AUTHOR(S) Söderlund, R.

TITLE Waiting times in healthcare: a literature review

YEAR 2023

DOI 10.1504/IJTMCP.2023.136158

CITATION Söderlund, R. (2023). Waiting times in healthcare: a literature review. *International Journal of Telemedicine and Clinical Practices*, 4(1), 16–42. https://doi.org/10.1504/IJTMCP.2023.136158

VERSION Accepted Manuscript

# Waiting times in health care: a literature review

Riitta Söderlund*

Information Systems Science, University of Turku

Rehtorinpellonkatu 3, 20500 Turku, Finland

Email: riitta.soderlund@utu.fi

*Corresponding author

Biographical notes: Riitta Söderlund is currently working on her doctoral dissertation at the Information Systems Science Unit at the University of Turku. She has received her Master's Degree in Information Systems Science and Specialist Degree in Dentistry in Health Care from the University of Turku. Her research interests include knowledge-based management, oral health care and waiting times.

## Abstract

**INTRODUCTION:** Waiting times in health care are a major challenge in many countries.

**OBJECTIVES:** The objective of this literature review was to form a comprehensive understanding of studies on waiting times in health care, especially in which health care areas and why the issue has been studied.

**METHODS:** For data searching, a multi-scientific database and the keywords waiting time and waiting lists were used. There were 95 articles included in the review.

**RESULTS**: Two-thirds of the articles handled waiting times for surgical procedures or hospital care. None of the articles analysed waiting for visiting a general practitioner. Regarding the study purposes, one-sixth of the articles were related to clinical outcomes or patient satisfaction. The rest focused on policy and management issues of waiting times.

**CONCLUSION:** Studies on waiting times for primary care are needed. For better management, research on information management of waiting times data is of great importance.

**Keywords: health care; hospital care; review; surgical procedures; waiting lists; waiting time**

## 1. Introduction

Waiting times in health care are a challenge in most OECD countries (OECD, 2020). Especially in countries with a Beveridge-type health care system, the waiting time length is a major problem (Or et al., 2010). Lengths of waiting times are critical, as they are associated with clinical outcomes (e.g., Chen et al., 2008), patient satisfaction (e.g., Rönnerstrand and Oskarson, 2020) and costs of care (e.g., Fielden et al., 2005). For shortening waiting times, many actions have been taken. Nationwide maximum waiting times for access to care have been set, for example, in Sweden already in 1992 for hip and knee replacement and cataract surgery (Hanning, 1996). The maximum waiting times set have varied from country to country, depending on the country's resources (OECD, 2020). Also, the need for scoring systems for key diagnostic and treatment services has been discussed (DeCoster, 2002). A scoring system should take into account the severity of symptoms, capacity for benefit, risks to social role and time in the queue waiting for treatment. In health care organisations, many strategies have been used for reducing waiting times. Naiker et al. (2018) classified these into three strategies: resource realignment, operational efficiencies and process improvement.

For measuring and assessing lengths of waiting times, the concept of waiting time must be defined. There are actually many definitions of waiting time. The differences between the definitions are explained by insights into what are the starting points of waiting and the endpoints. Sanmartin (2003) talked about three waiting times: waiting to see the specialist, waiting for hospital treatment and total waiting time. As for waiting for hospital treatment, its starting point is mainly the decision to treat the patient or the timepoint when the patient is listed (Viberg et al., 2013). Thus, the lengths of waiting times for hospital treatment depend among other things on the choice of the starting point. Comparisons between hospitals are challenging: one hospital may use the decision to treat the patient as a starting point for hospital treatment and another hospital when the patient is listed. Patients are listed in each

hospital on a waiting list which contains all the patients waiting for a planned procedure at the hospital (Godden and Pollock, 2009). Waiting lists are technical means for managing queues of patients waiting for treatment. A long waiting list does not necessarily mean a long waiting time, though quite often, there is an association between these two.

Waiting time data are transformed to different statistical key figures, e.g., for monitoring maximum waiting time guarantees, measuring performance and local planning (Godden and Pollock, 2009). Also, citizens must be informed about waiting time guarantees and how these targets are met (Winblad et al., 2010). Questions have been raised about which statistical key figures should be used in different situations (Siciliani et al., 2014). For monitoring, the number of patients on the waiting list has been suggested, as it shows health care providers' current efforts to keep waiting times within targets. The best statistical key figures for this are the median and proportion of long-waiting patients. For public reporting, the waiting times of treated patients can be used, as patients' interest is the total waiting time. The mean and proportion of patients waiting an excessively long time are easiest to understand.

Extensive research on waiting times in health care has mainly focused on surgical procedures. Siciliani and Hurst (2005) compared waiting time policies in 12 OECD countries, analysing how demand- and supply-side factors affect waits for elective surgery. In 2011–2012, Siciliani et al. (2014) collected the waiting time data of nine surgical procedures over 10 years across OECD countries. Waiting times for surgical procedures may be affected by new technologies. For example, telemedicine might be used for seeing the specialist before the operation. So far, the time to fix a remote appointment with a specialist has not been reduced (Ponraj and Selvakumar, 2019). Concerning primary care, Martin et al. (2020) have studied waiting times in ten OECD countries. The waiting time was defined as the time it took to get

an appointment to see a doctor or a nurse. According to the authors, the study was the first international study on waiting time inequalities by socioeconomic status in primary care.

For waiting time comparisons, the consistency of the definition of the waiting time is necessary. However, this consistency is not sufficient for relevant comparisons. Also, the accuracy of the data on which the statistical key figures are based is important. The data collected from patient information systems may be incorrect and incomplete (Hersh et al., 2013). Siddins et al. (2012) presented that hospital waiting lists are vulnerable to bias, manipulation and mismanagement. As staff rotate frequently, new staff may not be attuned to the management expectations. Study results from Italy indicated that the quality of the publicly reported waiting time information was fluctuating (De Rosis et al., 2020).

The aim of this literature review is to form a comprehensive understanding of studies on waiting times in health care. The interest is especially on where and why the issue has been studied. Are studies on waiting times focused on surgical procedures and hospital care? Are there studies on challenges of information management of waiting time data? The study questions are the following: 1) In which health care areas are waiting times studied? 2) What are the purposes of the studies on waiting times in health care? 3) How are waiting times in health care defined? 4) Which measure of central tendency – the mean or median – is used most in the studies on waiting times in health care? 5) How are data on waiting times for health care collected?

## 2. Materials and methods

### *2.1. Literature review*

This study is a literature review. A literature review is a rigorous review of research results (Lluch, 2011; Okoli, 2015). The objectives for this review are to identify, classify and summarise existing research on waiting times in health care and to identify areas and opportunities for future research.

For the review, we used the database Scopus. We chose it, because it is a multi-scientific abstract and citation database. With the query, we wanted to find journal articles written in English whose title includes “wait*” or “access to” but not “emergency”. In addition, the title, abstract or keywords of the article must include “health*”. The concept “emergency” was excluded, as we were not interested in accessing emergency health care. The search was limited to ten subject areas, e.g., medicine, nursing, management and accounting, business and computer science. Other subject areas, such as arts and humanities, engineering, neuroscience, psychology and veterinary, were excluded as irrelevant. The period was not limited. On the date of the search, 12.9.2020, 11,914 articles were retrieved from Scopus. See the whole flow of the literature review in Figure 1.

**Place Figure 1 about here**

After having tried different keywords for reducing the massive number of articles, we decided to use only the exact keyword “waiting time”. The reason for this was that “waiting time” is the key concept of the area. We decided not to use medical procedures or specialities for limiting, as the aim was to form a broad understanding in which health care areas waiting times have been studied. For an equivalent reason concerning the question why – the purposes

of the studies – we could not use concepts, such as patient satisfaction, management, measurement or politics, for limiting.

Using the exact keyword “waiting time” with Scopus, 183 articles were retrieved from our original sample of 11,914 articles. From these, we further manually picked the articles whose indexed keywords in the Medical Subject Headings (MeSH) included “waiting lists”. The singular form of “waiting list” is not included in the main heading terms, and thus, it could not be used. We chose “waiting lists” for similar reasons as we chose “waiting time”. After this limiting, the number of articles was 97. Two articles published in 1989 and 1998 were non-accessible, and thus, the total number of articles for the review was 95. In our quality assurance for the articles, we relied on the quality of the article selection process of Scopus (“Scopus Citation”, 2022).

### *2.2. Principles of classification*

Health care services can be classified into several areas. For example, Hulshof et al. (2012) classified the services into ambulatory, emergency, surgical, inpatient, home and residential care services for resource capacity planning and control. We used five areas for our study: 1) surgical procedure, 2) hospital care or clinic visit, 3) cancer, 4) mental health and 5) other services. We chose these areas, as waiting times for surgical procedures and hospital care have been studied a great deal (e.g., Siciliani et al., 2014). Cancer needs urgent treatment and can be addressed with many alternative clinical pathways. Mental health services differ from somatic services.

Fogarty and Cronin (2008) have categorised studies on waiting times in health care into three themes: quality of life, quality of the patient/client healthcare experience and managerial aspects. We created a classification with seven classes for enabling a more detailed analysis.

The classes were 1) clinical outcomes, 2) patient satisfaction, 3) description of waiting time, 4) explanatory factors for waiting time, 5) social equity, 6) intervention and 7) prioritisation.

The classification was formed as follows. Waiting time can be used either as a dependent or an independent variable. When waiting time is used as an independent variable, clinical outcomes and patient satisfaction are the two major dependent variables (Chen et al., 2008; Rönnerstrand and Oskarson, 2020). That is why the classes “clinical outcomes” and “patient satisfaction” were created. “Clinical outcomes” includes articles studying associations between waiting times and clinical outcomes and/or health-related quality of life. “Patient satisfaction” refers to studies on associations between waiting time and the quality of health care services from the point of view of a patient.

The other five classes were for studies with waiting time as a dependent variable. The classes were based on the following general research objectives: description, explanation and development. The class “description of waiting time” refers to descriptive studies on waiting times for different health care services. The class “explanatory factors for waiting time” was created for studies in which waiting times are explained with systemic and/or organisational factors like health care resources. As waiting times in health care may also be explained with social issues like patients’ education, income and geographic disparity, the class “social equity” was created. When developing health care, one objective may be shortening waiting times. The class “intervention” is for studies which evaluate the results of planned actions or events done either during the study or others were in charge of the intervention. Reducing waiting times may also be based on patients’ medical needs, with priority-setting models. The class “prioritisation” includes studies assessing impacts, when a first-in-first-out system is replaced with another system for managing waiting.

