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Social tariffs and democratic choice—Do population-based health state values reflect the will of the people?

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Abstract

In economic evaluations of health technologies, health outcomes are commonly measured in terms of quality-adjusted life years (QALYs). QALYs are the product of time and health-related quality of life. Health-related quality of life, in turn, is determined by a social tariff, which is supposed to reflect the public's preference over health states. This study argues that, because of the tariff's role in the societal decision-making process, it should not be understood as merely an operational (statistical) definition of health, but as a major instrument of democratic participation. I outline what implications this might have for both the method used to aggregate individual preferences, and the set of individuals whose preferences should count. Alternative tariff specifications and decision rules are explored, and future research directions are proposed.

KEYWORDS

conceptual model, decision-making, democracy, health state, normative theory, QALY, social choice, tariff, valuation

1 | INTRODUCTION

Societal decisions, on whether or not certain health programs should be publicly provided, are often informed by economic evaluations: The (additional) costs and health benefits of, say a new drug as compared against alternatives courses of action (e.g., another drug). The results are often summarized into an incremental cost-effectiveness ratio (ICER; Dakin et al., 2015). In England, as in many other countries, health effects are measured in quality-adjusted life years (QALYs), which are the product of length and health-related quality of life. The measurement of health-related quality of life, in turn, consists of a two components: a descriptive system of health states and a social tariff which maps these states to preference values.

The currently preferred instrument for valuing health outcomes in England is the UK social EQ-5D 3L tariff (MVH Group 1995; NICE, 2013). It is based on the preferences of (around 3000) members of the general public. When the tariff is applied in economic evaluations, it is supposed to incorporate societal (instead of patients') preferences into health policy decisions regarding the allocation of (publicly funded) health care resources (Whitehead & Ali, 2010). Therefore, I argue that the tariff should not be understood as merely an operational (statistical) definition of health, but as a major

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instruments of collective choice. As such, tariffs do not only have to adhere to scientific standards, but also need to reflect the norms and democratic principles of society as a whole.

Despite the considerable impact on health policy decision-making, the implied value judgments of social tariffs have received very little attention, and research into their conceptual and normative basis has been scarce (N. Devlin, Shah, & Buckingham, 2017; Dewitt, Davis, Fischhoff, & Hanmer, 2017). In this study, I make a first attempt to examine the role of the tariff within the wider decision-making framework from a collective choice perspective (section 2). I go on to highlight the (im)possibility of aggregating individual health state preferences into a societal preference (section 3) and outline further implications for health state valuation studies (section 4), before I propose future research directions (section 5).

2 | THE HEALTH POLICY DECISION-MAKING FRAMEWORK

In the following, I will provide a basic framework for economic evaluations, incorporating health state values from the general population. For clarity, some simplifications will be made: any uncertainty and discounting are being discarded; and we assume that allocative efficiency is the only relevant criterion for societal decision-making, ignoring any other consideration that may influence health policy in the real world (e.g., outcomes beyond health, approval regulations, or equity concerns). Moreover, it should be noted that the QALY is built on strong assumptions itself, including, among others, the measurability of interpersonally comparable, cardinal preferences over hypothetical health states (Carr-Hill, 1989; Dolan, 2000; Dolan, Shaw, Tsuchiya, & Williams, 2005; Fleurbaey & Hammond, 2004; Lipscomb, Drummond, Fryback, Gold, & Revicki, 2009). Challenging these assumptions is outside the scope of this study, and the function of the social tariff is only investigated within this given context.

