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ISPOR Report

A Systematic Review of Quantitative Health Preference Methods to Support Value Clarification and Shared Decision Making: A Report of an ISPOR Special Interest Group

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ABSTRACT

Objectives: This study aimed to explore the design and outcomes of preference-based value clarification methods (Pb-VCMs) used in the context of supporting patients' clinical decision making to understand whether guidance is used in Pb-VCM development and which Pb-VCM is most effective.

Methods: In April of 2023, PubMed, Scopus, and Web of Science were searched for studies reporting the development and/or evaluation of Pb-VCMs without restrictions on publication date. Two reviewers independently extracted data including context and clinical decisions, study methods, sample, Pb-VCM design and development, type of preference information, and measurement of outcomes, such as feasibility/acceptability and effectiveness. Data were synthesized using descriptive and narrative analyses.

Results: Of 3207 abstracts screened, 50 studies were included: 28 descriptive, 9 observational, and 13 experimental. The most common Pb-VCM approaches were adaptive conjoint analysis (n = 16), analytic hierarchy process (n = 9), and simple ranking (n = 6). Most studies (n = 37) did not report using preference- or decision aid-specific guidelines to support development. Personalized preference information was provided to participants in 45 studies. Most studies reported positive findings related to feasibility and participant experience, although complexity was identified as a challenge. The most-frequently assessed outcomes were decisional conflict and value congruence. Evidence on effectiveness was limited and mixed.

Conclusions: Although individual studies report positive findings, variation in design and reporting of existing studies hinders drawing of general conclusions regarding whether Pb-VCMs improve decision-making processes and outcomes. Future research should focus on developing guidelines, for which the data extraction form developed for this study could serve as a starting point.

Keywords: clinical decision support, patient-centered decision making, patient decision aids, shared decision making, value clarification methods.

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Highlights

- The most commonly used methods for preference-based value clarification in patient decision aids and decision support tools include adaptive conjoint analysis, the analytic hierarchy process, and simple ranking.
- No single preference-based value clarification method is proven best, highlighting the need for further comparative research on their impact on decision-making processes and outcomes.
- Several recommendations are proposed to help realize the potential for patient decision aids to improve decision making through user-centered design, grounding development in the preference and decision aid literature, and evaluating decision aids. Several gaps in the guidance for preference-based value clarification methods are identified.

Introduction

In shared decision making (SDM), clinicians and patients jointly make treatment decisions using the best available evidence.[1] Patient decision aids (PDAs) may facilitate SDM in healthcare by educating patients about different options and their respective outcomes.[2] The International Patient Decision Aid Standards (IPDAS) Collaboration recommends including value clarification methods (VCMs) in PDAs to help patients evaluate the desirability of options by reflection, deliberation and prioritization of outcomes.[3,4] In a PDA, VCMs are usually positioned after educational content but before the user is asked to state an intention or decision.

Increasingly, PDAs include explicit VCMs.[4,5] In explicit VCMs (see Table 1[6-10] for glossary with definition), the user interacts with the VCM, for instance users are asked to prioritize the outcomes based on their preferences.[5] Witteman et al[5] concluded that explicit VCMs show stronger alignment between values (what matters to the patient) and choices (which option they choose) than implicit VCMs.[5] Evidence of value congruence is stronger among explicit VCMs that (1) elicit quantitative preferences for pros and cons (here, we use the term attributes) of diagnostic, screening and treatment options and (2) help patients identify how these preferences are aligned with decisions regarding real-world options.[5] In this study, these are referred to

Table 1. Glossary of terms.

Term	Definition and source
Attributes	Attributes are features or characteristics of options such as effectiveness, safety, tolerability, duration of the effect, duration of use, frequency of use, mode of administration, lifestyle aspects of use, and other characteristics that impact benefit-risk considerations.
Attribute levels	In this review, attribute levels are the following: a description of the performance of an option with respect to an attribute. For example, an attribute describing types of treatment for prostate cancer may include the following levels: "watchful waiting," "surgery," "radiotherapy," and "chemotherapy." Another example is an attribute describing mode of administration that may include the following levels: "tablet," "subcutaneous injection," "intravenous infusion."[6]
Decision	A decision is a judgment, conclusion, or determination reached after consideration. A decision is a response in a situation that is composed of 3 parts: • there is more than 1 possible course of action in the choice set • the decision maker can form expectations about the outcomes that follow from each course of action • the consequences of the outcomes can be assessed relative to current goals and values.[7]
Explicit values clarification	Explicit values clarification methods are "strategies for facilitating values clarification that require people to interact with something or someone (eg, filling out a worksheet, using an interactive website, having a semi structured conversation with another person with the explicit purpose of clarifying values, or engaging in another structured exercise)"[5](p803).
Feasibility	The feasibility of a DA (with or without a Pb-VCM) describes characteristics of the implementation of the decision aid and can include whether providers refer patients to the DA, the identification of patients for whom the DA is relevant, timing of DA completion, sharing of the results of the Pb-VCM, among other things.[8]
Implicit values clarification	Implicit values clarification methods are "strategies for facilitating values clarification that do not require people to interact with anything or anyone—for example, describing options in detail or simply encouraging people to think about what matters to them."[5]
Options	In this review, we define options as follows: health interventions being considered by patients and health care providers in shared decision making.
Preference	Preferences are defined as "qualitative or quantitative statements of the relative desirability or acceptability of attributes that differ among alternative health interventions."[6] Different types of preferences include preferences for attributes (eg, relative importance, attribute weights), preferences for options (eg, real-world or hypothetical treatment options), and preferences for outcomes (the range of performance levels of options within a criterion).
Preference elicitation	Preference elicitation is the process of measuring preferences.
Preference elicitation methods	In general, preference elicitation methods are all methods that measure preference information. The methods included in this review are described in Table 2.
Preference information (VCM outputs)	In this review, we define outputs as including preference endpoints such as relative attribute importance or preferences for real-world options. They may also include the results of an assessment that applies elicited preferences to an option. Outputs of explicit VCM may be presented visually (using graphs or tables), or verbally.
Quantitative preference elicitation method	A quantitative preference elicitation method is a method collecting quantifiable data that can be reported through statistical inferences or mathematical analysis.[9] An alternative definition: "quantitative methods are structured, with the type of data to be collected clearly defined and the response options limited to permit statistical analysis."[10]
Relative importance	A type of preference information that indicates how much each attribute matters to a patient relative to other attributes.[10] Attribute importance is often expressed in attribute weights.
Trade-off	A measure of the extent to which a change in the level of one attribute of a medical product is offset by a change in another attribute of that medical product.[10]
Values	A value is an umbrella term referring to what matters to an individual relevant to a health decision. Values may be directly relevant to decisions (eg, "beliefs, feelings, or perceptions regarding attributes of a treatment option") or indirectly relevant (eg, goals; worldviews; family, religious, or cultural values). Values may be represented qualitatively or, in some cases, quantitatively.
Values clarification methods (VCM)	VCM are "strategies that are intended to help patients evaluate the desirability of options or attributes of options within a specific decision context, to identify which option [they] prefer."[4]
VCM Outcomes	VCM outcomes are measures of the results of a decision-making process informed by a patient decision aid, including values congruence, decision conflict, decision readiness, health outcomes, and others.[5]

as preference-based value clarification methods (Pb-VCMs). Various methods can be used as a Pb-VCM, differing in their preference elicitation tasks (eg, rating, ranking, or choices), the type of personalized preference output they can provide to users[9,11] and the extent to which they can provide individual preference information.

