TU Delft

Delft University of Technology

Participatory Value Evaluation (PVE)

A New Preference-Elicitation Method for Decision Making in Healthcare

Boxebeld, Sander; Mouter, Niek; van Exel, Job

DOI
10.1007/s40258-023-00859-9

Publication date
2023

Document Version
Final published version

Published in
Applied Health Economics and Health Policy

Citation (APA)
Boxebeld, S., Mouter, N., & van Exel, J. (2023). Participatory Value Evaluation (PVE): A New Preference-Elicitation Method for Decision Making in Healthcare. *Applied Health Economics and Health Policy*, *22*, 145-154. https://doi.org/10.1007/s40258-023-00859-9

Important note
To cite this publication, please use the final published version (if applicable).
Please check the document version above.

Copyright
Other than for strictly personal use, it is not permitted to download, forward or distribute the text or part of it, without the consent of the author(s) and/or copyright holder(s), unless the work is under an open content license such as Creative Commons.

Takedown policy
Please contact us and provide details if you believe this document breaches copyrights.
We will remove access to the work immediately and investigate your claim.

This work is downloaded from Delft University of Technology.
For technical reasons the number of authors shown on this cover page is limited to a maximum of 10.

Applied Health Economics and Health Policy
https://doi.org/10.1007/s40258-023-00859-9

PRACTICAL APPLICATION

Participatory Value Evaluation (PVE): A New Preference-Elicitation Method for Decision Making in Healthcare

Sander Boxebeld[1,2,3] · **Niek Mouter**[4,5] · **Job van Exel**[1,2,3]

Accepted: 20 November 2023
© The Author(s), under exclusive licence to Springer Nature Switzerland AG 2023

Abstract

Participatory value evaluation (PVE) has recently been introduced in the field of health as a new method to elicit stated preferences for public policies. PVE is a method in which respondents in a choice experiment are presented with various policy options and their attributes, and are asked to compose their portfolio of preference given a public-resource constraint. This paper aims to illustrate PVE's potential for informing healthcare decision making and to position it relative to established preference-elicitation methods. We first describe PVE and its theoretical background. Next, by means of a narrative review of the eight existing PVE applications within and outside the health domain, we illustrate the different implementations of the main features of the method. We then compare PVE to several established preference-elicitation methods in terms of the structure and nature of the choice tasks presented to respondents. The portfolio-based choice task in a PVE requires respondents to consider a set of policy alternatives in relation to each other and to make trade-offs subject to one or more constraints, which more closely resembles decision making by policymakers. When using a flexible budget constraint, respondents can trade-off their private income with public expenditures. Relative to other methods, a PVE may be cognitively more demanding and is less efficient; however, it seems a promising complementary method for the preference-based assessment of health policies. Further research into the feasibility and validity of the method is required before researchers and policymakers can fully appreciate the advantages and disadvantages of the PVE as a preference-elicitation method.

1 Introduction

Over recent decades, the use of preference-elicitation methods such as discrete choice experiments (DCEs) and best-worst scaling (BWS) has rapidly expanded, including in the health field [1]. One of the main purposes of employing such methods is the preference-based assessment of health-policy alternatives to inform governmental decision making in the authorisation of new pharmaceuticals and the public funding of treatments [2–5]. In this way, governmental decisions may be better aligned with public preferences and decision

Key Points for Decision Makers

Participatory value evaluation (PVE) can simultaneously elicit preferences for policy alternatives and trade-offs between public and private spending, while potentially also considering synergies between alternatives.

PVE presents respondents with a single choice set and, therefore, is less efficient than other multi-attribute preference-elicitation methods and may impose a greater cognitive burden on respondents.

PVE may be particularly useful for eliciting preferences when a portfolio of multiple policy alternatives can be selected within a constraint and both public and private resources can be allocated.

✉ Sander Boxebeld
boxebeld@eshpm.eur.nl

1 Department of Health Economics, Erasmus School of Health Policy & Management (ESHPM), Erasmus University Rotterdam, Rotterdam, The Netherlands

2 Erasmus Centre for Health Economics Rotterdam (EsCHER), Erasmus University Rotterdam, Rotterdam, The Netherlands

3 Erasmus Choice Modelling Centre (ECMC), Erasmus University Rotterdam, Rotterdam, The Netherlands

4 Transport and Logistics Group, Department of Technology, Policy and Management, Delft University of Technology, Delft, The Netherlands

5 Populytics B.V. Leiden, Leiden, The Netherlands

Published online: 16 December 2023

makers are provided with additional perspectives from citizens [2].

In addition to the methods commonly used for this purpose, participatory value evaluation (PVE) has been introduced in the fields of transportation [6] and environmental sciences [7, 8]. PVE is a method in which respondents in a choice experiment are presented with various policy projects and their characteristics and effects, and are asked to compose their preference portfolio given a public-resource constraint [9]. Respondents seem to find PVE a relevant, credible, and legitimate method [10] that increased their awareness about the policy issue in question and may be valuable for policymakers [8, 10–14].

Given the use of PVE for incorporating public preferences in resource-allocation decisions, one may compare the method to a variety of participatory and deliberative methods, such as participatory budgeting, referendums and opinion polls. Mouter et al. [12] have provided a conceptual comparison of PVE with such methods. PVE has also been conceptually compared with willingness to assign/willingness to allocate public budget experiments [7, 15], in which respondents allocate a public budget for several collective goods or services [16] without any connection between public and private resource capacities. Finally, a PVE has been compared both conceptually and empirically with the economic evaluation framework of cost-benefit analysis [6]. PVE has not yet been compared with other multi-attribute preference-elicitation methods. Such a comparison is straightforward as, from the modelling perspective, PVE essentially forms an extension of existing choice-modelling approaches [9]. A comparison also provides a better understanding of PVE compared to established preference-elicitation methods.

