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REVIEW



# Value-based health care in Western countries: a scoping review on the implementation of patient-reported-outcomes sets for hospital-based interventions

Job F.H. Eijnsink<sup>a,b</sup>, Annabel M. Fabian<sup>a</sup>, Johanna P.M. Vervoort<sup>a</sup>, Mohamed N.M.T. Al Khayat<sup>a,b</sup>, Cornelis Boersma<sup>a,c</sup> and Maarten J. Postma<sup>a,d</sup>

<sup>a</sup>Department of Health Sciences, University of Groningen, University Medical Center Groningen, Groningen, The Netherlands; <sup>b</sup>Department of Clinical Pharmacy, Isala hospital, Zwolle, The Netherlands; <sup>c</sup>Department of Management Sciences, Open University, Heerlen, The Netherlands; <sup>d</sup>Department of Economics, Econometrics & Finance, University of Groningen, Faculty of Economics, Groningen, The Netherlands

## ABSTRACT

**Introduction:** For implementation of the value-based health-care (VBHC) concept, use of patient-reported outcome measures (PROMs), patient-reported experience measures (PREMs), and clinical outcomes is crucial. The aim of this study was to summarize published studies on implemented PROMs, PREMs, and clinical-outcomes sets in health-care practice.

**Areas covered:** A scoping review was conducted by using PubMed and Embase. Our study focused on implementation examples of patient-reported outcome sets in Western countries' hospitals. Included papers were analyzed on content, in particular concerning PROMs, PREMs, and clinical outcomes. We also assessed differences between diseases, categorized as patient-reported outcomes in curative, chronic, and palliative treatments in the hospital.

**Expert opinion:** A total of 20 studies were found that presented VBHC implementation examples. Results illustrate the disconnection between the development of PROMs and PREMs and the implementation phase, with implementation still in infancy. Hospital organizations should enhance organization for the implementation of VBHC. It is crucial that leading examples of successful VBHC serve as blueprints for implementation, with the participation of all relevant stakeholders. Affordability and sustainability of health care can be enhanced by scaling up successful VBHC-interventions on population levels.

## ARTICLE HISTORY

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## KEYWORDS

Value-based health care; scoping review; patient-reported outcomes; implementation

## 1. Introduction

In health care, value is generally defined as health outcomes and costs within specific perspectives for the relevant health-care stakeholders [1]. A broadly accepted method to calculate value is a cost-effectiveness analysis, estimating the outcomes achieved per dollar/euro spend [2]. Typically, these analyses evaluate the costs and effects of an isolated intervention such as a pharmaceutical therapy [3]. Besides interventions, the organizational and cultural aspects of a health-care organization are also of great importance to the implementation of innovations and health-care initiatives, initiated to lead to increased patient value and improved health outcomes. Currently, another organizational development in hospitals is to involve patients, by using self-reported health status directly obtained from patients, which resulted in improved health and minimized costs [4]. Typically, these elements are included in evaluations following the principles of the value-based health-care (VBHC) concept [5–7]. Since generally there is no universal definition of value in health care, each value-based concept will require its own adjusted value specifications [8–10].

In the absence of clear definitions of value, the present VBHC concept has mostly been developed for use in hospitals. Since VBHC was introduced in 2006, hospital organizations chose a cost-benefit concept for their strategic programs.

For example, the Karolinska Institute in Sweden focused on outcomes and process improvement, resulting in more collaboration between the different specialists within the health-care delivery silos that create a network around the patient [11]. Initially, introduction of the VBHC concept in hospitals determined by consensus and collaboration resulted in improved treatment guidelines, but had a lack of patient involvement and limited findings on patient-reported outcomes [12,13]. Seen from the VBHC concept, value in health care is the measured improvement in patient's health outcomes in relation to the cost of achieving that improvement [14]. From the VBHC perspective, outcomes of primary interest should include those health circumstances that are most relevant to patients: the process of recovery and sustainability of health [15].

Hence, VBHC is potentially an outcome-oriented concept for key stakeholders. With regard to the concept, the first suggested step in the process of development and implementation in practice is forming integrated practice units and describing the stakeholders who collaborate closely together on the pathway of health care, around and with the patient (Figure 1). For application in practice, patient-reported outcomes will have to be developed and implemented for each specific disease or condition [16].

### Article highlights

- Patient-reported outcome measures (PROMs) and patient-reported experience measures (PREMs) are used to actively involve patients in individualized therapy during the entire health-care pathway. Implementation of the value-based health care in hospital-based interventions, is currently not well established.
- Overall, this study assessed implementation examples in the Western world and differences between diseases, specified as patient-reported outcomes in curative, chronic, and palliative treatments in the hospital.
- This study shows the value of implementing this concept in hospitals, and demonstrates the differences between generic (60%), domain-specific (70%), and disease-specific (60%) PROMs. Of all implemented outcome sets, 40% were initiated in a Dutch hospital setting, and 65% of outcome sets were implemented in a single center. This study showed that the implementation of PROMs is widely accepted, but that PREMs are less often implemented in hospital-based intervention settings.
- Integration of CEA and the VBHC concept could lead to a more transparent system that includes data from the patient. Stakeholders need to be cooperative to share data and knowledge on both concepts and integrate these data in their organizations. The future of cure and care could potentially become affordable in an economically favorable and ethically responsible manner if dynamically implement the principles of a concept like VBHC.

The implementation of VBHC is suggested as an opportunity to further improve resource allocation and to optimize efficient use of health-care services, with a specific focus on individual patients and stronger collaboration between health-care professionals. *IPU: integrated practice unit*

Patient-reported outcome measures (PROMs) and patient-reported experience measures (PREMs) are used to actively involve patients in individualized therapy during the entire health-care pathway [17]. PROMs are defined as measures of treatment outcomes from the patient's perspective and PREMs

are defined as questionnaires measuring patient experiences on their health-care pathway. The aim of applying PROMs and PREMs is to achieve long-term quality improvements of care, not only by including the objective view of the patient with regard to the effect of the treatment but also by including the individual's subjective perception by reporting symptoms, disability levels, functioning, quality of life, care satisfaction, and experience [18]. Furthermore, data such as mortality, survival, hospitalization, or readmission rates are summarized under 'patient clinical outcomes' and often automatically generated.

Integrated sets of outcomes including all three aspects are used to observe and quantify health outcomes from a patient's perspective and are becoming increasingly important for the assessment of specific treatments or health-care interventions.