There is a lack of specific guidance on designing Pb-VCMs, but some guidance can be drawn from other sources.[12-14] For instance, to obtain valid and reliable preference information, users must receive sufficient information to understand the decision problem, and the preference elicitation method itself must be methodologically sound and feasible for the users.[12] The attributes that are included in the Pb-VCM must reflect real-world options, be relevant to the decision, be nonoverlapping to prevent double-counting of effects, and be balanced to ensure that no option is unfairly advantaged.[13] In addition, if the aim of the Pb-

VCM is to provide preference estimates for real-world options, the clinical evidence that supports performance should be sufficiently accurate to do so.[13,14]

Existing literature reviews of VCMs[4,5,14,15] have not studied the extent to which existing guidance on the design of quantitative preference elicitation methods is being met.[12-14] In addition, they offer only limited guidance on which Pb-VCM is most feasible in clinical practice, and which type of preference output is most effective in terms of informing treatment decision making.[5,15,16]

Therefore, the objective of the current systematic literature review was to examine current practices and identify research gaps regarding the use of Pb-VCMs to support patient decision making. In addition to reviewing the design and development of these methods, we also evaluated the evidence on the feasibility of Pb-VCMs in clinical practice and investigated the effect of Pb-VCMs on decision processes and outcomes, to identify whether some Pb-VCMs outperform others. Finally, we address reporting and use of guidelines to identify the extent to which current reporting and guidance adequately addresses Pb-VCM development needs.

Methods

Preference elicitation methods suitable for a Pb-VCM must (1) elicit quantitative preference information; (2) accommodate health, nonhealth, and process attributes, and (3) capture stated preference information. We adopted the Medical Device Innovation Consortium classification and descriptions[6] of preference elicitation methods in our study (Table 2).[17,18] The protocol was submitted to PROSPERO (CRD42024503514).

Eligibility Criteria

The following criteria were used to determine whether to include a study:

- The study is a primary study that includes data about design, development, feasibility, or effectiveness of a VCM that uses one of the preference elicitation methods of interest; AND
- The aim of the VCM is to inform patients' clinical or health decisions; AND
- Study participants include patients, patient proxies (eg, parents of children or caregivers of patients with diminished cognitive ability) AND/OR healthy subjects asked to make a salient choice.

We included descriptive, observational, and experimental study designs as described in Witteman et al.[5] We included both studies that examined the Pb-VCM as a standalone decision support tool or as part of a PDA, but excluded studies that did not report on the design, development, feasibility, or effectiveness of the Pb-VCM method independently from other components of a PDA, if applicable.

Information Sources

We searched PubMed, Scopus, and Web of Science without restrictions on publication date to map the literature landscape over time. The last search was conducted in April 2023.

Search Strategy

We initially selected 32 potentially relevant articles based on 2 previous systematic reviews.[5,19] Endnote (v X9.3.3) was used to calculate subject heading frequencies across article abstracts. We then used PubMed PubReMiner to analyze the same set of abstracts to identify words frequently used in titles and abstracts. The identified keywords were used to build the search strategy (Appendix A). Forward and backward citation screening of included articles was used to identify additional studies.

Selection Process

Each abstract was screened for eligibility by 2 reviewers (8 authors and 16 contributors) in Covidence. Conflicts in the abstract screening were resolved by a third independent reviewer (J.v.T., H.P., or C.P.). Full texts were screened for eligibility by 2 reviewers (8 authors). Conflicts in the full-text screening were discussed between and resolved by 3 independent reviewers (J.v.T., H.P., and C.P.). Reasons for exclusion are detailed in Figure 2.

Data Collection Process

A standardized data extraction form was pilot tested twice for feedback, after which all authors pilot tested the form by extracting data from the same study (Appendix B). The results of data extraction were then discussed among all reviewers to resolve ambiguity in the form. Data from each article was extracted by 2 authors (randomized from all authors), who worked independently. Conflicts were resolved by a third independent reviewer (J.v.T., H.P. or C.P.).

Data Items

The items that were included in the data extraction table were based on existing guidelines for the design and development of health preference instruments,[12-14] and of previous systematic reviews.[4,5,12-14,16,19] Data items included details about clinical context, decision characteristics, decision context, study methods, study participants, development and design of the Pb-VCM and feasibility and effectiveness of the Pb-VCM (Appendix B). Appendix C details the definitions and measures of feasibility and effectiveness. Quality assessment was not conducted for reasons outlined in the discussion.

Data Synthesis

Descriptive statistics (frequencies, average, and range) are reported for all extracted data items. Reporting follows guidelines in Preferred Reporting Items for Systematic Reviews and Meta-Analyses (Appendix D).[20]

Results

A total of 50 studies met the inclusion criteria.[21-70] Full details of the screening and selection process can be found in Table 3. Details of the studies included can be found in Table 3.

Study Designs

Most studies (n = 37) tested 1 Pb-VCM in all participants, of which 28 were descriptive (eg, acceptability and feasibility study, development study)[21,22,28,31,32,34-37,40,45-47,49,51-54,58-60,63-68,70] and 9 were observational studies (eg, reporting outcomes before and after use of a Pb-VCM)[23,25,26,29,41,48,55,61,71]. Of the 13 experimental studies, 11 had 1,[27,30,33,38,39,42-44,56,57,69] and 2 had more than 1(50, 62) control group. Nine were randomized controlled trials,[27,30,33,38,42,43,56,57,62] and 4 compared groups but did not randomize participants.[39,44,50,69] The control group(s) received an implicit VCM in 5 studies,[27,30,38,50,62] another Pb-VCM in 4 studies,[33,50,62,69] usual care in 3 studies,[42,44,57] educational material in 2 studies,[39,56] and no intervention in 1 study.[43]

Table 2. Preference elicitation methods suitable for a preference-based value clarification method.