Now that PVE has been applied in the context of health [11–14], it seems appropriate to discuss the method more specifically and in relation to established methods for eliciting health preferences. To do so, this paper first introduces PVE in more detail and discusses its theoretical background. Next, we discuss the main features of published applications. This is not a systematic literature review, as only eight PVE applications have been published so far, but illustrates how the PVE design can be adapted to the policy question at hand. Finally, PVE is positioned relative to established preference-elicitation methods, with the aim of helping researchers and policymakers understand the comparative (dis)advantages of PVE and contribute to a better-informed selection of methods for preference-based assessments of health policy alternatives in the future.

2 Participatory Value Evaluation: The Method and its Theoretical Background

2.1 Policy Setting

Policymakers are typically faced with multiple decision problems when allocating scarce resources, such as a public budget. Not only do they need to decide on the amount of the budget to spend on a particular purpose, but also on the budget allocation to specific goods or services, and how much to spend on each good or service. These decisions take the form of both discrete choices (i.e. whether to allocate resources towards a specific good or service) and continuous choices (i.e. the amount of the budget spent in total and on each selected good or service).PVE has been developed as a method to elicit citizens' preferences towards each of these decision problems simultaneously.

2.2 Choice Task

PVE assesses the desirability of different policy options and their attributes by means of a choice experiment. Respondents are presented with a specific policy problem faced by a policymaker, a set of policy alternatives that address this problem and a (set of) constraint(s).[1] See Fig. 1 for a stylised example of a PVE choice task. Each policy alternative is described by a set of attributes, specifying its estimated impact on several relevant outcomes. Respondents are asked to select a portfolio of policies according to their preferences by comparing and trading off the attribute levels of the policy alternatives on offer, respecting the specified constraint(s). These constraints can, for example, take the form of a maximum budget and/or a target level on a relevant outcome (e.g. a minimum increase in a desired outcome or a minimum decrease in an undesired outcome). A PVE thus combines a portfolio-based choice task with the allocation of public resources, all assembled within a single framework embedded in random utility theory [7, 9, 12]. For an example of the practical implementation of the choice task explained above, we refer the reader to a description of a case study from the existing literature in the Electronic Supplementary Material (ESM).

An interesting feature of a PVE is that the budget constraint can be either fixed or flexible. In the case of a fixed budget, respondents can only select policies within the given budget constraint. In the case of a flexible budget, respondents may decide to raise or lower the budget, but then also need to accept that taxes (or premiums and tariffs) issued

[1] As an illustration of the PVE development process, Juschten and Omann [10] suggest seven development steps and describe the methods they used for knowledge creation within each step.

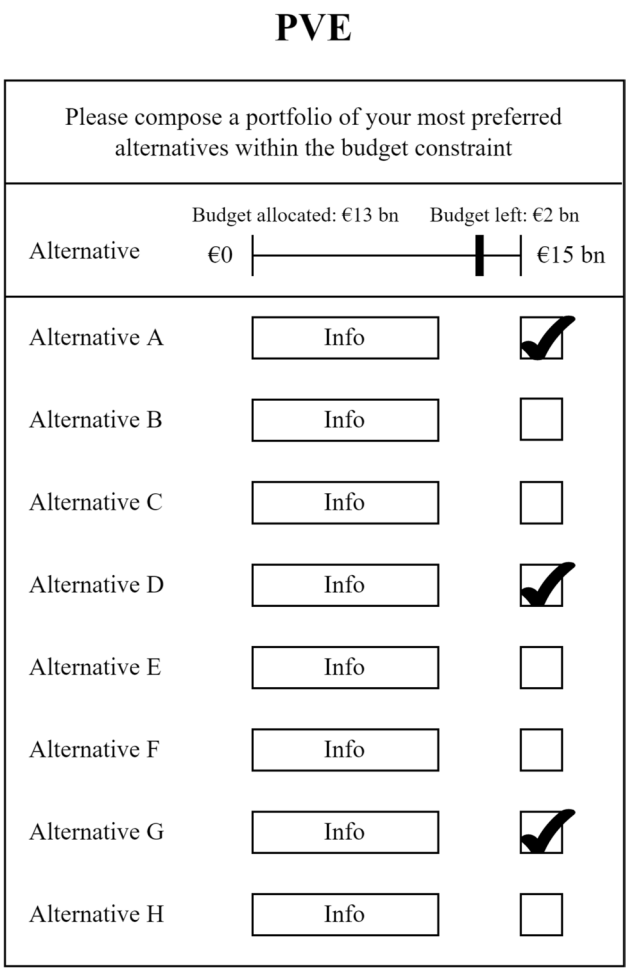

Fig. 1 Stylized example of the choice task of a participatory value evaluation (PVE). *bn* billion, *Info* information

to finance the policy will change upwards or downwards accordingly. Thus, in a flexible-budget PVE, respondents not only select a portfolio from a set of policy alternatives but simultaneously also trade-off public and private spending capacities.

2.3 Experimental Design

While the set of policy alternatives is constant, the levels of the attributes are randomised across respondents so that the effect of these levels on respondents' choices can be estimated [9]. Ideally, the experimental design should include all combinations of attribute levels, as the PVE then captures respondents' trade-offs between all possible combinations (i.e. a full-factorial design). However, such a design is typically unfeasible for the analyst to construct in practice because of the exponential growth in the number of possible combinations (i.e., profiles) when increasing the number of alternatives, attributes or levels. Therefore, a 'minimum-maximum correlation' design can be constructed using an algorithm, in which the correlation between attribute levels is minimised within a reasonable number of profiles. This algorithm is explained in the Appendix of the article by Mouter et al. [12].