Currently, VBHC hospitals are focused on the development of outcomes, and a few hospitals consider implementing outcome sets in standard of care, often on their own initiative and not integrated in the organization and culture of the hospital. Aging populations and unhealthy lifestyle behavior are contributing to a steady increase in costly long-term health problems [19]. One in three adults lives with multiple conditions, accruing a disproportionate health and cost burden [20]. This development, potentially enhancing VBHC, takes place in a context of rising per-patient costs in hospitals, which is partly due to an increase in multi-morbidity care and expensive interventions [21]. With regard to further development and the implementation of VBHC, hospitals could potentially introduce another form of financing, such as outcome-based incentive models or hospital value-based purchasing, especially when using expensive medication and expensive interventions [22,23]. Consequently, in health care, and especially in hospitals, the VBHC concept is widely introduced, and also urgently needed due to the rising costs of health care.

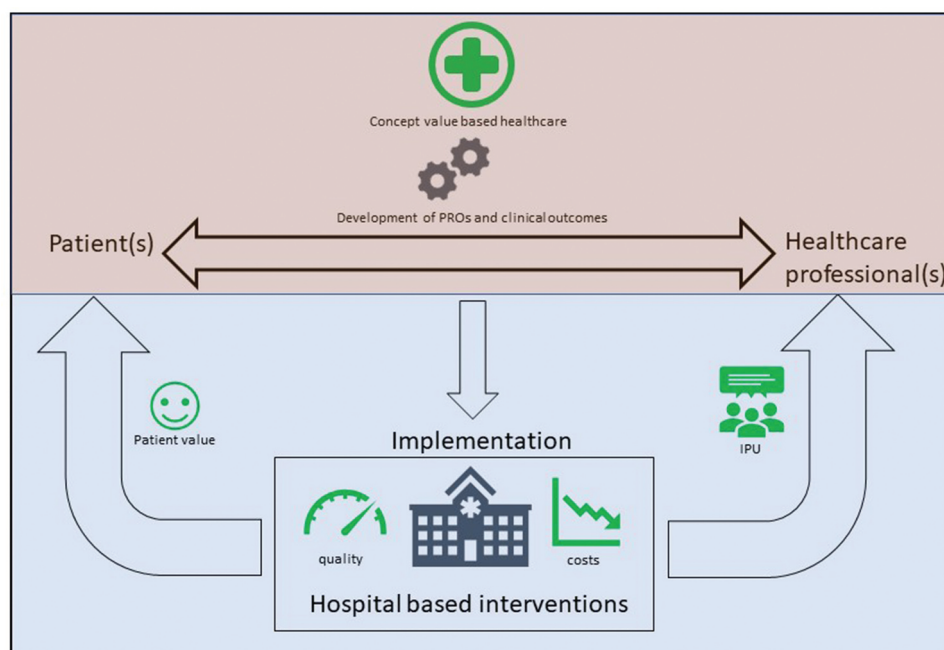


Figure 1. Implementation of patient-reported outcomes in hospital-based interventions.

The aim of this study is to conduct a scoping review on patient-reported and clinical outcomes resulting from hospital-based interventions in Western countries, within the explicit context of VBHC. Hypothesizing that findings may differ per intervention category, we clearly distinguished between curative, chronic (maintenance), and palliative treatments.

## 2. Methods

### 2.1. Study design

This scoping review was set up according to the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA-ScR) statement [24]. As we wanted to study how PROMs, PREMs, and clinical outcomes are implemented in hospital-based intervention, we chose a qualitative approach using content and outcomes/experiences analysis. A scoping review was best suited to address a broad research question in this study.

### 2.2. Search

A comprehensive search strategy was developed in Embase, Medline, and PubMed on implementation examples of VBHC in hospitals (Figure 2). All searches concerned the period between 1 January 2010 and 1 January 2022; 2 years before the International Consortium for Health Outcome Measurements (ICHOM) was created [25]. The search strategy combined indexed words and mesh terms related to the development and implementation of VBHC (Supplementary S1). The results of these database searches were cross-checked to eliminate duplicate entries.

### 2.3. Inclusion and exclusion criteria

We included publications focusing on the development and implementation of patient-reported outcomes in hospital-based interventions. First, published VBHC outcomes defined as PROMs and/or PREMs and clinical outcomes were included. Secondly, the disease-specific implementation of VBHC in practice was described and published. Furthermore, we included examples of VBHC implementation in practice in Western countries since the quality of care is comparable between these countries and the development of patients reported in hospital-based interventions is mainly expanded in high-income countries. We only included publications in English and excluded conference papers and (systematic) reviews. Furthermore, for diseases, we only excluded 'mental illnesses,' because treatment generally takes place in separate specialized (non-hospital) clinics.

### 2.4. Selection of studies and data extraction

One reviewer (AMF) removed all duplicates, after which two reviewers (AMF and JFHE) independently performed the selection in two stages: (1) title and abstract screening of each citation and (2) reviewing the full text of the retained articles. During each stage, disagreements were resolved by consensus or escalated to the research team (JPMV, MNMTAK, CB, and

MJP). One reviewer (AMF) extracted the data to a Microsoft Excel file; the other reviewer (JFHE) verified the extraction file.

### 2.5. VBHC concept

The conceptual framework of VBHC describes a six-step pathway to achieve improved treatment outcomes [14,15]. Notably, these steps are as follows: (1) organize care within integrated practice units (IPUs); (2) measure outcomes and costs per patient; (3) evaluate the growing trend toward implementation of alternative payment and compensation models; (4) integrate care delivery across separate facilities; (5) expand excellent services worldwide; and (6) build a robust technology platform to facilitate the process, as described in the other five steps above. In this study, we particularly focused on the first two steps.

### 2.6. Definition of outcome measures

In this study, outcome measures were classified by PROMs, PREMs, and patient clinical outcomes. The most ideal manner to measure value in health accurately, would be to follow real-time patient outcomes. Outcomes should include the health circumstances most relevant to patients. In this scoping review, we focused on hospital-based patient-reported outcomes and experiences, included in a time horizon. We collected all patient clinical outcomes currently applied in hospitals.