Structured weighting methods	
Simple direct weighting (rating exercises)	Simple direct weighting is a method for eliciting a weight for an attribute or attribute level on a predefined scale that measures importance. The scale can be numeric (0-100), qualitative (not important-very important) or a combination of both. In this systematic review, we excluded studies that exclusively use qualitative scale labels to elicit attribute or attribute level importance.
Ranking exercises	Ranking is a method for placing a set of attributes, attribute levels, or profiles in order of increasing or decreasing preference or importance. Weight approximation techniques can be used to provide quantitative weight estimates.
Swing weighting	Swing weighting is a method in which attributes are first ranked in decreasing order of importance based on the change in that attribute from minimum to maximum level. The attribute with the highest rank is assigned a weight of 100, and the importance of the other attributes is weighted on the same scale, compared with the highest-ranked attribute. The resulting weights are normalized to sum 100 and provide a weight for each attribute over the range of levels assigned to that attribute.
Point allocation	Point allocation is a method in which each attribute in a set is assigned points proportional to the importance associated with each attribute or specified changes in the levels of each attribute. The total number of points to be allocated among the attributes is fixed, most often totaling 100 points.
Analytic hierarchy process	Analytic hierarchy is a method in which pairwise comparisons between 2 attributes are made, and relative statements regarding the importance of (or preference for) an attribute (level) are elicited. The weight of each attribute in the set is calculated based on the reciprocal table of relative scores obtained from the pairwise comparisons of all weights.
Stated preference methods	
Conjoint analysis/discrete choice experiments	In discrete choice experiments and conjoint analysis, the attributes of each medical treatment are assigned different levels that can be combined into profiles, and the profiles are combined into groups of profiles known as choice sets. The key difference between conjoint analysis and discrete choice experiments in preference elicitation is that in conjoint analysis, patients are asked to rate or rank profiles, whereas in discrete choice experiments, patients are asked to repeatedly select one profile from a set of 2 or more profiles.
Conjoint analysis	In traditional conjoint analysis, patients are asked to rank the full factorial set of profiles and mathematical processes are used to estimate preferences. In later practical applications of conjoint analysis, fractional factorial designs are used instead of complete factorial designs, rating scales are used instead of rankings to elicit preference orders, and statistical models are used to estimate part-worth utilities and/or choice behavior.[17]
Discrete choice experiment	In discrete choice experiments, each patient is presented with a series of choice sets and asked to choose 1 profile in each choice set. The profiles and choice sets are determined by an experimental design. The pattern of responses is analyzed to estimate the rate at which patients are willing to trade off among the attributes and changes in attribute levels included in the study. The results can provide measures of the relative importance of attributes or changes in attribute levels and the rate of trade-off among attributes or attribute levels.
Adaptive (choice-based) conjoint analysis	In adaptive (choice-based) conjoint analysis, patients are asked to perform a combination of preference rankings of attribute levels, importance ratings of attributes, and discrete choice tasks with a partial and/or full set of the most important attributes. Information obtained from the rating and ranking tasks is used to optimize the experimental design for the choice tasks.[18]
Best-worst scaling exercises (BWS)	There are 3 types of best-worst scaling: object case, single-profile case, and multiple-profile case. In all cases, patients are presented with a set of options and asked to identify the best or most important alternative and the worst or least important alternative. In all 3 types of best-worst scaling, the pattern of responses is analyzed to estimate the relative importance of each attribute and/or attribute level.
Object case (BWS CASE 1)	In the object case, attributes are combined into sets. Each set does not necessarily (and often does not) include all attributes. For each of a series of sets, patients are asked to indicate which of the attributes in the set is best or most desirable (important) and which is worst or least desirable (important). In the object case, the attributes do not take on different levels.
Single-profile case (BWS CASE 2)	In the single-profile case, each attribute takes on different levels. The attribute levels are combined into profiles (1 level per attribute in each profile). Patients are presented with a series of profiles (1 profile at a time) and asked to indicate which attribute level in the profile is best or most desirable (important) and which attribute level in the profile is worst or least desirable (important).
Multiple-profile case (BWS CASE 3)	In the multiple-profile case, attribute levels are combined into profiles, and the profiles are combined into sets of 3 or more profiles. In each of a series of sets, patients are asked to indicate which profile is best or most desirable (important) and which profile is worst or least desirable (important).
Threshold technique	The threshold technique is a method in which patients are asked to choose between a reference profile and an alternative profile that are defined by a common set of attributes, although the levels of each attribute can vary between the 2 options. In the threshold technique, 1 attribute is considered to be the study object. If the reference profile is chosen, the level of the study object in the alternative profile is improved until the patient changes his or her choice from the reference profile to the alternative profile. If the alternative profile is chosen, the study object in the alternative profile is made worse until the patient changes his or her choice from the alternative profile to the reference profile. The point at which the patient switches his or her choice is the threshold.

Note. The description of the methods is based on the descriptions provided in (MDIC) MDIC. A Framework for Incorporating Information on Patient Preferences Regarding Benefit and Risk into Regulatory Assessments of New Medical Technology. 2013.[10]

Figure 1. (A) Number of studies that used a specific preference elicitation method as Pb-VCM identified in the systematic literature review (multiple methods per study possible). (B) Methods used to support attribute identification identified in the systematic literature review (multiple methods per study possible). (C) Research methods used in the formative research to develop a Pb-VCM (multiple methods per study possible). (D) Research methods used for assessment of outcomes per study design (multiple methods per study possible). Other methods include a Delphi study, observation of actual use or registered use, or a decision counselling session which was also used to evaluate the Pb-VCM. (E) Number of attributes in the Pb-VCM per preference elicitation method (for methods identified that were identified ≥5 times). (F) The provision of personalized preference information after use of the Pb-VCM (for methods identified that were identified ≥5 times, legend as E).