The articles were classified by the writer of this article. For increasing reliability, the classification was done several times.

## 3. Results

### *3.1. Enumerative bibliographical main findings*

The greatest number of articles (n=17) was from the United States of America. Twelve articles were from the United Kingdom, eight each from Australia and Canada, seven from Norway, six from Germany, five from Italy and four each from the Netherlands, Spain and Sweden. The trend of the number of articles by year of publication was increasing (Fig. 2). Seven journals had published three or more of these articles. Both the journal Health Economics and the journal Health Policy had published six articles each.

**Place Figure 2 about here**

### *3.2. The health care areas studied*

One-third of the 95 articles (n=31) focused on waiting times for surgical procedures, such as hip or knee operations. In about 30% of the articles (n=30), the issue was waiting for visiting clinics or hospital care, meaning in many cases elective surgery. The share of the articles presenting waiting times for cancer treatments was roughly 10% (n=10), and for mental health care services, a little less than 10% (n=8). The rest of the articles, about 15% (n=16), handled other services, such as emergency care[1], radiotherapy and screening.

[1] These four articles discussed emergency care, because with the query, we were looking for journal articles whose title do not include the concept “emergency”.

Of the articles on surgical procedures (n=31), 12 studied hip and knee operations (Table 1). Nikolova et al. (2016) were also interested in hernia repair and surgery of varicose veins and Viberg et al. (2013) in cataract surgery. Waiting for cataract surgery was also studied in four other studies (Table 1). Of the articles on other surgical procedures (n=15), a great number depicted waiting times for kidney transplants (Table 2).

**Place Table 1 about here**

**Place Table 2 about here**

Ten studies focused on waiting times and cancer (Table 3). Eight articles studied waiting times for mental, rather than somatic, health care services. Reichert and Jacobs (2018) studied waiting times for the treatment of psychosis. Two studies focused on waiting for psychotherapy (Grünzig et al., 2018; Reins et al., 2013). Also, substance abusers, addiction treatment and methadone maintenance treatment were studied (Carr et al., 2008; Peles et al., 2012; Quanbeck et al., 2013). Triva et al. (2013) analysed the significance of waiting times with chronic non-malignant pain. Bonati et al. (2019) stated that children and adolescents with attention-deficit hyperactivity disorder wait too long for treatment.

Sixteen studies handled other health care services. Waiting for radiotherapy was studied in four articles (Brouha et al., 2000; Danjoux et al., 2006; Dwyer et al., 2010; Scoccianti et al., 2012). Two articles were related to colorectal cancer screening (Jen et al., 2018; 2019), and four focused on emergency care[2] (Fatovich and Jacobs, 2001; Fitzpatrick et al., 2014; Meng et al., 2015; Rogg et al., 2017). Waiting for dental care was studied in two articles and for dermatologists in one (Badre et al., 2014; Lalloo and Kroon, 2015; Resneck Jr et al., 2007). In

[2] These four articles discussed emergency care, because with the query, we were looking for journal articles whose title do not include the concept “emergency”.

home care services, waiting for aged care packages was studied (Griffiths et al., 2014). Feldman (1994) discussed the cost of rationing medical care by waiting and insurance coverage. Gravelle and Siciliani (2008) investigated optimal allocation rules for public health care, where user charges are fixed and rationing is by waiting.

The rest of the articles (n=30) analysed waiting times for specialist clinic visits (e.g., Aeenparast et al., 2012; Feddock et al., 2005; Leung et al., 2003; Radina et al., 2010; Shrestha et al., 2017; Song et al., 2018) or care in hospitals (e.g., Carlsen and Kaarboe, 2015; Johar et al., 2013; Schulz 2017; Siciliani and Martin, 2007; Siciliani and Verzulli, 2009; Windmeijer et al., 2005).

**Place Table 3 about here**

### *3.3. The purposes of the studies on waiting time*

The purposes description of waiting time and explanatory factors for waiting time were both used in 22% of the articles (n=21, total n=42). The percentage of the studies with the purpose intervention was 21 (n=20). The share of the articles explaining the relationship between social equity and waiting times was 14% (n=13). Associations between waiting times and clinical outcomes and the health-related quality of life were presented in 12% of the articles (n=11). Patient satisfaction was studied in 4% of the articles (n=4), and about 5% focused on the management of waiting time instead of a first-in-first-out model with prioritisation and a scoring model (n=5). Some examples of representative articles are presented below.

Of explanatory factors for waiting time, systemic and organisational factors, such as governance, leadership, culture and resources, were analysed (Amar et al., 2015). Dedey et al.

(2016) studied patient, health care provider and health care system factors. Patients' willingness to pay for shortening the waiting was the interest of Leung et al. (2003). Also, non-attendance and private health insurances were associated with waiting times (Milne et al., 2014; Wübker et al., 2011).

In the descriptive studies, waiting for attention-deficit hyperactivity disorder assessments, public primary dental services, cosmetic botulinum toxin injections and blood specimen collection were studied (Bonati et al., 2019; Lalloo and Kroon, 2015; Resneck Jr et al., 2007; Song et al., 2018). Stanford et al. (2008) did a historical review of waiting for liver transplants in Canada during 2000-2004. Viberg et al. (2013) described how waiting times for elective surgery procedures were measured in 23 OECD countries. Of the studies on waiting times of patients with cancer, 40% described waiting times (Table 3).

The effects of interventions on waiting times were studied in one-fifth of the articles. Re-organising working by increasing the staff capacity at an eye clinic did not shorten waiting times (Chandra et al., 2018). A new clinical practice was taken into use in pregnancy termination in addition to some other changes at the clinic (Patel et al., 2008). Nouraei et al. (2007) developed an intranet-based tool for managing cross-speciality coordination. It led to a significant reduction in the number of patients whose treatment planning for cancer was delayed. Because of scarce resources in mental health care, it was seen as impossible to shorten waiting times for psychotherapy, but a web-based depression intervention was applied during the waits (Grünzig et al., 2018). Waiting for elective procedures in hospitals was compared before and after the reform of the year 2003 in Scotland (Nikolova et al., 2015).

Siciliani and Verzulli (2009) studied whether social factors, like high educational attainment, played a role in waiting in European countries. Also, Monstad et al. (2014) investigated the

relationship between waiting time, income and education. When studying the wait for kidney transplants in the USA, Davis et al. (2014) found, for example, that people waiting a longer time were more likely black and with low educational attainment. Kaarboe and Carlsen (2014) studied aspects of hospital supply with waiting times of different socioeconomic groups, and Schulz (2017) the association of education with waiting times for inpatient surgery in 11 European countries. Segev et al. (2008) analysed waiting times for liver transplants of obese persons.

Clinical outcomes and health-related quality of life were the areas of interest in 50% of the cases studying waiting times for hip and knee replacement. The studies on cataract surgery focused on explanatory factors for waiting times. (Table 1)

Patient satisfaction and prioritisation were studied in only a few articles. Fitzpatrick et al. (2014) studied parents' satisfaction with waiting times in emergency care for children. Feddock et al. (2005) suggested that physicians could mediate the negative effects of long waiting times by spending more time with their patients. Triva et al. (2013) did not find any association between waiting times and patient satisfaction with pain clinics. Escobar et al. (2009) stated that instead of the first-in-first-out system, some explicit priority criteria should be implemented in waiting for joint replacement. For radiotherapy, Scoccianti et al. (2012) modelled a priority list of patients based on clinical criteria to be used instead of the strategy "first-come, first-served".

### *3.4. The definition of waiting time*

The definition of waiting time used in the reviewed articles varied. At a general level, waiting time is the period between two points - a starting point and an endpoint. As the articles handled waiting times for different health care areas, the starting and endpoints varied and

thus, also the definitions of waiting time. In a study on kidney transplants, the endpoint was defined in five ways (Vranic et al., 2014).

In most non-urgent cases, phone calls are still needed for booking appointments in health care. If a health care unit has a voicemail system, a patient may be left waiting for a return call, and this is the patient's first waiting time. The results of the study on addiction treatment suggested that in nearly half of the cases, a patient's first phone call was met by voicemail or not answered at all (Quanbeck et al., 2013). After successful booking, there is a waiting time defined as the time duration between the date on which the appointment was booked and the actual consultation date (Leung et al., 2003). In a cross-sectional study analysing waiting time for a first consultation, the endpoint was the first nearest date for a visit according to the physician's waiting list (Aeenparast et al., 2012).

There is usually also waiting in the waiting room, before the patient meets the health care professional. In a study in China, this waiting time was defined as the period from the moment when the consultation was automatically allocated to a patient entering the health care unit upon the registration to the moment when the doctor recorded the patient's electronic card into the information system (Sun et al., 2017). Accordingly, waiting time in a laboratory was defined as the time difference between the time of the generation of a queue ticket for a patient and the time the patient is called with the queue ticket (Song et al., 2018).

When a physician decides to refer a patient to a hospital, the patient must again wait. Radina et al. (2010) talked about the total waiting time as meaning the time interval between the referral received in the hospital and the appointment date. This total waiting time was composed of three sub-waits: referrals' office handling, booking and scheduling.

The definitions of waiting times for hip and knee replacements and cataract surgery differed (Table 1). In one study, waiting time was not defined at all; and in another study, two definitions of waiting time for surgery were used, as the starting points in 2007 and 2014 were different because of changes in activities (Birk and Henriksen, 2006; Weingessel et al., 2018).

Also, the definitions of waiting times for cancer treatments varied (Table 3). Lee et al. (2019) analysed waiting times in a ward treating cancer patients. Waiting for cancer treatment was sometimes divided into sub-intervals. In the study by Osowiecka et al. (2018), waiting time - the total interval - was divided into two intervals: the diagnostic interval and the treatment interval. The diagnostic interval was the period from cancer suspicion to diagnosis. The treatment interval was the period from diagnosis to treatment. Concerning gynaecological cancers, the waiting time was defined as the period from being referred to being diagnosed for having the surgery (Su and Sykes, 2009). Waiting was divided into three sub-waits. Referral, diagnosis, placed on waiting list and surgery were used as reference points.