### 2.7. PROMs

Measures of treatment outcomes from the patient's perspective were defined as PROMs [26]. PROMs are central in measuring outcomes, as they provide a patient-centered assessment of health, quality of life, and functioning in practice. PROMs can be categorized into generic outcomes, domain-specific and disease-specific outcomes [27]. Generic outcomes are applicable to population-based questions, for example, a broad hospital population, useable in cost-effectiveness analyses. Furthermore, there are domain-specific PROMs quantifying various health attributes such as domain-related pain, fatigue, or anxiety. Domain-specific measures are detached from specific disease patterns and are used for independent comparisons between diseases. Disease-specific outcomes describe symptoms individually and precisely [28]. The target population and disease type are decisive in determining the most suitable PROM set. When examining patients with a specific diagnosis or a specific or frequent treatment, the use of disease-specific measures is recommended.

### 2.8. PREMs

Questionnaires measuring patient experiences on their health-care pathway while receiving care were defined as PREMs and could, for example, be used in a patient-satisfaction survey in a hospital [29]. Each individual might experience the same care in the same setting and during the same treatment in a different manner [30]. For that reason, large-scale and high-

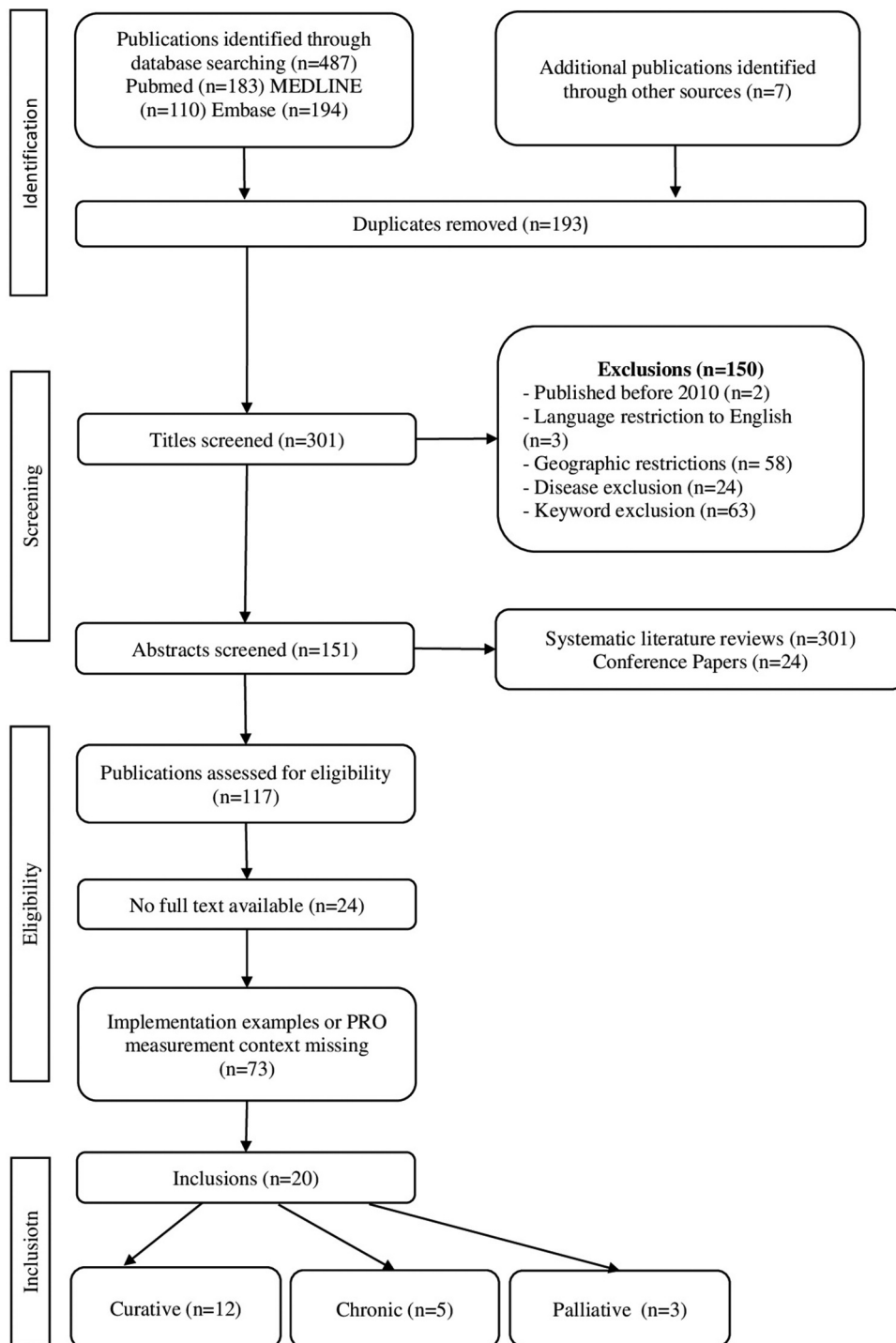


Figure 2. Flowchart of the scoping review.

quality PREMs need to be collected to monitor patient perception and experience. In contrast to PROMs, PREMs do not look at the outcomes of care but at the impact of the process of the care on the patient's experience, for example, with regard to communication and timelines of assistance [31].

## 2.9. Patient clinical outcomes

Clinical outcomes were defined as measurable changes that result from the health-care process and are not reported by

the patients, such as lab values, and outcomes measured in the clinic and determined by a (inter)national group of health-care professionals and other expertise, which formally submit guidelines [32]. Clinical outcomes can be measured from health-care resource use databases, such as hospital (re-) admission rates, or by agreed scales, such as disease activity or progression-free survival and other measurements [33,34]. These data are generally recorded by administrators or by clinical staff, such as doctors, nurses, psychologists, or other health professionals. Examples of clinical outcomes can be



survival, health status or recovery, time to recovery, termination of care or treatment process (e.g. ineffective care, treatment-related discomfort, complications, and adverse effects) [33].

### 2.10. Curative, chronic, and palliative treatments

This study assessed differences between diseases, specified as patient-reported outcomes in curative, chronic, and palliative treatments in the hospital. Curative treatment was defined as a condition with complete healing and no major health issues after healing. Chronic treatment was defined as a condition with continuous presence of the disease after the diagnosis has been made by a health professional, this can be variable over time, but a patient never (completely) recovers from the disease. Palliative treatment was defined as a condition with an approximate but unknown period of time after diagnosis, ultimately resulting in the patient dying of the disease. Palliative treatment is always life prolonging, but a patient will never be cured [35].