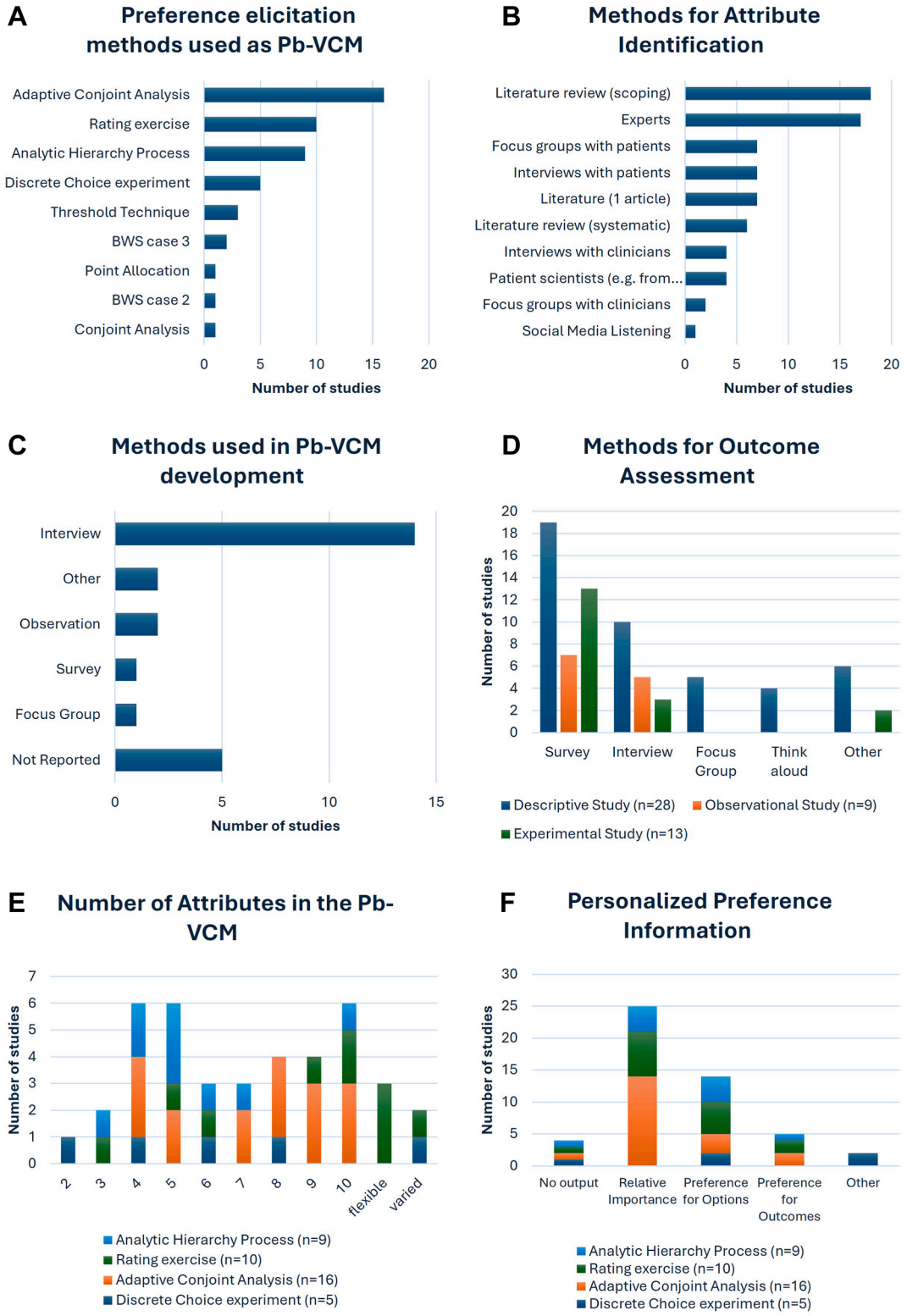
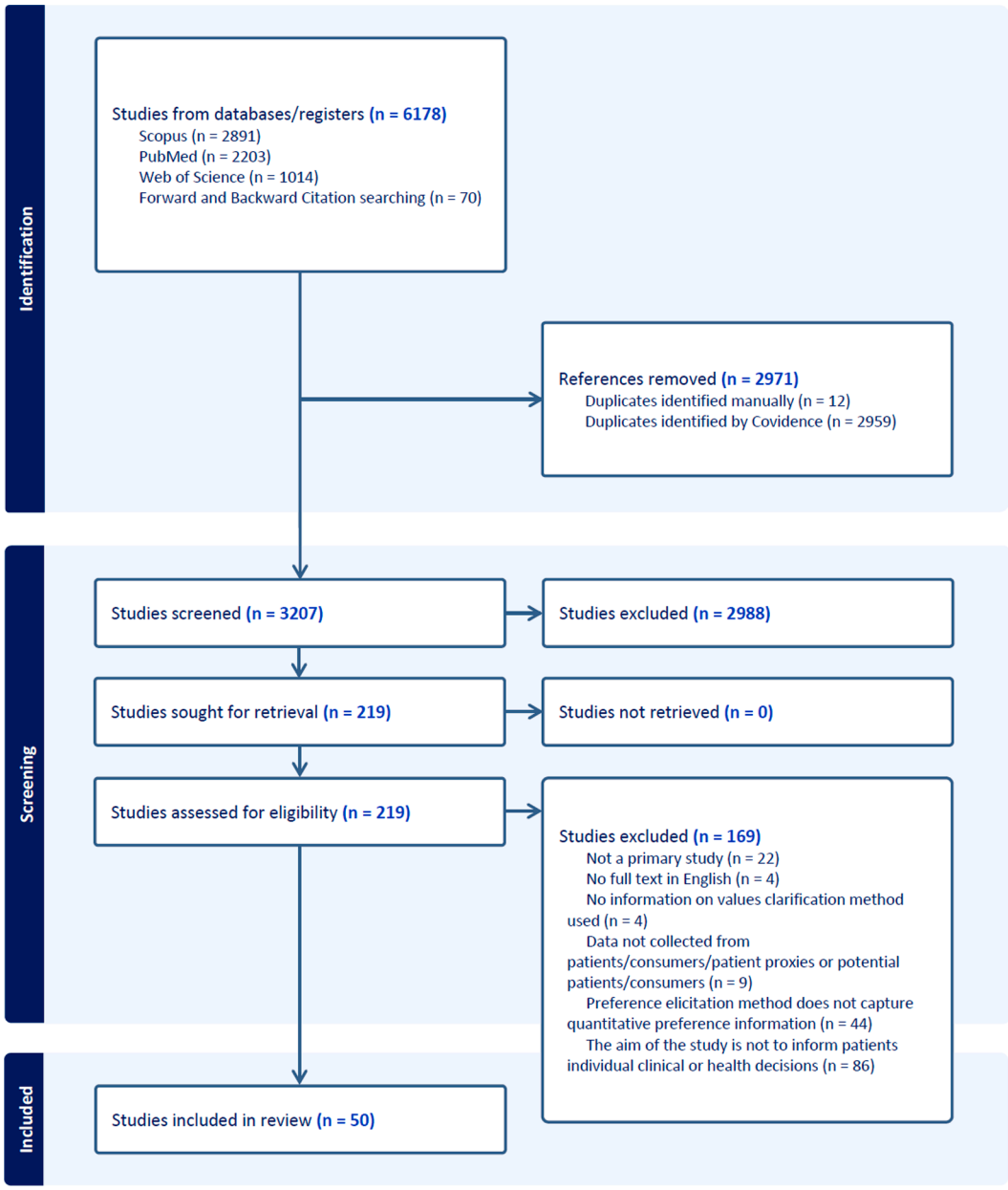


Figure 2. Prisma flow chart.



Study Participants

The average sample size for studies that included formative testing of the Pb-VCM (n = 12) was 56 patients (range 5-204). The average sample size for the studies that included testing of feasibility and effectiveness (n = 50) was 156 (range 5-1802). Studies included patients who were in the decision-making stage in 10 studies,[26,29-32,42-44,57,67] people who would be eligible but were not currently making that decision in 18 studies,[27,34,38,40,48,50,51,54-56,58,60,61,63,65,66,69,70] people who had made the decision in the past in 10 studies[21,25,28,33,35,36,39,52,53,64], and a convenience sample of people in 9 studies.[22-24,37,41,45-47,49,62,68] Two studies included participants in multiple stages of decision making,[23,24] and 1 study did not report patient characteristics.[59]

Development of the Pb-VCM

Most studies (n = 37) did not report on the use of guidelines to inform development of the Pb-VCM. Ten studies[8,36,38,39,43,45,55,59,64,66,67] mentioned the IPDAS guidelines,[3] and 3 studies[46,47,65] mentioned the ISPOR guidelines for DCE studies.[12]

Many studies used multiple methods to select attributes, for instance a scoping (n = 18)[21,23,25,31,39,43,49,51,52,54,58-61,63,65,67,69] and/or a systematic literature review (n = 6)[33,41,46,53,67,69]; meetings with clinical or methodological experts (n = 14)[23,24,26,32,36,38,42,47,53-55,58,59,61,64,65,67]; interviews (n = 7)[21,25,34,43,45,53,61] and focus groups (n = 6)[33,36,41,59,64,65] with patients or patient proxies, and interviews (n = 4)[25,33,34,43] and/or focus groups (n = 2)[53,64] with clinicians. Thirteen studies did not

Table 3. Characteristics of the included studies.

