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Value-Based Healthcare Initiatives in Practice: A Systematic Review

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EXECUTIVE SUMMARY

Value-based initiatives are growing in importance as strategic models of healthcare management, prompting the need for an in-depth exploration of their outcome measures. This systematic review aimed to identify measures that are being used in the application of the value agenda. Multiple electronic databases (PubMed/MEDLINE, Embase, Scopus, Cochrane Central Register of Controlled Trials) were searched. Eligible studies reported various implementations of value-based healthcare initiatives. A qualitative approach was used to analyze their outcome measurements. Outcomes were classified according to a tier-level hierarchy. In a radar chart, we compared literature to cases from Harvard Business Publishing. The value agenda effect reported was described in terms of its impact on each domain of the value equation. A total of 7,195 records were retrieved; 47 studies were included. Forty studies used electronic health record systems for data origin. Only 16 used patient-reported outcome

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surveys to cover outcome tiers that are important to patients, and 3 reported outcomes to all 6 levels of our outcome measures hierarchy. A considerable proportion of the studies (36%) reported results that contributed to value-based financial outcomes focused on cost savings. However, a gap remains in measuring outcomes that matter to patients. A more complete application of the value agenda by health organizations requires advances in technology and culture change management.

INTRODUCTION

Healthcare organizations historically have not connected general business management practices to patient requirements. Healthcare management centered on the patient—a premise of value-based healthcare (VBHC)—has been proposed as an innovative way to reform the healthcare system (Porter & Teisberg, 2006). Measuring outcomes and costs for each patient is part of the strategic agenda for moving to a high-value healthcare delivery system (Porter & Lee, 2013). The applications of VBHC reported by the Harvard Business School (HBS, where the VBHC concept originated) deserve investigation, as they are frequently used in benchmarking value-based management models. Many institutions are adopting components of VBHC in their clinical practices. Unfortunately, rigorous scientific reports on the outcomes of these approaches have been lacking (van Deen et al., 2017).

The VBHC model suggests that the health system needs to be managed in terms of outcomes that matter to patients (Porter, 2010). Still, measuring performance through generalized outcomes such as overall hospital mortality, infection rates, and medication errors is the more common practice. Those measures represent key roles in institutional sustainability and care delivery practice, but they do not capture all the dimensions that matter most to the patient (Porter & Lee, 2013; Tseng & Hicks, 2016).

To translate VBHC theory into health system operations practice, Porter established an outcome hierarchy to identify consensus on what constitutes an outcome and then applied domains to cover all phases of the continuum of care. This outcome measures hierarchy recognizes that the definition of success for any medical condition may have a broad variety of outcomes yet follow a standard 3-tiered hierarchy—Tier 1, health status achieved; Tier 2, the process of recovery; and Tier 3, sustainability of health (Porter, 2010).

Currently, healthcare providers are well-appointed with metrics and scales to measure outcomes (both for generic and particular disease classes). However, standard and tested measures would improve validity and enable comparisons across providers (Porter, 2010; Tsai et al., 2018; Van Der Wees et al., 2014). The great barrier to the implementation of outcome measurement in VBHC initiatives is its complexity. It requires the strategic engagement of healthcare managers, data collection, and technological advances (Tsai et al., 2018).

Another question that hangs over VBHC concerns the feasibility of following the six interdependent and mutually reinforcing steps toward a high-value healthcare delivery system (Porter & Lee, 2013; Porter & Teisberg, 2006; Teisberg et al., 2020). The six steps are as follows:

1. Organize integrated practice units.
2. Measure costs and outcomes for every patient.
3. Move to bundled payment for the care cycle.
4. Integrate care delivery across separate facilities.
5. Expand excellent services across geography.
6. Enable a suitable information technology platform.

An in-depth analysis of value-based initiatives in terms of outcome measurement can begin with a subset of medical conditions and then expand over time as infrastructure and experience grow (Porter, 2010).

Recognizing the increasing interest in VBHC as reflected in the amount of recently published material about it, our systematic review aimed to identify which outcomes were considered in studies of the value agenda, apply them to an outcome measures hierarchy, and analyze the origin of the data used to report the outcomes of a value-based initiative.

Methods

This systematic review followed the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) process proposed by Moher and colleagues (2009) and is consistent with the methods of systematic review proposed by Cochrane (Chalmers et al., 2018).

Literature Search Strategy

The MEDLINE (via PubMed), Embase, Scopus, and Cochrane Central Register of Controlled Trials electronic databases were searched for studies indexed January 1, 2010–March 4, 2020. Next, the specific journals and the reference lists of the retrieved articles were reviewed. The search strategy combined indexed words and wildcard terms related to VBHC (Table S1, provided as Appendix 1 to this article, published as Supplemental Digital Content at http://links.lww.com/JHM/A57, presents the full strategy). The results of these database searches were cross-checked to eliminate duplicate entries.

Eligibility Criteria and Study Selection

Two reviewers were responsible for the independent screening of all titles and abstracts identified in the electronic search. Potentially eligible studies were retrieved for full-text assessments. When a disagreement arose or a consensus was not reached, a third reviewer made the final decision. The included studies applied the VBHC initiative definition established by Porter (Porter & Lee, 2013). Only studies in English, Spanish, or Portuguese were considered. Specific cost analysis studies, studies of the effectiveness of drugs or diagnostic tests, and studies from an insurance perspective were excluded. Editorials and commentaries were considered if they presented results from a VBHC case study.

Data Extraction Process

Data collection was performed independently by the two reviewers; when uncertainty persisted, a third reviewer guided the decision. Data extraction started with the general characteristics of the studies: year of publication, setting, healthcare field, value initiative, and cost measurement methodology (if applied). To meet our objectives, we extracted information on which outcomes the study collected, the

origin of the data to evaluate these outcomes, and whether any outcome instrument was used as a collection tool. All data were consolidated with Microsoft Excel 2010 software.