2.1 | Basic notations and concepts

Suppose society consists of n individuals, whose preference functions over m (mutually exclusive) health states, given by $H = \{h_1, h_2, \dots, h_m\}$, are denoted p_1, p_2, \dots, p_n , with $p : H \rightarrow u$, ($u \in \mathbb{R}, u \leq 1$). Note that preference values over health states are measured on a ratio scale, in relation to the preference for “full health,” denoted h^* , with $p'(h_j) = \frac{p(h_j)}{p(h^*)}$. The societal value of health states is captured by the social tariff $t(\cdot)$, which is an aggregate function of individual preference functions, given by $t(h_j) = f(p'_1(h_j), p'_2(h_j), \dots, p'_n(h_j))$. Let $S = \{s_{11}, s_{12}, \dots, s_{21}, \dots, s_{nm}\}$ then denote an $n \times m$ matrix containing individuals' ‘Health States Times’, that is, the amount of time that individual i spent in state j . If we assume additive separability and zero time preference, the number of QALYs (as valued by society) accrued by all members of society $Q^t = \{q_1^t, q_2^t, \dots, q_n^t\}$ is determined by the products of individuals' Health States Times and the corresponding societal valuation, given by $Q^t = t(H) \times S$. The total number of QALYs in society can be evaluated by the following formula:

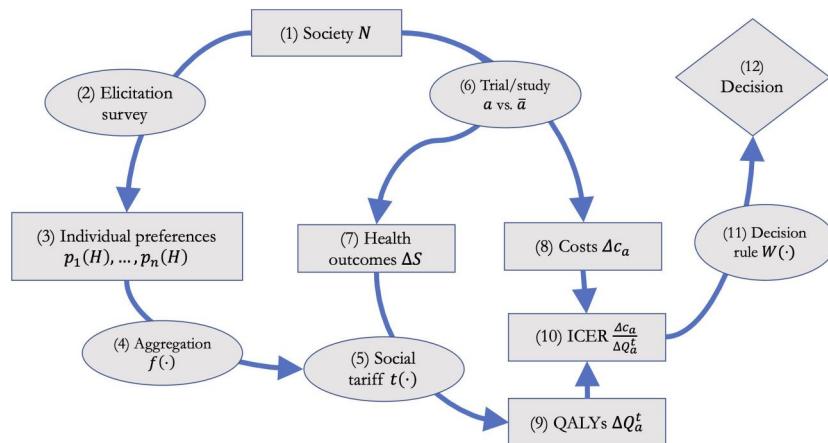
$$\sum_{i=1}^n q_i^t = \sum_{i=1}^n \sum_{j=1}^m t(h_j) \times s_{ij}$$

2.2 | The role of the tariff in societal decision-making

The role of the social tariff in societal decision-making is outlined below, and Figure 1 provides a schematic overview of the framework (superscripts are used to link the text with the figure). The aim of the health system is assumed to be the maximization of QALYs, subject to a fixed budget constraint. The marginal opportunity costs of 1 QALY are further assumed to be θ —that is a marginal decrease in the health care spending by θ results in a 1 QALY loss. The societal decision⁽¹²⁾ over some health program a thus depends on its ICER⁽¹⁰⁾, compared to its most cost-effective alternative \bar{a} . While the incremental costs⁽⁸⁾, given by $\Delta c_a = [c | a] - [c | \bar{a}]$, can, in principle, be directly observed in a study⁽⁶⁾, the incremental QALYs⁽⁹⁾ ΔQ_a^t are not only determined by the incremental health outcomes⁽⁷⁾ $\Delta S_a = ([S | a] - [S | \bar{a}])$, but also by the social tariff⁽⁵⁾ $t(\cdot)$, with $\Delta Q_a^t = t(H) \times \Delta S_a$. To derive t , however, first individual health state preferences⁽³⁾ have to be elicited, for example using the time-trade-of method⁽²⁾. Preferences are then aggregated⁽⁴⁾, as specified by $f(\cdot)$, before the tariff can be used to translate health outcomes into QALYs.