First Author (reference)	Year published	Disease context	Study type	Type	Pb-VCM	Attribute #	Control
Abraham et al[41]	2015	Cardiovascular Disease	Descriptive Study	Stand-Alone Pb-VCM	Adaptive Conjoint Analysis	7 attributes	N/A
Ahmed et al[31]	2008	Growth Hormone Deficiency	Descriptive Study	Stand-Alone Pb-VCM	Adaptive Conjoint Analysis	11 attributes	N/A
Almario et al[49]	2018	Inflammatory Bowel Disease	Descriptive Study	Stand-Alone Pb-VCM	Adaptive Conjoint Analysis	9 attributes	N/A
Al-Omari et al[46]	2017	Osteoarthritis	Descriptive Study	Stand-Alone Pb-VCM	Adaptive Conjoint Analysis	8 attributes	N/A
Austria et al[70]	2023	Prostate Cancer	Descriptive Study	PDA or DS that includes Pb-VCM	Best-Worst Scaling Case 3	7 attributes	N/A
Bogza et al[58]	2020	Mild cognitive impairment	Descriptive Study	PDA or DS that includes Pb-VCM	Ranking Exercise	4 attributes	N/A
Brundage et al[23]	1998	Lung Cancer	Descriptive Study	Stand-Alone Pb-VCM	Threshold Technique	8 attributes	N/A
Brundage et al[25]	2000	Lung Cancer	Descriptive Study	Stand-Alone Pb-VCM	Threshold Technique	8 attributes	N/A
Brundage et al[26]	2001	Lung Cancer	Descriptive Study	Stand-Alone Pb-VCM	Threshold Technique	8 attributes	N/A
Chhatre et al[65]	2021	Overactive bladder	Descriptive Study	Stand-Alone Pb-VCM	Adaptive Conjoint Analysis	>10 attributes	N/A
Cole et al[68]	2022	Hematologic Malignancies	Descriptive Study	Stand-Alone Pb-VCM	Best-Worst Scaling (type I, II) and DCE	5-7 attributes	N/A
Culver et al[36]	2011	Breast Cancer	Descriptive Study	PDA or DS that includes Pb-VCM	Rating Exercise	>10 attributes	N/A
de Achaval et al[38]	2012	Knee osteoarthritis	Observational Study	PDA or DS that includes Pb-VCM	Adaptive Conjoint Analysis	8 attributes	Implicit VCM
de Angst et al[59]	2020	Prostate Cancer	Descriptive Study	PDA or DS that includes Pb-VCM	Analytic Hierarchy Process	4 attributes	N/A
Dolan[22]	1995	Colon cancer	Descriptive Study	Stand-Alone Pb-VCM	Analytic Hierarchy Process	5 attributes	N/A
Dolan and Veazie[50]	2018	Cardiovascular Disease	Observational Study	Stand-Alone Pb-VCM	Rating Exercise & Ranking Exercise & Analytic Hierarchy Process	5 attributes	Pb-VCM; Implicit VCM
Dolan and Frisina[27]	2002	Colon cancer	Randomized Controlled Trial	PDA or DS that includes Pb-VCM	Analytic Hierarchy Process	6 attributes	Implicit VCM
Dolan et al[40]	2014	Colon cancer	Descriptive Study	Stand-Alone Pb-VCM	Ranking Exercise & Analytic Hierarchy Process	4 attributes	N/A
Eckman et al[45]	2017	Cystic fibrosis	Descriptive Study	Stand-Alone Pb-VCM	Analytic Hierarchy Process	5 attributes	N/A
Eden et al[33]	2009	Childbirth	Randomized Controlled Trial	PDA or DS that includes Pb-VCM	Analytic Hierarchy Process	>10 attributes	Pb-VCM
Feldman-Stewart et al[29]	2006	Prostate Cancer	Descriptive Study	Stand-Alone Pb-VCM	Rating Exercise	>10 attributes	N/A
Fraenkel et al[30]	2007	Knee pain	Randomized Controlled Trial	Stand-Alone Pb-VCM	Adaptive Conjoint Analysis	5 attributes	Implicit VCM
Garvelink et al[39]	2013	Breast Cancer	Observational Study	PDA or DS that includes Pb-VCM	Rating Exercise	Users could add their own attributes	DA without Pb-VCM

continued on next page

Table 3. Continued

First Author (reference)	Year published	Disease context	Study type	Type	Pb-VCM	Attribute #	Control
Green et al[63]	2021	Chronic Kidney Disease	Descriptive Study	Stand-Alone Pb-VCM	Rating Exercise	>10 attributes	N/A
Hampson et al[48]	2017	Urethral Stricture Disease	Descriptive Study	Stand-Alone Pb-VCM	Discrete Choice Experiment	6 attributes	N/A
Hawley et al[43]	2016	Breast Cancer	Descriptive Study	PDA or DS that includes Pb-VCM	Discrete Choice Experiment	4 attributes	No Intervention
Hazlewood et al[60]	2020	Rheumatoid Arthritis	Descriptive Study	PDA or DS that includes Pb-VCM	Discrete Choice Experiment	8 attributes	N/A
Hess et al[42]	2015	Abnormal uterine bleeding	Randomized Controlled Trial	Stand-Alone Pb-VCM	Adaptive Conjoint Analysis	8 attributes	Usual Care
Ho et al[67]	2022	Contracture of the Elbow	Descriptive Study	PDA or DS that includes Pb-VCM	Rating Exercise	>10 attributes	N/A
Hutyra et al[56]	2019	Dislocation of the shoulder	Randomized Controlled Trial	PDA or DS that includes Pb-VCM	Adaptive Conjoint Analysis	4 attributes	DA without Pb-VCM
Imaeda et al[34]	2010	Colorectal cancer screening	Descriptive Study	Stand-Alone Pb-VCM	Best-Worst Scaling Case 1	>10 attributes	N/A
Jayadevappa et al[53]	2019	Prostate Cancer	Descriptive Study	Stand-Alone Pb-VCM	Adaptive Conjoint Analysis	>10 attributes	N/A
Johnson et al[44]	2016	Prostate Cancer	Observational Study	PDA or DS that includes Pb-VCM	Best-Worst Scaling Case 3	7 attributes	Usual Care
Kremer et al[64]	2021	Multiple sclerosis	Descriptive Study	PDA or DS that includes Pb-VCM	Rating Exercise	9 attributes	N/A
Liberatore et al[32]	2009	Prostate Cancer	Descriptive Study	PDA or DS that includes Pb-VCM	Analytic Hierarchy Process	3 attributes	N/A
Loewen et al[55]	2019	Atrial fibrillation	Descriptive Study	PDA or DS that includes Pb-VCM	Best-Worst Scaling Case 1	9 attributes	N/A
Maas and Stalpers[21]	1992	Laryngeal Cancer	Descriptive Study	Stand-Alone Pb-VCM	Discrete Choice Experiment	2 attributes	N/A
Moreton et al[69]	2022	Osteoarthritis	Observational Study	PDA or DS that includes Pb-VCM	Rating Exercise	7-9 attributes	Pb-VCM
O'Connor et al[24]	1998	Hormone Replacement Therapy	Descriptive Study	PDA or DS that includes Pb-VCM	Rating Exercise	6 attributes	N/A
Pieterse et al[35]	2010	Rectal Cancer	Descriptive Study	Stand-Alone Pb-VCM	Adaptive Conjoint Analysis	4 attributes	N/A
Pieterse et al[57]	2019	Rectal Cancer	Observational Study	Stand-Alone Pb-VCM	Adaptive Conjoint Analysis	4 attributes	N/A
Richman et al [28]	2005	Prostate Cancer	Descriptive Study	Stand-Alone Pb-VCM	Ranking Exercise & Analytic Hierarchy Process	7 attributes	N/A
Rochon et al[37]	2012	Knee osteoarthritis	Descriptive Study	Stand-Alone Pb-VCM	Adaptive Conjoint Analysis	7 attributes	N/A
Shapiro et al[51]	2019	Trigger finger	Descriptive Study	Stand-Alone Pb-VCM	Ranking Exercise	6 attributes	N/A
Shapiro et al[52]	2019	Fracture of the Radius	Descriptive Study	Stand-Alone Pb-VCM	Ranking & Point Allocation	7 attributes	N/A
Snaman et al[54]	2019	Advanced cancer	Descriptive Study	Stand-Alone Pb-VCM	Adaptive Conjoint Analysis	9 attributes	N/A
Snaman et al[66]	2021	Advanced cancer	Descriptive Study	Stand-Alone Pb-VCM	Adaptive Conjoint Analysis	9 attributes	N/A
Streufert et al[47]	2017	Dislocation of the shoulder	Descriptive Study	Stand-Alone Pb-VCM	Adaptive Conjoint Analysis	5 attributes	N/A