2.4 Data Analysis and Outcomes

Under the random utility theory, the utility of each choice alternative can be divided into a deterministic component (i.e. the aggregate of the utilities attached to its attribute levels and, if applicable, its label) and a stochastic component captured in the error term of the utility function [17]. In a PVE framework, an individual's utility is affected by both the utility of the choice alternatives as well as the utility of private consumption and any remaining (non-allocated) public budget. The PVE choice model can be econometrically estimated using the multiple discrete-continuous extreme value (MDCEV) model, which is an established choice model for the estimation of both discrete and continuous choices [18, 19]. Dekker et al. [9] have proposed extensions to the MDCEV model for the analysis of PVE data.[2] An alternative choice model that can be used for PVE is the portfolio choice model [20], which is more useful in the absence of a resource constraint.

Dekker et al. [9] show that PVE's embeddedness in random utility theory makes it possible to estimate and aggregate individual utility functions and implement these into the social welfare function, yielding welfare estimates that can be used as inputs into economic evaluation frameworks such as a cost-utility analysis or a cost-benefit analysis. As such, the link between public and private budget constraints through the tax system allows one to align the PVE with the Kaldor–Hicks welfare economics framework [7, 9] to evaluate the (re)allocation of scarce resources. Thereby, it becomes possible to derive willingness-to-pay estimates from PVE data. However, most existing PVE applications estimate direct utility functions in preference space [9], as there is often no need for a monetary valuation, as the PVE is already framed in the context of the application and the results can therefore directly inform policymakers [9]. Thus, the analysis of PVE data typically yields preference parameters that capture the marginal utility that respondents attach to a policy alternative or a one-level increase of an attribute. These preference parameters can be used to calculate the marginal rate of substitution between attributes, the probability that a portfolio of policy alternatives results in an

[2] These extensions include the non-linear utility impact that the two outside goods may have and the connection of public and private spending capacities through the tax system. The rationale for and formalisation of these extensions are described by Dekker et al. [9].

improvement of social welfare and the optimal composition of a portfolio given a specific constraint [7, 9, 11].

3 Main Features of Published Applications

To provide a better understanding of how PVE can be used, we discuss below the main features of published studies applying PVE so far (either in peer-reviewed journals or in online working paper repositories). Given the distinct design features of these applications, the discussion centres around the variety of choices one can make to adapt specific core elements (i.e. the constraint(s) and the alternatives) in the design of a PVE to the policy question at hand.

3.1 Type of Constraint

The type of constraint is a distinct design feature that varies between existing applications. Most studies use a monetary constraint, typically in the form of a maximum public budget that can be allocated towards a range of policy alternatives to be selected by the respondent. For example, Mulderij et al. [11] conducted a PVE to elicit citizens' preferences regarding the public funding of interventions promoting healthy body weight among people with low incomes. Respondents were asked to select their preferred portfolio of policies considering a maximum public budget that was not sufficient to fund all projects. They were informed that any surplus budget would be shifted to next year and used for the same policy purpose [11]. Alternatively, a monetary constraint may also take the form of a minimum rather than a maximum. In a study on citizens' preferences for disinvestment in healthcare, Rotteveel et al. [13] asked respondents to select a portfolio of treatments for which the government should discontinue reimbursement, so that a minimum saving of €100 million could be achieved.

A constraint can also take a form other than monetary. For example, in two different PVE applications regarding citizens' preferences for COVID-19 lockdown restrictions, it was considered that the pressure on the healthcare system was the most important constraint for policymakers. Therefore, in the PVE application by Mouter et al. [12] on the relaxation of COVID-19 lockdown restrictions, respondents could select a portfolio of restrictions they preferred to be relaxed while respecting the constraint of a maximum of 50% additional pressure on the healthcare system. Similarly, in one of the scenarios of a PVE application regarding public preferences for the introduction of COVID-19 lockdown restrictions under different scenarios by Mouter et al. [14], the constraint was that respondents were required to select a portfolio of policy alternatives resulting in a risk reduction of at least 30%. It should be noted that the link with the Kaldor–Hicks framework is lost when a non-monetary constraint is selected, as respondents no longer trade-off their private income with public resource allocations.

3.2 Fixed or Flexible Constraint

Another design feature is the choice of a fixed or flexible constraint. Most existing PVE applications have included a fixed constraint. This may be desirable in cases where the level of the constraint is predetermined and policymakers need to adopt and implement policies within that constraint. A flexible constraint may be more appropriate if the goal of the PVE is to elicit citizens' preferences towards both a set of policy alternatives and the trade-off between public expenditure and private spending capacity. Two PVE applications, on citizens' preferences for flood-protection programmes and for urban-mobility investments applied such a flexible constraint [7, 9]. In one of the versions of both experiments, respondents were allowed to select a portfolio of projects with a total expenditure that was either lower or higher than the target budget, in which case the related tax would be lowered or raised accordingly. This allowed the studies to elicit public preferences for the policy alternatives and the level of governmental expenditure on the policy issue simultaneously.

3.3 Number of Constraints

In a PVE, one or multiple constraints can be implemented. Most existing applications have included a single constraint; however, an application on public preferences for CO_2 emission reduction policies required respondents to consider two constraints when selecting policy options: the target level for the CO_2 reduction and the available budget [21]. The potential to include multiple constraints in a PVE is an advantage if policymakers must consider (all) those constraints in the actual policy context. The disadvantages are that it may increase the cognitive burden on respondents and it increases the number of parameters, complicating the model estimation.

