

## Strategies to reduce waiting times in outpatient rehabilitation services for adults with physical disabilities: A systematic literature review

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## Strategies to reduce waiting times in outpatient rehabilitation services for adults with physical disabilities: A systematic literature review

### Abstract

**Objective:** Identifying effective strategies to reduce waiting times is a crucial issue in many areas of health services. Long waiting times for rehabilitation services have been associated with numerous adverse effects in people with disabilities. The main objective of this study was to conduct a systematic literature review to assess the effectiveness of service redesign strategies to reduce waiting times in outpatient rehabilitation services for adults with physical disabilities.

**Methods:** We conducted a systematic review, searching three databases (MEDLINE, CINAHL and EMBASE) from their inception until May 2021. We identified studies with comparative data evaluating the effect of rehabilitation services redesign strategies on reducing waiting times. The Mixed Methods Appraisal Tool was used to assess the methodological quality of the studies. A narrative synthesis was conducted.

**Results:** Nineteen articles including various settings and populations met the selection criteria. They covered physiotherapy (n=11), occupational therapy (n=2), prosthetics (n=1), exercise physiology (n=1) and multidisciplinary (n=5) services. The methodological quality varied (n=10 high quality, n=6 medium, n=3 low); common flaws being missing information on the pre-redesign setting and characteristics of the populations. Seven articles assessed access processes or referral management strategies (e.g. self-referral), four focused on extending/modifying the roles of service providers (e.g. to triage), and eight changed the model of care delivery (e.g. mode of intervention). The different redesign strategies had positive effects on waiting times in outpatient rehabilitation services.

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3 **Conclusions:** This review highlights the positive effects of many service redesign strategies. These  
4 findings suggest that there are several effective strategies to choose from to reduce waiting times  
5 and help better respond to the needs of persons experiencing physical disabilities.  
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### 11 **Keywords**

12 waiting times, service redesign strategies, rehabilitation  
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### 19 **Introduction**

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21 Access to health care has been defined by Levesque et al. as ‘the possibility to identify healthcare  
22 needs, to seek healthcare services, to reach the healthcare resources, to obtain or use healthcare  
23 services, and to actually be offered services appropriate to the needs for care’.<sup>1(p4)</sup> Long waiting  
24 times are one of the main barriers to access experienced by patients in different health care sectors,  
25 including medical and paramedical services.<sup>2,3</sup> In health care, the concept of waiting can be  
26 expressed in different ways, but is most commonly measured as the time elapsed between referral  
27 for a service and first appointment.<sup>4,5</sup>  
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40 Findings to date have highlighted major gaps and disparities in access to publicly funded outpatient  
41 rehabilitation services in several countries, such as Canada, the United Kingdom (UK) and  
42 Australia.<sup>6-10</sup> Long waiting times in accessing public outpatient rehabilitation services for people  
43 with physical disabilities contribute, for instance, to the deterioration of health, more pain and  
44 disabilities, poor quality of life and psychological symptoms.<sup>4,11</sup> While some patients turn to the  
45 private sector to obtain services (when available), many are unable to afford them, which raises  
46 important equity and ethics-related issues.<sup>4,12</sup> These findings highlight the need for effective  
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3 strategies to reduce waiting times in public rehabilitation services and ensure equitable access to  
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5 services.  
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10 Previous work on efforts to improve access to health care have mostly been in areas such as  
11 hospital emergency departments,<sup>13</sup> primary medical care (e.g. access to a family physician)<sup>14</sup> or  
12 surgery (e.g. cancer, hip/knee replacement).<sup>15</sup> Strategies for the redesign of services, defined as  
13 creating or changing the processes of health care activities, at any level of the continuum of care,<sup>14</sup>  
14 are promising strategies to improve access to services. Redesign strategies have been examined  
15 for different rehabilitation services, such as outpatient physiotherapy (PT) services, ambulatory  
16 services for people with chronic diseases, occupational therapy (OT) services and pediatric  
17 rehabilitation services. Reported redesign strategies include reviewing admission procedures,  
18 changing personnel delivering interventions (e.g. therapists vs technicians) or modes of  
19 interventions (e.g. group vs individual, telerehabilitation). However, their effects on waiting times  
20 are still not well known.<sup>6,8,14,16-21</sup> Because of the negative consequences associated with long  
21 waiting times, identifying effective and efficient redesign strategies to reduce waiting times for  
22 outpatient rehabilitation services for persons with physical disabilities is crucial. To our  
23 knowledge, no systematic review has appraised the existing literature on this specific topic.  
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45 The main objective of this study was to perform a systematic review of the literature to assess the  
46 evidence on the effectiveness of service redesign strategies to reduce waiting times for outpatient  
47 rehabilitation services for adults with physical disabilities. A secondary objective was to appraise  
48 the effectiveness of service redesign strategies on other outcomes, such as patient satisfaction and  
49 cost-effectiveness.  
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5 The protocol for this systematic review was registered in the PROSPERO database (ID:  
6 CRD42020157535). Preferred Reporting Items for Systematic Reviews and Meta-analyses  
7 (PRISMA) guidelines were followed to report methods and results.<sup>22</sup>  
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## 14 **Methods**

### 15 *Search strategy*

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17 Three databases were searched from their inception to May 5<sup>th</sup>, 2021. MEDLINE (Ovid), CINAHL  
18 and EMBASE. A combination of keywords, MeSH terms and Boolean operators was used. The  
19 complete search strategy for each database is presented in Table S1 (Online Supplement 1).  
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### 28 *Study selection*

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30 Included studies had to meet the following criteria: (1) be an original study evaluating the  
31 effectiveness of a redesign strategy to reduce waiting times for an adult outpatient rehabilitation  
32 service targeting persons with physical disabilities, (2) report comparative data, such as pre/post  
33 comparisons, on waiting times for accessing outpatient rehabilitation services (or the size of the  
34 waiting list), (3) be published in a peer-review journal, and (4) be written in English or French as  
35 these two languages could be read by the authors. Rehabilitation services were defined as those  
36 that are typically provided by members of the allied health professions (mainly physiotherapists,  
37 occupational therapists, speech and language therapists, social workers, nutritionists and  
38 psychologists) to optimize functioning and to reduce impairments, activity limitations, and/or  
39 participation restrictions for adults with physical disabilities.<sup>23</sup> Physical disability was defined  
40 based on the World Health Organization's definition of disability as representing an umbrella term  
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3 including impairments, activity limitations and participation restrictions<sup>24</sup> and was considered to  
4 relate to hearing, vision, language or motor activities.<sup>25</sup> Outpatient services were understood to be  
5 those provided outside of a bed-based setting, such as in hospital outpatient departments,  
6 community centres, day rehabilitation centres, home care, or primary care settings.<sup>25</sup> They  
7 consequently excluded settings such as inpatient residential or hospital services, and hospital  
8 medical emergency department services. Waiting times was defined as time elapsed from referral  
9 to start of rehabilitation care.<sup>4,5</sup> The latter was defined as the first contact that provides a  
10 meaningful service that fits within the definition of rehabilitation services above - for example, it  
11 would not include a phone call to acknowledge a referral, gather data, aid in a triage process, or  
12 let someone know that he/she has been put onto a waiting list. We also excluded studies that  
13 reported the effect of a redesign strategy to reduce waiting times to receive a medical intervention  
14 (such as surgery) without reporting waiting times to obtain rehabilitation services. Detailed  
15 selection criteria are presented in Table S2 (Online Supplement 1).  
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### 35 *Screening and selection process*

36 Data retrieved from the databases were exported to Endnote (EndNote X9, *Clarivate Analytics*),  
37 and to Covidence (Covidence systematic review software, *Veritas Health Innovation*). After  
38 removal of duplicates, two reviewers independently screened the title and abstracts of studies  
39 against selection criteria using Covidence. Full texts of the remaining articles were retrieved and  
40 again independently assessed by two reviewers to determine their eligibility. At each stage, any  
41 discrepancies between reviewers were resolved by consensus. If the disagreement could not be  
42 resolved, a third reviewer was consulted. Studies selected for inclusion, as well as relevant review  
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3 papers identified during the search, had their reference lists checked and citations tracked to  
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5 identify further studies that met the inclusion criteria.  
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### 8 9 10 *Methodological quality assessment*