### *3.5. Measuring central tendency in the studies*

As a measure of central tendency, the mean and/or median of waiting times were presented in 78% of the studies reviewed (n=74). The mean was used most, in 32% (n=30) of all the studies (e.g., Aeenparast et al., 2012; Bowers, 2011; Dawson et al., 2007; Dyrstad et al., 2016; Fitzpatrick et al., 2014; Monstad et al., 2014; Reichert and Jacobs, 2018; Schulz, 2017; Siciliani and Verzulli, 2009; Tuominen et al., 2009; Weingessel et al., 2018). The median was used slightly less (n=25) (e.g., Arnesen et al., 2002; Collins et al., 2009; Dedey et al., 2016; Jen et al., 2019; Lai et al., 2016; Leung et al., 2003; Milne et al., 2014; Reese et al., 2014; Rogg et al., 2017; Triva et al., 2013; Ziemann et al., 2017). In one-fifth of all the articles (n=19), both the mean and median were used (e.g., Carlsen and Kaarboe, 2015; Hirvonen et al., 2007; Kaarboe and Carlsen, 2014; Kahokehr et al., 2016; Mathews et al., 2016; Nikolova

et al., 2015; Pillay et al., 2011; Quon et al., 2013; Resneck Jr et al., 2007; Windmeijer et al., 2005).

In addition to mean and/or median, the waiting time was also dichotomised based on the clinically meaningful cut-point or because of the skewness of the waiting times data (Mathews et al., 2016; Quon et al., 2013). Reese et al. (2014) made three categories of waiting times, which were short (<=180 days), medium (181-270 days) and long (>270 days).

In the rest of the articles (n=21), neither mean nor median was used. In seven articles, waiting times for services were not measured. For example, being on the waiting list was used as a criterion for inclusion in two studies (Grünzig et al., 2018; Reins et al., 2013). Birk and Henriksen (2006) didn't ask about waiting times. They assumed that patients could not answer the question after three years. Waiting was studied with some target time in five studies (e.g., Amar et al., 2015; Lalloo and Kroon, 2015). In Petrelli et al. (2017), they categorised the waiting time into two classes: > 2 days or <= 2 days, and in Atkinson et al. (2016), six classes were used. In a pregnancy termination clinic, after the development of activities, the overall reduction of the waiting time was from 20.3 to 3.6 days (Patel et al., 2008). Dwyer et al. (2010) stated that after the changes, 14 extra patients per month could be treated in the department. Leung et al. (2006) studied patients' willingness to pay for shortening the waiting time by two weeks. Lee et al. (2019) wrote that the largest share of patients reported long waiting times for examinations and procedures.

### *3.6. Collection methods of waiting time data*

The data of waiting times were collected from clinical or administrative health care data in 64% of the cases (n=61). In 34 studies, the sources of data were other than clinical or administrative health care data (Table 4).

**Place Table 4 about here**

Primary data on waiting times were collected by interviews and questionnaires. A mail survey was chosen for analysing the differences in patients' perceived waiting times by health insurance (Lee et al., 2019). Also, the internet was used for a survey (Logvinov et al., 2018). Cao et al. (2011) conducted telephone interviews and used questionnaires to get data from patients. Sometimes a questionnaire was the only method used for collecting data from patients (e.g., Conner-Spady et al., 2007; Feddock et al., 2005; Triva et al., 2013). Fatovich and Jacobs (2001) sent a postal survey to the directors of emergency medicine. Physicians were also interviewed over the phone (Aeenparast et al., 2012). An online survey was used when collecting data from health centres to study waiting times for obesity surgery (Arteaga-González et al., 2018). When studying the effects of health insurance on waiting times, trained graduate students called hospitals with predetermined questions to get a doctor's appointment as a patient (Wübker et al., 2011). Also, in other studies, data were collected by calling health care units for getting an appointment (Quanbeck et al., 2013; Resneck Jr et al., 2007).

Most of the articles reviewed, 61 of 95, used clinical or administrative health care data for studying waiting times. In these studies, patients' health records (e.g., Badre et al., 2014; Dedey et al., 2016; Kahokehr et al., 2016; Patel et al., 2008; Radina et al., 2010) and waiting lists (e.g., Escobar et al., 2009; Lizaur-Utrilla et al., 2016; Midttun and Martinussen, 2005; Nilsdotter and Lohmander, 2002; Ostendorf et al., 2004) were used for getting data. Data were also retrieved from disease-specific or national patient registries (e.g., Bonati et al., 2019; Carlsen and Kaarboe, 2015; Le Page et al., 2015; Monstad et al., 2014; Smirthwaite et al., 2014) and from other administrative health care data, such as referrals (e.g., Danjoux et

al., 2006; Fitzpatrick et al., 2014; Johar et al., 2013; Reichert and Jacobs, 2018; Windmeijer et al., 2005).

In some articles, challenges in data collecting were presented. Data were missing (Stanford et al., 2008). Timings, when patients were placed on a waiting list, could not be identified fully (Le Page et al., 2015). Surgeons had resistance entering data into the system, which contributed to data inaccuracy, and this was strengthened by the high turnover rate among trained clerical staff (Amar et al., 2015). In the study on aged care packages, none of the agencies collected data for monitoring the waiting times of these packages (Griffiths et al., 2014).

## 4. Discussion

The aim of this literature review was to analyse in which health care areas waiting times have been studied and the purposes of these studies. In addition, the definition, measure of central tendency and data collection were studied. The results indicate that two-thirds of the articles presented waiting for surgical procedures, hospital care or clinic visits. None of the articles analysed waiting times for visiting a general practitioner. Of the purposes, 16% of the articles were related to clinical outcomes or patient satisfaction. The rest focused on policy and management issues of waiting times. None of the articles handled information management of waiting time data, though problems with data collection were presented in some studies. The definition of waiting time varied because of the difference between the starting and endpoints of the services. For presenting central tendency, mean and/or median were used in four-fifths of the studies. In two-thirds of the studies, the data on waiting times were collected from patients' health records or administrative health-care data. One-third used surveys or public documents.

*Waiting times for different health care areas*

The number of published articles by year had an increasing trend. Many articles came from Beveridgean countries, where waiting times are an important form of rationing in health care (Or et al., 2010). The articles retrieved studied waiting times for different health care services, both somatic and mental services. Waiting times for hospital care, clinic visits and surgical procedures, especially hip and knee operations, were studied most. In this review, none of the articles handled waiting for a general practitioner or a nurse. One article analysed waits for public primary dental care. In earlier literature, Martin et al. (2020) have studied waiting times for primary care in OECD countries with socioeconomic inequalities. Otherwise, the major interest in waiting times has been in elective surgery (Siciliani and Hurst, 2005; Siciliani et al., 2014).

Maximum waiting time guarantees, which were laid down for hip and knee replacements and cataract surgery for example in Sweden (Hanning, 1996), probably are one explanation for studying long waiting times for those procedures. Though more money is spent on surgery than for visits with general practitioners, these visits are of importance. They are the real starting point of the whole patient pathway in most non-urgent cases. This is why we were curious as to why there were no studies on waiting for a general practitioner. There were many studies on waiting for clinic visits, and the practices of visiting a hospital clinic or a general practitioner do not essentially differ. The difference in the number of studies might be partly explained by the greater tradition of scientific research activities in university hospitals than in primary care.

*Purposes of the studies*

We categorised the articles into seven classes based on their purposes. The classes were as follows: 1) clinical outcomes and health-related quality of life, 2) patient satisfaction, 3)

description of waiting time, 4) explanatory factors for waiting time, 5) social equity, 6) intervention and 7) prioritisation. The class clinical outcomes and health-related quality of life is comparable to the theme quality of life used by Fogarty and Cronin (2008), and the class patient satisfaction with their theme quality of the patient/client health care experience. The remaining five classes are equivalent to their managerial-aspects theme. We made a greater number of classes for getting a better understanding of the managerial aspects of waiting times.

In the articles reviewed, waiting time was used as an explanatory variable for clinical outcomes and patient satisfaction as in earlier literature (Chen et al., 2008; Rönnerstrand and Oskarson, 2020). The share of these articles was about one-sixth. Clinical outcomes and the health-related quality of life were studied most in studies on hip and knee operations. Patient satisfaction was not a major area of interest. Yet all research results for reducing waiting times may have a positive effect on patient satisfaction.

Waiting times were described, explained or interventions evaluated in three-fourths of the studies with managerial purposes. The shares were quite equal, each about 20 % of all the articles reviewed. Their great share may partly be explained by the reforms for reducing waiting times and using waiting times for performance measurements (Godden and Pollock, 2009; Or et al., 2010). While reducing waiting in organisations, processes and operational efficiency were also improved (Naiker et al., 2018). More innovative units assessed the impacts of changing a first-in-first-out model with prioritisation and a scoring model as DeCoster (2002). Though Siddins et al. (2012) presented problems with managing waiting lists, none of the articles focused on information management of the data.

*Definitions of waiting times*

The definitions of waiting times varied, as the starting and endpoints of waiting varied depending on the service studied. The finding corresponds with earlier research (Sanmartin, 2003). The definitions varied even within one health care service. For hip and knee replacements, the most-used definition of waiting time was the period between the date a patient was put on a waiting list for a planned procedure and the date the surgical procedure was done. The typical starting point used in these operations was not the referral, as defined by Godden and Pollock (2009). All definitions of waiting times for cancer treatment were different. In some cases, waiting was divided into sub-periods. This may be reasonable, as cancer treatments are very diverse. From the point of view of the patient, it is the total waiting which is most important.

With different definitions, comparisons are impossible or at least challenging. For comparisons, definitions of waiting times should be harmonised for equal services. Defining the starting and endpoints is more difficult, the more diverse medical treatments are used in the service studied. The definition should be with the need for information in the case.

*Mean or median*

Mean and/or median of waiting times were presented in about 80% of the studies. Of these statistical indicators, Siciliani et al. (2014) suggested using the median for monitoring health care providers and the mean for informing citizens. In statistics, the mean is more reliable for normal distributions, and the median should be used when the distribution of the variable is skewed. We suggest that the statistical indicator should be chosen based on the distribution of the variable rather than on the use of the indicator. With statistics software, it is easy to choose the proper indicator or use both indicators and explain their difference.