3.4 Labelled or Unlabelled Alternatives

The policy alternatives in a PVE are described by a range of attribute levels and may come with or without labels. Most existing PVE applications are labelled, meaning that respondents are informed about the actual policy alternatives represented by the attribute levels, such as policies promoting a healthy body weight [11], lockdown restrictions [11, 14] or climate policies [21, 22]. The application by Rotteveel et al. [13] on disinvestment in healthcare, however, employed unlabelled alternatives because the authors anticipated that labels could influence respondents' preferences, when their study was focused on the importance of the attributes of

Table 1 Overview of the design characteristics of published participatory value evaluation (PVE) applications

Study	Topic	Fixed or flexible constraint	Type of constraint	Single or multiple constraints	Presentation of policy alternatives
Health					
Mulderij et al. [9]	Policies promoting a healthy body weight	Fixed	Budget	Single	Labelled
Mouter et al. [10]	COVID-19 lockdown policies	Fixed	Maximum pressure on healthcare system	Single	Labelled
Rotteveel et al. [11]	Disinvestment of healthcare interventions	Fixed	Minimum expenditure savings	Single	Unlabelled
Mouter et al. [12]	COVID-19 restrictions under different scenarios	Fixed	Maximum pressure on healthcare system	Single	Labelled
Other domains					
Dekker et al. [13]	Urban mobility investments	Fixed/flexible	Budget	Single	Labelled
Mouter et al. [7]	Flood protection programmes	Flexible	Budget	Single	Labelled
Van Beek et al. [26]	Reduction in CO_2 emission	Fixed	Budget and minimum CO_2 emission reduction	Multiple	Labelled
Hössinger et al. [27]	Reduction in CO_2 emission in transport	Flexible	CO_2 emission reduction target	Single	Labelled

healthcare interventions. Similar to a labelled DCE, the inclusion of labels for the alternatives in a PVE limits the generalisability of the preference estimates for attribute levels, as respondents may incorporate other factors in their decision making. However, the inclusion of labels adds to the realism of the choice task [23, 24].

3.5 Overview of Published Applications

This discussion of the distinct design characteristics of existing PVE applications shows that there is considerable room within the PVE framework to adapt and tailor the design to the relevant features of the policy question at hand. This concerns especially the constraint (i.e. fixed or flexible, monetary or another type, single or multiple) as well as the presentation of policy alternatives (labelled or unlabelled). Table 1 presents a summary overview of these characteristics and their implementation in the PVE applications published so far, four in the health domain and four in other domains. An overview of other characteristics of these eight studies (e.g. the number of respondents, the estimated choice model) is provided in Table S1 of the ESM.

4 Position of PVE Relative to Other Preference-Elicitation Methods

In the domain of health, a wide range of preference-elicitation methods is used [25]. To obtain a better view on the position of PVE relative to other methods, in this section, PVE is compared to a selection of established methods. This selection is based on the final recommendations of the PREFER consortium [26], in which 11 preference-elicitation methods are recommended based on an appraisal of methods by stakeholders and experts [27]. Of these, five were explored in depth by the PREFER consortium: the DCE or BWS Case 3 (BWS-3), BWS Case 1 (BWS-1), BWS Case 2 (BWS-2), the (probabilistic) threshold technique and swing weighting (SW). All of these are included in the comparison with PVE[3], except for the threshold technique, as this is not a multi-attribute method [41] and therefore the least related to a PVE. Table 2 presents an overview of the similarities and differences in the structure and nature of the choice tasks of the four remaining preference-elicitation methods and PVE.[4]

4.1 Number of Choice Tasks

While SW and PVE present all attribute levels (and all alternatives in the case of PVE) in a single choice task, a DCE

[3] **DCE**: See Lancsar and Louviere [28] and Mühlbacher and Johnson [29] for introductions into the DCE method, and De Bekker-Grob et al. [30], Clark et al. [31] and Soekhai et al. [32] for systematic reviews of DCE applications.

BWS: See Flynn et al. [33] for an introduction into BWS-2, Mühlbacher et al. [34] for a survey of all three cases of BWS, methodological issues and the applied BWS literature, and Cheung et al. [35] and Hollin et al. [36] for extensive reviews of BWS applications.

SW: See Edwards and Barron [37] and Srivastava et al. [38] for early discussions and comparisons of various ranking methods including SW, Tervonen et al. [39] for a description of the SW method and a conceptual comparison with a DCE, and Whichello et al. [40] for an empirical comparison with a DCE.

[4] Figure S1 in the ESM provides stylised examples of the choice tasks of all five compared preference-elicitation methods.

Table 2 Overview of the various characteristics regarding the structure and focus of the choice tasks in the included preference-elicitation methods

Method	Number of choice sets	Type of choice task	Focus of choice task	Embedded in RUT	Constraint
DCE	Multiple	1 discrete choice	Attribute levels (and alternatives)	Yes	No
BWS-1	Multiple	2 discrete choices	Attributes	Yes	No
BWS-2	Multiple	2 discrete choices	Attribute levels	Yes	No
SW	Single	Ranking and point allocation	Attribute levels	No	No
PVE	Single	Continuous and discrete choices	Alternatives (and attribute levels)	Yes	Yes

BWS-1 best-worst scaling case 1, *BWS-2* best-worst scaling case 2, *DCE* discrete choice experiment, *PVE* participatory value evaluation, *RUT* random utility theory, *SW* swing weighting

and both types of BWS involve multiple choice tasks. An advantage of the former is that it is probably closer to the reality of the policymaker, who faces all choice options at once rather than in multiple choice tasks. An advantage of multiple choice sets is that this is more efficient as multiple choices are observed for every respondent and, therefore a smaller number of respondents is required. As another potential advantage of multiple choice tasks, the cognitive burden imposed on respondents may be lower, given that these choice tasks typically offer only two[5] rather than all policy alternatives simultaneously.

4.2 Type of Choice Task

The methods present respondents with different types of choice tasks. In a DCE, respondents need to make one discrete choice per choice task, for their most preferred alternative. In BWS-1 and BWS-2, respondents need to make two discrete choices per choice task, for the most and least preferred attribute or attribute level, respectively. In SW, respondents do not make discrete choices, but are asked to first rank level improvements in each attribute from most to least desired, and then assign points to weigh the importance of each attribute level improvement. In a PVE, finally, respondents make multiple discrete choices by selecting policies in their portfolio and simultaneously make a continuous choice by determining the extent of allocated resources. This portfolio-based choice task allows respondents to evaluate all the alternatives on offer in relation to each other. This may lead them to select combinations of portfolios that are not necessarily in line with their ranking of the individual alternatives, as synergies between projects and distributional effects may be considered [6, 7, 20].