continued on next page

Table 3. Continued

First Author (reference)	Year published	Disease context	Study type	Type	Pb-VCM	Attribute #	Control
Studts et al[61]	2020	Lung cancer screening	Descriptive Study	Stand-Alone Pb-VCM	Conjoint Analysis	5 attributes	N/A
Witteman et al[62]	2020	Colon cancer	Randomized Controlled Trial	Stand-Alone Pb-VCM	Rating Exercise	3 attributes	Pb-VCM; Implicit VCM

Randomized Controlled Trial: Study includes at least 2 groups, and study participants are randomized over different interventions. Observational study: Study includes at least 2 groups of participants that test/evaluate at least 2 interventions, but participants are not randomized. Descriptive study: Study includes 1 group of participants that test/evaluate 1 intervention.
PDA indicates patient decision aid; DS, decision support; Pb-VCM, preference-based value clarification methods.

report on methods used for attribute selection.[27-30,35,37,44,48,50,57,62,66,70]

Only 18 studies report on some properties of the attribute set.[22-26,30,31,34-36,40,42,43,47-49,63,69] The relevance of the attribute to the decision was mentioned most frequently as a reason to include attributes (n = 13),[22,24-26,30,34,36,42,43,47,48,63,69] whereas overlap between attributes (n = 4),[25,31,35,49] preferential dependence (n = 4)[25,33,35,49] between candidate attributes or redundancy of attributes (n = 1)[40] were used as arguments to remove attributes.

Design of the Pb-VCM

The most used preference elicitation methods were adaptive conjoint analysis (ACA) (n = 16),[30,31,35,37,38,41,42,46,47,49,53,54,56,57,65,66] rating (n = 10)[24,29,36,39,50,62-64,67,69] and the analytic hierarchy process (AHP) (n = 9)[22,27,28,32,33,40,45,50,59] (see Fig. 1).

The number of attributes included in the Pb-VCM varied between 3 and more than 10 attributes, with no apparent relationship to the preference elicitation method. For example, of the studies using ACA, 3 studies[31,53,65] included 10 or more attributes, whereas 3 studies included 4 attributes.[35,56,57] Similarly, of the studies using AHP, 1 study included 10 or more attributes,[33] and 3 studies included 3(32) or 4 attributes.[40,59] In 3 studies the participant could add attributes to the Pb-VCM,[32,36,39] and in 2 studies the participant could select which attributes to include from a predefined set.[29,69] All other Pb-VCMs were not flexible in terms of attributes.

Pb-VCM were intended to be used by patients on their own (n = 20),[24,25,27,34,39,42-44,49,50,54-58,61,64,65,69,70] with a health professional (n = 9),[26,28,31-33,45,47,51,52] or with a research assistant (n = 5),[37,38,40,60,66] either before (n = 20)[23,24,26-28,30,33,35,38,39,42-44,49,53,54,57,65,67,70] or during (n = 5)[31,32,45,51,52] a consultation with a health professional, or both (n = 3).[47,48,63] Most Pb-VCM were digital (n = 40).[22,24,27,29-31,33-39,41-44,46,47,49-69]

Provision of Personalized Preference Information

In 45 studies, personalized preference information was provided to the user. Sixteen of the 30 studies[28-30,33,35-39,41,42,44,45,47,49,51,53-59,62-66,69,70] that showed attribute importance provided the explanation of how this was presented to users in the article. Examples include: "For you, it is important to …"[42] or "the figure below shows the relative importance of …"[45] Four of 5 studies[32,39,42,49,69] that showed desirability or acceptability of specific attribute-levels within 1 attribute reported on how preferences for attribute levels were introduced; "It seems that you prefer to receive the medicine "given through an IV into the vein in your home" and want it "given every 8 weeks." Ten of the 18 studies[26,27,29-32,36,37,43-45,55,58-60,62,64,69] that showed preferences for real-world options provided the text they used to introduce this information, for instance by introducing them as "your best match is…"[60] and "the treatment that is the best fit for you is…"[43] Of the 3 most frequently used preference elicitation methods, 3 out of 16 studies using ACA,[30,31,37] 5 out of 10 studies using rating[29,36,62,64,69] and 4 out of 9 studies using AHP[27,32,45,59] presented users with preferences for real-world options. Nine studies did not report which personalized preference information was provided.[21-25,34,40,67,68]

Feasibility of Pb-VCM Implementation

Most studies (n = 36) presented some data on feasibility within the context of use and the participant experience.[22,23,25,26,29-31,33-37,39,41,43,45,47,48,50-55,57-60,63-70] Feasibility was most often reported in terms of completion time[22,39,45,47,51,52,55,63,66] but also through completion rate[25,26] and needing assistance during the task.[63] The completion time varied considerably, ranging from 3 minutes or less[39,51] to 30 minutes or longer,[22,65] but most studies concluded that the tools were appropriate and feasible to integrate in a clinical setting in that they were not too time consuming or burdensome.