## 3. Results

### 3.1. Overview of study characteristics

The search of the databases resulted in 487 hits for the used search criteria; 7 publications were manually included. After removing 193 duplicates, the final set consisted of 301 unique publications. We excluded five non-English language publications. Furthermore, 27 Embase publications and 8 articles from PubMed were excluded based on the region criterion. Publications from Europe (including the United Kingdom), the United States of America, Canada, and Australia were included. Mental health disorders (21 publications) were also excluded since the treatment of people with a mental illness takes place in separate specialized clinics. Since we wanted to focus specifically on hospital implementation examples, publications with implementation examples outside the hospital were excluded, 33 articles from the Embase database and 15 PubMed publications. In total, there were 109 exclusions, resulting in a final number of 151 publications for abstract screening. Publications identified as either conference abstracts or (systematic) literature reviews of VBHC were excluded because we assessed them as insufficient for the purpose of the current study. Overall, 117 publications were assessed for eligibility, 73 articles lack a clearly developed VBHC outcome set, with PROMs and/or PREMs, and examples of implementation in hospitals. For 24 articles, there was no full text available.

In total, 20 publications were included (Figure 1) in this study. First, an overview of the identified PROMs is presented followed by the PREMs in the second section. In the third section, the patient clinical outcomes are presented. Subsequently, implementation of VBHC for different treatments (curative, chronic, and palliative) is compared. Finally, the experiences on VBHC implementation reported by patients and health-care professionals were presented.

### 3.2. PROMs analysis

For studies with PROM sets included (Table 1), a generic measure was implemented in 60% (12/20) of the outcome sets. A domain-specific measure was implemented in 70% of the outcome sets (14/20 papers). Disease-specific measures were used in 60% (12/20) of the outcome sets, and quality of life (QoL) measurements were most frequently reported and implemented. Of all PROM sets, 65% were implemented in a single center, and 40% of the studies have been published and implemented in a Dutch hospital.

BAROS: Bariatric Analysis and Reporting Outcome System; BCTQ: Boston Carpal Tunnel Questionnaire; BSHS: Burn Specific Health Scale 114-questions; BSHS-B: Burn Specific Health Scale 40-questions; BSSC-W: Brief Sexual Symptom Checklist for women; Carer-QoL-7D: Care-related Quality of Life; CIS-20: Check individual strength; CTCEAv4.0: Therapy and Common Terminology Criteria for Adverse Events I-V; EORTC: European Organisation for Research and Treatment of Cancer; EQ-5D: EuroQoL-5 dimensions; EQ-6D: EuroQoL-6 dimensions; Ferti-QoL9: Fertility Quality of Life; FSFD-R: Female Sexual Distress Scale-Revised; FSFI: Female Sexual Functioning Index; HADS: Hospital Anxiety and Depression Scale; HOOS-PS: Hip disability and Osteoarthritis Outcome Score; KOOS-PS: Knee injury and Osteoarthritis Outcome Score; MD-HAQ: Multidimensional Health Assessment Questionnaire; mHI-CD: Mobile Health Index-Crohn's Disease; mHI-UC: Mobile Health Index-Ulcerative Colitis; MHQ: Michigan Health Questionnaire; mRS: Modified Rankin Scale; PDQ: PainDETECT Questionnaire; PHQ: Patient Health Questionnaire; PSS-10: Perceived Stress Scale; RCS-NL: Reproductive Concerns Scale; SF-12: Short-Form 12 questions; SF-26 equal to RAND-36: Short-Form 36 questions; TRANS-Q: Transition Questionnaire Score; VAS: Visual-Analog Scale; WPAI: Work Productivity and Activity Impairment Questionnaire.

Depending on the study type, study protocols [40,47] were published. For implementation trials and prospective single-center trials [36,41], studies were published with a region-specific approach. Multi-center [38,53] studies had a broader implementation perspective but almost always within a specific country. All studies were directed at transferring the study design into standard care. During the design phase of the trial, most studies offered new opportunities [40]. The most broadly implemented PROM set was hernia care, with 38 participating centers worldwide [42]. Hernia care also had the highest rate of patients included with 2377 in a multi-center study.

Of all studies included, 25% concerned oncology diseases [7,46,50,52,54]. The PROM sets showed recognizable, rather standardized, structures in the sets, with special focus on questions about mental well-being. Generic measures were used consistently in questionnaires such as European Organisation for Research and Treatment of Cancer QLQ-C30 (EORTC), which were developed for patients with cancer in general. In patients with lung cancer, deterioration was pronounced during and after treatment for physical, role, and social functioning. Clinically meaningful negative effects did persist for physical and role functioning. Of all lung-cancer patients included, 65% of deceased patients had died in the

Table 1.. PROM analysis.