[5] In a systematic review of DCE applications in health, 83% of the 301 identified studies between 2013 and 2017 were found to include two alternatives per choice set (excluding any opt-out or status quo alternative) [32].

4.3 Focus of Choice Task

The methods focus on different aspects of the decision problem. In a DCE, respondents choose between two or more alternatives described by a number of attribute levels. Commonly, alternatives are unlabelled in a DCE [23] and, therefore, respondents base their choices on the attribute levels only. As such, the focus of the choice task is on the attribute levels. If the alternatives are labelled, there is an additional focus as respondents are also informed about the labels of the policy alternatives and can, therefore, incorporate factors other than the included attributes and levels in their decision making. In BWS-1, respondents are presented with a single alternative (in the context of this method often referred to as 'object') described by a set of attributes and are asked to select their most-preferred and least-preferred attribute. The attributes are presented without levels so there is an exclusive focus on attributes. In BWS-2, respondents are also presented with a single alternative described by a number of attributes; however, the attributes are presented with levels, and respondents need to select their most-preferred and least-preferred attribute levels. The focus of BWS-2 is, therefore, on attribute levels. In SW, the focus is also on attribute levels as respondents need to rank and weight improvements in various attribute levels. Finally, in a PVE, the focus is predominantly on the alternatives as respondents compose portfolios of labelled alternatives. In addition, there is a secondary focus on attribute levels as these are also included to describe the impact of the alternatives on various outcomes.

4.4 Theoretical Foundations

Four of the five methods are embedded in random-utility theory, only SW is not. Therefore, welfare estimates can be derived from DCE, BWS-1, BWS-2 and PVE, but not for SW. For DCE, BWS-1 and BWS-2, this is straightforward [42], but it requires a more elaborate procedure for a PVE [43]. The resulting welfare estimates can be used as inputs in other economic methods for policy evaluations, such as

cost-effectiveness analysis, cost-benefit analysis or cost-utility analysis [44].

4.5 Inclusion of a Constraint

Only the PVE design includes a constraint. Thus, PVE is the only method that forces respondents to explicitly incorporate the constraint(s) faced by policymakers in their actual decision making where resources are scarce and the allocation of (collective) resources is therefore constrained. In the case of a flexible budget, PVE also allows respondents to trade-off public and private expenditures.

5 Discussion

PVE is a new preference-elicitation method for the preference-based assessment of policy alternatives. This paper introduces PVE in the health policy domain, discusses its theoretical background and the main features of recently published practical applications, and positions it relative to the established methods of DCE, BWS-1, BWS-2 and SW. We find that PVE comes with three (potential) advantages and two (potential) disadvantages relative to established methods.

5.1 Potential Advantages

A first advantage of PVE is that its portfolio-based choice task allows respondents to evaluate policy alternatives in relation to each other while also considering synergies between alternatives and distributional consequences. For example, in two recent PVE applications on investments in transport projects and flood-protection programmes, a substantial number of respondents selected a portfolio of projects in different parts of the region or country under consideration and explained that they considered spatial fairness in their portfolio choice [6, 7]. In the health domain, such considerations may play a role in, for example, the distribution of healthcare services across regions or health outcomes across population subgroups. Unlike most other preference-elicitation methods, such distributional considerations as well as synergies between projects can be explicitly captured by the PVE framework [20]. A potential second advantage is that it forces respondents to make their decisions within the constraint(s) that policymakers face. As stressed in the literature applying portfolio theory to economic evaluations and resource allocations in health, healthcare budgets can be considered fixed in the short run and to be spent on a portfolio of goods and services. The choice set of policymakers is, therefore, constrained by the public budget, rendering opportunity costs important [45–47]. Other preference-elicitation methods typically do not incorporate budget constraints and opportunity costs explicitly. Previous research has shown that a substantial share of respondents in these studies either discount the scarcity of resources [48] or even ignore the cost attribute entirely [49–51], which may reduce the external validity of the findings.

These characteristics of the PVE choice task mean that it reflects actual policy decisions more closely than the other methods discussed, which may contribute to the involvement of respondents in the study and the acceptance and support of its findings. Respondents in the PVE studies discussed indicated that they appreciated the method for presenting them with the dilemmas policymakers actually face, increasing their awareness, and as a means for voicing their opinion [8, 10–14]. A third advantage of PVE is its capability to simultaneously elicit public preferences for policy alternatives and the trade-off between public and private expenditure in the respective policy area. This may be especially useful in the context of deciding on the reimbursement of new treatments in the context of increasing healthcare expenditures.

5.2 Potential Disadvantages

A first disadvantage of PVE is that it is less efficient than a preference-elicitation method that uses multiple choice tasks to elicit preferences (i.e. DCE, BWS-1, BWS-2). As respondents are only presented with a single choice task in a PVE, and there is only experimental variation in attribute levels between respondents and not within respondents, the method requires larger samples of respondents to accomplish an estimation of similar accuracy. Second, because of its single choice task presenting all alternatives and attribute levels at once, PVE may impose a larger cognitive burden on respondents than methods containing multiple choice tasks. The amount of information presented to respondents and the complexity of the choice task may limit the inclusiveness of the method [10]. However, the single choice task in a PVE may also prevent respondent fatigue and boredom that is sometimes observed in methods with multiple choice tasks, such as a DCE [52–54]. This risk of a cognitive overload requires close attention to the PVE design and consideration of the feasibility of using PVEs across all population subgroups (e.g. elderly individuals, people at the lower end of the cognitive ability distribution) and warrants further study.