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12 The assessment of the methodological quality of the studies was conducted using the Mixed  
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14 Methods Appraisal Tool.<sup>26</sup> The choice of tool was based on an expectation that the search would  
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16 result in studies with diverse designs. The tool has been used repeatedly in reviews in health  
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18 services research and contains specific sets of criteria that allow appraisal of all types of empirical  
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20 studies. The ratings of each criterion are reported as recommended by the authors of the tool.<sup>26</sup> In  
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22 addition, to synthesize and allow a classification of the methodological quality, an overall rating  
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24 score was calculated, ranging from 0 (i.e. 0 criteria were met) to 5 (i.e. 5 of the 5 criteria were  
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26 met).<sup>26</sup> Studies were then classified as low quality (LQ) (0 or 1 of the 5 criteria were met), medium  
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28 quality (MQ) (2 or 3 of the 5 criteria were met) or high quality (HQ) (4 or 5 of the 5 criteria were  
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30 met) quality studies.<sup>26</sup> Two members of the research team independently assessed the  
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32 methodological quality of each paper. Results were compared and any disagreements discussed  
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34 until consensus was reached. If required, a third reviewer was consulted. A pre-consensus  
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36 interrater agreement was also calculated with SPSS for the final scores (/100) using an intraclass  
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38 correlation coefficient.  
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### 44 45 46 47 *Data extraction and synthesis*

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49 Data extraction was conducted using a pre-designed grid that included the following headings:  
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51 authors, title of publication, year of publication, country, setting, study design, objectives, redesign  
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53 strategies (i.e. interventions), participants' characteristics (comparison and intervention groups),  
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55 data analysis, outcome measures and results. The primary outcome was the effect on waiting times  
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3 or size of the waiting list. Additional outcomes - including patients and therapists' level of  
4 satisfaction with the redesign strategy, clinical outcomes, and failed-to-attend rate - were also  
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6 extracted when available. Data extraction was conducted by one reviewer and validated by a  
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8 second reviewer.  
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14 A meta-analysis methodology was not possible because of the heterogeneity of the studies'  
15 methodologies and outcome measures. A descriptive analysis was judged more appropriate.  
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17 Hence, a narrative synthesis was conducted, including tables illustrating effects on waiting times  
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19 and, when applicable, on the secondary outcomes.  
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## 28 **Results**

### 29 *Description of included studies*

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31 A total of 3804 articles were screened based on their titles and abstracts (Figure 1). After reviewing  
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33 286 full texts, 19 articles were included, reporting the results of 18 studies: two randomized  
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35 controlled trials (in three articles)<sup>27-29</sup> and sixteen observational studies.<sup>17, 30-44</sup>  
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39 To present the effectiveness of redesign strategies on reducing waiting times, redesign strategies  
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41 could be regrouped into three categories to synthesize the findings: (1) access processes or referral  
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43 management (n=7 studies)<sup>17,28,32,38,41,42,44</sup>, (2) roles of service providers (e.g. extending the role of  
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45 a rehabilitation professional to triage) (n=5)<sup>34,35,37,40,43</sup>, and (3) model of care delivery (e.g. mode  
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47 or intensity of intervention, location of intervention) (n=7 articles, 6 studies).<sup>27,28,30,31,33,36,39</sup> More  
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49 detailed characteristics of the included studies are presented in Table 1.  
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### *Settings and populations*

Most studies were conducted in the UK (n=8) and the remaining were conducted in Australia (n=4), Canada (n=2), New Zealand (n=2), the United States (n=2) and Sweden (n=1). The type of rehabilitation services that were targeted varied: 11 of the 18 studies focused on PT,<sup>27,29,33-35,38,40-43,44</sup> two on OT,<sup>31,32</sup> one on prosthetic and orthotic services,<sup>28</sup> one on exercise physiology,<sup>30</sup> two combined PT and OT services,<sup>17,39</sup> and two combined PT and audiology services.<sup>36,37</sup> Sample sizes varied from 30 to 6617 patients. Health conditions treated were musculoskeletal (n=9),<sup>17,27,29,33,38-40,41,44</sup> vestibular (n=2),<sup>37,43</sup> urogynecological (n=3),<sup>34,35,42</sup> and neurological (n=2)<sup>31,36</sup> disorders, while three studies examined respectively people in need of shoe insoles (n=1),<sup>28</sup> cardiac conditions (n=1)<sup>30</sup> and nonspecific disability or illness (n=1).<sup>32</sup>

### *Studied outcomes*

Waiting times were computed in days between referral to the start of rehabilitation intervention. In addition to waiting times, included studies reported different outcomes of redesign strategies, such as patient's level of satisfaction (measured with questionnaires for patient-reported outcomes), clinical outcomes (measured notably using self-administrated questionnaires, e.g. EQ-5D index score, SF36-V2 score) or answers to questions, such as symptom duration and lost work time, failed-to-attend rate, and cost-effectiveness analysis covering outcomes such as health care usage costs (e.g. medical tests, assessments), costs of indemnity, costs associated with productivity loss, costs associated with transportation and missed appointments.

### *Methodological quality of included studies*

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3 In terms of their methodology, 10 articles (53%) were identified as being HQ, as they met 4 or 5  
4 of the quality criteria. Six articles (32%) were classified as MQ as they only met 2 or 3 of the 5  
5 criteria. Three articles (17%) were classified as having LQ because they met only one criterion  
6 (Table 2). The pre-consensus agreement between reviewers was excellent (intraclass correlation  
7 coefficient: 0.94; 95% CI 0.86-0.98). Common flaws were missing information on the pre-redesign  
8 setting and population's characteristics (n=9),<sup>17,32-34,36-38,42,43</sup> which greatly limits the appreciation  
9 and interpretation of the external validity of the reported results. Another significant limitation  
10 observed was that statistical testing was not reported in 53% of the included studies  
11 (n=10).<sup>27,29,32,33,35-37,40,42,43</sup> Detailed results are presented in Table 2.  
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#### 26 *Effects of service redesign strategies that modified access processes or referral management*

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28 Seven studies evaluated strategies that address access processes or referral management, four of  
29 HQ<sup>17,28,33,41,44</sup>, two of MQ<sup>38,42</sup> and one of LQ.<sup>32</sup> They all demonstrated positive effects on waiting  
30 times. Mallet et al. (MQ) and Holdsworth et al. (HQ) examined the impact of patients' self-referral  
31 (i.e. direct access) for PT services instead of GP's or specialist referral.<sup>38,41</sup> They found that self-  
32 referral decreased waiting times by 40.6% (i.e. mean of 32 days to 19 days,  $p < 0.001$ ) and 88.3%  
33 (i.e. 31 days to 3.6 days  $p < 0.001$ ).<sup>38,41</sup> Bishop and Brott (LQ) evaluated the impact of a centralized  
34 clinical triage/waiting list for community OT services (i.e. centralizing requests for rehabilitation  
35 services of different departments/service points).<sup>32</sup> This strategy reduced the mean waiting times  
36 by 13.8% (199.3 to 172.6 days) and the size of the waiting list by 10.5%. Jarl et al. (HQ) evaluated  
37 the impact of a walk-in clinic (i.e. providing care without appointment) instead of scheduled  
38 appointments. This resulted in a 22.9% reduction of the mean waiting times (175 to 135 days,  $p <$   
39  $0.001$ ).<sup>28</sup> Harding et al. (HQ) evaluated a strategy where all clinicians created a specified number  
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3 of assessment times in their weekly schedule, and where patients booked directly without using a  
4 waiting list.<sup>17,445</sup> This strategy led to a decrease in waiting times of 42.9% (i.e. from 17.5 to 10  
5 days [ $p < 0.01$ ])<sup>17</sup> and 22.2% (i.e. 18 to 14 days [ $p < 0.01$ ]).<sup>44</sup> Similarly, Brennen et al. (MQ)  
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8 evaluated a patients-based booking process where patients had to contact the PT department on  
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19 their own to book their initial assessment once the GP referral was received. It led to a 17% waiting  
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19 These studies also reported effects on secondary outcomes such as patient's level of satisfaction  
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(n=2),<sup>28,38</sup> clinical outcomes (n=3),<sup>38,41,44</sup> failed-to-attend rate (n=3),<sup>17,41,42</sup> and time lost from work  
(n=1).<sup>41</sup> Self-referral (i.e. direct access) led to an increased patients' level of satisfaction and was  
reported as cost-effective, as it resulted in a reduction of costs associated with missed appointments  
(i.e. £36.4 savings per patient per episode of care).<sup>38</sup> As for clinical outcomes, direct access  
significantly decreased symptoms duration ( $p = 0.011$ ) and the number of missed work days (mean  
missed work days from 6 to 2.5,  $p = 0.048$ ) in Holdsworth's study,<sup>41</sup> while Mallet et al. did not  
report any significant effect on clinical outcomes (i.e. EQ-5D-5L quality of life scale).<sup>38</sup> Patients'  
direct booking for services had no impact on quality of life and led to a decreased failed-to-attend  
rate, as did self-referral.<sup>17,41,42</sup> Finally, implementing walk-in clinic hours was not associated with  
any impact on patient's satisfaction.<sup>28</sup>