Author	Country	Patients included (n)	Disease	Generic measure	Unspecified QoL measure	Domain-specific measure	Disease-specific measure
<b>Curative treatments</b>							
[36] Goretti et al. (2020)	Italy	N = 2122 Single center	Bariatric surgery		X		BAROS
[37] Bernstein et al. (2019)	The United States of America	N = 70 Single center	Pain interference in carpal tunnel release			MHQ	BCTQ
[38] Oemrawsingh et al. (2019)	The Netherlands	N = 1022 Multi center	Ischemic stroke	EQ-6D without the cognitive dimension → transformation to EQ-5D			mRS
[39] Lam et al. (2018)	The Netherlands	N = 75 Single center	Minor stroke and transient ischemic attack	RAND-36PROMIS-Global 10 Score		PHMH	
[40] Kuklinski et al. (2020)	Germany	Protocol study multicenter	Total knee and hip replacement	EQ-5D-5 L		Analogue pain scale PHQ-9 Fatigue	HOOS-PS KOOS-PS
[41] Zipfel et al. (2020)	The Netherlands	A toolbox: the Intervention Selection Toolbox Single center	Aortic valve disease	SF-36			
[42] Poulse et al. (2016)	World-wide	N = 2377 multicenter	Hernia care		X	Pain Intensity Scale	
[43] Bush et al. (2019)	The United states of America	-Single center	Hepatitis C			WPAI fatigue	
[44] Bernstein et al. (2019)	The United states of America	N = 185 Single center	Orthopedic surgery			Physical function Pain interference Depression	
[45] van Veghel et al. (2020)	The Netherlands	N = 1455 multicenter	Coronary artery disease				Individual questionnaire: PROMs, PREMs, patient satisfaction
[7] van Egdome et al. (2019)	The Netherlands	-Single center	Breast cancer	EQ-5D-5 L CarerQoL-7D		RCS-NL	EORTC-QLQ-Core EORTC-QLQ-BR23 BREST-Q
[46] Legendijk et al. (2018)	The Netherlands	N = 496 multicenter	Breast cancer	EORTC QLQ-C30			EORTC QLQ-C30 EORTC-QLQ-BR23 BREST-Q
<b>Chronic treatments</b>							
[47] Jørgensen et al. (2018)	Danish	-Protocol study	Inflammatory arthritis	EQ-5D		PDQ TRANS-Q MD-HAQ VAS-pain VAS-fatigue	
[48] van den Hoven et al. (2020)	The Netherlands	N = 177 Single center	Turner syndrome	EQ-5DFerti-QoI9		HADS CIS-20 PSS-10 BSSC-W FSFI FSFD-R	
[49] van Deen et al. (2017)	The United states of America	N = 210 Single center	IBD		Individual score; Developed	Individual score: Productivity, Disease control and QoL	mHI-CD mHI-UC
[50] Hennink et al. (2013)	The Netherlands	N = 62 Single center	Lynch syndrome			VAS Scores	Patient satisfaction questionnaire
[51] Friedstat et al. (2017)	The United States of America	-Single center	Burn injury	SF-12SF-36		Vancouver Scar Scale: Patient observer Scar assessment scale	BSHC BSHC-B Burn outcome questionnaire
<b>Palliative treatments</b>							
[52] Schuler et al. (2017)	Germany	N = 371 Single center	Cancer care	EQ-5DEORTC QLQ-C30			EORTC QLQ-C30
[53] Parra et al. (2017)	Spain	N = 220 multicenter	Hemodialysis	SF-36		Modified Charlson co-morbidity index VAS Scores	
[54] Nguyen et al. (2019)	Belgium	N = 32 Single center	Advanced non-small-cell lung cancer	EORT-QLQ-C30		Quality of death	EORT-QLQ-C30



hospital [54]. For oncology, measuring PROMs can lead to identifying issues for improvement of the value of care delivered.

Significant results mentioned in the other studies were often more adequate and targeted related outcomes for the individual, resulting in reduced side effects, or focused more on mental aspects in patients who have a life-threatening condition. For example, the PROMs documented in bariatric surgery during the follow-up visit of 1 year after discharge resulted in increased productivity and quality of life [], and in Inflammatory Bowel Disease (IBD) care, QoL was more important to patients than disease control or productivity [49]. Another practical approach for implementation in hospitals was the disease ‘minor stroke and transient ischemic attack,’ and they validated and implemented the PROMIS-10 scores [39]. The PROMs implemented in value-based medicine strategies to eradicate hepatitis C virus have greatly improved treatment success rates, as is documented by the very high cure rates and by improving patient-reported outcomes, including HRQoL [43]. The results of patients with hemodialysis were easily interpreted and compared between five centers. The overall result was that the highest patient benefit achieved at the lowest cost provided the greatest value [[53]].

Despite strong acceptance among patients, program recruitment rates decreased over time in all studies. For example, in cancer care, fully integrated PROMs in the hospital system during the hospital stay resulted in clinically meaningful improvements for health utility and QoL. Patients reported a variety of symptoms at admission and discharge [52]. However, after discharge from the hospital, patients were less motivated to complete (electronic) PROMs.

### 3.3. PREMs analysis

Most studies included did not include or mention PREMs. A few studies mentioned the experience measures of patients during treatment in hospital. For the treatment of cardiac patients diagnosed with coronary artery diseases, patient satisfaction questionnaires to determine the quality of medical specialists and hospital performance were implemented [45]. Dimensions of questionnaire interests were as follows: quality of care delivery, hospital admission, personal contact with the specialist as experienced from the patient’s perspective, as well as the individual value perception [45].

For hemodialysis, patient satisfaction questionnaires showed a similar result [53]. In a hemodialysis study, treatment satisfaction was measured from 31 questions on practitioners (7 questions), nurses (8 questions), treatment(s) (8 questions), and facilities (8 questions); and a Visual Analog Scale was used to quantify the patient’s individual preferences. The obtained satisfaction scores were weighted and matched with other PROMs, such as the modified Charlson comorbidity index, to adjust for the degree of comorbidity between patients. The results were used to compare outcomes and experiences from patients between the different hemodialysis facilities.

The study on total hip and knee replacements was designed as a randomized controlled trial and included patients from nine different clinics [40]. Besides the PROMs (Supplementary S2), the authors applied Patient Experience

Questionnaires (PEQs) to quantify patient satisfaction; these questionnaires could not be published for reasons of confidentiality.

Patients perceived routine orthopedic care as a better treatment experience when the patient-reported outcome measurement information system (PROMIS) was implemented into their care pathway. For this, the clinician and group consumer assessment of health-care providers and systems (CGCAHPS) survey was used, which is a validated experience questionnaire [44]. In this study, 2.2% (185 out of 8607) of the patients were eligible for the study were included. In coronary artery disease, the level of patient satisfaction (response rate 32.2%; 216 out of 669) improved and reached statistically significant higher scores on patient information and education [45].

### 3.4. Patient clinical outcomes

Besides PROMs and PREMs, clinical measures are also important to guarantee quality of care, and to benchmark between similar hospitals, either in specific regions or possibly even between Western countries. A cumulative overview of the underlying clinical measures of the included studies is presented in Table 2. In the following paragraphs the patient and clinical outcomes as well as different treatments are compared.

### 3.5. Curative, chronic, and palliative treatments

Twelve papers were classified as curative treatment (Table 1), five as chronic treatment, and three as a palliative treatment. For chronic treatments, there are more domain-specific measures implemented compared to curative treatments, and palliative treatments were more evenly distributed across the three PROM measures (generic, domain- and disease-specific).

The results for curative treatments showed that the diseases were difficult to compare on PROM level. Generic, domain-specific, and disease-specific measures appeared more heterogeneous, as was found for the chronic treatments. However, in contrast to the curative disease section, the questionnaires for chronic diseases focused thematically on pain issues and mental well-being of the patient. We also observed that a larger number, respectively, of six different domain-specific measures were integrated into the questionnaires used.