5.3 Discussion of Limitations and Directions for Future Research

Two reflections should be made regarding the selection of methods in this paper for comparison with PVE. First, we compared PVE only with a selection of frequently used multi-attribute preference-elicitation methods. Other preference-elicitation methods such as the volumetric choice

experiment [55, 56], constant-sum paired comparisons [57, 58], the basked-based choice experiment [59] and the basked and expenditure based choice experiment [60] are more comparable to PVE as they ask respondents to make continuous (and discrete) choices. These methods have not been included in this study, however, as they have not (yet) or rarely been applied in the health domain. Further research should compare PVE with these as well as a wider range of other methods, such as frameworks that only evaluate policy alternatives without eliciting preferences themselves (e.g. cost-effectiveness analysis, cost-utility analysis) as well as methods that are not multi-attribute in nature (e.g. [probabilistic] threshold technique) [41] or that scored worse in the appraisal of preference-elicitation methods by Whichello et al. [27], such as a contingent valuation [61, 62] or a person trade-off [63, 64]. One could also envisage positioning PVE relative to multi-criteria decision analysis, which is a framework often used to support decision making in healthcare [65–67]. Multi-criteria decision analysis has not been included in this paper as it is not considered to be an elicitation method itself, but instead a decision-making framework that incorporates preference-elicitation methods as its choice task [26].

Another limitation worth mentioning is that PVE is still a relatively novel method. The literature on the method is growing, including in the healthcare field, but is still limited. For example, while PVE might seem closer to the reality of policymakers than other preference-elicitation methods because of its constraint(s) and portfolio-based choice task in a single choice set, it has not yet been studied empirically whether respondents, or policymakers, in fact experience this. Even though PVE may be expected to impose a larger cognitive burden on respondents relative to some of the other methods, this has not yet been empirically examined. Therefore, further research is warranted to empirically assess the feasibility and face validity of PVE as well as the extent to which the method actually reflects the reality of political decision making, including in comparison with more established preference-elicitation methods. Information on these aspects would allow researchers and policymakers to make better-informed choices for preference-elicitation methods. Furthermore, additional applications of PVE to policy problems in health are needed to further explore its usefulness and implications for health policy decision making.

6 Conclusions

PVE seems a promising complementary method for eliciting preferences and involving citizens or patients in healthcare decision making, but there is still room to further explore the method. PVE differs from the other preference-elicitation methods in its inclusion of an explicit resource constraint and its ability to simultaneously elicit preferences for policy alternatives and trade-off public and private spending, while also considering synergies between alternatives and distributional effects. This may come at the expense of the efficiency of the method and the understandability of the choice task for a broad set of respondents. These findings suggest that researchers and policymakers interested in the preference-based assessment of health policy alternatives should trade-off the advantages and disadvantages of PVE against each other in their selection of a preference-elicitation method for a policy dilemma at hand. In a context in which a portfolio of multiple policy alternatives can be selected within a constraint and in which both public and private resources can be allocated, PVE seems to add value. Further research is required, nevertheless, into the feasibility and validity of PVE.

Supplementary Information The online version contains supplementary material available at https://doi.org/10.1007/s40258-023-00859-9.

Acknowledgement We would like to thank seminar and conference participants at an internal seminar of the Erasmus Choice Modelling Centre, the lowlands Health Economics Study Group 2022 in Maastricht (NL), the bi-annual conference of the European Health Economics Association 2022 in Oslo (NO), and the 13th Meeting of the International Academy of Health Preference Research in Berlin (DE) for their valuable feedback and suggestions. Any errors are our own responsibility.

Declarations

Funding No funding was obtained to conduct this research.

Conflict of interest Sander Boxebeld and Job van Exel have no conflicts of interest that are directly relevant to the content of this article. Niek Mouter reports having stocks in the private company Populytics, a start-up of Delft University of Technology, which commercially applies the method of participatory value evaluation.

Ethics approval Not applicable.

Consent to participate Not applicable.

Consent for publication Not applicable.

Availability of data and material Not applicable.

Code availability Not applicable.

Authors' contributions Concept and design: SB, NM, JvE; drafting of the manuscript: SB; critical revision of the paper for important intellectual content: NM, JvE; supervision: NM, JvE.

References

1. Haghani M, Bliemer MCJ, Hensher DA. The landscape of econometric discrete choice modelling research. J Choice Model. 2021;40: 100303.