*Collection methods of waiting time data*

Data on waiting times were collected in 64% of the studies from patients' health records, waiting lists or administrative health care data. Siciliani et al. (2013, p. 13) stated that administrative data is the best method for measuring waiting times accurately. Public databases, documents and www-pages are mainly based on the data sources already mentioned. Also, it is most probable that the data collected from professionals by interviewing or questionnaires are based on clinical or administrative health care data. Only rarely are data needed from other sources, such as from patients about perceived waiting times or from observing waits in a waiting room. This means that patients' health records, waiting lists and administrative health care data are almost always the most important data sources. That is why health care organisations must plan and implement their information management processes and tools, so that getting relevant information on waiting times is possible.

*Limitations of the study and suggestions for future research*

The multi-scientific database Scopus was chosen for this study, as we wanted to have articles from different health care services from different points of view with waiting times. We did not use the more biomedical databases, like Cochrane or Medline, including perhaps numerous studies on the associations between waiting times and clinical outcomes. For searching, the keywords waiting time and waiting lists were used, which was not the most logical choice. We chose the singular form waiting time, and the MeSH keywords include only the plural form waiting lists. If we had also chosen, instead of just waiting time, other forms of the concept, like waiting times, wait time and wait times, the search would have included a greater number of studies. However, we think that the choice did not fundamentally change the variety of the collection of the articles retrieved and reviewed. Choosing waiting lists might have had a greater effect on the collection. It may be that the

concept of waiting lists is not used as much in primary care as it is used in elective surgery and hospital care; thus, the number of studies on primary care was minimal.

The classification of the articles into different health care areas and purposes of the study was challenging. Should we classify a study on screening for colorectal cancer into the category cancer or other services? The category of other services was chosen. These choices change the proportions of health care areas and purposes, where and why waiting times have been studied. The choices did not concern choices between primary care and any other health care service or between information management and any other purpose. Thus, the choices made during the classification didn't affect the major results of this review.

The results of the study indicate that the number of scientific studies on waiting times in primary health care and information management of waiting times data is minor. Research on waiting times in primary care is needed, as visits in primary care are those from where patients' waiting times for surgery and many other treatments start in most non-urgent cases. Information management of waiting time data is of great importance, as the management of waiting is based on this information. If the waiting times data are not up-to-date and trustworthy, we cannot have relevant information for managing waiting times in health care.

## 5. Conclusions

In this literature review, we analysed where and why waiting times have been studied in health care. Waiting times for surgical procedures, clinic visits and hospital care were studied, but no article was about waiting times for visiting a general practitioner. The results support earlier research. The purposes of the studies were mostly related to managerial aspects. This was probably partly caused by using the database Scopus rather than more biomedical

databases for searching. None of the articles focused on the information management of waiting times data, though some articles reviewed presented problems with the quality of data on waiting times. In the future, research on waiting times for primary care is needed, as a primary care encounter is the starting point of most patients' care pathways. For reducing waiting times, research and sophisticated information management systems handling waiting and waiting times data are of importance. More employees are not the only solution for shorter waiting times.

**References**

*References marked with an asterisk indicate studies included in the review.*

*Aeenparast, A., Farzadi, F. and Maftoon, F. (2012) 'Waiting time for specialist consultation in Tehran', *Archives of Iranian Medicine*, Vol. 15 No. 12, pp.756–758.

*Amar, C., Pomey, M.P., Sanmartin, C. and De Coster, C. (2015) 'Sustainability: Orthopaedic surgery wait time management strategies', *International Journal of Health Care Quality Assurance*, Vol. 28 No. 4, pp.320–331.

*Arnesen, K.E., Erikssen, J. and Stavem, K. (2002) 'Gender and socioeconomic status as determinants of waiting time for inpatient surgery in a system with implicit queue management', *Health Policy*, Vol. 62 No. 3, pp.329–341.

*Arteaga-González, I.J., Martín-Malagón, A.I., Ruiz de Adana, J.C., de la Cruz Vigo, F., Torres-García, A.J. and Carrillo-Pallares, A.C. (2018) 'Bariatric Surgery Waiting Lists in Spain', *Obesity Surgery*, Vol. 28 No. 12, pp.3992–3996.

*Atkinson, L.M., Vijeratnam, D., Mani, R. and Patel, R. (2016) ' 'The waiting game': are current chlamydia and gonorrhoea near-patient/point-of-care tests acceptable to service users and will they impact on treatment?', *International Journal of STD and AIDS*, Vol. 27 No. 8, pp.650–655.

*Badre, B., Serhier, Z. and El Arabi, S. (2014) 'Waiting times before dental care under general anesthesia in children with special needs in the Children's Hospital of Casablanca', *Pan African Medical Journal*, Vol. 17 [online] https://panafrican-med-journal.com/content/article/17/298/pdf/298.pdf (Accessed 15 October 2020).

*Birk, H.O. and Henriksen, L.O. (2006) 'Why do not all hip- and knee patients facing long waiting times accept re-referral to hospitals with short waiting time? Questionnaire study', *Health Policy*, Vol. 77 No. 3, pp.318–325.

*Bonati, M., Cartabia, M., Zanetti, M., Conte, S., Renzetti, V., Salvoni, L., . . . Rossi, G. (2019) 'Waiting times for diagnosis of attention-deficit hyperactivity disorder in children and adolescents referred to Italian ADHD centers must be reduced', *BMC Health Services Research*, Vol. 19 No. 1 [online] https://bmchealthservres.biomedcentral.com/track/pdf/10.1186/s12913-019-4524-0.pdf (Accessed 15.10.2020).

*Bowers, J.A. (2011) ‘Simulating waiting list management’, *Health Care Management Science*, Vol. 14 No. 3, pp.292–298.

*Brouha, X.D.R., Op De Coul, B., Terhaard, C.H.J. and Hordijk, G.J. (2000) ‘Does waiting time for radiotherapy affect local control of T1N0M0 glottic laryngeal carcinoma?’, *Clinical Otolaryngology and Allied Sciences*, Vol. 25 No. 3, pp.215–218.

*Cao, W., Wan, Y., Tu, H., Shang, F., Liu, D., Tan, Z., . . . Xu, Y. (2011) ‘A web-based appointment system to reduce waiting for outpatients: A retrospective study’, *BMC Health Services Research*, Vol.11 No. 1 [online] https://bmchealthservres.biomedcentral.com/track/pdf/10.1186/1472-6963-11-318.pdf (Accessed 15.10.2020).

*Carlsen, F. ]and Kaarboe, O.M. (2015) ‘The relationship between educational attainment and waiting time among the elderly in Norway’, *Health Policy*, Vol. 119 No. 11, pp.1450–1458.

*Carr, C.J.A., Xu, J., Redko, C., Lane, D.T., Rapp, R.C., Goris, J. and Carlson, R.G. (2008) ‘Individual and system influences on waiting time for substance abuse treatment’, *Journal of Substance Abuse Treatment*, Vol. 34 No. 2, pp.192–201.

*Casimiro Pérez, J.A., Fernández Quesada, C., del Val Groba Marco, M., Arteaga González, I., Cruz Benavides, F., Ponce, J., . . . Marchena Gómez, J. (2018) ‘Obesity Surgery Score (OSS) for Prioritization in the Bariatric Surgery Waiting List: a Need of Public Health Systems and a Literature Review’, *Obesity Surgery*, Vol. 28 No. 4, pp.1175–1184.

*Chandra, P., Kumawat, D., Tewari, R., Panyala, R.R. and Sreeshankar, S.S. (2018) Reducing ‘Waiting-time of Preterm Babies at a Retinopathy of Prematurity Clinic: A Quality Improvement Project’, *Indian Pediatrics*, Vol. 55 No. 9, pp.776–779.

Chen, Z., King, W., Pearcey, R., Kerba, M. and Mackillop, W.J. (2008) ‘The relationship between waiting time for radiotherapy and clinical outcomes: A systematic review of the literature’, *Radiotherapy and Oncology*, Vol. 87 No. 1, pp.3–16.

*Collins, I., Naidoo, J., Rowley, S., Reynolds, J.V. and Kennedy, M.J. (2009) ‘Waiting times for access, diagnosis and treatment in a cancer centre’, *Irish Medical Journal*, Vol. 102 No. 9, pp.279-282.

*Conner-Spady, B.L., Johnston, G.H., Sanmartin, C., McGurran, J.J., Noseworthy, T.W., Weiler, R., . . . Truscott, T. (2007) ‘A bird can't fly on one wing: Patient views on waiting for hip and knee replacement surgery’, *Health Expectations*, Vol. 10 No. 2, pp.108–116.

*Danjoux, C., Chow, E., Drossos, A., Holden, L., Hayter, C., Tsao, M., . . . Farhadian, M. (2006) ‘An innovative rapid response radiotherapy program to reduce waiting time for palliative radiotherapy’, *Supportive Care in Cancer*, Vol. 14 No. 1, pp.38–43.

*Davis, A.E., Mehrotra, S., McElroy, L.M., Friedewald, J.J., Skaro, A.I., Lapin, B., . . . Ladner, D.P. (2014) ‘The extent and predictors of waiting time geographic disparity in kidney transplantation in the United States’, *Transplantation*, Vol. 97 No. 10, pp.1049–1057.

*Dawson, D., Gravelle, H., Jacobs, R., Martin, S. and Smith, P.C. (2007) ‘The effects of expanding patient choice of provider on waiting times: Evidence from a policy experiment’, *Health Economics*, Vol. 16 No. 2, pp.113–128.

DeCoster, C. (2002) ‘Measuring and managing waiting times: what's to be done?’, *Healthcare management forum*, Vol. 15 No. 2, pp.6–10.

*Dedey, F., Wu, L., Ayettey, H., Sanuade, O.A., Akingbola, T.S., Hewlett, S.A., . . . Adanu, R. (2016) ‘Factors Associated With Waiting Time for Breast Cancer Treatment in a Teaching Hospital in Ghana’, *Health Education and Behavior*, Vol. 43 No. 4, pp.420–427.

De Rosis, S., Guidotti, E., Zuccarino, S., Venturi, G. and Ferré, F. (2020) 'Waiting time information in the Italian NHS: A citizen perspective', *Health policy (Amsterdam)*, Vol. 124 No. 8, pp.796–804.