To classify outcomes used by the studies' authors to report a value result, we categorized data into the 3-tiered hierarchy defined earlier (Porter, 2010). Each tier of the hierarchy contained two broad levels, illustrated in Figure S1, provided as Appendix 2 to this article, published as Supplemental Digital Content at http://links.lww.com/JHM/A61. Patients' initial conditions, demographics, and disease-related factors were considered to evaluate patient outcomes adjusted to their risk (Porter, 2010). Therefore, we also assessed whether baseline characteristics were a variable considered in the studies' methods.

Data Analyses

In accordance with the studies' initial purposes and the elements of the value agenda, value-added initiatives were distinguished into three classes:

1. Clinical or surgical pathway redesign.
2. Computational intelligence platform development.
3. Clinical, process, and financial outcomes measurement (i.e., a traditional VBHC program).

Clinical or surgical pathway redesign calls for standardized care and a reorganized healthcare system structure to improve access and efficiency, which is strongly related to the value agenda components of integrated practice units and bundled payments for care cycle (Porter & Lee, 2013). The second class, computational intelligence, comprises the information technology element. It proposes a value-based implementation using artificial intelligence to compose the numerator of the value equation or a shared data platform to optimize care and access. The third class, a traditional value program, consists of studies centered on the foundational premise of value, the organization of the care pathway as a function of each patient's clinical condition, and the ability to measure outcome and cost for each patient.

The country of the study, year of publication, healthcare field, and setting were also assessed. The setting was defined as *system* when the study covered a multicentric or national perspective and as *hospital* when the scenario featured the provider or institution level.

For each article, outcome information was retrieved and classified according to its corresponding tier level so we could map the most frequent outcome driver of each tier in the studies. We also assessed the data source of each outcome to determine whether any measurement instruments were used. The degree of tier-level outcome reporting was determined by counting how many levels of the outcome hierarchy in each study could be mapped. In addition, we evaluated the differences in outcomes or costs before and after the implementation of a value initiative in healthcare. The effect was described and classified into the following categories mentioned in the literature as expected results from a value-based program: financial outcomes, clinical outcome improvements, patient-reported outcomes (PROs) improvement, providers' education, and value culture and management (Kaplan & Porter, 2011; Lee, 2010;

Porter, 2010; Porter & Lee, 2013; Teisberg et al., 2020; Trimble, 2016).

Finally, we created a radar chart depicting the metrics of outcomes, baseline characteristics, and costs to illustrate the balance of outcome measurements in the literature. To recognize gaps and opportunities in the evolution of VBHC studies and the comprehensive definition of value, we retrieved VBHC cases from the Harvard Business School Case Collection (2020). These cases served as a standard reference for the selected studies in the systematic review, using the eligibility criteria described earlier.

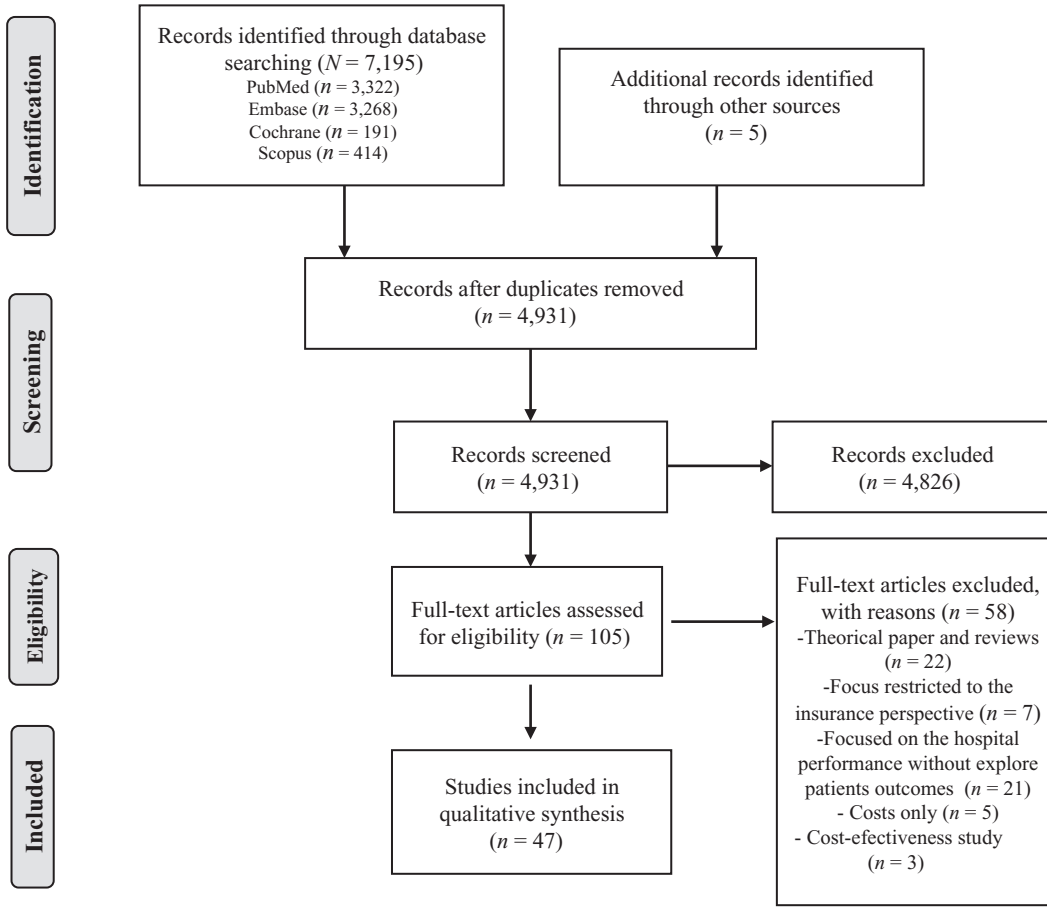
RESULTS

Study Selection

The literature search found 7,195 records; 105 full-text articles were assessed and 47 fulfilled the inclusion criteria for the review. Figure 1 illustrates the PRISMA diagram, which represents the review process for this study.