#### *Effects of service redesign strategies extending the role of rehabilitation professionals*

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Five studies focused on extending/modifying the roles of service providers: all of them evaluating  
the impact of extending the scope of rehabilitation professionals' roles to the screening process  
and initial assessment before the beginning of rehabilitation interventions.<sup>34,35,37,40,43</sup> Two were of  
HQ,<sup>34,35</sup> one of MQ<sup>37</sup> and two of LQ.<sup>40,43</sup> They all reported positive outcomes on waiting times.

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3 Lee et al. (MQ) and Kasbekar et al. (LQ) investigated the impact of an allied health professional-  
4 led clinic at triage and initial assessment of patients with vestibular problems instead of the  
5 standard medical triage and management, and both reported a reduction of the mean waiting times  
6 of 61.2% (i.e. 147 to 84 days) and 66.7% (i.e. 63 days to 21 days), respectively.<sup>37,43</sup> Brennen et al.  
7 (HQ) and Howard et al. (HQ) evaluated the impact of an advanced practice PT-led assessment  
8 clinic instead of the usual specialist's triage before referring to urogynecology rehabilitation  
9 services, and reported a reduction of the mean waiting times of 68.1% (i.e. from 386 to 123 days)  
10 and 58.6% (i.e. from 372 to 154 days), respectively.<sup>34,35</sup> Similarly, Rymaszewski et al. (LQ)  
11 reported a 50.5% reduction of the mean waiting times (i.e. from 182 to 90 days) following the  
12 implementation of a PT-led clinic for musculoskeletal disorders.<sup>40</sup>

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29 Only one study reported effects on a secondary outcome: the advanced practice PT-led clinic was  
30 shown to be cost-effective for reducing health care usage associated costs (i.e. cost savings  
31 between \$9 and \$75 per patient).<sup>34</sup>

### 32 33 34 35 36 37 *Effects of service redesign strategies that changed the model of care delivery*

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39 Six studies changed the model of care delivery, including four of HQ<sup>29-31,36</sup> and two of MQ.<sup>33,39</sup>  
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41 The effects on waiting times were positive in each study, except for one.<sup>31</sup> Among the studies,  
42 three changed the *mode of clinical intervention*. Bachmann et al. (HQ) implemented group sessions  
43 instead of standard individual appointments for cardiac rehabilitation.<sup>30</sup> The group sessions  
44 reduced the mean waiting times of 23.6% (i.e. from 19.5 to 14.9 days).<sup>30</sup> Barlow et al. examined  
45 offering telerehabilitation to out-of-region patients instead of standard face-to-face appointments  
46 (HQ).<sup>31</sup> Their strategy did not result in any change in mean waiting times (29.2 vs 31.8 days [p >  
47 0.05]).<sup>31</sup> Salisbury et al. (HQ, also reported by Hollinghurst et al. [MQ]) similarly, used phone  
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3 assessments (i.e. PhysioDirect service) instead of standard face-to-face appointments.<sup>27,29</sup> They  
4 found decreased mean waiting times of 79.4% (i.e. from 34 to 7 days).<sup>27,29</sup> Two studies evaluated  
5 changes made to the *personnel delivering the intervention* (without extending their usual role).  
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7 Phillips et al. (MQ) focussed on implementing multidisciplinary teams for the initial assessment  
8 of injured workers (i.e. a multidisciplinary assessment instead of distinct assessments by each  
9 professional).<sup>39</sup> This decreased mean waiting times for PT services by 100% (i.e. from 49 to 0 days  
10 [p < 0.000]) and 88.9% for OT services (i.e. from 48.1 days to 5.3 days [p < 0.000]).<sup>39</sup> Boak et al.  
11 (MQ) examined the impact of trained specialized physiotherapist teams evaluating and treating  
12 persons presenting specific conditions (e.g. a specialized physiotherapists team for low back  
13 pain).<sup>33</sup> They found a decreased mean waiting times of 32% (e.g. from 37.1 to 25.2 days).<sup>33</sup> The  
14 last study, Langstaff et al. (HQ), changed the intensity of interventions by adopting an intensive  
15 in-home rehabilitation service after stroke (e.g. increased OT and PT visits per week).<sup>36</sup> This  
16 resulted in the reduction of mean waiting times by 90% (e.g. from 44 to 4.4 days), which was  
17 explained by the reduction of the total number of visits per professional following the  
18 implementation of the enhanced rehabilitation programme.<sup>36</sup>

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40 Some of these studies also reported effects on other outcomes, such as patient's level of satisfaction  
41 (n=3),<sup>27,31,33</sup> clinical outcomes (n=2),<sup>27,39</sup> failed-to-attend rate (n=1),<sup>27</sup> and cost-effectiveness  
42 (n=3).<sup>27,29,36,39</sup> Telerehabilitation and specialized physiotherapists teams did not have any effect on  
43 patient's level of satisfaction, but the authors mentioned that patients' level of satisfaction  
44 remained high following the interventions.<sup>31,33</sup> In contrast, PhysioDirect services led to a reduction  
45 of patient's level of satisfaction, but decreased the failed-to-attend rate.<sup>27</sup> The two studies that  
46 evaluated the effects on clinical outcomes and time lost from work did not report any changes.<sup>27,39</sup>



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3 Finally, changing the model of care delivery was found to be cost-effective in two studies, while  
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5 no impact was reported in two others: intensive in-home rehabilitation care reduced hospital costs  
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7 (i.e. estimated regional cost-saving of \$1.3 million annually),<sup>36</sup> multidisciplinary initial assessment  
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9 reduced indemnity costs (i.e. \$3,107.18 to \$884.04 per claim) and total costs of claims (i.e. from  
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11 \$4,873 to \$2,649.24 per claim), but had no effect on health care usage costs (i.e. number or therapy  
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13 visits, medical consultations).<sup>39</sup> PhysioDirect did not show any impact on health care usage when  
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15 compared to face-to-face assessments.<sup>27,29</sup>  
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## 21 **Discussion**

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23 Given that prolonged waiting times is known to have detrimental effects on pain severity,  
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25 functional disability, quality of life and psychological health,<sup>4,11,47</sup> this systematic review aimed to  
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27 assess the evidence on the effectiveness of service redesign strategies to reduce waiting times in  
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29 outpatient rehabilitation services for adults with physical disabilities. Eighteen studies, mostly of  
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31 high quality (10 out of 18), were identified. The studies varied in settings and populations. All of  
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33 them were carried out in developed countries.<sup>48</sup> All service redesign strategies identified had  
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35 positive effects on waiting times, which suggests that some actions can be taken to address the  
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37 crucial waiting times issue. These strategies include implementing direct access to care services,  
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39 allowing patients to book their own appointments, extending the role of allied-health professionals,  
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41 and changing intervention mode by offering group sessions or remote rehabilitation services.  
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49 Results from Mallet et al. and Holdsworth et al.'s studies,<sup>38,41</sup> which reported on the effects of  
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51 direct access to PT services, are in line with findings from a previous review by Robert et al. that  
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53 compared different existing models of PT services (i.e. no redesign interventions).<sup>49</sup> They found  
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3 that under direct access schemes, waiting times for treatment are significantly lower than those  
4 where PT services are accessible via medical referral. Hence, this redesign strategy appears to be  
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8 effective to reduce waiting times in outpatient rehabilitation services. Our findings also showed  
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10 that centralizing clinical triage waiting lists, allowing patients to book their own appointments and  
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13 introducing walk-in clinic hours were effective redesign strategies.