For curative and palliative treatments, we identified a wide range of operational and diagnostic measures, summarized under clinical outcomes as systematic and objective information. The most frequently registered clinical outcome resulted in disease- and time-dependent survival rates. For palliative treatments, progression-free survival was often added to give an overview during the state of diagnosis and death, which means that the disease does not develop further during that phase of treatment. For curative treatments, the clinical outcomes were focused on pre- and post-operative differences. Furthermore, curative clinical outcomes resulted in registration of possible readmission due to complications or possible recurrence of the disease, which reflects the impact of the interventions in hospitals

by curative treatments. The chronic treatments emerged as an exception to include clinical outcomes, as the only chronic conditions, Turner syndrome [48], and burn injuries [51] included clinical measures as part of the outcome sets.

### 3.6. Implementation experiences reported from patients and IPU

For curative conditions, such as bariatric surgery, increased patient adherence was reported after redesign of the health-care pathway. This is along with the principles of the value agenda of the VBHC concept [36]. Due to developments toward an IPU, treatment costs were reduced, and savings made it possible to offer patients further motivational activities, such as counseling or creation of a personal diary [36]. Providers observed higher adherence among their patients and better overall treatment results. Another study tested the impact on patient experience by using PROMIS to a patient population undergoing orthopedic surgery [44]. Direct comparison between the intervention and the control group showed that patients who completed PROMIS questionnaires before the consult with the health-care professional reported better experiences regarding the treatment afterward. Patients reported that treatment information had been better explained and that the doctor had spent sufficient time with them. Moreover, patients reported that they would recommend the doctor to other patients and at the same time rated the health-care professionals higher [44]. In the chronic treatment group, health-care professionals faced general compliance problems among patients with Lynch Syndrome, specifically during the treatment process [50]. Changes in compliance were monitored in intervals of 6 years, with the aim to reach a compliance rate of over 95% [50]. In the cancer care group, the VBHC implementation process for breast cancer care also received positive feedback based on the patient-reported outcomes and experiences sets [7,46]. Patients reported that by completing the questionnaires they gained greater awareness of their own functioning and that the questionnaires supported them in their cancer treatment. By adding three dedicated questions at the end of the questionnaire, health-care professionals were enabled to get a better insight into satisfaction with and acceptability of the PROMS questionnaires. The evaluation showed that almost all patients reacted positively to the questions added, showing that improvements in care, self-reflection, and acceptability of the PROM sets were high among the respective patient groups.

## 4. Discussion

VBHC is an innovative framework for redesigning the delivery of care, which is aimed at achieving better outcomes for patients while at the same time reducing cost [10]. This study addressed hospital-based implementations of PROMs, PREMs, and clinical outcomes based on published studies. Notably, this research distinguishes between categories of care that can be summarized with curative, chronic, and palliative treatments. The VBHC concept is a widely discussed topic in the literature but still lacks a supported practical approach [55,56]. This study shows the value of implementing this concept in hospitals, and demonstrates the differences between generic (60%), domain-specific (70%), and disease-specific (60%) PROMs. Of all implemented outcome sets, 40% were initiated in a Dutch hospital setting, and 65% of outcome sets were implemented in a single center. This study showed that the implementation of PROMs is widely accepted, but that PREMs are less often implemented in hospital-based intervention settings.

All studies included aimed at transferring the study design into practical implementation as part of standard care. During the design phase of an implemented trial, the studies reviewed generally resulted in new opportunities to improve health-care pathways. When the practical approach of VBHC, aimed to improve patient value during the health-care pathway, is compared to the more scientific approach, of validated questionnaires in a trial setting, neither method necessarily leads to clinical improvements for the patient. However, it appeared that the practical as well as the scientific approach to the implementation of the VBHC concept will lead to an improvement in other types of patient value.

Consequently, the results illustrate that the generic EQ5-5D measure is most frequently used in the outcome sets that have been implemented in hospital practice. This is not only because of the generic application but also as a standard for the conversion to quality-adjusted life years in health technology assessments or health economics and outcome research. For scientific reasons, questionnaires can be designed more comprehensively; the PROM EQ-5D is generic and as such can be applied to most diseases. Moreover, it is a patient-friendly PROM. However, a very generic questionnaire may be too general to capture individual-specific treatment issues. General questions could lead to a lack of understanding and may cause compliance problems and result in a willingness to answer the questionnaires accurately although patient satisfaction and patient benefit are occasionally part of the VBHC concept.

**Table 2.** Patient clinical outcomes.

Treatment	Clinical outcomes
Curative	30-day mortality, 120-day mortality, 3-month mortality, 1-year mortality, survival, morbidity, comorbidity, symptom scores (fatigue, nausea, pain, dyspnea, insomnia, appetite loss, constipation, diarrhea, and financial difficulties), postoperative complications, postoperative revision, readmission, 30-day readmission, 30-day re-operation, re-operation, early recurrence, free of intervention, surgical site occurrence rate, surgical site infection rate requiring reoperation, pain, cerebrovascular accident within 72 h, deep sternal wound infection within 30 days, myocardial infarction within 30 days, event-free survival, and excess weight loss at 1 and 3 years
Chronic	Mortality and morbidity
Palliative	Mortality, 2-year mortality, survival, 2-year cumulative survival, comorbidities, symptom scores (fatigue, nausea, pain, dyspnea, insomnia, appetite loss, constipation, and diarrhea), follow-up time, time to progression of the disease, CTCAEv4.0, complication rate or complication burden, hospitalization rate, dialysis adequacy, hemoglobin concentration, serum calcium, and serum phosphorous.

Uniformity in the implementation of patient-reported outcomes could lead to standardization. Standardized implementation guidelines may support IPU in restructuring their care pathways since it would minimize any uncertainty with regard to implementation failure [46]. For example, the ICHOM creates and publishes disease-specific outcome sets on a global level, ensuring that the patient's needs are considered as the main focus of treatment [57]. Standardization of outcome sets and central implementation may well lead to support within an IPU. As health-care systems vary greatly across countries, it is questionable whether patient-reported outcome sets should be developed on an international level. An international outcome set may not just be feasible to be implemented in any health-care system or patient population. Countries differ greatly in terms of size, organization, and structure of their health-care system, and it may seem reasonable for each country to develop its own outcome sets and respective implementation roadmap. A systematic review on VBHC initiatives in practice reported similar results compared to our study and concluded that only a few studies fully evaluate implementation strategies [55]. For example, components in the six-step model are only performed and implemented in fragments. Another study described how VBHC is conceptualized in the literature and implemented in hospitals [58]. The authors discussed a gap in VBHC implementation strategy in the real-world setting as compared to theories. In their results, the authors described that most hospitals implemented only one or two components of the six-step model, mainly the measurement of outcomes and IPU. Both studies concluded that there is an urgent need in creating a robust and reproducible VBHC implementation strategy [55,58]. As such, our study updates and confirms these findings as well as presents an explicit differentiation in findings and recommendations for curative, chronic, and palliative treatments in hospitals.