FIGURE 1

PRISMA Diagram



Note. PRISMA = Preferred Reporting Items for Systematic Reviews and Meta-Analysis.

Study Characteristics

The characteristics of each of the 47 included studies are displayed in Table S2, provided as Appendix 2 to this article, published as Supplemental Digital Content at http://links.lww.com/JHM/A58. The years of publication ranged from 2010 to early 2020, with 2019 being the year with the most publications (n = 18). Most selected studies were performed in the United States (n = 39). Most (n = 34) focused on surgical inpatient conditions. We identified 10 studies in which in-hospital medical (nonsurgical) patients were assessed and 3 studies that involved both medical and surgical cohorts of patients. We found 15 articles exploring the system setting, especially multicenter or national studies, and 32 that considered the application at a local hospital setting. The value programs in the studies focused on pathway redesign (n = 21) and traditional VBHC studies (n = 20). We identified only 6 studies in which computational intelligence platforms supported value programs.

Outcomes Measurement

The summary of outcome measures by tier-level and healthcare field identified in the studies is presented in Table 1.

In Tier 1, mortality (or survival) was expressed as 4 different measures across 19 studies. The most-cited measure was in-hospital death (n = 18), which covered all healthcare fields among the studies. Regarding the degree of health or recovery, 5 measures were identified in 31 studies; the most prominent measure was discharge related (e.g., discharge disposition, n = 18). Among the 22 studies that considered the first level of Tier 2, time to recovery, 4 measures could be assigned according to the time needed to complete different phases of care (expressed as the time to return to usual activities, time to care initiation, and operative time/duration of procedure) and time in the recovery phase. The second level of Tier 2, the disutility of the care or treatment process, essentially comprised measures that providers directly control or traditionally measured clinical indicators such as length of stay (n = 33) and short-term complications (n = 14). This level was most frequently represented in the studies, comprising 7 measures for all healthcare fields. Tier 3, sustainability of health, included 4 measures from 35 studies: 30-day readmissions, 90-day readmissions, additional procedures, and post-discharge complications. The second level of Tier 3, long-term consequences of therapy, was mentioned least in the studies (n = 15), and when they were reported, the measures focused on patient-reported health status that were measured through PRO surveys.

The tiers measured, financial outcomes, instruments used to support data collection, and data origin for all studies are shown in Table S3, provided as Appendix 3 to this article, published as Supplemental Digital Content at http://links.lww.com/JHM/A59. Financial outcomes were evaluated in 37 studies (79%); among them, 13 applied microcosting estimation; time-driven activity-based costing (TDABC)—the method recommended in the literature to be used in VBHC—was used in only 6 studies. The remaining 24 studies used reimbursement (n = 6), institutional accounting systems (n = 6), external databases (n = 6), hospital charges (n = 5), diagnosis-related groups (n = 2), and cost of implementation (n = 1) as measures, as displayed in the financial

TABLE 1

Outcome Measures Considered in Each Tier Level and Healthcare Field

Tier	Level	Measure	Healthcare Field	Studies	References
Tier 1: Health Status Achieved	Survival	*In-hospital death*	Oncological surgery	2	Bateni et al. (2019), Khullar et al. (2015)
			General practice	2	Bernstein et al. (2019), Boltz et al. (2019)
			Orthopedic surgery	4	Colegate-Stone et al. (2016), DiGioia & Greenhouse (2012), Gabriel et al. (2019), Lee et al. (2016)
			Cardiovascular care	1	Ebinger et al. (2018)
			Cardiac surgery	3	Glotzbach et al. (2018), Kirkpatrick et al. (2015), van Veghel et al. (2016)
			Bariatric surgery	1	Goretti et al. (2020)
			Obstetrics and gynecology	1	Van Den Berg et al. (2020)
			Cancer care	2	Thaker et al. (2016), van Egdom et al. (2019)
			Mixed	2	Chatfield et al. (2019), Ravikumar et al. (2010)
		Intervention survival	Oncological surgery	1	Khullar et al. (2015)
			Cancer care	1	Thaker et al. (2016)
			Orthopedic surgery	2	Colegate-Stone et al. (2016), Gabriel et al. (2019)
		30-day mortality	Cardiovascular care	2	Ebinger et al. (2018), Glotzbach et al. (2018)
			Orthopedic surgery	1	Lee et al. (2016)
			Oncological surgery	1	Gustafsson et al. (2016)

TABLE 1

(Continued)