Finally, program a should be adopted if its ICER is smaller or equal to θ . The societal decision function⁽¹¹⁾ $W(\cdot)$ can be defined as follows:

FIGURE 1 The role of the social tariff within the wider decision-making framework. Ovals represent functions and rectangles the inputs/outputs. ICER, incremental cost-effectiveness ratio; QALYs, quality-adjusted life years [Colour figure can be viewed at wileyonlinelibrary.com]



$$W(a) = \begin{cases} 0 & \text{if } \frac{\Delta c_a}{\Delta Q_a^t} > \theta \\ 1 & \text{if } \frac{\Delta c_a}{\Delta Q_a^t} \leq \theta \end{cases}$$

The overview (see Figure 1) illustrates the central role of the social tariff $t(\cdot)$ in the decision-making framework: the tariff specifies the societal value of the time individuals spend in any health state other than full health, and thereby, it determines to some, potentially great extent whether or not a health program is considered cost-effective. Depending on the distribution of preferences, the method of aggregation $f(\cdot)$ can, thus, also have significant impact on societal decision-making.

2.3 | The social tariff as an instrument of collective choice

Before I go on to discuss the aggregation of individual preference functions, it will be useful to briefly consider what the resulting societal preference values represent. First of all, it should be noted that the current social tariff framework is fundamentally incompatible with the notion of utility maximization. This is because, even though the tariff is based on individual (health state) preferences, it is not individual i 's own valuation of their own (actual or potential) health state (s) that informs societal decisions. Instead, a change in individual i 's health from state j to state k is valued by the aggregate preference of society. Since individual i 's preference will generally not be identical to the societal preference, $p'_i(h_j) \neq t(h_j)$, it follows that maximizing societal QALYs is not the same as maximizing health-related utilities: $\sum_{i=1}^n \sum_{j=1}^m t(h_j) \times s_{ij} \neq \sum_{i=1}^n \sum_{j=1}^m p'_i(h_j) \times s_{ij}$.

A more convincing interpretation of the QALY can be derived from 'extra-welfarism', which offers an alternative approach for the evaluation of health policies beyond utilities (Brouwer, Culyer, van Exel, & Rutten, 2008; Coast, Smith, & Lorgelly, 2008; Cookson, 2005; Culyer, 1989). Here, health is not primarily recognized as a source of utility, but it has a social value in itself. In fact, this is how the QALY seems to be generally understood: as an operational definition of *health*. Hence, it seems inadequate to define the social tariff as a statistical summary function of individual (health-related) utilities. Instead, it should be understood more broadly as a mechanism, through which society collectively derives an interpersonally comparable index of value for different sets of health functionings (Cookson, 2005).

3 | AGGREGATING INDIVIDUALS' HEALTH STATE PREFERENCES

3.1 | Problem statement

With only few exceptions (e.g., Shaw et al., 2010), health state valuation studies have used the arithmetic mean to aggregate individual preferences into a societal preference (Xie, Gaebel, Perampaladas, Doble, & Pullenayegum, 2014; MVH, 1995). If the tariff would reflect individuals' own, self-assessed (health-related) utilities, the use of the mean could

potentially be justified by utilitarian welfare maximization through potential pareto improvements. But, as argued above, the current framework is incompatible with this interpretation of the QALY (N. Devlin et al., 2017). Within the ‘extra-welfarist’ approach, however, there does not seem to be a normative basis for selecting the mean over any of the (infinitely) many other possible aggregation functions (Roberts, 1980). In particular, it cannot be assumed that there is an objectively true value for each health state. Differences between individuals’ health state valuations can, therefore, not be regarded as measurement errors, which cancel out when taking the average. Rather, differences have to be understood as genuine disagreements. If all individuals had similar preferences, however, the choice of the aggregation method would be trivial. Yet, empirical studies show that health state preferences differ considerably (Xie et al., 2014; also see Figure 2), and the societal preference is thus intimately dependent on the method of aggregation—if the method is changed, the outcome might differ. This raises the question: how should preferences be aggregated?