*Dwyer, P., Hickey, B., Burmeister, E. and Burmeister, B. (2010) 'Hypofractionated whole-breast radiotherapy: Impact on departmental waiting times and cost', *Journal of Medical Imaging and Radiation Oncology*, Vol. 54 No. 3, pp.229–234.

*Dyrstad, K., Halvorsen, T., Hem, K.G. and Rohde, T. (2016) 'Sick of waiting: Does waiting for elective treatment cause sickness absence?', *Health Policy*, Vol. 120 No. 12, pp.1383–1388.

*Escobar, A., Quintana, J.M., González, M., Bilbao, A. and Ibañez, B. (2009) 'Waiting list management: Priority criteria or first-in first-out? A case for total joint replacement', *Journal of Evaluation in Clinical Practice*, Vol. 15 No. 4, pp.595–601.

*Fatovich, D.M. and Jacobs, I.G. (2001) 'NTS versus waiting time: An indicator without definition', *Emergency Medicine*, Vol. 13 No. 1, pp.47–50.

*Feddock, C.A., Hoellein, A.R., Griffith, C.H., Wilson, J.F., Bowerman, J.L., Becker, N.S. and Caudill, T.S. (2005) 'Can physicians improve patient satisfaction with long waiting times?', *Evaluation and the Health Professions*, Vol. 28 No. 1, pp.40–52.

*Feldman, R. (1994) 'The cost of rationing medical care by insurance coverage and by waiting', *Health Economics*, Vol. 3 No. 6, pp.361–372.

Fielden, J.M., Cumming, J.M., Horne, J.G., Devane, P.A., Slack, A. and Gallagher, L.M. (2005) 'Waiting for hip arthroplasty: Economic costs and health outcomes', *Journal of Arthroplasty*, Vol. 20 No. 8, pp.990–997.

*Fitzpatrick, N., Breen, D.T., Taylor, J., Paul, E., Grosvenor, R., Heggie, K. and Mahar, P.D. (2014) 'Parental satisfaction with paediatric care, triage and waiting times', *EMA - Emergency Medicine Australasia*, Vol. 26 No. 2, pp.177–182.

Fogarty, C. and Cronin, P. (2008) 'Waiting for healthcare: A concept analysis', *Journal of Advanced Nursing*, Vol. 61 No. 4, pp.463–471.

Godden, S. and Pollock, A.M. (2009) 'Waiting list and waiting time statistics in Britain: A critical review', *Public Health*, Vol. 123 No. 1, pp.47–51.

*Gravelle, H. and Siciliani, L. (2008) 'Ramsey waits: Allocating public health service resources when there is rationing by waiting', *Journal of Health Economics*, Vol. 27 No. 5, pp.1143–1154.

*Griffiths, M., Russell, R., Brunker, G., Boccalatte, M. and Goldstraw, P. (2014) 'Waiting times for Aged Care Packages: The need to know', *Australasian Journal on Ageing*, Vol. 33 No. 1, pp.26–28.

*Grünzig, S.D., Baumeister, H., Bengel, J., Ebert, D. and Krämer, L. (2018) 'Effectiveness and acceptance of a web-based depression intervention during waiting time for outpatient psychotherapy: Study protocol for a randomized controlled trial', *Trials*, Vol. 19 No. 1 [online] https://trialsjournal.biomedcentral.com/track/pdf/10.1186/s13063-018-2657-9.pdf (Accessed 15.10.2020).

Hanning, M. (1996) 'Maximum waiting-time guarantee - An attempt to reduce waiting lists in Sweden', *Health Policy*, Vol. 36 No. 1, pp.17–35.

Hersh, W.R., Weiner, M.G., Embi, P.J., Logan, J.R., Payne, P.R.O., Bernstam, E.V., . . . Saltz, J.H. (2013) 'Caveats for the Use of Operational Electronic Health Record Data in Comparative Effectiveness Research', *Medical Care*, Vol. 51 No. 8, ppS30–S37.

*Hirvonen, J., Blom, M., Tuominen, U., Seitsalo, S., Lehto, M., Paavolainen, P., . . . Sintonen, H. (2007) 'Evaluating waiting time effect on health outcomes at admission: A prospective randomized study on patients with osteoarthritis of the knee joint', *Journal of Evaluation in Clinical Practice*, Vol. 13 No. 5, pp.728–733.

Hulshof, P.J.H., Kortbeek, N., Boucherie, R.J., Hans, E.W. and Bakker, P.J.M. (2012) 'Taxonomic classification of planning decisions in health care: a structured review of the state of the art in OR/MS', *Health systems*, Vol. 1 No. 2, pp.129–175.

*Jen, H.H., Hsu, C.Y., Chen, S.L.S., Yen, A.M.F., Chiu, S.Y.H., Fann, J.C.Y., . . . Chiu, H.M. (2018) 'Rolling-out Screening Volume Affecting Compliance Rate and Waiting Time of FIT-based Colonoscopy', *Journal of Clinical Gastroenterology*, Vol. 52 No. 9, pp.821–827.

*Jen, H.H., Wang, T.H., Chiu, H.M., Peng, S.M., Hsu, C.Y., Chiu, S.Y.H., . . . Fann, J.C.Y. (2019) 'Hurdle Poisson Regression Model for Identifying Factors Related to Noncompliance and Waiting Time for Confirmatory Diagnosis in Colorectal Cancer Screening', *International Journal of Technology Assessment in Health Care*, Vol. 35 No. 2, pp.85–91.

*Johannessen, K.A. and Alexandersen, N. (2018) 'Improving accessibility for outpatients in specialist clinics: Reducing long waiting times and waiting lists with a simple analytic approach', *BMC Health Services Research*, Vol. 18 No. 1 [online] https://bmchealthservres.biomedcentral.com/track/pdf/10.1186/s12913-018-3635-3.pdf (Accessed 15.10.2020).

*Johar, M., Jones, G., Keane, M.P., Savage, E. and Stavrunova, O. (2013) 'Discrimination in a universal health system: Explaining socioeconomic waiting time gaps', *Journal of Health Economics*, Vol. 32 No. 1, pp.181–194.

*Kaarboe, O. and Carlsen, F. (2014) 'Waiting times and socioeconomic status. Evidence from Norway', *Health Economics (United Kingdom)*, Vol. 23 No. 1, pp.93–107.

*Kahokehr, A., Glasson, J. and Studd, R. (2016) 'Surgical waiting time for radical cystectomy: a New Zealand experience', *ANZ Journal of Surgery*, Vol. 86 No. 12, pp.1042–1045.

*Karlberg, I. (2006) 'Comments on Midttun and Martinussen: "Hospital waiting time in Norway: What is the role of organizational change?"', *Scandinavian Journal of Public Health*, Vol. 34 No. 3, pp.332.

*Kirkegård, J., Mortensen, F.V., Hansen, C.P., Mortensen, M.B., Sall, M. and Fristrup, C. (2019) 'Waiting time to surgery and pancreatic cancer survival: A nationwide population-based cohort study', *European Journal of Surgical Oncology*, Vol. 45 No. 10, pp.1901–1905.

*Lai, Q., Nicolini, D., Inostroza, M., Iesari, S., Goffette, P., Agostini, A., . . . Lerut, J. (2016) 'A novel prognostic index in patients with hepatocellular cancer waiting for liver transplantation Time-Radiological-response-Alpha-fetoprotein-INflammation (TRAIN) score', *Annals of Surgery*, Vol. 264 No. 5, pp.787–796.

*Lalloo, R. and Kroon, J. (2015) 'Analysis of public dental service waiting lists in Queensland, *Australian Journal of Primary Health*, Vol. 21 No. 1, pp.27–31.

*Le Page, A.K., Johnstone, L.M. and Kennedy, S.E. (2015) 'Australian deceased donor kidney allocation protocols: Transplant waiting and graft quality for children and adolescents', *Pediatric Transplantation*, Vol. 19 No. 6, pp.588–594.

*Lee, S., Gross, S.E., Pfaff, H. and Dresen, A. (2019) 'Differences in Perceived Waiting Time by Health Insurance Type in the Inpatient Sector: An Analysis of Patients With Breast Cancer in Germany', *Inquiry (Chicago)*, Vol. 56 No.1 [online] https://journals.sagepub.com/doi/pdf/10.1177/0046958019875897 (Accessed 15.10.2020).

*Leung, G.M., Castan-Cameo, S., McGhee, S.M., Wong, I.O.L. and Johnston, J.M. (2003) 'Waiting time, doctor shopping, and nonattendance at specialist outpatient clinics: Case-control study of 6495 individuals in Hong Kong', *Medical Care*, Vol. 41 No. 11, pp.1293–1300.

*Leung, G.M., Yeung, R.Y.T., Wong, I.O.L., Castan-Cameo, S. and Johnston, J.M. (2006) 'Time costs of waiting, doctor-shopping and private-public sector imbalance: Microdata evidence from Hong Kong', *Health Policy*, Vol. 76 No. 1, pp.1–12.

*Lizaur-Utrilla, A., Martinez-Mendez, D., Miralles-Muñoz, F.A., Marco-Gomez, L. and Lopez-Prats, F.A. (2016) 'Negative impact of waiting time for primary total knee arthroplasty on satisfaction and patient-reported outcome', *International Orthopaedics*, Vol. 40 No. 11, pp.2303–2307.

Lluch, M. (2011) 'Healthcare professionals' organisational barriers to health information technologies—A literature review', *International journal of medical informatics (Shannon, Ireland)*, Vol. 80 No. 12, pp.849–862.

*Logvinov, I.I., Dexter, F., Dexter, E.U. and Brull, S.J. (2018) 'Patient survey of referral from one surgeon to another to reduce maximum waiting time for elective surgery and hours of overutilized operating room time', *Anesthesia and Analgesia*, Vol. 126 No. 4, pp.1249–1256.

Martin, S., Siciliani, L. and Smith, P. (2020) 'Socioeconomic inequalities in waiting times for primary care across ten OECD countries', *Social Science and Medicine*, Vol. 263 [online] Socioeconomic inequalities in waiting times for primary care across ten OECD countries (sciencedirectassets.com) (Accessed 15.10.2020).

*Mathews, M., Ryan, D., Gadag, V. and West, R. (2016) 'Patient satisfaction with wait-times for breast cancer surgery in Newfoundland and Labrador', *Healthcare Policy*, Vol. 11 No. 3, pp.42–53.