Therefore, we would like to suggest the development of generic sets worldwide and country-specific sets, which can be applied per region or ideally nationwide. A simplified digital outcome set would improve the performance and uniformity of VBHC implementation. Also, outcomes collected in real-world clinical data registries provide support for the implementation of quality improvement initiatives [59]. Uniformity and organizational readiness are key to achieving improved patient value.

Furthermore, we categorized three groups of treatments: 12 curative treatments, 5 chronic treatments, and 3 palliative treatments. Our results showed considerable differences between curative and chronic PROM sets, due to the heterogeneous structure of the sets, with differentiation in course of condition as well as length of disease progression. In contrast, the oncology sets in the groups 'palliative and curative conditions' showed higher comparability due to the implementation of quality of life (EORTC) questionnaires. This may show that cancer was among the first diseases for which standardized sets were designed and that these PROM sets were supported by clinical professional groups. As yet, the satisfaction and experience scores from patients are not used as a standard implementation tool in practice and are more considered to be an instrument used by the

organization. The clinical outcomes are widely used in practice, and there is a great deal of consensus-based evidence from health-care professionals.

#### 4.1. Strengths and limitations

Since the literature in the field of VBHC implementations has only been available for a short period of time, we adapted our search strategy by means of an extensive screening process in the literature. Although mental illnesses were excluded for reason of associations with distress and/or problems functioning in social, work, or family activities over time, we did not determine any other disease-specific inclusion criteria. The selected 20 publications focused on common medical indications, which we consider to be a strength. Furthermore, we only analyzed implementation examples in Western countries, which generally have more advanced and comparable health-care systems, and may cause potential selection bias. Furthermore, we limited the focus to hospital implementation examples, but in order to successfully implement VBHC it should involve an integrated health-care pathway approach including implementation aspects outside the hospital setting. This could be considered a type of selection bias, as hospitals are generally able to combine considerably more research resources and expertise compared to primary care. In this study, we mainly focus on the implementation of VBHC outcomes in standard care. Impact on clinical results is a gap in our results and suggests that further research is needed to come from VBHC implementation examples to impact in a broader perspective. Finally, in the title-abstract screening phase, we found that a large number of studies used the term VBHC implementation in their abstract, whereas the main focus of the study was neither VBHC nor implementation. This also underlines the earlier observation that the concept of VBHC has a high level of interpretative variability in the literature.

## 5. Conclusions

With regard to the theoretical VBHC concept and the patient-value equation, there are significant differences between theory and practical implementation of the VBHC concept [14]. This study shows that there are only few published examples of VBHC implementation in the literature [16] and shows that compared to PREMs, PROMs are more frequently applied in outcome sets. Additionally, this study shows the difference in patient-reported outcomes between curative, chronic, and palliative treatments in the early development from concept to practice in Western countries. However, to improve and ensure comparability of outcomes, it is important to develop and implement simplified, digital, and standardized outcome sets founded on evidence-based research and with equal participation from key stakeholders, in particular from the patient itself.

## 6. Expert opinion

### 6.1. The frontrunners

Since the introduction of the concept VBHC in 2006, the lack of actual implementation in hospital settings is remarkable and highlights the need for a plan of action. Hospitals are organized by professionals with, on the one hand, specialist knowledge of diagnosing and treating diseases and, on the other hand, sufficient expertise and insights in efficiency and quality of care. Here, hospital organizations can play an important role in a network of nursing homes for the care of the elderly and primary care in regions/countries, which became apparent during the Covid-19 crisis. Therefore, hospital organizations should be better organized to play a leading role and/or a frontrunner position in the implementation of VBHC. Currently, PROM sets are more frequently implemented in hospitals compared to PREM sets. It is essential that simplified, digital, and standardized VBHC outcome sets are implemented with equal participation from the important stakeholders involved, and most importantly patients themselves. From our perspective, frontrunners that implement outcomes measures such as PROMs and PREMs should ask themselves to what extent this leads to health impact, or is it part of a bigger VBHC dogma assuming that development and implementation of practical case-examples leads to better patient outcomes. The role of the patient and the IPU

In this study, experiences reported by patients and IPU's on the implemented outcome sets were particularly valuable with regard to future implementation processes, and to reflect the importance of implemented outcome sets in practice. The implementation experiences were important to see how the PROMs and PREMs affected patients, and how providers managed to bring patient participation into practice. An IPU, and especially a physician, is crucial in breaking up existing patterns and boundaries in a health-care organization. For example, they could focus on ownership of the implementation steps, and stimulate improvement cycles, with the aim to maximize patient value. As such, the patients' reflections are essential for an optimal implementation of the concept in practice.

### 6.2. VBHC is a continuous implementation process

Treatment and therapy strategies are continuously undergoing development and improvement, such as those seen in the disease Hepatitis C virus, which showed an exceptional change from palliative care to a curative disease [43]. The new direct-acting antivirals lead to substantial improvements in clinically important outcomes, and as such bring value to patients and society. Furthermore, the costs associated with these treatment regimens can be recovered by preventing the future economic burden of complications and value-based driven medicine [8]. New innovative and potentially expensive curative, chronic, and palliative treatments warrant enhanced development and implementation of VBHC-oriented hospital-based interventions. Therefore, a dynamic way of VBHC implementation in a continuous process of innovative treatment options is the key to success.

### 6.3. Future perspective

Differences in current treatments and developments in treatment options and techniques over time are crucial for the actual implementation of the VBHC concept. From a public-health and health-economic perspective, it would be reasonable to consider increasing integration between health technology assessments and the concept of VBHC. Yet, decades of cost-effectiveness analyses resulted in outcomes expressed in increased cost-effectiveness ratios and were used as the leading outcome method in comparing expensive drugs though this does not always reflect the value of such treatment options in reality. Adding individual real-time QoL data following the VBHC principle will finally result in a more transparent system and an enriched dataset including data from patients. Assuming that key stakeholders are sufficiently cooperative in sharing and integrating data and knowledge, the future of cure and care could become affordable in an economically favorable and ethically responsible manner if the principles of VBHC are being implemented following a dynamic approach.

