improving the efficiency and quality of health care	International	Pharmaceuticals	No
Orso et al., 2017	Systematic literature review (n=38) with data collection on socio-economic indicators and the existence of HTA agency/ies from countries in OECD, BRICS and Indonesia	No	(i) Resources re-allocation (ii) Supporting policy makers in disinvestment decisions (iii) Improving quality of care (iv) Rationalization of resources	International and Regional (OECD countries, BRICS [Brazil, India, China, South Africa] and Indonesia)	General	No
Seo et al., 2016	Systematic literature review (n=45) followed by interviews with experts from NICE (UK) and Osteba (Spain)	No	(i) Increase the efficiency and quality of care (ii) Enhance the optimal use of health technologies (iii) Value for money/cost-effective	International and Country-specific (UK, Canada, Australia, Spain)	General	Yes - HTR process for South Korean

Author & publication year	Review type & number of articles included	Clarifying concepts and terms for disinvestment (Yes / No)	Purpose of disinvestment	Disinvestment implementation (Local / Country-level / Regional / International / Not specified)	Areas of disinvestment (general / pharmaceuticals / non-pharmaceuticals)	Propose framework for disinvestment / HTR
Mayer et al., 2015	Systematic literature review (n=120) followed by questionnaire and interviews with international experts	Yes (no specific reason mentioned)	(i) Improve quality of health care and patient safety (ii) Reduction of the waste of resources (iii) Reallocation of resources	International	General	No
Niven et al., 2015	Systematic literature review (n=109)	Yes – to provide guide for the de-adoption of services and clinical practices, and directing future research (no clear, established taxonomy for de-adoption)	Resource optimisation	International	General	Yes - synthesis model for de-adoption process
Parkinson et al., 2015	Systematic literature review (number of articles included not mentioned)	No	Reallocation to higher value interventions	Country-specific (UK, France, Canada, Australia and New Zealand)	Pharmaceuticals	No
Garner et al., 2013	Selective review of Cochrane systematic reviews - scan the 'implications for practice' section in the authors' conclusions of new or updated Cochrane reviews (n=28)	No	Not mentioned	Not specified (using Cochrane reviews as identification tool for disinvestment)	General	No
Polisena et al., 2013	Systematic literature review of disinvestment case studies (n=14)	No	Resource re-allocation to more beneficial services / programmes	International	General	No

Author & publication year	Review type & number of articles included	Clarifying concepts and terms for disinvestment (Yes / No)	Purpose of disinvestment	Disinvestment implementation (Local / Country-level / Regional / International / Not specified)	Areas of disinvestment (general / pharmaceuticals / non-pharmaceuticals)	Propose framework for disinvestment / HTR
Leggett et al., 2012	Systematic literature reviews (n=36)	Yes - to differentiate between "disinvestment" and "health technology reassessment"	(i) Minimise waste and inefficiency (ii) Reduce harms and variation in practice (iii) Maintaining quality of care (iv) Sustainability of health care system (v) Optimal use of technology	International	Non-pharmaceuticals	No

For Peer Review

Supplementary Table 6: The main themes and sub-themes for Purpose of Disinvestment

Authors	Value-based spending			Resource re-allocation			Improving quality of health care					Informed policy-making		
	CE	RW	SH	FR	RHT	SR	IB	RNV	OES	VP	IQW	SDP	RR	BG
<i>Walsh-Bailey (2021)</i>		√			√			√						
<i>Mitchell (2021)</i>	√			√			√							
<i>Embrett (2020)</i>						√								
<i>Esandi (2020)</i>				√					√					
<i>Calabrò (2018)</i>			√		√									√
<i>Soril (2018)</i>									√					
<i>Agirrezabal (2017)</i>			√	√	√									
<i>Chambers (2017)</i>					√						√			
<i>Maloney (2017)</i>									√		√			
<i>Orso (2017)</i>				√							√	√	√	
<i>Seo (2016)</i>	√								√		√			
<i>Mayer (2015)</i>		√		√							√			
<i>Niven (2015)</i>									√					
<i>Parkinson (2015)</i>					√									
<i>Polisena (2013)</i>					√									
<i>Leggett (2012)</i>		√	√						√	√	√			
Value-based spending			Resource re-allocation			Improving quality of health care					Informed policy-making			
<ul style="list-style-type: none"> • CE = Cost-effective spending • RW = Reduction of the waste • SH = Sustainability of health care 			<ul style="list-style-type: none"> • FR = Reallocation of freed resource • RHT = Reinvestment in health technologies • SR = Shifting resources from one to another 			<ul style="list-style-type: none"> • IB = Increase benefits to patients • RNV = Remove “no added value” technologies • OES = Optimum effectiveness and safety • VP = Reduce variation in practice • IQW = Improve quality and widen service provision 					<ul style="list-style-type: none"> • SDP = Support decision and policy-making • RR = Rationalization of resource allocation • BG = Addressing budgetary gaps 			

Supplementary Table 7: Elements in Identification Process of Disinvestment

Triggers for Identification of Candidates	Implementation of Identification Process
<ul style="list-style-type: none"> • Presence of new research evidence • Conflicting practice to clinical practice guidelines (CPG) / recommendations • Variations in care / practice • Evidence of public interest or controversies • Harmful to patients (safety issues) • Decreased frequency of use • Low-value interventions / practices • Presence of new technology • Legacy technologies • Leakage / indication creep 	<ul style="list-style-type: none"> • Ad hoc identification method • Embedded identification method • Fixed time for reassessment • Criteria-based identification method • Identification through established methods / frameworks / tools • Efficient, systematic and transparent processes • "One-in-one-out" policy
Source for Identification Process	
<ul style="list-style-type: none"> • Scientific evidence (Clinical guideline, Cochrane Reviews, HTA reports, literature / publications) • Consultation with experts (clinical specialist, technical advisory committee, programme coordinator) • Administrative record / databases (e.g. utilisation, prescription, adverse events databases) 	

Supplementary Table 8: Tools and Criteria in the Prioritization Process

PriTec Prioritization Tool (AVALIA-T)	Other Prioritization Criteria
<p>Domain 1: Population / Users</p> <ul style="list-style-type: none"> • Burden of disease / disease frequency • Frequency of technology use • Patients preferences <p>Domain 2: Risk / benefits</p> <ul style="list-style-type: none"> • Efficacy / effectiveness / validity • Adverse effects • Risks if de-adoption / disinvestment takes place <p>Domain 3: Cost / Organisation / Others</p> <ul style="list-style-type: none"> • Efficiency • High budget of technology (e.g. maintenance costs) 	<ul style="list-style-type: none"> • Evidence of futility • Promising evidence on existing alternative • Not for vulnerable populations • Small benefits (lack of improvement for health) • Time-based / duration (technology life cycle) • Strength of evidence on lack of efficacy • Using existing tools for priority setting (e.g. tools for HTA / Early Awareness and Alert Systems / Horizon Scanning) • Opportunity cost