User experience data were generally positive. The constructs used to understand user experience varied widely, and both qualitative, as well as quantitative formats were used. Many studies focused on understanding the user experience regarding the process of using the Pb-VCM, finding it was perceived as beneficial,[36] helpful,[48,53,65] or useful,[23] that it provided insight,[57] made it easier to make decisions,[29,57] and that users were satisfied with the process[51,52] or found it interesting to do the task.[35]

Another category of outcomes focused on evaluating the task itself, in terms of user comprehension[31,35,60,67] and understanding,[31,39,45,57] whether it was easy to do,[30,34,45,50,57,66,68] whether instructions were easy to understand,[53,65] and whether the Pb-VCM was easy to use.[37,55] Often, iterative changes were made based on these findings. A positive user experience was sometimes expressed in their willingness to recommend it to others,[22,30] or use the results in a consultation with their clinician.[23,35,65,66,69]

A final category of outcomes focused on the intended effect of the Pb-VCM using a qualitative study design. Studies focused on whether it helped users think about values,[70] understand preferences,[30,41,60] and increase knowledge[26,29,35] or understanding of the decision.[34] In some articles, authors reported that experience challenges were resolved,[58] and in other cases, challenges remained.[39]

Across these studies (eg, 38, 56, 59, 71) barriers to an optimal user experience included (1) the complexity of the Pb-VCM and resulting information overload; (2) confusion about

the goal of the Pb-VCM; or (3) misunderstanding the instructions for the Pb-VCM, the attributes, and the resulting preference information outputs. Strategies for improving Pb-VCMs included (1) clearer instructions, (2) limiting and simplifying attributes, (3) allowing participants to add new attributes, (4) reducing and simplifying numerical information, (5) simplifying and layering educational content that introduces the decision and the attributes, and (6) improving the layout or user interface.

Effectiveness of a Pb-VCM

Twenty-three studies assessed the effect of the Pb-VCM on the decision-making process and outcomes. The most-frequently assessed outcome measure was decisional conflict (n = 15).[24-27,29,33,38,48,50,55-57,60-62] Decisional conflict is "an individual's level of comfort with a decision."[72] To measure decisional conflict, 2 studies used the SURE scale,[73] 11 studies used (subscales of) the Decisional Conflict Scale (DCS),[72] and 2 used the low literacy version of the DCS.[74] Four studies provided only postintervention data,[25,26,29,60] giving no insight into whether decisional conflict was reduced after use of the Pb-VCM. Three studies measured decisional conflict before and after Pb-VCM and identified reduced decisional conflict after preference elicitation with BWS1(55), rating,[24] and CA.[61] Of the 15 studies that measured decisional conflict, 4 presented participants with attribute importance,[33,38,56,57] 2 presented participants with preferences for options,[26,60] 4 presented participants with both,[27,29,55,62] and 5 presented no preference information.[24,25,48,50,61] The effect of informing participants about preferences for options on decisional conflict cannot be determined because of differences in study designs, measurement instruments, and preference elicitation methods used.

Seven studies compared a Pb-VCM with a control intervention.[27,33,38,50,56,57,62] Of these, the 3 studies that tested ACA did not identify a difference in reduction in overall decisional conflict between ACA and educational material (56), usual care[57] or an implicit VCM.[38] Of the 3 studies that tested AHP,[27,33,50] 1 found a significant reduction in overall decisional conflict compared with an implicit VCM,[27] 1 found lower decisional conflict after ranking compared with rating and AHP,[50] and the third found lower decisional conflict with both versions of an AHP but no difference between a numerical or qualitative scale used to elicit preferences.[33] One study tested 2 versions of a Pb-VCM using rating to elicit preferences and found decreased decisional conflict compared with an implicit VCM but no difference between rating formats.[62]

Eleven studies did some assessment of congruence between predicted preferences for options—based on preferences elicited through the Pb-VCM—and the intended or actual treatment choice.[24,25,27,29,31,41-43,60,62,65] However, the types of assessment varied, and only 2 of these studies measured intended treatment choice before and after using a Pb-VCM.[24,62] O'Connor et al,[24] found higher congruence between predicted preference for options and intended treatment choice after a rating exercise, without showing any preference information to patients. Witteman et al,[62] found increased congruence between predicted and actual treatment choice after using a rating exercise that also showed preferences for options compared with a rating exercise that did not.

The low frequency of other outcome measures and wide variety in the instruments used to measure these outcomes did not allow for further quantitative analysis of Pb-VCM outcomes.

Discussion

The inclusion of a Pb-VCM in a DA may lead to improvements in SDM processes and outcomes. Our review summarizes Pb-VCM design and development practices and assessments of feasibility and effectiveness for SDM.

Development and Design of a Pb-VCM

We found that ACA, rating, and AHP are the 3 most-frequently used preference elicitation methods used in Pb-VCMs. It was previously suggested that using Pb-VCMs is more cognitively burdensome to the user than implicit VCM.[13] This review found insufficient evidence to favor Pb-VCM over implicit VCM, or to differentiate between Pb-VCM variants based on user cognitive burden. Only 1 study directly compared ease of use of an implicit VCM with a Pb-VCM.[30] Of the studies that did compare different explicit methods, 1 concluded that the AHP was easier than ranking and rating,[38] and 1 found that conjoint analysis was more useful than ranking and rating.[43] Contrary to our hypothesis, the stated preference methods did not include fewer attributes than structured weighting methods, despite their reliance on statistical modeling and the need for more observations (ie, tasks for users) as attribute numbers increase.

A perceived benefit of using a Pb-VCM is that it can inform patients about how well real-world options align with their preferences.[13,14] Information on alignment between preference for attributes and preferences for real-world options must account for dynamic preferences and an evolving treatment landscape, raising questions about how often a Pb-VCM should be repeated and how frequently it and the accompanying educational materials need updating. Although 18 studies provided users with information of preferences for real-world options, only a minority of the studies addressed the challenges of the dynamic nature of both preferences and treatment options, indicating that more methodological studies are needed.

Feasibility of a Pb-VCM

Although many studies referred to challenges associated with the complexity of the Pb-VCM activity and/or user understanding of treatment information, most studies that addressed feasibility and user experience were positive about the possible implementation of the Pb-VCM developed in their studies, in that users were willing to use the Pb-VCMs and the time required was acceptable. This suggests that good pilot testing can address most feasibility challenges.

Most studies used individual interviews with patients during development, making iterative changes based on the input received. One of the key challenges in addressing the feasibility of Pb-VCMs on an aggregate level was the significant variation in how authors envisioned integrating Pb-VCMs with educational materials. At one extreme, some Pb-VCMs were designed as stand-alone interventions, relying on clinicians to provide education. At the other, they were intended to be embedded within a PDA developed in accordance with IPDAS guidelines[3,75] which offer structured guidance for creating high-quality, standardized educational content. These differences significantly affect how the a Pb-VCM is implemented in clinical practice and the time required from both patients and clinicians. Another challenge in determining feasibility is the large variation in constructs used to quantify and qualify the user experience. More uniformity in outcome measures and study designs is required to aggregate outcomes across individual studies.