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17 Changing the roles of rehabilitation professionals was the most studied strategy. The results are  
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19 consistent with those of previous reviews, which explored strategies to reduce waiting times for  
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21 medical services (e.g. waiting times for specialist assessment).<sup>15,50</sup> These concluded that extending  
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23 rehabilitation professionals' roles (e.g. physiotherapists, occupational therapists) to include tasks,  
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25 such as initial assessment and triage, was effective in reducing waiting times before accessing  
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27 medical specialists' services (i.e. orthopedists, rheumatology and neurosurgery).<sup>15</sup> Such strategies  
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29 reduce waiting times when implemented in medical care settings, but also seem effective when  
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31 introduced regarding rehabilitation services, as shown in our review. This could be explained by  
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33 the fact that such strategies allow an accurate identification of patients requiring rehabilitation  
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35 services or medical management, a better referral to appropriate services without multiple  
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37 assessments, and thereby, a better usage of time and human resources.<sup>15,50</sup>  
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45 As for strategies that changed the model of care delivery, increasing the intensity of rehabilitation  
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47 care (i.e. increasing weekly visits to reduce therapy's length),<sup>36</sup> developing initial assessments by  
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49 multidisciplinary teams (instead of separate initial assessment),<sup>39</sup> conducting assessments and  
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51 delivering advice by phone,<sup>27,29</sup> as well as implementing specialized teams for specific  
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53 musculoskeletal conditions,<sup>33</sup> were all effective for reducing waiting times. Redesign strategies for  
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3 remote interactions with therapists (e.g. telerehabilitation) demonstrated conflicting results on  
4 waiting times. Still, these results should be interpreted with caution as the study that reported no  
5 effect on waiting times associated with telerehabilitation had a small sample size (n=30),<sup>31</sup> while  
6 the study that reported a positive effect had 2256 participants.<sup>27</sup> In medical services, telehealth has  
7 been associated with a reduced waiting times to specialists' diagnosis.<sup>51</sup> Telehealth has also been  
8 found to have other benefits than reducing waiting times, such as making services more accessible  
9 (e.g. for people unable to travel).<sup>52</sup>

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12 Regarding effects on other outcomes, we found that direct access to rehabilitation services was  
13 shown to be associated with same or improved patient satisfaction,<sup>38</sup> clinical outcomes (i.e. quality  
14 of life and duration of symptoms),<sup>41</sup> and higher cost-effectiveness.<sup>38,41</sup> Two previous reviews  
15 evaluating the effects of direct access to PT compared to GP referral reported similar results,  
16 including higher patient satisfaction, quality of life and cost-effectiveness.<sup>15,53</sup> The authors  
17 hypothesized that the decrease of waiting times for services could be a factor indirectly explaining  
18 these positive impacts on other outcomes, as long waiting times are known to impact quality of  
19 life and psychological health, further supporting the importance of taking action to reduce waiting  
20 times.<sup>4,11,49,53,54</sup>

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23 A surprising result is the lower patient satisfaction associated with a phone-based initial  
24 assessment, despite the reduction in waiting times.<sup>27</sup> As discussed in a previous review, a  
25 disadvantage of telerehabilitation is patient potential skepticism about remote interactions with  
26 their therapist, which could, at least partly, explain these findings.<sup>52</sup> Indeed, patients have long  
27 been accustomed to talking face-to-face with their health care professional, which promotes good

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3 therapeutic relationships and helps the working alliance. Even though telehealth has been  
4 demonstrated to be as effective as face-to-face appointments for clinical outcomes (e.g. pain  
5 intensity, functional limitations, and quality of life)<sup>52</sup> and may lead to reduced waiting times, these  
6 benefits need to be weighed up against potential disadvantages related to engagement and  
7 satisfaction.  
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### 14 15 16 17 **Limitations**

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19 There are six limitations to this review that need to be considered in the interpretation of the  
20 findings. First, although many strategies were found to positively impact on waiting times in the  
21 current review, each strategy is only supported by the results of a few studies, which highlights the  
22 need for further research on this subject. It is possible that the highly positive results found reflect  
23 publication bias, knowing that negative findings have traditionally been harder to publish. Second,  
24 several included studies did not conduct statistical analysis, which makes it hard to conclude on  
25 the magnitude of the effects reported. Third, types of population, settings (including health care  
26 systems), and sample size were heterogenous among included studies. These are all factors that  
27 need to be taken into account before generalizing the results in this review to a particular practice  
28 setting. For example, some redesign strategies may not be adapted and effective to other  
29 populations than those reported (e.g. telerehabilitation for older people who present a lower level  
30 of numeracy).  
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47 Fourth, most included studies reported little to no information about the implementation process  
48 of the redesign strategies (e.g. time, financial and human resources required). These factors may  
49 significantly influence the feasibility and impacts of any given redesign strategies and, thus, make  
50 it more difficult to judge the applicability of such innovations in practice. Fifth, there is a lack of  
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3 evidence to strongly recommend the application of any of the strategies in a specific context. Sixth,  
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5 as this review aimed to include studies that reported waiting times as an outcome, the search  
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7 strategy was not inclusive of all studies that might have evaluated the effects of a redesign strategy  
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9 on the secondary outcomes presented in this review. These limitations should be considered when  
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11 analyzing the effects reported on secondary outcomes.  
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15 In sum, there is currently no guidance on the size of a meaningful improvement in waiting times  
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17 for persons seeking to receive rehabilitation services. Nonetheless, many HQ and MQ studies  
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19 reported high percentages of improvement following implementation of service redesign  
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21 strategies.  
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## 24 25 26 **Conclusions**

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28 This review aimed to assess the evidence on the effectiveness of service redesign strategies to  
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30 reduce waiting times for outpatient rehabilitation services for adults with physical disabilities.  
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32 Based on 18 studies with varying methodological quality, different service redesign strategies have  
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34 the potential to reduce waiting times. These strategies include implementing direct access to  
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36 services, allowing patients to book their own appointments, extending the role of rehabilitation  
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38 professionals, and changing intervention mode by offering group sessions or remote rehabilitation  
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40 services. Several redesign strategies were also shown to be cost-effective and to maintain great  
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42 clinical outcomes.  
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47 Based on our results, service redesign strategies should be considered to reduce waiting times to  
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49 outpatient services and better respond to the needs of persons experiencing physical disabilities.  
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51 However, the implementation of a redesign strategy depends on several factors, such as population,  
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53 type of service and resources available. While the results of the current study do not allow to  
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3 conclude whether some strategies are more useful than others, this may indicate that selecting and  
4 tailoring any strategy to the local context may lead to positive effects.  
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### 11 **Declaration of conflicting interests**

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13 The authors declare that there is no conflict of interest.  
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### 18 **Ethics approval**

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20 Ethics approval was not required for this systematic review/research article.  
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Under Review