Tier	Level	Measure	Healthcare Field	Studies	References
Tier 1: Health Status Achieved		*1-year mortality*	Cardiovascular care	1	Ebinger et al. (2018)
			Bariatric surgery	1	Goretti et al. (2020)
	Degree of health or recovery	*Discharge disposition (to home or care facilities)*	Orthopedic surgery	9	Ahn et al. (2019), Bolz & Iorio (2016), DiGioia & Greenhouse (2012), Dundon et al. (2016), Featherall et al. (2019), Featherall et al. (2018), Gray et al. (2019), Iorio et al. (2016), Johnson et al. (2019)
			General practice	3	Bernstein et al. (2019), Hernandez et al. (2019), D. V. Williams et al. (2019)
			Cardiovascular care	1	Ebinger et al. (2018)
			Cardiac surgery	1	Glotzbach et al. (2018)
			Spine surgery	1	Parker et al. (2017)
			Cancer care	1	van Egdom et al. (2019)
			Pediatric care	1	Weiss et al. (2019)
			Oncological surgery	1	Gustafsson et al. (2016)
		Physical function-related	Orthopedic surgery	7	Ahn et al. (2019), Berglund et al. (2019), DiGioia & Greenhouse (2012), Gabriel et al. (2019), Johnson et al. (2019), McCreary et al. (2019), Pelt et al. (2016)

TABLE 1

(Continued)

Tier	Level	Measure	Healthcare Field	Studies	References
Tier 1: Health Status Achieved			General practice	3	Bernstein et al. (2019), Hernandez et al. (2019), D. V. Williams et al. (2019)
			Bariatric surgery	1	Goretti et al. (2020)
			Spine surgery	1	Parker et al. (2017)
			Cancer care	2	Thaker et al. (2016), van Egdom et al. (2019)
			Cardiac surgery	1	van Veghel et al. (2016)
		Pain-level achieved	Oncological surgery	1	Ackerman et al. (2019)
			Orthopedic surgery	2	Berglund et al. (2019), Gabriel et al. (2019)
			Cardiac surgery	1	van Veghel et al. (2016)
		Diagnoses-related (freedom from disease)	Cancer care	2	Thaker et al. (2016), van Egdom et al. (2019)
		Surgical outcomes[*]	Obstetrics and gynecology	2	Danilyants et al. (2019), Van Den Berg et al. (2020)
			Bariatric surgery	1	Goretti et al. (2020)
			Orthopedic surgery	2	McCreary et al. (2019), Pelt et al. (2016)
			Oncological surgery	1	Peard et al. (2019)
			Cardiac surgery	1	J. B. Williams et al. (2019)
Tier 2: Process of Recovery	Time to recovery	*Time to return to usual activities*	Orthopedic surgery	2	Berglund et al. (2019), Gabriel et al. (2019)
			Bariatric surgery	2	Goretti et al. (2020), Noria et al. (2015)
			Mixed	1	Makdisse et al. (2018)

TABLE 1

(Continued)

Tier	Level	Measure	Healthcare Field	Studies	References
Tier 2: Process of Recovery			Spine surgery	1	Parker et al. (2017)
			Cancer care	2	Thaker et al. (2016), van Egdom et al. (2019)
		Time to care initiation	Orthopedic surgery	4	Colegate-Stone et al. (2016), DiGioia & Greenhouse (2012), Lee et al. (2016), McCreary et al. (2019)
			Cardiac surgery	1	Glotzbach et al. (2018)
			Obstetrics and gynecology	1	Van Den Berg et al. (2020)
			General practice	1	D. V. Williams et al. (2019)
		Operative time (duration of procedure)	Orthopedic surgery	2	DiGioia & Greenhouse (2012), McCreary et al. (2019)
			Oncological surgery	1	Ackerman et al. (2019)
		Time in the recovery phase	General practice	2	Bernstein et al. (2019), Hernandez et al. (2019)
			Orthopedic surgery	4	DiGioia & Greenhouse (2012), Gray et al. (2019), Johnson et al. (2019), Pelt et al. (2016)
			Cardiac surgery	1	Glotzbach et al. (2018)
	Disutility of the care or treatment process	*Length of inpatient stay*	Oncological surgery	6	Ackerman et al. (2019); Bateni et al., 2019; Gustafsson et al., 2016; Khullar et al., 2015; Kulkarni et al., 2011; Peard et al., 2019
			General practice	3	Bernstein et al. (2019), Boltz et al. (2019), D. V. Williams et al. (2019)

TABLE 1

(Continued)

Tier	Level	Measure	Healthcare Field	Studies	References
Tier 2: Process of Recovery			Orthopedic surgery	12	Bolz & Iorio (2016), Colegate-Stone et al. (2016), DiGioia & Greenhouse (2012), Dundon et al. (2016), Featherall et al. (2019), Featherall et al. (2018), Gray et al. (2019), Iorio et al. (2016), Johnson et al. (2019), McCreary et al. (2019), Navarro et al. (2018), Pelt et al. (2016)
			Mixed	2	Chatfield et al. (2019), Ravikumar et al. (2010)
			Obstetrics and gynecology	2	Danilyants et al. (2019), Van Den Berg et al. (2020)
			Cardiovascular care	1	Ebinger et al. (2018)
			Cardiac surgery	3	Glotzbach et al. (2018), Kirkpatrick et al. (2015), J. B. Williams et al. (2019)
			Bariatric surgery	2	Goretti et al. (2020), Noria et al. (2015)
			Spine surgery	1	Parker et al. (2017)
			Pediatric care	1	Weiss et al. (2019)
		Short-term complications	Oncological surgery	5	Bateni et al. (2019), Khullar et al. (2015), Kulkarni et al. (2011), Peard et al. (2019), Smith et al. (2016)
			Obstetrics and gynecology	1	Danilyants et al. (2019)
			Cardiovascular care	2	Ebinger et al. (2018), Golas et al. (2018)

TABLE 1

(Continued)