2. Van Til JA, IJzerman MJ. Why should regulators consider using patient preferences in benefit-risk assessment? Pharmacoeconomics. 2014;32:1–4.
3. Marsh K, Van Til JA, Molsen-David E, et al. Health preference research in Europe: a review of its use in marketing authorization, reimbursement, and pricing decisions: report of the ISPOR Stated Preference Research Special Interest Group. Value Health. 2020;23(7):831–41.
4. Whichello C, Bywall KS, Mauer J, et al. An overview of critical decision-points in the medical product lifecycle: where to include patient preference information in the decision-making process? Health Policy. 2020;124:1325–32.
5. Whitty JA, Lancsar E, Rixon K, Golenko X, Ratcliffe J. A systematic review of stated preference studies reporting public preferences for healthcare priority setting. Patient. 2014;7:365–86.
6. Mouter N, Koster P, Dekker T. Contrasting the recommendations of participatory value evaluation and cost-benefit analysis in the context of urban mobility investments. Transp Res Part A Policy Pract. 2021;144:54–73.
7. Mouter N, Koster P, Dekker T. Participatory value evaluation for the evaluation of flood protection schemes. Water Resour Econ. 2021;36: 100188.
8. Mouter N, Shortall R, Spruit S, Itten A. Including young people, cutting time and protecting useful outcomes: participatory value evaluation as a new practice of public participation in the Dutch energy transition. Energy Res Soc Sci. 2021;75: 101965.
9. Dekker T, Koster P, Mouter N. The economics of participatory value evaluation. Tinbergen Institute discussion paper. No. TI 2019-008/VIII. Amsterdam/Rotterdam: Tinbergen Institute; 2019.
10. Juschten M, Omann I. Evaluating the relevance, credibility and legitimacy of a novel participatory online tool. Environ Sci Policy. 2023;146:90–100.
11. Mulderij L, Hernández JI, Mouter NM, Verkooijen KT, Wagemakers A. Citizen preferences regarding the public funding of projects promoting a healthy body weight among people with a low income. Soc Sci Med. 2021;280: 114015.
12. Mouter N, Hernández JI, Itten AV. Public participation in crisis policymaking: how 30,000 Dutch citizens advised their government on relaxing COVID-19 lockdown measures. PLoS ONE. 2021;16(5): e0250614.
13. Rotteveel AH, Lambooij MS, Over EAB, et al. If you were a policymaker, which treatment would you disinvest? A participatory value evaluation on public preferences for active disinvestment of healthcare interventions in the Netherlands. Health Econ Policy Law. 2022;17(4):428–43.
14. Mouter N, Jara KT, Hernandez JI, et al. Stepping into the shoes of the policy maker: results of a participatory value evaluation for the Dutch long term COVID-19 strategy. Soc Sci Med. 2022;314: 115430.
15. Mouter N. Willingness to allocate public budget and participatory value evaluation. In: Mouter N, editor. New methods, reflections and application domains in transport appraisal. Advances in transport policy and planning, vol. 7. Cambridge: Academic Press; 2021. pp. 83–102.
16. Costa-Font J, Rovira J. Eliciting preferences for collectively financed health programmes: the 'willingness to assign' approach. Appl Econ. 2005;37(14):1571–83.
17. Baltas G, Doyle P. Random utility models in marketing research: a survey. J Bus Res. 2001;51:115–25.
18. Bhat CR. The multiple discrete-continuous extreme value (MDCEV) model: role of utility function parameters, identification considerations, and model extensions. Transp Res Part B Methodol. 2008;42(3):274–303.
19. Bhat CR. A new flexible multiple discrete-continuous extreme value (MDCEV) choice model. Transp Res Part B Methodol. 2018;110:261–79.
20. Bahamonde-Birke FJ, Mouter N. About positive and negative synergies of social projects: treating correlation in participatory value evaluation.: conference paper. hEART Conference. 2019. Available from: https://transp-or.epfl.ch/heart/2019/abstracts/hEART_2019_paper_166.pdf. Accessed 11 Dec 2023.
21. Van Beek L, Mouter N, Pelzer P, Hajer M, Van Vuuren D. The role of experts and expertise in practices of citizen engagement in climate policy: a comparative analysis of two contrasting cases. Research Square Working Paper. 2022. https://doi.org/10.21203/rs.3.rs-2226349/v1.
22. Hössinger R, Peer S, Juschten M. Give citizens a task: an innovative tool to compose policy bundles that reach the climate goal. Transp Res Part A Policy Pract. 2022;173: 103694.
23. De Bekker-Grob EW, Hol L, Donkers B, et al. Labeled versus unlabeled discrete choice experiments in health economics: an application to colorectal cancer screening. Value Health. 2010;13(2):315–23.
24. Kruijshaar ME, Essink-Bot ML, Donkers B, et al. A labelled discrete choice experiment adds realism to the choices presented: preferences for surveillance tests for Barrett esophagus. BMC Med Res Methodol. 2009;9:31.
25. Soekhai V, Whichello C, Levitan B, et al. Methods for exploring and eliciting patient preferences in the medical product lifecycle: a literature review. Drug Discov Today. 2019;24(7):1324–31.
26. PREFER consortium. PREFER recommendations: why, when and how to assess and use patient preferences in medical product decision-making. Zenodo. 2022. https://doi.org/10.5281/zenodo.6470922.
27. Whichello C, Levitan B, Juhaeri J, et al. Appraising patient preference methods for decision-making in the medical product lifecycle: an empirical comparison. BMC Med Inform Decis Mak. 2020;20:114.
28. Lancsar E, Louviere J. Conducting discrete choice experiments to inform healthcare decision making. Pharmacoeconomics. 2008;26(8):661–77.
29. Mühlbacher A, Johnson FR. Choice experiments to quantify preferences for health and healthcare: state of the practice. Appl Health Econ Health Policy. 2016;14(3):253–66.
30. De Bekker-Grob EW, Ryan M, Gerard K. Discrete choice experiments in health economics: a review of the literature. Health Econ. 2012;21(2):145–72.
31. Clark MD, Determann D, Petrou S, Moro D, De Bekker-Grob EW. Discrete choice experiments in health economics: a review of the literature. Pharmacoeconomics. 2014;32(9):883–902.
32. Soekhai V, De Bekker-Grob EW, Ellis AR, Vass CM. Discrete choice experiments in health economics: past, present and future. Pharmacoeconomics. 2019;37(2):201–26.
33. Flynn TN, Louviere JJ, Peters TJ, Coast J. Best-worst scaling: what it can do for health care research and how to do it. J Health Econ. 2007;26(1):171–89.
34. Mühlbacher AC, Kaczynski A, Zweifel P, Johnson FR. Experimental measurement of preferences in health and healthcare using best-worst scaling: an overview. Health Econ Rev. 2016;6:2.
35. Cheung KL, Wijnen BFM, Hollin IL, et al. Using best-worst scaling to investigate preferences in health care. Pharmacoeconomics. 2016;34:1195–209.
36. Hollin IL, Paskett J, Schuster ALR, Crossnohere NL, Bridges JFP. Best-worst scaling and the prioritization of objects in health: a systematic review. Pharmacoeconomics. 2022;40:883–99.
37. Edwards W, Barron FH. SMARTS and SMARTER: improved simple methods for multiattribute utility measurement. Organ Behav Hum Decis Process. 1994;60:306–25.