Effectiveness of a Pb-VCM

Evidence of the effectiveness of a Pb-VCM on decision making was sparse and mixed. Less than half of the studies measured the impact of the Pb-VCM and/or PDA on decision processes and outcomes. We found some evidence that a Pb-VCM can reduce decisional conflict in uncontrolled studies, but only 3 (27, 38, 62) out of the 7 controlled studies[27,33,38,50,56,57,62] found reduced decisional conflict in the Pb-VCM group when compared with an implicit VCM or educational materials, and only 2 of them provided personalized preference information.[27,62] Few studies compared different Pb-VCMs directly,[33,50,62,69] limiting conclusions about which may be most effective. In contrast with the findings of an earlier review,[5] we cannot conclude that Pb-VCMs providing more personalized preference information to users are more likely to increase congruence between preferences and treatment choices than those that do not.

Reporting Standards and Adherence to Good Practice Guidelines

This review lies at the intersection of 2 different streams of research/application (SDM and health preference research), and each stream has its own guidance, conceptual framework, and literature. Most studies did not report on the use of either preference or PDA guidelines in developing the Pb-VCM. Although many studies report on methods used to identify attributes and provide evidence supporting the performance of options, as recommended by the guidelines,[12-14] they fall short in justifying the validity of these methods and their results, particularly in light of their intended purpose: to provide valid and reliable individual-level preference information. Similarly, many studies provided only limited detail on the educational materials used to explain the study problem, the attributes and performance of real-world options, and the information used to explain the preference task to study participants.[12] Based on the review findings and research gaps identified, current guidance is both not adopted, but also falls short in the context in which preference information is sought at the individual patient-level for the direct purpose of informing shared decision making in clinical practice.

Limitations

We acknowledge several study limitations. First, we did not use a quality assessment tool. We decided against quality assessment because the development of Pb-VCMs is an emerging field with few reporting standards, and existing checklists lack face validity in this context. The PREFS checklist,[76] most commonly used in preference research, includes items (such as clear preference statements and significance testing) that do not apply to Pb-VCMs. The IPDAS guidelines have standards for the content and process of development for PDAs, which were too extensive for the purpose of this review. In addition, some necessary information for quality assessment, including supplementary materials and PDAs, was unavailable via provided links, potentially leading to reporting bias and some authors reported multiple design and testing steps across 1 or more articles, whereas others reported Pb-VCM findings alongside overall PDA results, making quality assessment difficult.

Second, we observed significant variation in interventions, making it difficult to separate the impact of the Pb-VCM from the educational components. Although this does not affect the clinical value of PDAs that include Pb-VCMs, it limits our ability to identify the most effective elements. Similarly, meta-analysis could not be performed because of heterogeneity in clinical, methodological, and statistical study characteristics. More uniformity in study designs and outcome measures to evaluate feasibility and effectiveness consistently would enable meta-analysis in the future. Finally, our literature search was last updated in April 2023. Because forward citation screening of the articles included in this review resulted in only 1 study that would have met our inclusion criteria, we do not feel that updating the search would result in different conclusions to our study.

Recommendations and Research Priorities

We did not find sufficient evidence to recommend any specific preference-based method for use as a VCM. More comparative research is needed to determine the feasibility of different preference-based methods (ie, overly complicated or time-consuming methods will not be effective in real-world settings) and the impact of different preference activities (eg, elicitation of attribute importance through rating or ranking, choosing between options) and outputs (eg, whether and which personalized preference information is provided) on effectiveness in clinical practice.

To enhance the design and feasibility of Pb-VCMs, developers should engage a transdisciplinary team, including experts in preference research, PDAs, health communication, and user-centered design.

Based on our findings and the literatures on health preference and patient decision making (eg,[13,14]), we have developed several recommendations to help realize the potential for PDAs to improve decision making, we recommend the following for Pb-VCM developers:

(1) Clearly explain the rationale for using a quantitative Pb-VCM, considering the choice of a specific preference elicitation method, its theoretical strengths, attribute balance (to ensure no option is unfairly advantaged), and the user burden relative to the number and types of attributes included.[13,14] Guidance on how to develop a descriptive framework for a health preference task can be found in Mühlbacher et al.[77]
(2) Streamline and layer educational content within the PDA and Pb-VCM, aligning it with clinicians' responsibilities to provide information and discuss values, based on the IPDAS guidelines.[3]
(3) Use an iterative user-centered design process to improve the preference elicitation task, aiming to minimize patient and clinician burden, ensure understanding of the attributes and the elicitation process, and align the presentation of personalized preference information with user needs. Report on the iterative improvements made during feasibility testing, including contextual information that informed the design of a fit-for-purpose Pb-VCM.[78,79]

Additional studies are needed to evaluate the effectiveness of Pb-VCMs in clinical practice.

We recommend the following for Pb-VCM developers:

(1) Conduct additional randomized studies to determine whether specific Pb-VCMs result in better outcomes than implicit VCM, and studies to directly compare outcomes of different methods used for Pb-VCMs.
(2) Use the DCS to evaluate effectiveness.[72] The DCS, and specifically the "clarity about personal values" subscale, is currently the most frequently used in this review, as well as

in a recent Cochrane review of patient decision aids more broadly.[2,80] Along with the DCS, developers should consider other measures of decision process and outcomes (particularly when the Pb-VCM is included in a PDA), including participation in decision making, decision regret, value congruence (ie, agreement between predicted and actual choices) and treatment adherence when such data are available.

(3) Report on the type of personalized preference information shown to users to determine the most effective outputs of Pb-VCM but also consider the accuracy of preference estimates and clinical outcome data, as well as the comparability of clinical outcome data across options, in the decision to present preferences for real-world options.

Existing guidance should be used as appropriate in the context of Pb-VCM design and development (Appendix E). However, additional guidance is needed in several areas:

(1) Pb-VCMs are essentially preference studies with a sample size of 1; therefore, the information provided to each user must be comprehensive enough to elicit preferences for the most relevant attributes;
(2) given that the purpose of the Pb-VCM is value clarification, guidelines may need to be adapted to prioritize recommendations that fit this application;
(3) additional guidance should address more standardized reporting on Pb-VCMs in publications. Recommendations for reporting key characteristics of Pb-VCMs in studies or supplementary material, including screenshots or copies of the tool, will help ensure that important information is available to stakeholders.

Future research should focus on developing guidelines, for which the data extraction form developed for this study could serve as a starting point.

Conclusions

Although this review finds that the literature on Pb-VCMs is growing, diverse, and draws on multiple fields of research, numerous questions about design, implementation, feasibility and acceptability, and effectiveness remain unresolved at this stage.

From this systematic review, we conclude that ACA, rating scales ratings, and the AHP are most used as Pb-VCMs. Although the feasibility of several methods in clinical practice appears promising, evidence of the effectiveness of Pb-VCMs on decision making is sparse and mixed.

Therefore, it is unclear which preference-based method is most suitable for supporting SDM. Interpretation of feasibility and effectiveness findings and the most valuable components of Pb-VCMs are complicated by (1) variations in Pb-VCM design, (2) use as a stand-alone tool or within a PDA, (3) whether and which outputs were shared with users, and (4) differences in study methods and outcome measures. Future research should examine the effectiveness and feasibility of different Pb-VCMs, compare Pb-VCMs with other VCM approaches, and explore its implementation in clinical practice.

Author Disclosures

Author disclosure forms can be accessed below in the Supplemental Material section.

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