Tier	Level	Measure	Healthcare Field	Studies	References
Tier 2: Process of Recovery			Cardiac surgery	1	Kirkpatrick et al. (2015)
			Mixed	1	Makdisse et al. (2018)
			Orthopedic surgery	1	Rosner et al. (2018)
			Cancer care	2	Thaker et al. (2016), van Egdom et al. (2019)
			Bariatric surgery	1	Noria et al. (2015)
		Intensive care unit days	Oncological surgery	3	Ackerman et al. (2019), Khullar et al. (2015), Kulkarni et al. (2011)
			General practice	1	Bernstein et al. (2019)
			Orthopedic surgery	1	Johnson et al. (2019)
			Cardiac surgery	2	Kirkpatrick et al. (2015), D. V. Williams et al. (2019)
		Infection rate	Oncological surgery	1	Smith et al. (2016)
			Orthopedic surgery	2	DiGioia & Greenhouse (2012), Lee et al. (2016)
		Target medication usage	Oncological surgery	2	Ackerman et al. (2019), Kulkarni et al. (2011)
			Orthopedic surgery	2	Berglund et al. (2019), Gray et al. (2019)
			General practice	3	Bernstein et al. (2019), Hernandez et al. (2019), van Deen et al. (2017)
			Cardiac surgery	2	Glotzbach et al. (2018), J. B. Williams et al. (2019)

TABLE 1

(Continued)

Tier	Level	Measure	Healthcare Field	Studies	References
Tier 2: Process of Recovery			Cardiovascular care	1	Golas et al. (2018)
		Patient satisfaction	Orthopedic surgery	4	Berglund et al. (2019), Colegate-Stone et al. (2016), DiGioia & Greenhouse (2012), Featherall et al. (2019)
			General practice	3	Boltz et al. (2019), Hernandez et al. (2019), D. V. Williams et al. (2019)
			Mixed	1	Chatfield et al. (2019)
			Obstetrics and gynecology	1	Danilyants et al. (2019)
			Bariatric surgery	2	Goretti et al. (2020), Noria et al. (2015)
			Cancer care	1	van Egdom et al. (2019)
			Cardiac surgery	1	J. B. Williams et al. (2019)
		Psychological markers†	Orthopedic surgery	2	Gabriel et al. (2019), Lee et al. (2016)
			Bariatric surgery	1	Goretti et al. (2020)
			General practice	2	Hernandez et al. (2019), D. V. Williams et al. (2019)
			Spine surgery	1	Parker et al. (2017)
			Cancer care	2	Thaker et al. (2016), van Egdom et al. (2019)
Tier 3: Sustainability of Health	Sustainability of health	*30-day readmissions*	Oncological surgery	3	Bateni et al. (2019), Gustafsson et al. (2016), Khullar et al. (2015)
			General practice	5	Bernstein et al. (2019), Boltz et al. (2019), Hernandez et al. (2019), van Deen et al. (2017), J. B. Williams et al. (2019)

TABLE 1

(Continued)

Tier	Level	Measure	Healthcare Field	Studies	References
Tier 3: Sustainability of Health			Mixed	2	Chatfield et al. (2019); Ravikumar et al. (2010)
			Orthopedic surgery	3	Dundon et al. (2016), Iorio et al. (2016), Lee et al. (2016)
			Cardiovascular care	1	Golas et al. (2018)
			Bariatric surgery	2	Goretti et al. (2020), Noria et al. (2015)
			Cardiac surgery	3	Kirkpatrick et al. (2015), van Veghel et al. (2016), D. V. Williams et al. (2019)
			Pediatric care	1	Weiss et al. (2019)
		90-day readmissions	Oncological surgery	1	Khullar et al. (2015)
			Orthopedic surgery	5	Ahn et al. (2019), Bolz & Iorio (2016), Dundon et al. (2016), Gray et al. (2019), Rosner et al. (2018)
		Need for revision/ reoperation	Oncological surgery	2	Abdulla et al. (2012), Smith et al. (2016)
			Bariatric surgery	1	Goretti et al. (2020)
			Mixed	1	Makdisse et al. (2018)
			General practice	1	van Deen et al. (2017)
			Cardiac surgery	1	J. B. Williams et al. (2019)
		After-discharge complications	Orthopedic surgery	4	Ahn et al. (2019), Featherall et al. (2019), Featherall et al. (2018), Rosner et al. (2018)
			Spine surgery	1	Parker et al. (2017)
			Oncological surgery	1	Smith et al. (2016)

TABLE 1

(Continued)

Tier	Level	Measure	Healthcare Field	Studies	References
Tier 3: Sustainability of Health	Long-term consequences	*Health-reported status*	Orthopedic surgery	5	Ahn et al. (2019), Berglund et al. (2019), Gabriel et al. (2019), Johnson et al. (2019), Lee et al. (2016)
			Obstetrics and gynecology	1	Danilyants et al. (2019)
			Bariatric surgery	1	Goretti et al. (2020)
			General practice	3	Hernandez et al. (2019), van Deen et al. (2017), D. V. Williams et al. (2019)
			Mixed	1	Makdisse et al. (2018)
			Spine surgery	1	Parker et al. (2017)
			Cancer care	2	Thaker et al. (2016), van Egdom et al. (2019)
			Cardiac surgery	1	van Veghel et al. (2016)

*Surgical outcomes related to organ function preservation, method of tissue extraction, and estimated blood loss.
†Psychological markers are defined as measures of anxiety, discomfort, and ability to work or function normally while undergoing treatment.

outcome information in Table S3 (http://links.lww.com/JHM/A59).

The main data source in the studies was the electronic health record (EHR), including medical and hospital records (85%) or an external database (15%). Only 16 studies (34%) used PRO surveys as instruments to cover outcome tiers (see Table S3 http://links.lww.com/JHM/A59). Among those, generic metrics of multiple conditions appeared in 8 studies (e.g., EQ-5D); metrics tailored to disease classes were reported in 12 studies (e.g., International Consortium for Health Outcomes Measurement [ICHOM] specific surveys). Other surveys relating to patient experience were conducted in nine studies (e.g., Hospital Consumer Assessment of Healthcare Providers and Systems), and scales completed by professionals (e.g., Activity Measure in Post-Acute Care) were used in three studies.