**Table 1.** Detailed characteristics of the included studies.

Study	Country, Setting	Rehabilitation services involved (Study design)	n and participants' characteristics/ disorders	Redesign strategies (strategy classification)	Effects on waiting times
Bachmann, et al. (2017) <sup>30</sup>	US, Cardiac rehabilitation, Certified medical fitness center	Exercise physiology (Nonrandomized study)	n=603 Patients in need of cardiac rehabilitation	Group session for cardiac rehabilitation and open time blocks for exercising vs usual individual appointments (changed the model of care)	Mean Usual individual appointments=19.5 days Group sessions= 14.9 days 23.6% reduction p < 0.001
Barlow, et al. (2009) <sup>31</sup>	Canada, Community services, seating intervention, secondary care	Occupational therapy (Nonrandomized study)	n=30 Neurological disorders requiring seating intervention	Telerehabilitation vs face-to-face intervention out-of-region patients vs within region (changed the model of care)	Mean ± SD Usual face-to-face intervention: 29.2± 24.63 days Telerehabilitation services: 31.8± 24.63 days 8.9% difference p=0.16
Bishop and Brott (2019) <sup>32</sup>	New Zealand, Community occupational therapy service, secondary care	Occupational therapy (Nonrandomized study)	n=444 Temporary or long-term disability or illness	Centralized waiting list and the booking and scheduling process (addressed access process)	Mean Before implementation=199.3 days Centralised waiting lists=172.6 days 13.8% reduction Waiting lists size=10.5% reduction No statistical testing reported
Boak, et al. (2015) <sup>33</sup>	UK, Community and secondary musculoskeletal care	Physiotherapy (Nonrandomized study)	n=not reported Musculoskeletal problem	A single waiting list Specialized team for particular body part/More time allocated to new patients' appointment rather than old patients appointment/Computer generated notes and standardized assessment protocols. (changed the model of care)	Mean Controls= 37.1 days Intervention=25.2 days 32.0% reduction No statistical testing reported

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3	Brennen, et al.	Australia,	Physiotherapy	n=268	Advanced practice	Mean
4	(2019) <sup>34</sup>	Public health	(Nonrandomized	Gynecology,	physiotherapy-led assessment	Usual medical triage= 386 days
5		clinic;	study)	urogynecology	clinic integrated into the triage	Advanced practice Physical therapy-led clinic= 123 days
6		urogynecology		and urology	and assessment process vs	68.1% reduction
7		services,		outpatients	medical initial assessment and	No statistical testing reported
8		secondary care			triage	
9					(modified the roles of	
10					professionals)	
11	Brennen, et al.	Australia,	Physiotherapy	n=957	Patients-focused booking	Mean
12	(2020) <sup>42</sup>	Public health	(Nonrandomized	Gynecology,	process: Patients had to book	Usual appointments allocation=71days
13		clinic;	study)	urogynecology	their own appointments by	Patients-focussed booking process=59 days
14		urogynecology		and urology	contacting the physiotherapy	17% reduction
15		services,		outpatients	department once the referral	No statistical testing reported
16		secondary care			from the GP was received vs	
17					appointments allocated by the	
18					administrative staff once the	
19					referral was received.	
20					(addressed access process)	
21	Harding, et al.	Australia,	Occupational	n=971	All clinicians created a specified	Mean $\pm$ SD
22	(2013) <sup>17</sup>	Community	therapy and	Musculoskeletal	number of assessment times in	Referrals managed using a waiting list = 17.5 $\pm$ 11.9 days
23		rehabilitation	physiotherapy	problem	their weekly schedule and	Direct booking to protected appointments = 10.0 $\pm$ 8.4 days
24		programme,	(Nonrandomized		patients booked directly without	42.9% reduction
25		secondary care	study)		using a waiting list	p < 0.01
26					(addressed access process)	
27						
28						
29	Harding, et al.	Australia,	Physiotherapy	n=1428	Same as Harding <sup>17</sup> above	Median (IQR/ interquartile range)
30	(2016) <sup>44</sup>	Secondary care	(Nonrandomized	Musculoskeletal	(addressed access process)	Referrals managed using a waiting list =18 (11 to 33) days
31		outpatient	study)	problem		Direct booking to protected appointments =14 (9 to 21) days
32		physiotherapy				22.2% reduction
33		services				p < 0.01
34						
35	Holdsworth, et	UK,	Physiotherapy	n=3010	Self-referral vs GP's referral	Median $\pm$ SD (range)
36	al. (2006) <sup>41</sup>	26 urban and rural	(Nonrandomized	Musculoskeletal	(addressed access process)	GP's referral to physiotherapy=32.0, $\pm$ 29.5, 0 to 153 days
37		GPs and physio	study)	problem		Self-referral (direct access)=19.0, $\pm$ 31.4, 0 to 146 days
38		practices,				40.6% reduction
39		secondary care				p < 0.001
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3	Hollinghurst, et al. (2013) <sup>27</sup>	UK, Community physiotherapy services, secondary care	Physiotherapy (Randomized controlled trial)	n=2249 Musculoskeletal problem	PhysioDirect services: initial assessment and advice from a physiotherapist by phone vs face-to-face assessment (changed the model of care)	Mean (range) Usual face-to-face assessment=34 (20 to 55) days PhysioDirect=7 (4 to 15) days 79.4% reduction 95% CI: 0.32 (0.29 to 0.35)
8	Howard, et al. (2018) <sup>35</sup>	New Zealand, Public urogynecology outpatient clinic, secondary care	Physiotherapy (Nonrandomized study)	n=105 Women with urogynaecology disorders responsive to physiotherapy	Advanced physio-led clinic vs usual care with specialists' triage (modified the roles of professionals)	Median Advanced physio-led clinic vs usual care Usual care=372 days Physio-led clinic=154 days 58.6% of reduction No statistical testing reported
15	Jarl, et al. (2017) <sup>28</sup>	Sweden, Secondary care prosthetic and orthotist services	Prosthetic and Orthotist (Randomized controlled trial)	n=1260 Individuals in need of shoe insoles	Walk-in clinic vs scheduled appointments (addressed access process)	Mean Scheduled appointments=175 days Walk-in clinic=135 days 22.9% reduction p < 0.001
21	Kasbekar, et al. (2014) <sup>43</sup>	UK, Public balance clinic, audiology department, secondary care	Physiotherapy (Nonrandomized study)	n=200 Vestibular dysfunction	Physiotherapist-led clinic (i.e. assessment, diagnosis, treatment and therapies and discharge if applicable) vs usual ENT doctor and audiology services assessment and referral (modified the roles of professionals)	Mean Controls= 63 days Intervention= 21 days 66.7% reduction No statistical testing reported
29	Langstaff, et al. (2014) <sup>36</sup>	Canada, Regional rehabilitation services for stroke (rural), secondary care	Physiotherapy and Audiology (Nonrandomized study)	n=524 Post-stroke patients	Enhanced and intensive in-home rehabilitation services (e.g increased occupational therapy and physiotherapy weekly visits) after stroke vs usual care (changed the model of care)	Mean Usual rehabilitation care=44 days Enhanced and intensive rehabilitation care=4.4 days 90% reduction No statistical testing reported
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3	Lee, et al.	UK,	Physiotherapy and	n=194	Implementation of a	Mean
4	(2011) <sup>37</sup>	Hospital balance	Audiology	Vestibular	multidisciplinary balance clinic	Controls: 147 days
5		clinic, secondary	(Nonrandomized	dysfunction	run by allied health professional	Intervention: 84 days
6		care	study)		vs ENT consultant management	61.2% reduction
7					and referral	No statistical testing reported
8					(modified the roles of	
9					professionals	
10						
11	Mallett, et al.	UK,	Physiotherapy	n=194	Self-referral to physiotherapy vs	Mean ± SD, range
12	(2014) <sup>38</sup>	Urban	(Nonrandomized	Musculoskeletal	GP referral	GP's referral to physiotherapy= 30.99 ±15.4, 0–67 days
13		physiotherapy	study)	problem	(addressed access process)	Self-referral to physiotherapy =3.55± 2.7, 0–12 days
14		service, secondary				88.3% reduction
15		care				p ≤ 0.001
16						
17	Phillips, et al.	US,	Occupational	n=558	Multidisciplinary initial	Mean ± SD
18	(2017) <sup>39</sup>	Healthcare for	therapy and	Injured workers	evaluation (i.e. addition of	<u>Separate evaluation by discipline:</u>
19		injured workers,	Physiotherapy	(Musculoskeleta	physical therapy evaluation at	Physio services= 49.3 ± 40.4 days /Occupational therapy
20		self-insured	(Nonrandomized	l problem)	the point of initial care with the	services= 48.1 ± 26.6
21		healthcare,	study)		team vs usual occupational	<u>Multidisciplinary initial evaluation :</u>
22		secondary care			medicine evaluation alone and	Physio services= 0 days/Occupational therapy services=5.3 ±
23					separate assessment for physical	4 days
24					therapy if needed	Physio= 100% /Occupational therapy=88.9% reduction
25					(changed the model of care)	p = 0.000
26						
27	Rymaszewski,	UK,	Physiotherapy	n=6617	Extended scope: specialist nurse	Mean
28	et al. (2005) <sup>40</sup>	Orthopaedic and	(Nonrandomized	Musculoskeletal	and advanced practice	Usual specialists screening=182 days
29		rheumatology	study)	problem	physiotherapist screen all the	Extended scope=90 days
30		departments			referrals and initial treatment if	50.5% reduction
31		providing			appropriate condition vs	No statistical testing reported
32		musculo-skeletal			orthopedic surgeon/doctors	
33		outpatient care,			screening and referring to	
34		secondary care			physiotherapy /other doctors	
35					(modified the roles of	
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Salisbury et al. (2013) <sup>29</sup>	UK, Community physiotherapy services, secondary care	Physiotherapy (Randomized controlled trial)	n=2256 Musculoskeletal problem	PhysioDirect services: initial assessment and advice from a physiotherapist by phone vs face-to-face assessment (changed the model of care)	Median Face-to-face assessments=34 days PhysioDirect=7 days 79.4% reduction No statistical testing reported
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UK: United Kingdom, US: United States, SD: standard deviation, ENT: Ear nose and throat