### Author contributions

All authors: study concept and design, critical revision of the manuscript, and interpretation of data. J Eijsink and A Fabian: data acquisition and management. J Eijsink and A Fabian: drafting of the manuscript. C Boersma and M Postma: study supervision. All authors read and agree for the final version of the manuscript to be published.

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### Reviewer disclosures

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## Appendix

### Query Embase (01.01.2022)

(((((('health care'/exp OR care OR health) AND patient OR patients) AND reporting OR reportings OR research OR reported) AND clinic OR clinical OR clinically OR 'outpatient department' OR ambulatory) AND implementation OR implementations OR implementors OR implementational) AND outcome OR outcomes) AND 'value based health care':ab,ti AND (2010:py OR 2011:py OR 2012:py OR 2013:py OR 2014:py OR 2015:py OR 2016:py OR 2017:py OR 2018:py OR 2019:py OR 2020:py OR 2021:py) AND [english]/lim NOT (asia OR Thailand OR Malaysia OR Japan OR Philippines OR China OR Korea) NOT (africa OR Kenya OR Egypt) NOT (new AND zealand) NOT Russia NOT (south AND america OR Brazil) NOT (central AND america OR Mexico) NOT (mental AND illness OR depression) NOT (primary AND care)

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((((((((((((((((((((((((((('health'[MeSH Terms] OR 'health'[All Fields] OR 'health's'[All Fields] OR 'healths'[All Fields]) AND 'patient's'[All Fields]) OR 'patients'[MeSH Terms] OR 'patients'[All Fields] OR 'patient'[All Fields]) AND 'reportable'[All Fields]) OR 'reporting'[All Fields] OR 'reportings'[All Fields] OR 'research report'[MeSH Terms] OR ('research'[All Fields] AND 'report'[All Fields]) OR 'research report'[All Fields] OR 'report'[All Fields] OR 'reported'[All Fields] OR 'reports'[All Fields] OR ((((((('ambulatory'[All Fields] OR 'ambulatory care facilities'[All Fields] OR 'clinic'[All Fields] OR 'clinic's'[All Fields] OR 'clinical'[All Fields] OR 'clinically'[All Fields] OR 'clinical's'[All Fields] OR 'clinics'[All Fields]) AND 'implementation'[All Fields]) OR 'implementation's'[All Fields] OR 'implementational'[All Fields] OR 'implementations'[All Fields] OR 'implementer'[All Fields] OR 'implementers'[All Fields] OR 'implementation'[All Fields] AND 'outcome'[All Fields]) OR 'outcomes'[All Fields]) AND 'loattrfull text'[Filter])) AND 'value based health care'[Title/Abstract] AND 2010/01/01:2022/01/01[Date - Publication]) NOT ('Russia'[MeSH Terms] OR 'Russia'[All Fields] OR 'Russia s'[All Fields] OR 'russias'[All Fields])) NOT ('asia'[MeSH Terms] OR 'asia'[All Fields])) NOT ('new zealand'[MeSH Terms] OR 'new'[All Fields] AND 'zealand'[All Fields]) OR 'new zealand'[All Fields])) NOT ('south america'[MeSH Terms] OR 'south'[All Fields] AND 'america'[All Fields]) OR 'south america'[All Fields])) NOT ('central america'[MeSH Terms] OR 'central'[All Fields] AND 'america'[All Fields]) OR 'central america'[All Fields])) NOT ('Malaysia'[MeSH Terms] OR 'Malaysia'[All Fields] OR 'Malaysia s'[All Fields])) NOT ('Japan'[MeSH Terms] OR 'Japan'[All Fields] OR 'Japan s'[All Fields] OR 'japans'[All Fields])) NOT ('Thailand'[MeSH Terms] OR 'Thailand'[All Fields] OR 'Thailand s'[All Fields])) NOT ('africa'[MeSH Terms] OR 'africa'[All Fields] OR 'africa s'[All Fields] OR 'africas'[All Fields])) NOT ('Kenya'[MeSH Terms] OR 'Kenya'[All Fields] OR 'Kenya s'[All Fields])) NOT ('philippine'[All Fields] OR 'Philippines'[MeSH Terms] OR 'Philippines'[All Fields])) NOT ('Brazil'[MeSH Terms] OR 'Brazil'[All Fields] OR 'Brazil s'[All Fields] OR 'brazils'[All Fields])) NOT ('caribbean s'[All Fields] OR 'caribbeans'[All Fields] OR 'west indies'[MeSH Terms] OR 'west'[All Fields] AND 'indies'[All Fields]) OR 'west indies'[All Fields] OR 'caribbean'[All Fields] OR 'caribbean region'[MeSH Terms] OR ('caribbean'[All Fields] AND 'region'[All Fields]) OR 'caribbean region'[All Fields])) NOT ('China'[MeSH Terms] OR 'China'[All Fields] OR 'China s'[All Fields] OR 'chinas'[All Fields])) NOT ('Egypt'[MeSH Terms] OR 'Egypt'[All Fields] OR 'Egypt s'[All Fields])) NOT ('Korea'[MeSH Terms] OR 'Korea'[All Fields] OR 'Korea s'[All Fields] OR 'koreas'[All Fields])) AND 2010/01/01:2022/01/01[Date - Publication]) NOT ('mental disorders'[MeSH Terms] OR ('mental'[All Fields] AND 'disorders'[All Fields]) OR 'mental disorders'[All Fields] OR ('mental'[All Fields] AND 'illness'[All Fields]) OR 'mental illness'[All Fields])) NOT ('depressed'[All Fields] OR 'depression'[MeSH Terms] OR 'depression'[All Fields] OR 'depressions'[All Fields] OR 'depression s'[All Fields] OR 'depressive disorder'[MeSH Terms] OR ('depressive'[All Fields] AND 'disorder'[All Fields]) OR 'depressive disorder'[All Fields] OR 'depressivity'[All Fields] OR 'depressive'[All Fields] OR 'depressively'[All Fields] OR 'depressiveness'[All Fields] OR 'depressives'[All Fields])) AND 2010/01/01:2022/01/01[Date - Publication]) NOT ('primary health care'[MeSH Terms] OR ('primary'[All Fields] AND 'health'[All Fields] AND 'care'[All Fields]) OR 'primary health care'[All Fields] OR ('primary'[All Fields] AND 'care'[All Fields]) OR 'primary care'[All Fields]))