*Meng, F., Teow, K.L., Ooi, C.K., Heng, B.H. and Tay, S.Y. (2015) 'Analysis of patient waiting time governed by a generic maximum waiting time policy with general phase-type approximations', *Health Care Management Science*, Vol. 18 No. 3, pp.267–278.

*Midttun, L. and Martinussen, P.E. (2005) 'Hospital waiting time in Norway: What is the role of organizational change?', *Scandinavian Journal of Public Health*, Vol. 33 No. 6, pp.439–446.

*Milne, V., Kearns, R. and Harrison, A. (2014) 'Patient age, ethnicity and waiting times determine the likelihood of non-attendance at a first specialist rheumatology assessment', *International Journal of Rheumatic Diseases*, Vol. 17 No. 1, pp.19–25.

*Monstad, K., Engesæter, L.B. and Espehaug, B. (2014) 'Waiting time and socioeconomic status - An individual-level analysis', *Health Economics (United Kingdom)*, Vol. 23 No. 4, pp.446–461.

Naiker, U., FitzGerald, G., Dulhunty, J.M. and Rosemann, M. (2018) Time to wait: A systematic review of strategies that affect out-patient waiting times', *Australian Health Review*, Vol. 42 No. 3, pp.286–293.

*Nikolova, S., Harrison, M. and Sutton, M. (2016) 'The Impact of Waiting Time on Health Gains from Surgery: Evidence from a National Patient-reported Outcome Dataset', *Health Economics (United Kingdom)*, Vol. 25 No. 8, pp.955–968.

*Nikolova, S., Sinko, A. and Sutton, M. (2015) 'Do maximum waiting times guarantees change clinical priorities for elective treatment? Evidence from Scotland', *Journal of Health Economics*, Vol. 41, pp.72–88.

*Nilsdotter, A.K. and Lohmander, L.S. (2002) 'Age and waiting time as predictors of outcome after total hip replacement for osteoarthritis', *Rheumatology*, Vol. 41 No. 11, pp.1261–1267.

*Nouraei, S.A.R., Philpott, J., Nouraei, S.M., Maude, D.C.K., Sandhu, G.S., Sandison, A. and Clarke, P.M. (2007) 'Reducing referral-to-treatment waiting times in cancer patients using a multidisciplinary database', *Annals of the Royal College of Surgeons of England*, Vol. 89 No. 2, pp.113–117.

OECD. (2020) *Waiting Times for Health Services: Next in Line.* [online] OECD Health Policy Studies, OECD Publishing, Paris. https://doi.org/10.1787/242e3c8c-en (Accessed 15.10.2020).

Okoli, C. (2015) ‘A Guide to Conducting a Standalone Systematic Literature Review’, *Communications of the Association for Information Systems*, Vol. 37 No. 1, pp.879–910

Or, Z., Cases, C., Lisac, M., Vrangbæk, K., Winblad, U. and Bevan, G. (2010) ‘Are health problems systemic? Politics of access and choice under Beveridge and Bismarck systems’, *Health Economics, Policy and Law*, Vol. 5 No. 3, pp.269–293.

*Osowiecka, K., Nawrocki, S., Kurowicki, M. and Rucinska, M. (2019) ‘The waiting time of prostate cancer patients in Poland’, *International Journal of Environmental Research and Public Health*, Vol. 16 No. 3 [online] https://mdpi-res.com/ijerph/ijerph-16-00342/article_deploy/ijerph-16-00342.pdf?version=1548488637 (Accessed 15.10.2020).

*Osowiecka, K., Rucinska, M., Nowakowski, J.J. and Nawrocki, S. (2018) ‘How long are cancer patients waiting for oncological therapy in Poland?’, *International Journal of Environmental Research and Public Health*, Vol. 15 No. 4 [online] https://mdpi-res.com/ijerph/ijerph-15-00577/article_deploy/ijerph-15-00577.pdf?version=1525344950 (Accessed 15.10.2020).

*Ostendorf, M., Buskens, E., Van Stel, H., Schrijvers, A., Marting, L., Dhert, W. and Verbout, A. (2004) ‘Waiting for total hip arthroplasty: Avoidable loss in quality time and preventable deterioration’, *Journal of Arthroplasty*, Vol. 19 No. 3, pp.302–309.

*Patel, A., Panchal, H., Patel, R. and Keith, L. (2008) ‘Decreased waiting periods in a public pregnancy termination clinic’, *Contraception*, Vol. 77 No. 2, pp.105–107.

*Peles, E., Schreiber, S., Sason, A. and Adelson, M. (2012) ‘Long waiting period to enter methadone maintenance treatment: Relation to patient characteristics and outcome’, *European Addiction Research*, Vol. 18 No. 3, pp.149–152.

*Petrelli, A., De Luca, G., Landriscina, T., Costa, G. and Gnavi, R. (2017) ‘Effect of socioeconomic status on surgery waiting times and mortality after hip fractures in Italy, *Journal for Healthcare Quality*, Vol. 40 No. 4, pp.209–216.

*Pillay, D., Johari Dato Mohd Ghazali, R., Hazilah Abd Manaf, N., Hassan Asaari Abdullah, A., Abu Bakar, A., Salikin, F., . . . Ismefariana Wan Ismail, W. (2011) ‘Hospital waiting time: The forgotten premise of healthcare service delivery?’, *International Journal of Health Care Quality Assurance*, Vol. 24 No. 7, pp. 506–522.

Ponraj, V. and Selvakumar, K. (2019) ‘Improving efficiency and effectiveness of the telemedicine system between a remote clinic and a super specialty hospital – a case study and its key determining factors’, *International Journal of Telemedicine and Clinical Practices*, Vol. 3 No. 2, pp.111–131. https://www.inderscienceonline.com/doi/abs/10.1504/IJTMCP.2019.100032

*Quanbeck, A., Wheelock, A., Ford, J.H., Pulvermacher, A., Capoccia, V. and Gustafson, D. (2013) ‘Examining access to addiction treatment: Scheduling processes and barriers’, *Journal of Substance Abuse Treatment*, Vol. 44 No. 3, pp.343–348.

*Quon, J.A., Sobolev, B.G., Levy, A.R., Fisher, C.G., Bishop, P.B., Kopec, J.A., . . . Schechter, M.T. (2013) ‘The effect of waiting time on pain intensity after elective surgical lumbar discectomy’, *Spine Journal*, Vol. 13 No. 12, pp.1736–1748.

*Radina, M., Sharma, A.P., Yasin, A. and Filler, G. (2010) ‘Adherence to waiting-time targets for pediatric nephrology clinic referrals’, *Pediatric Nephrology*, Vol. 25 No. 2, pp.311–316.

*Reese, P.P., Hwang, H., Potluri, V., Abt, P.L., Shults, J. and Amaral, S. (2014) ‘Geographic determinants of access to pediatric deceased donor kidney transplantation’, *Journal of the American Society of Nephrology*, Vol. 25 No. 4, pp.827–835.

*Reichert, A. and Jacobs, R. (2018) ‘The impact of waiting time on patient outcomes: Evidence from early intervention in psychosis services in England’, *Health Economics (United Kingdom)*, Vol. 27 No. 11, pp.1772–1787.

*Reins, J.A., Ebert, D.D., Lehr, D., Riper, H., Cuijpers, P. and Berking, M. (2013) 'Internet-based treatment of major depression for patients on a waiting list for inpatient psychotherapy: Protocol for a multi-centre randomised controlled trial', *BMC Psychiatry*, Vol. 13 No. 1 [online] https://bmcpsychiatry.biomedcentral.com/track/pdf/10.1186/1471-244X-13-318.pdf (Accessed 15.10.2020).

*Resneck Jr, J.S., Lipton, S. and Pletcher, M.J. (2007) 'Short wait times for patients seeking cosmetic botulinum toxin appointments with dermatologists', *Journal of the American Academy of Dermatology*, Vol. 57 No. 6, pp.985–989.

*Rogg, J.G., Huckman, R., Lev, M., Raja, A., Chang, Y. and White, B.A. (2017) 'Describing wait time bottlenecks for ED patients undergoing head CT', *American Journal of Emergency Medicine*, Vol. 35 No. 10, pp.1510–1513.

*Ryu, J.H., Koo, T.Y., Ha, J.Y., Jung, M.R., Ha, J.W. and Yang, J. (2018) 'Factors Associated With Waiting Time to Deceased Donor Kidney Transplantation in Transplant Candidates', *Transplantation Proceedings*, Vol. 50 No. 4, pp.1041–1044.

Rönnerstrand, B. and Oskarson, M. (2020) 'Standing in Line When Queues Are on the Decline: Services Satisfaction Following the Swedish Health Care Waiting Time Guarantee', *Policy Studies Journal*, Vol. 48 No. 2, pp.469–493.

Sanmartin, C.A. (2003) 'Toward Standard Definitions for Waiting Times', *Healthcare Management Forum*, Vol. 16 No. 2, pp.49–53.

*Schulz, M. (2017) 'The intertwined relationship between patient education, hospital waiting times and hospital utilization', *Health Services Management Research*, Vol. 30 No. 4, pp.213– 218.

*Scoccianti, S., Agresti, B., Simontacchi, G., Detti, B., Cipressi, S., Iannalfi, A., . . . Biti, G. (2012) 'From a waiting list to a priority list: A computerized model for an easy-to-manage and automatically updated priority list in the booking of patients waiting for radiotherapy', *Tumori*, Vol. 98 No. 6, pp.728–735.

*Scopus Citation.* (2022) [online] https://www.elsevier.com/solutions/scopus/why-choose-scopus (Accessed 19.2.2022).

*Segev, D.L., Thompson, R.E., Locke, J.E., Simpkins, C.E., Thuluvath, P.J., Montgomery, R.A. and Maley, W.R. (2008) 'Prolonged waiting times for liver transplantation in obese patients', *Annals of Surgery*, Vol. 248 No. 5, pp.863–870.

*Shrestha, M.P., Hu, C. and Taleban, S. (2017) 'Appointment Wait Time, Primary Care Provider Status, and Patient Demographics are Associated with Nonattendance at Outpatient Gastroenterology Clinic', *Journal of Clinical Gastroenterology*, Vol. 51 No. 5, pp.433–438.