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**Table 2.** Methodological evaluation of the included studies using the Mixed Methods Appraisal Tool.

Randomized controlled trials								
Study	Is randomization appropriately performed?	Are the groups comparable at baseline?	Are there complete outcome data?	Are outcome assessors blinded to the intervention provided?	Did the participants adhere to the assigned intervention?	Comments	Global rating score out of 100	Methodological quality
Hollinghurst, et al. (2013) <sup>27</sup>	Cannot tell	Y	N	Cannot tell	Y	Refers to a previous article for methodological information Loss to follow-up >30%	40	MQ
Jarl, et al. (2017) <sup>28</sup>	Y	Y	Y	Cannot tell	Y	No comments	80	HQ
Salisbury, et al. (2013) <sup>29</sup>	Y	Y	Y	Y	Y	No comments	100	HQ
Quantitative nonrandomized trials								
Study	Are the participants representative of the target population?	Are measurements appropriate regarding both the outcome and intervention (or exposure)?	Are there complete outcome data?	Are the confounders accounted for in the design and analysis?	During the study period, is the intervention administered (or exposure occurred) as intended?	Comments	Global rating score out of 100	Methodological quality
Bachmann, et al. (2017) <sup>30</sup>	Y	Y	Y	Y	Y	Methodology clearly described and appropriate. Low risk of bias.	100	HQ
Barlow, et al. (2009) <sup>31</sup>	N	Y	Y	Y	Y	Small sample size (n=30).	80	HQ
Bishop and Brott (2019) <sup>32</sup>	Cannot tell	Cannot tell	Cannot tell	N	Y	No information on pre-intervention population or service organization. No information on total n and follow-up rate.	20	LQ



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No statistical power or variance reported.

Boak, et al. (2015) <sup>33</sup>	Cannot tell	Y	Cannot tell	N	Y	No information on pre-intervention population and setting. No information on follow-up rate. No statistical power/variance reported.	40	MQ
Brennen, et al. (2019) <sup>34</sup>	Y	Y	Y	N	Y	Missing information on preintervention population and setting. No statistical power reported.	80	HQ
Brennen, et al. (2020) <sup>42</sup>	Y	Y	N	Cannot tell	Y	Missing information on preintervention population and setting. No statistical power reported.	60	MQ
Harding, et al. (2013) <sup>17</sup>	Cannot tell	Y	Y	Y	Y	Missing information on group attribution and population.	80	HQ
Harding, et al. (2016) <sup>44</sup>	Y	Y	Y	Y	Y	Methodology clearly described and appropriate. Low risk of bias.	100	HQ
Holdsworth, et al. (2006) <sup>41</sup>	Y	Y	Y	Y	Y	Methodology clearly described and appropriate. Low risk of bias.	100	HQ
Howard, et al. (2018) <sup>35</sup>	Y	Y	Y	N	Y	Missing information on clinical outcomes presented in the methodology and waiting time analysis (comparison between the groups).	80	HQ
Kasbekar, et al. (2014) <sup>43</sup>	N	Cannot tell	N	N	Y	Low participation rate for satisfaction surveys. Missing information on preintervention population and setting, total number of participants not reported. No statistical power reported.	20	LQ

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3	Langstaff, et al.	Cannot tell	Y	Y	N	Y	Missing information on preintervention	80	HQ
4	(2014) <sup>36</sup>						population and setting.		
5							No statistical power reported		
6									
7	Lee, et al.	Cannot tell	N	Y	N	Y	Missing information on preintervention	40	MQ
8	2011) <sup>37</sup>						population and setting.		
9							Missing information on waiting time		
10							measurement.		
11									
12	Mallett, et al.	Cannot tell	Y	N	N	Y	Missing information on control group and	40	MQ
13	(2014) <sup>38</sup>						preintervention setting.		
14							Low participation rate for clinical outcomes		
15							surveys (39%).		
16							Missing information on preintervention		
17							setting and criteria for group attribution.		
18	Phillips, et al.	Y	Y	Cannot tell	Cannot tell	Y	No control for confounding between the	60	MQ
19	(2017) <sup>39</sup>						groups.		
20							No follow-up rate/participation rate.		
21									
22	Rymaszewski,	Cannot tell	Cannot tell	Cannot tell	N	Y	Missing information on outcome	20	LQ
23	et al. (2005) <sup>40</sup>						measurements and responder rate to		
24							surveys.		
25							Missing information on both population		
26							(pre/post intervention) and settings.		
27									

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HQ=High methodological quality, MQ=Medium methodological quality, LQ=Low methodological quality, Y=yes, N=no.

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**Table 3.** Detailed effects of redesign interventions on the different measured outcomes.

1) Redesign strategies that address access processes or referral management without modifying service providers' roles										Quality
Author(s)	Strategies description	Outcomes studied and effects							Quality	
		Waiting time	Waiting list	Satisfaction	Cost effectiveness	Clinical outcomes	Failed to attend rate	Time lost from work		
Bishop et al. <sup>32</sup>	Centralized clinical triage and waiting list for OT services	[+]							LQ	
Brennen et al. <sup>42</sup>	Patients-focused booking process Patients must book their own appointments by contacting the physiotherapy department	[+]					[+]		MQ	
Harding et al. <sup>17</sup>	All clinicians created a specified number of assessment times in their weekly schedule and patients booked directly without using a waiting list	[+]					[+]		HQ	
Harding et al. <sup>44</sup>	Same as Harding 2013 above	[+]				I/I			HQ	
Holdsworth et al. <sup>41</sup>	Self-referral vs GP's referral for physiotherapy services	[+]				[+]	[+]	[+] N participants taking days off N of days off	HQ	
Jarl et al. <sup>28</sup>	Walk-in clinic vs scheduled appointments for orthotic services	[+]	[+]	I/I According to clients					HQ	
Mallett et al. <sup>38</sup>	Self-referral to physiotherapy vs GP referral for physiotherapy services	[+]		[+] According to clients	[+] Cost associated with wasted appointments	I/I			MQ	
2) Redesign strategies that are mainly about modifying the roles of service providers (for example, extending the role of a rehabilitation professional to the screening and prioritizing process)										Quality
Outcomes studied and effects										Quality