The reported saturation of tier-level outcomes showed limited coverage for value assessments in the literature reporting VBHC initiatives. Only three studies

(Gray et al., 2019; Noria et al., 2015; Thaker et al., 2016) reported outcomes to all levels of the tier hierarchy. Studies covered three levels of the outcome hierarchy (n = 24, 51%) most frequently, followed by four levels (19%) and five levels (15%).

Value Effect Reported by Studies

The reported results that triggered a value increase in each case studied are consolidated in Table 2, which also shows whether the contribution was observed in the financial outcome, clinical outcome improvement, PRO improvement, provider education and value culture, or hospital management.

A considerable proportion of the studies (36%) achieved results that contributed to value-based financial outcomes focused on cost savings. An important common finding was that the calculated savings were derived from reductions in readmissions and inpatient stays, and the savings are accounted for as an indirect financial impact. However, these opportunities for future cost savings are not measured by accurate costs and economical methods (Etges et al., 2020). Two studies (Johnson

TABLE 2

A Summary of Value Effect and Domains Reported in Real-World Settings

Value Effect	Domain	Reported
$\text{Value} = \frac{\text{Outcomes}(t=1) - \text{Outcomes}(t=0)}{\text{Costs}(t=1) - \text{Costs}(t=0)}$ Where: Outcomes include measures stratified in Tiers 1, 2, and 3. Costs may consider costs over the complete pathway; t = time	Financial outcome	Direct cost savings (Ackerman et al., 2019; Bernstein et al., 2019; Boltz et al., 2019; Bolz & Iorio, 2016; Chatfield et al., 2019; Dundon et al., 2016; Ebinger et al., 2018; Featherall et al., 2019; Glotzbach et al., 2018; Goretti et al., 2020; Gray et al., 2019; Iorio et al., 2016; Lee et al., 2016; Pelt et al., 2016)
		Indirect cost savings (DiGioia & Greenhouse, 2012; Weiss et al., 2019)
		Reduced variance in cost (Ackerman et al., 2019)
		Sustainable (Goretti et al., 2020)
	Clinical outcome improvement	Reduced complications (Danilyants et al., 2019; Goretti et al., 2020; Rosner et al., 2018)
		Reduced mortality (Colegate-Stone et al., 2016; DiGioia & Greenhouse, 2012; Iorio et al., 2016)
		Improved laboratories and recovered from comorbidities (Abdulla et al., 2012; Goretti et al., 2020; Iorio et al., 2016; D. V. Williams et al., 2019)
		Perioperative outcomes (J. B. Williams et al., 2019)
		Reduced pharmacological treatment time (Hernandez et al., 2019; Kirkpatrick et al., 2015; Lee et al., 2016)

TABLE 2

(Continued)

Value Effect	Domain	Reported
	Patient-reported outcome improvement	Patient satisfaction with service (Colegate-Stone et al., 2016; DiGioia & Greenhouse, 2012; Noria et al., 2015; van Egdom et al., 2019)
		Improved work and function relationships (Hernandez et al., 2019; Ahn et al., 2019; Goretti et al., 2020; Parker et al., 2017; Weiss et al., 2019)
		Improved/favorable quality of life scores (Ahn et al., 2019; Iorio et al., 2016; Parker et al., 2017; J. B. Williams et al., 2019)
		Improved well-being (Hernandez et al., 2019; Bateni et al., 2019; Goretti et al., 2020)
	Provider education and value culture	Support for innovative implementations (Boltz et al., 2019)
		Value consciousness and engagement (Ackerman et al., 2019; Chatfield et al., 2019; Gustafsson et al., 2016; Navarro et al., 2018; Noria et al., 2015; Ravikumar et al., 2010)
		Replicable (Goretti et al., 2020)
	Hospital management	Increased hospital capacity (Abdulla et al., 2012; Ackerman et al., 2019; Bolz & Iorio, 2016; Chatfield et al., 2019; Dundon et al., 2016; Featherall et al., 2019; Gabriel et al., 2019; Gray et al., 2019; Johnson et al., 2019; Kirkpatrick et al., 2015; Kulkarni et al., 2011; Noria et al., 2015; Pelt et al., 2016; Weiss et al., 2019; D. V. Williams et al., 2019)
		Improved discharge efficiency (Bolz & Iorio, 2016; (DiGioia & Greenhouse, 2012; Dundon et al., 2016; Ebinger et al., 2018; Featherall et al., 2019; Featherall et al., 2018)
		Better resource and capacity allocating (Colegate-Stone et al., 2016; Gustafsson et al., 2016; Van Den Berg et al., 2020)
		Value-office (Hernandez et al., 2019; Makdisse et al., 2018)
		Improved quality through risk adjustment (Bernstein et al., 2019; Golas et al., 2018; Khullar et al., 2015; Smith et al., 2016; D. V. Williams et al., 2019)
		Benchmarking (Van Den Berg et al., 2020; van Veghel et al., 2016)

et al., 2019; van Deen et al., 2017) identified neutral effects or were not able to consistently observe improved results even though they showed these effects as potential improvements.

Regarding PRO improvement, 25% of the studies reported improved PROs; however, of the studies that used PRO measurement instruments (n = 16), 11 achieved positive results. Management effects were mainly related to hospital capacity (n = 15), improved quality through risk adjustments (n = 5), and better resource allocation (n = 3).