38. Srivastava J, Connolly T, Beach LR. Do ranks suffice? A comparison of alternative weighting approaches in value elicitation. Organ Behav Hum Decis Process. 1995;63(1):112–6.
39. Tervonen T, Gelhorn H, Sri Bhashyam S, et al. MCDA swing weighting and discrete choice experiments for elicitation of patient benefit-risk preferences: a critical assessment. Pharmacoepidemiol Drug Saf. 2017;26:1483–91.
40. Whichello C, Smith I, Veldwijk J, De Wit GA, Rutten-Van Molken MPMH, De Bekker-Grob EW. Discrete choice experiment versus swing-weighting: a head-to-head comparison of diabetic patient preferences for glucose-monitoring devices. PLoS ONE. 2023;18(7): e0283926.
41. Hauber B, Coulter J. Using the threshold technique to elicit patient preferences: an introduction to the method and an overview of existing empirical applications. Appl Health Econ Health Policy. 2020;18:31–46.
42. Lancsar E, Savage E. Deriving welfare measures from discrete choice experiments: inconsistency between current methods and random utility and welfare theory. Health Econ. 2004;13(9):901–7.
43. Lloyd-Smith P. A new approach to calculating welfare measures in Kuhn-Tucker demand models. J Choice Model. 2018;26:19–27.
44. McIntosh E. Using discrete choice experiments within a cost-benefit analysis framework. Pharmacoeconomics. 2006;24(9):855–68.
45. Bridges JFP, Stewart M, King MT, Van Gool K. Adapting portfolio theory for the evaluation multiple investments in health with a multiplicative extension for treatment synergies. Eur J Health Econ. 2002;3:47–53.
46. Sendi P, Al MJ, Gafni A, Birch S. Optimizing a portfolio of health care programs in the presence of uncertainty and constrained resources. Soc Sci Med. 2003;57:2207–15.
47. Bridges J. Understanding the risks associated with resource allocation decisions in health: an illustration of the importance of portfolio theory. Health Risk Soc. 2004;6(3):257–75.
48. Ding M, Grewal R, Liechty J. Incentive-aligned conjoint analysis. J Mark Res. 2005;42(1):67–82.
49. Erdem S, Campbell D, Hole AR. Accounting for attribute-level non-attendance in a health choice experiment: does it matter? Health Econ. 2015;24(7):773–89.
50. Koetse M. Effects of payment vehicle non-attendance in choice experiments on value estimates and the WTA–WTP disparity. J Environ Econ Policy. 2017;6(3):225–45.
51. Sever I, Verbič M, Sever EK. Estimating willingness-to-pay for health care: a discrete choice experiment accounting for non-attendance to the cost attribute. J Eval Clin Pract. 2019;25(5):843–9.
52. Savage SJ, Waldman DM. Learning and fatigue during choice experiments: a comparison of online and mail survey modes. J Appl Econ. 2008;23(3):351–71.
53. Swait J, Adamowicz W. The influence of task complexity on consumer choice: a latent class model of decision strategy switching. J Consum Res. 2001;28(1):135–48.
54. Weng W, Morrison MD, Boyle KJ, Boxall PC, Rose J. Effects of the number of alternatives in public good discrete choice experiments. Ecol Econ. 2021;182: 106904.
55. Carson RT, Eagle TC, Islam T, Louviere JJ. Volumetric choice experiments (VCEs). J Choice Model. 2022;42: 100343.
56. Chalak A, Nakkash R, Abu-Rmeileh NME, et al. Own-price and cross-price elasticities of demand for cigarettes and waterpipe tobacco in three Eastern Mediterranean countries: a volumetric choice experiment. Tob Control. 2023;32:86–92.
57. Skedgel C, Regier DA. Constant-sum paired comparisons for eliciting stated preferences: a tutorial. Patient. 2015;8:155–63.
58. Skedgel C, Wailoo AJ, Akehurst RL. Choosing vs. allocating: discrete choice experiments and constant-sum paired comparisons for the elicitation of societal preferences. Health Expect. 2015;18(5):1227–40.
59. Caputo V, Lusk JL. The basked-based choice experiment: a method for food demand policy analysis. Food Policy. 2022;109: 102252.
60. Neill CL, Lahne J. Matching reality: a basked and expenditure based choice experiment with sensory preferences. J Choice Model. 2022;44: 100369.
61. Diener A, O'Brien B, Gafni A. Health care contingent valuation studies: a review and classification of the literature. Health Econ. 1998;7(4):313–26.
62. Smith RD, Sach TH. Contingent valuation: what needs to be done? Health Econ Policy Law. 2010;5(1):91–111.
63. Green C. On the societal value of health care: what do we know about the person trade-off technique? Health Econ. 2001;10(3):233–43.
64. Nord E. The person-trade-off approach to valuing health care programs. Med Decis Mak. 1995;15:201–8.
65. Hansen P, Devlin N. Multi-criteria decision analysis (MCDA) in healthcare decision-making. In: Oxford research encyclopedia of economics and finance. Oxford: Oxford University Press; 2019.
66. Thokala P, Devlin N, Marsh K, et al. Multiple criteria decision analysis for health care decision making: an introduction: report 1 of the ISPOR MCDA Emerging Good Practices Task Force. Value Health. 2016;19(1):1–13.
67. Marsh K, IJzerman M, Thokala P, et al. Multiple criteria decision analysis for health care decision making: emerging good practices: report 2 of the ISPOR MCDA Emerging Good Practices Task Force. Value Health. 2016;19(2):125–37.

Springer Nature or its licensor (e.g. a society or other partner) holds exclusive rights to this article under a publishing agreement with the author(s) or other rightsholder(s); author self-archiving of the accepted manuscript version of this article is solely governed by the terms of such publishing agreement and applicable law.