Author(s)	Strategies description	Waiting time	Waiting list	Satisfaction	Cost effectiveness	Clinical outcomes	Failed to attend rate	Time lost from work	Quality
Brennen et al. <sup>34</sup>	Advanced practice physiotherapy-led assessment and triage clinic vs specialists' triage	[+]	[+]		[+] Healthcare usage				HQ
Howard et al. <sup>35</sup>	Physiotherapy-led pelvic health clinics to provide care vs specialists' referral	[+]							HQ
Kasbekar et al. <sup>43</sup>	Physiotherapy-led clinic vs usual ENT doctor and audiology services referral	[+]							LQ
Lee et al. <sup>37</sup>	Physiotherapy-led clinic vs usual ENT doctor and audiology services referral	[+]							MQ
Rymaszewski et al. <sup>40</sup>	Specialist nurse and physiotherapist screen referrals GP's and specialist screening and referring	[+]							LQ
<b>3) Redesign strategies s that change a model of care delivery</b>									
<b>Outcomes studied and effects</b>									<b>Quality</b>
Author(s)	Strategies description	Waiting time	Waiting list	Satisfaction	Cost effectiveness	Clinical outcomes	Failed to attend rate	Time lost from work	Quality
Bachmann et al. <sup>30</sup>	Group sessions and open time blocks for cardiac rehabilitation vs usual individual appointments	[+]							HQ
Barlow et al. <sup>31</sup>	Telerehabilitation vs face-to-face OT intervention for out-of-region patients	/		/  According to clients and therapists					HQ
Boak et al. <sup>33</sup>	Specialized physiotherapist teams to provide care for specific body parts vs usual non-specialized therapists	[+]		/  According to clients					MQ
Hollinghurst et al. & Salisbury et al. <sup>27,28</sup>	Phone initial assessment and advices from a PT vs face-to-face assessment	[+]		[-] According to clients	/  Healthcare usage	/	[+]	/	MQ HQ
Langstaff et al. <sup>36</sup>	Intensive in-home rehabilitation services after stroke vs usual home care	[+]			[+]				HQ

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**Phillips et al.<sup>39</sup>**

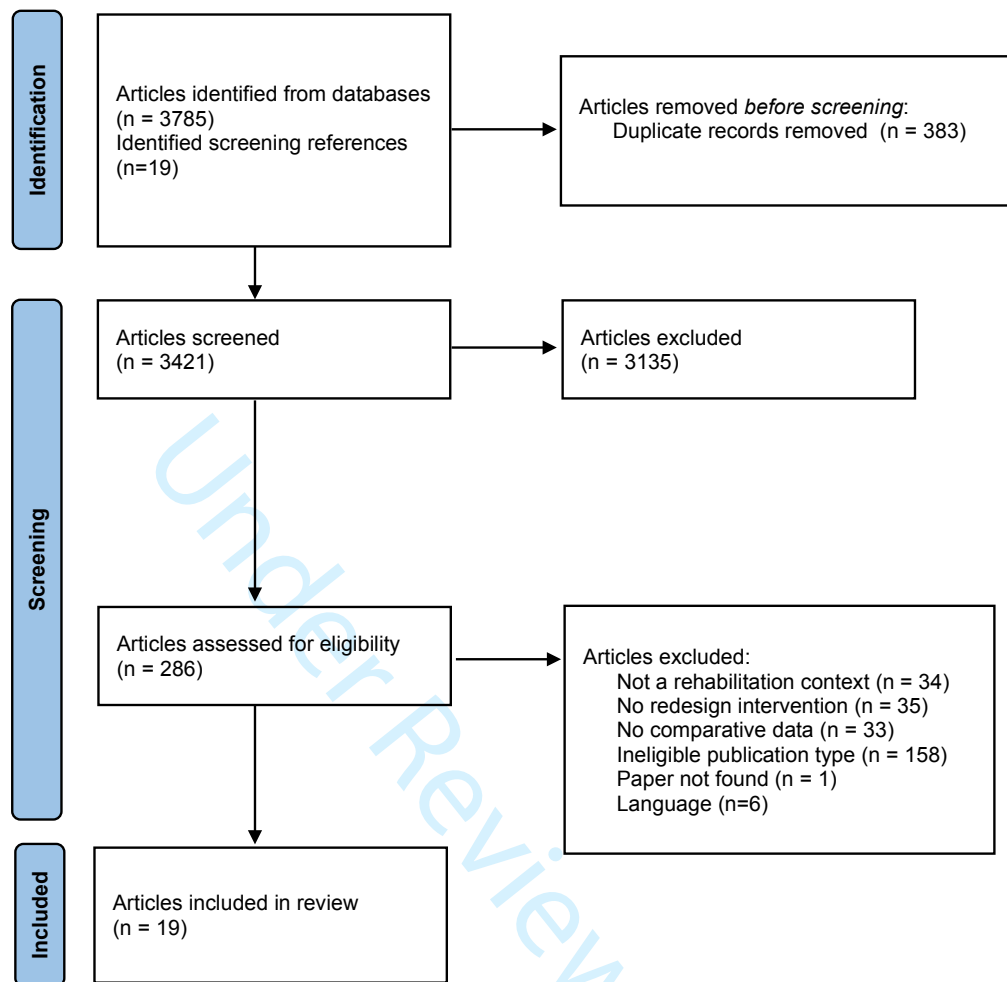
Multidisciplinary team initial evaluation vs separate assessment done by each professional

			Lenght of hospital stay cost	
			[+] Total cost of claim and Cost of indemnity	
	[+]		[/] Healthcare usage	/

MQ

[+]: positive effect on outcome of interest; [-]: negative effect on outcome of interest; [/]: no effect; empty: not evaluated  
 †: satisfaction according to clients and therapists. \*: satisfaction according to clients only  
 PT: physiotherapy; OT: occupational therapy  
 HQ=High methodological quality; MQ=Medium methodological quality; LQ=Low methodological quality;

Under Review

**Figure 1.** Flowchart describing the selection process

## Online supplement 1

**Table S1: Search strategies****Search Strategy: Medline-Ovid**

Rehabilitation services	Waiting time/list
Allied Health Personnel/ Allied Health Occupations/ "Allied Health".ab,kf,ti. Rehabilitation/ "Rehabilitation".ab,kf,ti. Physical Therapy Specialty/ Physical Therapists/ "Physiotherap*".ab,kf,ti. "Physical therap*".ab,kf,ti. Occupational Therapy/ Occupational Therapists/ "Occupational therap*".ab,kf,ti. Speech-Language Pathology/ Speech Therapy/ Language Therapy/ "Speech Therap*".ab,kf,ti. "Language Therap*".ab,kf,ti. Nutritionists/ Dietetics/ "Nutritionist*".ab,kf,ti. "Dietet*".ab,kf,ti. "Dietit*".ab,kf,ti. Social Workers/ Social Work/ "Social work*".ab,kf,ti. "Psychology".ab,kf,ti. "Psychologist*".ab,kf,ti.	Waiting Lists/ "Appointments and Schedules"/ "Wait*".ti. (Wait* adj5 (list or lists)).ab,kf. "waitlist*".ab,kf,ti. (Wait* adj5 (time or times)).ab,kf. (Wait* adj5 length*).ab,kf. (Wait* adj5 duration*).ab,kf. (Wait* adj5 size).ab,kf. (Wait* adj5 number*).ab,kf. (Wait* adj5 access).ab,kf. (Access adj5 delay*).ab,kf.
<i>Combine using 'OR'</i>	<i>Combine using 'OR'</i>  <i>Add</i>  <i>NOT</i> (wait* adj2 control).ab,kf,ti. <i>to exclude papers describing a waiting list control group</i>
<i>Combine results with the 'AND' operator</i>	