On the Radar: Literature and HBS Cases

Twelve HBS cases were selected for value initiatives in the fields of prostate cancer (Porter, Deerberg-Wittram, et al., 2014), orthopedic surgeries (Kaplan et al., 2012; Porter, Marks, et al., 2014), pediatric care (Porter, Bachmann et al., 2014; Porter et al., 2016), and primary general practice (Kaplan et al., 2018; Porter, Landman, et al., 2014; Porter & Teisberg, 2009 ; Porter et al., 2017) (see Table S4, which summarizes the main characteristics of these cases, provided as Appendix 4 to this article, published as Supplemental Digital Content at http://links.lww.com/JHM/A60). In all HBS cases, the PRO measures were used. Figure 2 presents the comparison of the outcome tier coverage profiles of the included studies from the literature and the selected HBS cases. Of note, one initiative was reported in both metrics: the HBS and literature search (Hernandez et al., 2019).

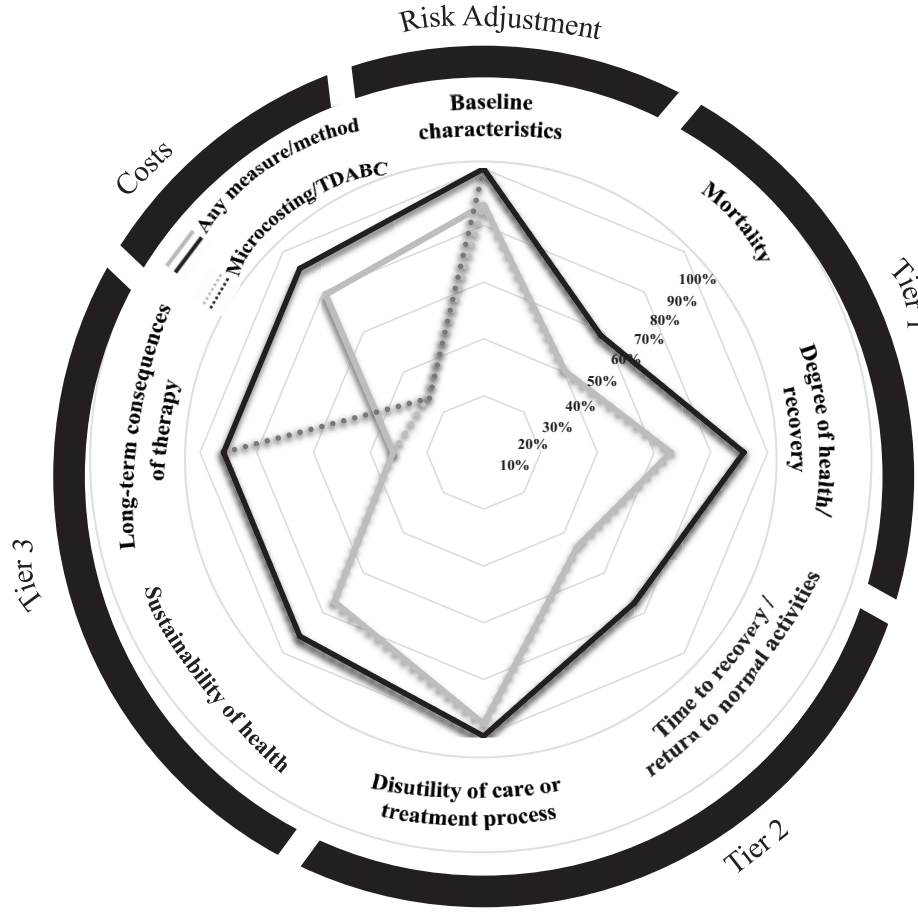
The most conflicting information concerns tier levels that are more dependent on PRO measures such as Tier 2's time to recovery and Tier 3's long-term consequences, which are expressed less frequently in the literature (47% and 32%, respectively); in contrast, the same levels were more commonly considered in HBS cases (75% and 92%, respectively). This was not surprising, as predicted by the number of studies using PRO measures earlier in the results. Regarding microcosting or TDABC methods, the studies showed similarly low prevalence in both the literature (27%) and HBS cases (28%) as revealed by the dotted lines in Figure 2. Studies that used methods other than microcosting to measure financial information had a greater proportion of both the literature and HBS cases (79% and 92%, respectively). Tier 1's mortality survival-related metrics were also not widely computed in the selected studies (40% in the literature and 60% in HBS cases). Regarding the literature, two studies (Abdulla et al., 2012; Ahn et al., 2019) did not measure Tier 2's disutility of the care process or treatment process level, and six did not measure baseline characteristics for risk-adjustment data, making these two tiers the most prevalent in the literature (96% and 87%, respectively), This pattern was also verified for HBS cases, because those two levels were reported in all cases.

DISCUSSION

This systematic review was intended to map how outcomes are being measured in the studies of the value agenda. We identified a significant imbalance of outcome measurements in many aspects, such as the configuration of tier levels chosen in value initiatives, instruments applied to support data, and the rare use of microcosting methods to determine financial outcomes.

FIGURE 2

Radar Chart of Literature and Cases Profile in Outcome Information Coverage



Note. The black line inside the circle represents the proportion of Harvard Business School cases in each tier; the gray line demonstrates the same profile for the systematic review studies. The dotted line represents the studies within the financial result category that used microcosting methods or time-driven activity-based costing (TDABC).

Tier 3, especially long-term consequences, was the least explored, whereas traditional clinical and process outcomes such as length of stay and infections were still the most frequent measures considered in the literature.