The (im)possibility of aggregating individual preferences into a social preference has been extensively discussed in social choice and welfare economic literature. Various welfare functions and voting rules have been axiomatically examined and their attractions and drawbacks have been described (Arrow, 1951; Brandt, Conitzer, Endriss, Lang, & Procaccia, 2016; Fleurbaey & Hammond, 2004; Sen, 2018). Seminal findings suggest that no method can be assumed to be unequivocally superior, or unanimously accepted. The decision which method to use always requires making value judgments. This means, to be able to say one method is better than another, it first needs to be decided what values should be incorporated. However, since this question has not yet been addressed in the context of population-based health state valuations, it is unclear what properties these functions should have. Currently, it is not even obvious what types of aggregation functions are admissible at all. In a recent discussion study, N. Devlin et al. (2017) suggested that a reasonable starting point for conceptualizing a social tariff would be the fundamental principle of the democratic system within which the health system operates: the majority rule. As an example, they consider the most common measures of central tendency (mode, mean, and median), but do not derive at a conclusive solution. In the following, I expand on their analysis and show that none of the three measures can appropriately reflect the majority view.

3.2 | Measures of central tendency and the majority rule

3.2.1 | The arithmetic mean

The arithmetic mean is commonly used to aggregate preferences in health state valuation studies (Xie et al., 2014; MVH, 1995), and it has convenient properties: it is easy to compute and to predict using regression models, and, unlike the median or mode, it is consistent with $[f(p_1(h_1), p_n(h_1))] - [f(p_1(h_2), p_n(h_2))] = f([p_1(h_1) - p_1(h_2)], [p_n(h_1) - p_n(h_2)])$. However, it takes into account the preference intensity of individuals, and thus does not reflect the majority view: the mean gives more weight to individual values that are distant from the average, which makes it sensitive to individuals with extreme preferences and outliers. This clearly conflicts with the democratic principle of ‘one man (or woman), one vote’. As an example, consider Figure 2. The histogram shows the distribution of 735 individual preferences values for the EQ-5D 3L health state, “11,131” (no problems with mobility, self-care, usual activities and no anxiety or depression, but extreme pain or discomfort). Even though 58% of the individuals would prefer a higher value, the average is 0.24, because it is “pulled down” by individuals with more extreme negative utility values.

3.2.2 | The mode

Selecting the most frequent value from a complex distribution of cardinal preference values seems to be meaningless. The frequency of values mainly depends on the accuracy of the measurement and the extent of up- and down-rounding. In our example (Figure 2), 1 is by far the most frequent value ($n = 72$). However, 90% ($n = 663$) prefer a lower value. Overall, in the MVH (1995) data, all health states have a mode value of either 1, 0, or -1 .

3.2.3 | The median

At first glance, the median provides a promising alternative: according to the Median Voter Theorem (Black, 1948), a majority will select the outcome most preferred by the median voter (given single peaked preferences).