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**Search Strategy: CINAHL**

<b>Rehabilitation services</b>	<b>Waiting time/list</b>
(MH "Allied Health Personnel")	(MH "Waiting Lists")
(MH "Allied Health Professions")	(MH "Appointments and Schedules")
TI "Allied Health"	TI "Wait*"
AB "Allied Health"	AB Wait* N5 (list or lists)
(MH "Rehabilitation")	TI "waitlist*"
TI "Rehabilitation"	AB "waitlist*"
AB "Rehabilitation"	AB Wait* N5 (time or times)
(MH "Physical Therapy")	AB Wait* N5 length*
(MH "Physical Therapy Service")	AB Wait* N5 duration*
(MH "Physical Therapists")	AB Wait* N5 size
TI "Physiotherap*"	AB Wait* N5 number*
AB "Physiotherap*"	AB Wait* N5 access
TI "Physical therap*"	AB Access N5 delay*
AB "Physical therap*"	
(MH "Occupational Therapy")	
(MH "Occupational Therapy Service")	
(MH "Occupational Therapists")	
TI "Occupational therap*"	
AB "Occupational therap*"	
(MH "Speech-Language Pathology")	
(MH "Rehabilitation, Speech and Language")	
(MH "Speech Therapy")	
(MH "Language Therapy")	
(MH "Speech-Language Pathologists")	
TI "Speech Therap*"	
AB "Speech Therap*"	
TI "Language Therap*"	
AB "Language Therap*"	
(MH "Nutrition Services")	
(MH "Dietetics")	
(MH "Dietitians")	
TI "Nutritionist*"	
AB "Nutritionist*"	
TI "Dietet*"	
AB "Dietet*"	
TI "Dietit*"	
AB "Dietit*"	
(MH "Social Workers")	
(MH "Social Work")	
(MH "Social Work Service")	
TI "Social work*"	
AB "Social work*"	



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(MH "Psychologists")  
TI "Psychologist\*"  
AB "Psychologist\*"  
TI "Psychology"  
AB "Psychology"

*Combine using 'OR'*

*Combine using 'OR'*

*Add*

*NOT*

TI Wait\* N2 control

AB Wait\* N2 control

*to exclude papers describing a waiting list  
control group*

*Combine results with the 'AND' operator*

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**Search Strategy: Embase**

Rehabilitation services	Waiting time/list
'paramedical personnel'/de	'waiting time'/de
'paramedical profession'/de	'appointment* and schedule*':ab,ti
'Allied Health':ab,ti	Wait*:ti
'rehabilitation'/de	(Wait* NEAR/5 (list or lists)):ab
Rehabilitation:ab,ti	waitlist*:ab,ti
'physiotherapy'/de	(Wait* NEAR/5 (time or times)):ab
'physiotherapist'/de	(Wait* NEAR/5 length*):ab
Physiotherap*:ab,ti	(Wait* NEAR/5 duration*):ab
'Physical therap*':ab,ti	(Wait* NEAR/5 size):ab
'occupational therapy'/de	(Wait* NEAR/5 number*):ab
'occupational therapist'/de	(Wait* NEAR/5 access):ab
'Occupational therap*':ab,ti	(Access NEAR/5 delay*):ab
'speech and language rehabilitation'/de	
'speech language pathologist'/de	
'language therapy'/de	
'speech therapy'/de	
'Speech Therap*':ab,ti	
'Language Therap*':ab,ti	
'dietetics'/de	
'dietitian'/de	
'nutrition service'/de	
Nutritionist*:ab,ti	
Dietet*:ab,ti	
Dietit*:ab,ti	
'social worker'/de	
'social work'/de	
'Social work*':ab,ti	
'psychologist'/de	
Psychology:ab,ti	
Psychologist*:ab,ti	
<i>Combine using 'OR'</i>	<i>Combine using 'OR'</i>
<i>Combine using 'OR'</i>	<i>Add</i>
<i>Combine using 'OR'</i>	<i>NOT</i>
<i>Combine using 'OR'</i>	(wait* NEAR/2 control):ab,ti
<i>Combine using 'OR'</i>	<i>to exclude papers describing a waiting list control group</i>
<i>Combine results with the 'AND' operator</i>	

**Strategies to reduce waiting times in outpatient rehabilitation services for adults with physical disabilities: A systematic literature review**

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**Table S2: Summary of eligibility criteria**

PICOS	Inclusion Criteria	Exclusion Criteria
<b>Setting/ population</b>	<ul style="list-style-type: none"> <li>• Rehabilitation services provided by the allied health professionals (PT, OT, SLT, dietetics, psychology, etc.) to aid in the recovery of illness/injuries or provide treatment/support for adults or elderly with physical disabilities.</li> <li>• Rehabilitation services provided to adults and elderly with physical disabilities within the community or on an outpatient basis (e.g., rehabilitation centre, community health centre).</li> <li>• Rehabilitation services provided in the home (including outreach services into a residential care setting).</li> <li>• Rehabilitation services provided by the allied health professionals, either alone or within a multi-disciplinary team.</li> </ul>	<ul style="list-style-type: none"> <li>• Inpatient (bed based) services (e.g., hospitals, residential rehabilitation)</li> <li>• Medical only services</li> <li>• Advanced-practice in a hospital emergency department</li> </ul>
Strategies	<p>Service redesign strategies that aim to reduce waiting time between referral and first appointment, e.g.:</p> <ul style="list-style-type: none"> <li>• Waiting list management</li> <li>• Substitution services (e.g., skill mix, using less specialist staff)</li> <li>• Changes to scheduling</li> <li>• Changes to care models (e.g., individual to group)</li> <li>• Changes to resourcing</li> </ul>	<ul style="list-style-type: none"> <li>• Patient level interventions (e.g., different therapies). For example, comparison of different interventions that might be applied or introduced by the therapist for an individual patient.</li> <li>• Strategies that are designed to reduce time spent in clinic waiting rooms, or improve the experience in clinic waiting rooms.</li> <li>• Interventions from an allied health professional to reduce waiting time for a medical service (e.g., orthopaedic surgery).</li> </ul>
<b>Comparison</b>	Studies reporting comparative data on timeliness of care under different service conditions (e.g., models of care) or with/without an intervention to address waiting time.	<ul style="list-style-type: none"> <li>• Papers that do not include comparative data for the primary outcome</li> </ul>
<b>Outcomes</b>	<p><b>Primary outcome:</b> Timeliness of care, e.g.:</p> <ul style="list-style-type: none"> <li>• Time to first appointment</li> </ul>	<ul style="list-style-type: none"> <li>• Factors that predict/affect waiting time</li> </ul>

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	<ul style="list-style-type: none"> <li>• Size of waiting list</li> </ul> <p><b>Secondary outcomes</b> to be extracted from included papers:</p> <ul style="list-style-type: none"> <li>• Clinical outcomes</li> <li>• Failed to attend rates</li> <li>• Satisfaction (staff or patients)</li> <li>• Economic outcomes (direct or indirect care costs, sick leave duration)</li> <li>• Other patient or service outcomes</li> <li>• Qualitative outcomes related to users' perceptions (staff or consumers)</li> </ul>	
<b>Study designs</b>	<p>Any design reporting comparative data on timeliness of care under different service conditions (e.g., models of care) or with/without an intervention to address waiting time. This could include:</p> <ul style="list-style-type: none"> <li>• Pre/post trials</li> <li>• Randomized controlled trials</li> <li>• Observational/cohort studies comparing waiting time in different settings/time periods with different conditions</li> <li>• Cluster designs</li> <li>• Mixed methods with quantitative data on primary outcome and qualitative methods for additional outcomes (e.g., satisfaction)</li> </ul>	<ul style="list-style-type: none"> <li>• Studies that describe a change or alternative model of care without comparative data on the primary outcome</li> <li>• Opinion pieces</li> <li>• Reviews</li> <li>• Studies reporting qualitative data only, as these would not be expected to meet criteria of comparative data on primary outcome</li> </ul>