Siciliani, L., Borowitz, M. and V. Moran, V. (eds.). (2013) *Waiting Time Policies in the Health Sector: What Works?* [online] OECD Health Policy Studies, OECD Publishing, Paris. https://doi.org/10.1787/9789264179080-en (Accessed 15.10.2020).

Siciliani, L. and Hurst, J. (2005) 'Tackling excessive waiting times for elective surgery: A comparative analysis of policies in 12 OECD countries', *Health Policy*, Vol. 72 No. 2, pp.201–215.

*Siciliani, L. and Martin, S. (2007) 'An empirical analysis of the impact of choice on waiting times', *Health Economics*, Vol. 16 No. 8, pp.763–779.

Siciliani, L., Moran, V. and Borowitz, M. (2014) 'Measuring and comparing health care waiting times in OECD countries', *Health Policy*, Vol. 118 No. 3, pp.292–303.

*Siciliani, L. and Verzulli, R. (2009) 'Waiting times and socioeconomic status among elderly europeans: Evidence from share', *Health Economics*, Vol. 18 No. 11, pp.1295 - 1306.

Siddins, M.T., Boland, J., Mathews, B. and Swanborough, P. (2012) 'Achieving waiting list reform: A pilot program integrating waiting time, category and patient factors', *Australian Health Review*, Vol. 36 No. 3, pp.248–253.

*Simons, P.A.M., Ramaekers, B., Hoebers, F., Kross, K.W., Marneffe, W., Pijls-Johannesma, M. and Vandijck, D. (2015) 'Cost-Effectiveness of Reduced Waiting Time for Head and Neck Cancer Patients due to a Lean Process Redesign', *Value in Health*, Vol. 18 No. 5, pp.587–596.

*Sivey, P. (2012) 'The effect of waiting time and distance on hospital choice for English cataract patients', *Health Economics*, Vol. 21 No. 4, pp.444–456.

*Smirthwaite, G., Lundström, M., Albrecht, S. and Swahnberg, K. (2014) 'Indication criteria for cataract extraction and gender differences in waiting time', *Acta Ophthalmologica*, Vol. 92 No. 5, pp.432–438.

*Song, Y.E., Kang, H. and Park, H. (2018) 'Algorithm to estimate the extended turnaround time including outpatient waiting time for blood specimen collection when a stand-alone queue ticket system not connectable to laboratory information system is used', A*nnals of Clinical and Laboratory Science*, Vol. 48 No. 6, pp.726–735.

*Stanford, D.A., Renouf, E.M. and McAlister, V.C. (2008) 'Waiting for liver transplantation in Canada: Waitlist history 2000-2004 and sensitivity analysis for the future', *Health Care Management Science*, Vol. 11 No. 2, pp.184–195.

*Su, H.Y. and Sykes, P.H. (2009) 'Waiting times for gynaecological cancer surgery', *New Zealand Medical Journal*, Vol. 122 No. 1305, pp.26–33.

*Sun, J., Lin, Q., Zhao, P., Zhang, Q., Xu, K., Chen, H., . . . Liu, Y. (2017) 'Reducing waiting time and raising outpatient satisfaction in a Chinese public tertiary general hospital-an interrupted time series study', *BMC Public Health*, Vol. 17 No. 1 [online] https://bmcpublichealth.biomedcentral.com/track/pdf/10.1186/s12889-017-4667-z.pdf (Accessed 15.10.2020).

*Triva, P., Jukić, M. and Puljak, L. (2013) 'Access to public healthcare services and waiting times for patients with chronic nonmalignant pain: Feedback from a tertiary pain clinic', *Acta Clinica Croatica*, Vol. 52 No. 1, pp.79–85.

*Tuominen, U., Sintonen, H., Hirvonen, J., Seitsalo, S., Paavolainen, P., Lehto, M., . . . Blom, M. (2009) 'The effect of waiting time on health and quality of life outcomes and costs of medication in hip replacement patients: a randomized clinical trial', *Osteoarthritis and Cartilage*, Vol. 17 No. 9, pp.1144–1150.

*Viberg, N., Forsberg, B.C., Borowitz, M. and Molin, R. (2013) 'International comparisons of waiting times in health care - Limitations and prospects', *Health Policy*, Vol. 112 No. 1-2, pp.53–61.

*Vranic, G.M., Ma, J.Z. and Keith, D.S. (2014) 'The role of minority geographic distribution in waiting time for deceased donor kidney transplantation', *American Journal of Transplantation*, Vol. 14 No. 11, pp.2526–2534.

*Weingessel, B., Richter-Mueksch, S. and Vécsei-Marlovits, P.V. (2011) 'Which factors influence patients' maximum acceptable waiting time for cataract surgery? - A questionnaire survey', *Acta Ophthalmologica*, Vol. 89 No. 3, pp.e231-e236.

*Weingessel, B., Wahl, M. and Vécsei-Marlovits, P.V. (2018) 'Patients' maximum acceptable waiting time for cataract surgery: a comparison at two time-points 7 years apart', *Acta Ophthalmologica*, Vol. 96 No. 1, pp.88–94.

Winblad, U., Vrangbæk, K. and Östergren, K. (2010) 'Do the waiting-time guarantees in the Scandinavian countries empower patients?', *The International Journal of Public Sector Management*, Vol. 23 No. 4, pp.353–363.

*Windmeijer, F., Gravelle, H. and Hoonhout, P. (2005) 'Waiting lists, waiting times and admissions: An empirical analysis at hospital and general practice level', *Health Economics*, Vol. 14 No. 9, pp.971–985.

*Wübker, A., Schwierz, C., Wübker, A. and Kuchinke, B.A. (2011) 'Discrimination in waiting times by insurance type and financial soundness of German acute care hospitals', *European Journal of Health Economics*, Vol. 12 No. 5, pp.405–416.

*Ziemann, M., Heßler, N., König, I.R., Lachmann, N., Dick, A., Ditt, V., . . . Kelsch, R. (2017) ‘Unacceptable human leucocyte antigens for organ offers in the era of organ shortage: Influence on waiting time before kidney transplantation’, *Nephrology Dialysis Transplantation*, Vol. 32 No. 5, pp.880–889.

**Table 1**

The articles discussing waiting times for hip and knee replacements or cataract surgery.

| Reference | Surgical procedure | Purpose of the study | Definition of waiting time |
|---|---|---|---|
| Birk and Henriksen, 2006 | Hip or knee replacement | EXPLANATORY FACTORS FOR WAITING TIME: why patients accepted or declined the offer of earlier treatment at a distant hospital | Not defined, the question on waiting time was not included in the questionnaire |
| Conner-Spady et al., 2007 | Hip or knee joint replacement | EXPLANATORY FACTORS FOR WAITING TIME: to examine patient views on issues associated with waiting | "the interval from the decision date (when the patient and surgeon decide to proceed with the replacement surgery) to the actual date of surgery." |
| Escobar et al., 2009 | Total hip or knee replacement | PRIORITISATION: to compare real time on waiting list with a priority criteria score | "the day in which the surgeon placed them on the waiting list to the day in which the surgery was carried out" |
| Hirvonen et al., 2007 | Total knee replacement | CLINICAL OUTCOMES: the effect of WT on health-related quality of life, pain and physical function | "the period from the date the patient was added to the waiting list to the date of surgery" |
| Lizaur-Utrilla et al., 2016 | Total knee arthroplasty | CLINICAL OUTCOMES: the influence of the time on waiting list on the post-operative patient-reported outcomes | "the period between the date of inclusion on the surgical waiting list and the date of surgery" |
| Monstad et al., 2014 | Hip replacement | SOCIAL EQUALITY: the relationship between waiting time, income, and education | "the time elapsed between referral and the date of hospitalization" |
| Nilsdotter and Lohmander, 2002 | Total hip replacement | CLINICAL OUTCOMES: the relationships between waiting time, pre-operative status and post-operative outcome | "the effect of time on the waiting list for surgery, at the time when they were placed on the waiting list for surgery" |
| Ostendorf et al., 2004 | Total hip arthroplasty | CLINICAL OUTCOMES: the effect of waiting times on the health status of patients and outcomes | "from the date the patient was placed on the waiting list to the date of surgery" |
| Petrelli et al., 2017 | Hip replacement after fracture | SOCIAL EQUITY: the role of socioeconomic differences in delaying surgery | "the dates of hospital admission and of surgical procedures" |
| Tuominen et al., 2009 | Total hip replacement | CLINICAL OUTCOMES: the effect of waiting time on health and quality of life outcomes | "from the date the patient was added to the waiting list to the date of admission for surgery" |
| Nikolova et al., 2016 | Hip and knee replacement, hernia repair and varicose veins | CLINICAL OUTCOMES: new evidence on how waiting times affect outcomes | "the delay between when the specialist decides that the patient requires treatment and the treatment date. This is commonly called 'the in patient wait" |
| Viberg et al., 2013 | Total hip replacement, elective surgery and cataract surgery | DESCRIPTION OF WAITING TIME: to describe how countries measure waiting times and to assess whether waiting times can be compared internationally | different starting points: "patient listed"; "decision to treat"; "referral received"; "referral written"; "unclear" |
| Sivey, 2012 | Cataract operation | EXPLANATORY FACTORS FOR WAITING TIME: the choice of hospital, the effects of travel time and waiting time | "the outpatient waiting time is the wait between the referral from the GP and the outpatient appointment with the specialist. The inpatient waiting time is the wait from the outpatient appointment (and decision to admit the patient) and the actual date of the operation" |
| Smirthwaite et al., 2014 | Cataract extraction | PRIORITISATION: national indication criteria, a clinical tool for establishing levels of indications | "the time from the date of the decision to operate to the date of surgery |
| Weingessel et al., 2011 | Cataract surgery | EXPLANATORY FACTORS FOR WAITING TIME: to assess the determinants of patient perceptions of maximum acceptable waiting times | "the waiting time following consultation to surgery" |
| Weingessel et al., 2018 | Cataract surgery | EXPLANATORY FACTORS FOR WAITING TIME: factors influencing patients' maximum acceptable waiting times | "the waiting time from consultation to surgery (in 2007) or the time from receiving the fax to surgery (in 2014)" |

**Table 2**

The articles discussing waiting times for surgical procedures other than hip and knee replacements or cataract surgery.