VBHC was introduced to reduce waste and increase the quality of care (Porter & Lee, 2013). As shown in this review, the increase in the quality of care is usually measured by the hospital and clinical outcomes, not necessarily by patient perceptions, and the financial results are not being reported with highly precise accounting methods. PRO measures play a central role in the value agenda model. Nevertheless, studies evaluating long-term consequences and new conditions are rare (Halpern et al., 2020). However, these factors received the most attention when we

looked at the applied cases of VBHC in the HBS Case Collection (Kaplan et al., 2012, 2018; Porter, Bachmann, et al., 2014 Porter, Deerberg-Wittram, et al., 2014; Porter, Landman, et al., 2014; Porter, Marks, et al., 2014; Porter & Teisberg, 2009; Porter et al., 2007; Porter et al., 2016).

We found that widespread and consistent use of PRO measurements has proven to be ambiguous for a range of reasons, including the complexity of the measures tracked and the fluctuating reliability of patient assessments on many measures (Schupbach et al., 2016), which may explain the gap seen in the radar chart regarding the comprehensiveness of the value definition.

In agreement with the factors listed by Martin and colleagues (2019), our results demonstrate that measuring outcomes in healthcare has been difficult for three reasons: (1) current outcome measurements consist of nonstructured and condition-related data that are difficult to access, (2) adherence to evidence-based processes rather than clinically and patient-reported driven results is limiting, and (3) the healthcare provider seldom incorporates an integrated view of the patient's outcomes over the full cycle of care.

The evolution to electronic registries that provide practicable patient-centered care could take two main routes: (1) the education and dissemination of a value culture, which can instantly reinforce staff to register important outcomes about the patient either through validated questionnaires or more effective multidisciplinary meetings, and (2) the creation of an EHR system-integrated real-time outcome measurement platform. This reflection leads us to surmise that VBHC is not feasible without investment in information technology (Boscolo et al., 2020). Once a functionally integrated EHR system is implemented, it must be validated to ensure that it provides quality measurements —an essential component of quality improvement (Etges et al., 2020). Addressing suboptimal outcomes and comparing cost data for treatment options will facilitate process improvement and value (Thaker et al., 2016).

Academics and consultants created the ICHOM in 2012 to address the shortcomings of outcome measurement. Today, the ICHOM working group stipulates that the intention of such parameterization is not to devise new measures of results but rather to agree on a well-assessed outcome measure indicator that everyone should use to cover a much broader spectrum of the outcome hierarchy for a health condition (ICHOM, n.d.). The use of the ICHOM questionnaires in the literature is still restricted to a few studies concentrated in the fields of orthopedic surgery (Berglund et al., 2019; Glotzbach et al., 2018; Pelt et al., 2016), general practice (Hernandez et al., 2019; Kulkarni et al., 2011), bariatric surgery (Noria et al., 2015), obstetrics (Van Den Berg et al., 2020), breast cancer (van Egdom et al., 2019), and prostate cancer (Thaker et al., 2016).

In addition to the ICHOM, however, some processual measures are still needed to add all the tiers of value (Thaker et al., 2016). It is evident in the HBS cases that measuring outcomes—clinical, processual, financial, and PRO—is a valuable tool that helps healthcare providers to be more intentional about quality, efficiency, and (especially) patient outcomes (Porter, 2010; Schupbach et al., 2016), and this model of measuring

outcomes has been demonstrated to have a higher success rate and permanence (Porter, 2010; Thaker et al., 2016).

Regarding financial outcomes, we note that cost studies were not part of our main scope. Nevertheless, in the spectrum of value initiatives, we would expect an exploration of both numerators and denominators to compose the value equation. Because we could identify only 13 studies and 3 cases that applied advanced methods to evaluate real costs, we suggest that scaled VBHC adoption would require more methodological rigor in the evaluation of financial outcomes (Etges et al., 2020; Tsai et al., 2018).

Developments in the EHR are making outcomes far less costly to measure (Porter & Teisberg, 2006). The majority of VBHC studies used medical records to collect data to evaluate the value of healthcare. However, as verified from the studies that covered the full range of the outcome hierarchy (Noria et al., 2015), the EHR does not uniformly capture the three tiers of outcomes we described, requiring additional staff to manually maintain parallel control of the data and update the research databases (Noria et al., 2015).

Study Limitations

There are both weaknesses and strengths to consider in our work. To the best of our knowledge, this is the first systematic review to perform a broad literature search of VBHC initiative studies with a priori–defined methods and well-established methodological guidelines. However, as there is not a valid instrument to assess the methodological quality of VBHC initiative studies, the methodological quality of these studies could not be determined. We also did not identify studies with negative results associated with the outcome measurement in the VBHC initiative; thus, there is potential publication bias toward those only reporting successful results in this field. In addition, the searches were conducted in early March 2020, so this study does not include or reflect the possible movement in VBHC initiatives driven by the COVID-19 pandemic. Thus, we should stress that this was a prepandemic systematic review of VBHC initiatives.

CONCLUSION

Our systematic review suggests that, in a real-world setting, there is still a gap between measuring outcomes that matter to patients and measuring financial outcomes through rigorous methodological methods. Advances in technology capacity and a culture of change in management appear to be the main barriers to making the value agenda more easily reproducible.

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PRACTITIONER APPLICATION: Value-Based Healthcare Initiatives in Practice: A Systematic Review

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Zanotto and colleagues provide a unique assessment of value-based outcome measurements to-date, noting that while there have been reported benefits from such initiatives, there are gaps in accurate measurement of costs and long-term outcomes at the patient level. Their research aggregated improvement efforts into three main categories: standardizing care through pathways; developing technology; and improving traditional measures tied to clinical, process, and financial outcomes at the facility level. The authors suggest that the true impact of value-based measures can only be understood through a more consistent approach to outcome measurement at the patient level. While value-based care models thus far have been necessary experiments to transform

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