| **References** | **Number of references** | **Surgical procedure** |
|---|---|---|
| Davis et al., 2014; Le Page et al., 2015; Reese et al., 2014; Ryu et al., 2018; Vranic et al., 2014; Ziemann et al., 2017 | 6 | Kidney transplants |
| Lai et al., 2016; Segev et al., 2008; Stanford et al., 2008 | 3 | Liver transplants |
| Arteaga-González et al., 2018; Casimiro Pérez et al., 2018 | 2 | Bariatric surgery |
| Bowers, 2011 | 1 | Orthopaedics, general and ear, nose and throat surgeries |
| Kahokehr et al., 2016 | 1 | Radical cystectomy |
| Logvinov et al., 2018 | 1 | Cholecystectomy or lung resection |
| Quon et al., 2013 | 1 | Elective lumbar discectomy |

**Table 3**

The articles discussing waiting times for cancer treatment.

| Reference | Body location of cancer | Purpose of the study | Definition of waiting time |
|---|---|---|---|
| Dedey et al., 2016 | Breast | EXPLANATORY FACTORS FOR WAITING TIME:<br>patients' factors, health worker factors and health system factors that contribute to prolonged waiting time | "between when they first reported to the hospital and when definitive treatment was started" |
| Lee et al., 2019 | Breast | EXPLANATORY FACTORS FOR WAITING TIME:<br>the relationship between health insurance and waiting time in the inpatient sector | "There were often long waiting times for examinations and procedures"<br>"I had to wait a long time to be discharged"<br>"When I rang for the nurse in my room, I had to wait a long time before any nursing staff arrived"<br>"When I asked to speak with the physician outside of the rounds, I had to wait for a long time"<br>"I was satisfied with the wait for my surgery appointment" |
| Mathews et al., 2016 | Breast | PATIENT SATISFACTION:<br>do shorter waits lead to greater wait-related patient satisfaction | "from first visit with a surgeon to surgery" |
| Collins et al., 2009 | Breast, lung, colorectal and upper gastrointestinal | DESCRIPTION OF WAITING TIME:<br>waiting times in a hospital from 2001 to 2006 and trends in each of the four diagnoses | "a) Time from referral to first seen:<br>b) Time from first seen to diagnosis:<br>c) Time from diagnosis to the start of definitive treatment" |
| Su and Sykes, 2009 | Gynaecological | DESCRIPTION OF WAITING TIME:<br>to identify the perceived acceptable waiting times and to audit actual waiting times | "(a) referral to diagnosis,<br>(b) diagnosis to treatment plan, and<br>(c) treatment plan to surgery" |
| Nouraei et al., 2007 | Head and neck | INTERVENTION:<br>to improve the efficiency of the multidisciplinary teams | "the referral-to-treatment" |
| Simons et al., 2015 | Head and neck | INTERVENTION:<br>to redesign the care process | Not defined |
| Osowiecka et al., 2018 | Other than prostate | DESCRIPTION OF WAITING TIME:<br>to determine the amount of time that is necessary to be diagnosed and treated | "from the suspicion to the diagnosis (the diagnostic interval),<br>from the suspicion to the treatment (the total interval), and<br>from the diagnosis to the treatment (the treatment interval)" |
| Kirkegård et al., 2019 | Pancreas | CLINICAL OUTCOMES:<br>the impact of waiting time on survival | waiting time to surgery in two ways:<br>"1) from the date of entry into the National Cancer Pathway to the date of surgery and<br>2) from the date of the last preoperative computed tomography (CT) or positron emission tomography (PET-CT) scan to the date of surgery" |
| Osowiecka et al., 2019 | Prostate | DESCRIPTION OF WAITING TIME:<br>to determine the waiting time for diagnosis and treatment | "from the cancer suspicion to the diagnosis (suspicion—diagnosis interval);<br>from the cancer suspicion to the start of treatment (suspicion—treatment interval) and from the diagnosis to the start of treatment (diagnosis—treatment interval)" |

**Table 4**

The source of data was other than clinical or administrative health care data in 34 articles.

| **References** | **Number of references** | **Source of data** |
|---|---|---|
| Atkinson et al., 2016;<br>Cao et al., 2011;<br>Conner-Spady et al., 2007;<br>Feddock et al., 2005;<br>Lee et al., 2019;<br>Logvinov et al., 2018;<br>Pillay et al., 2011;<br>Schulz, 2017;<br>Triva et al., 2013 | 9 | Patients |
| Aeenparast et al., 2012;<br>Arteaga-González et al., 2018;<br>Fatovich and Jacobs, 2001;<br>Griffiths et al., 2014;<br>Quanbeck et al., 2013;<br>Resneck Jr et al., 2007;<br>Scoccianti et al., 2012;<br>Wübker et al., 2011 | 8 | Professionals |
| Amar et al., 2015;<br>Gravelle and Siciliani, 2008;<br>Johannessen and Alexandersen, 2018;<br>Lalloo and Kroon, 2015;<br>Siciliani and Verzulli, 2009;<br>Viberg et al., 2013 | 6 | Public databases, documents, www-pages |
| Carr et al., 2008;<br>Leung et al., 2006;<br>Mathews et al., 2016;<br>Su and Sykes, 2009;<br>Weingessel et al., 2011; 2018 | 6 | Patients and health care data |
| Birk and Henriksen, 2006;<br>Feldman, 1994;<br>Karlberg, 2006 | 3 | No data collected |
| Chandra et al., 2018 | 1 | Observation |
| Nouraei et al., 2007 | 1 | Professionals and observation |

| | | |
|---|---|---|
| **The original query** | ( ( ( TITLE ( wait* ) OR TITLE ( "access to" ) AND NOT TITLE ( emergency ) ) AND TITLE-ABS-KEY ( health* ) ) ) AND DOCTYPE ( ar ) AND ( LIMIT-TO ( SRCTYPE , "j" ) ) AND ( LIMIT-TO ( SUBJAREA , "MEDI" ) OR LIMIT-TO ( SUBJAREA , "NURS" ) OR LIMIT-TO ( SUBJAREA , "HEAL" ) OR LIMIT-TO ( SUBJAREA , "MULT" ) OR LIMIT-TO ( SUBJAREA , "BUSI" ) OR LIMIT-TO ( SUBJAREA , "ECON" ) OR LIMIT-TO ( SUBJAREA , "COMP" ) OR LIMIT-TO ( SUBJAREA , "DECI" ) OR LIMIT-TO ( SUBJAREA , "Undefined" ) ) AND ( LIMIT-TO ( LANGUAGE , "English" ) ) | |
| **Title containing** | Wait* or "access to" | |
| **Title not containing** | Emergency | |
| **Title-Abstract-Keyword containing** | Health* | |
| **Used subject areas** | MEDI | Medicine |
| | NURS | Nursing |
| | HEAL | Health professions |
| | DENT | Dentistry |
| | MULT | Multidisciplinary |
| | BUSI | Business, Management and Accounting |
| | ECON | Economics, Econometrics and Finance |
| | COMP | Computer Science |
| | DECI | Decision Sciences |
| | Undefined | Undefined |
| **Document type** | Article | |
| **Source type** | Journal | |
| **Used language** | English | |

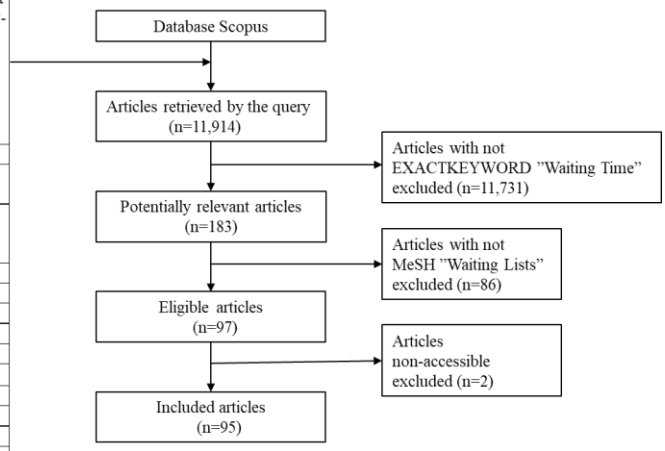


**Fig. 1** The original query and flow diagram of the literature review.

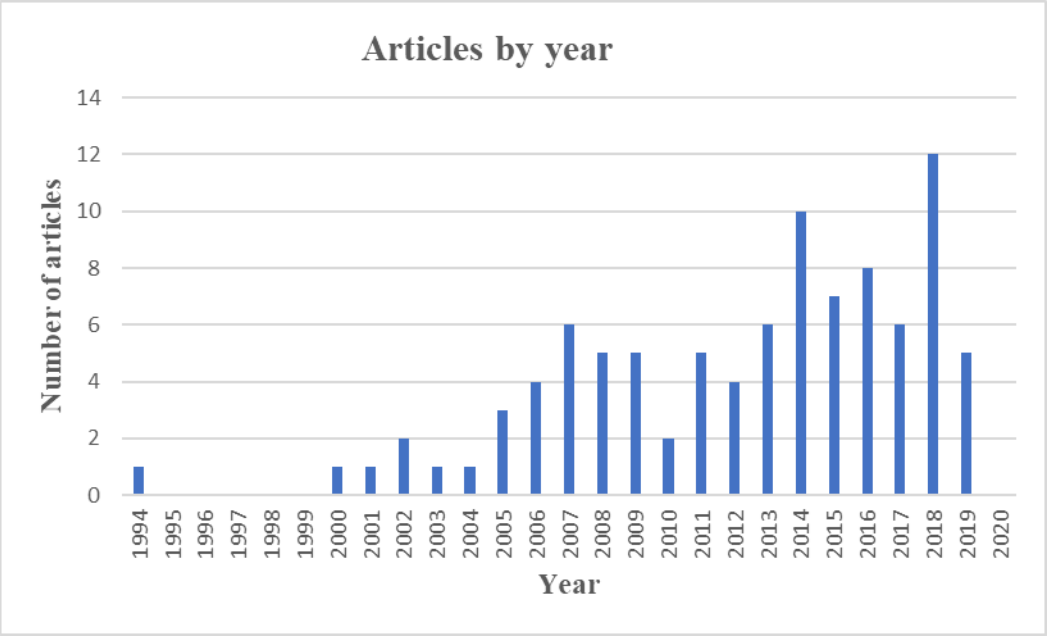


**Fig. 2** The numbers of articles by year of publication.