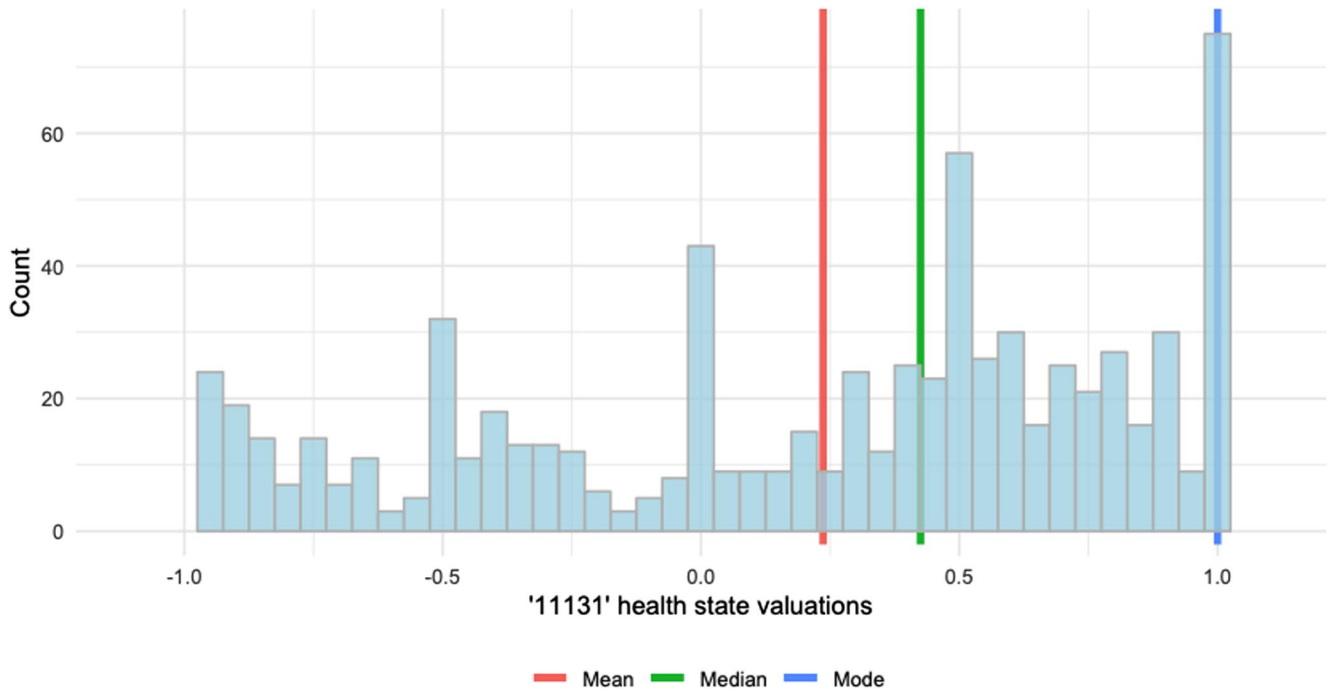


FIGURE 2 Distribution of individual preferences values ($n = 735$) for EQ-5D 3L health state, “11,131”, and the corresponding mean, mode, and median. Source: data from MVH (1995)

Correspondingly, in our example, there is no majority for a value that is higher (preferred by 49.5%) or lower (preferred by 48.3%) than the median ($=0.43$). From this one might conclude that this is the value that the majority supports. However, the Median Voter Theorem only applies to voting on one dimension. For multiple dimensions, there is not necessarily a stable majority, and societal preferences might be intransitive (McKelvey, 1976). For the valuation of multiple health states, this means that although median values would reflect the majority view for each state individually, combining the median values of multiple health states into a social tariff might not represent the majority view globally. Moreover, the interpretation of median preferences is further complicated by the fact that the difference between the medians for two health states is not equal to the median difference. This can lead to paradoxical results, as the following example may illustrate.

Suppose individuals x_1 , x_2 , and x_3 have preferences over health states h_1 and h_2 : x_1 prefers h_1 ($p_{x_1}(h_1) = 0.65$) over h_2 (0.44); x_2 also prefers h_1 (0.94) over h_2 (0.83); and only x_3 prefers h_2 (0.98) over h_1 (0.34). One could thus conclude that a majority of individuals prefers h_1 . However, the median values for the two health states are 0.65 and 0.83 (the geometric medians are 0.68 and 0.72), which would indicate that the group prefers h_2 . See Figure 3 for a visual illustration.

3.3 | Constructing a democratic decision rule

None of the three measures of central tendency discussed above are able to incorporate the majority rule into the social tariff, let alone into decision-making. In the following, I will thus outline an alternative approach: a reformulation of the social tariff as a majority voting system over health programs (see Figure 4). Even if the proposed method is unlikely to be considered a viable alternative to the current system in the near future, it might serve to illustrate the conception of the social tariff as an instrument of democratic participation.

As noted above, the incremental societal QALYs of program a are given by ΔQ_a^t whereby the superscript indicates that incremental Health State Times ΔS are valued using the societal tariff $t(\cdot)$. Alternatively, QALY estimates could be derived from individuals' health state preference functions directly, with $\Delta Q_a^{p_i} = p'_i(H) \times \Delta S$. The societal health effects of program a would then be evaluated by all n individuals separately (i.e., how many QALYs does program a generate in society from the perspective of individual i ?). Imposing the societal efficiency decision rule $W(\cdot)$ on everyone, individual i 's decision function is given by

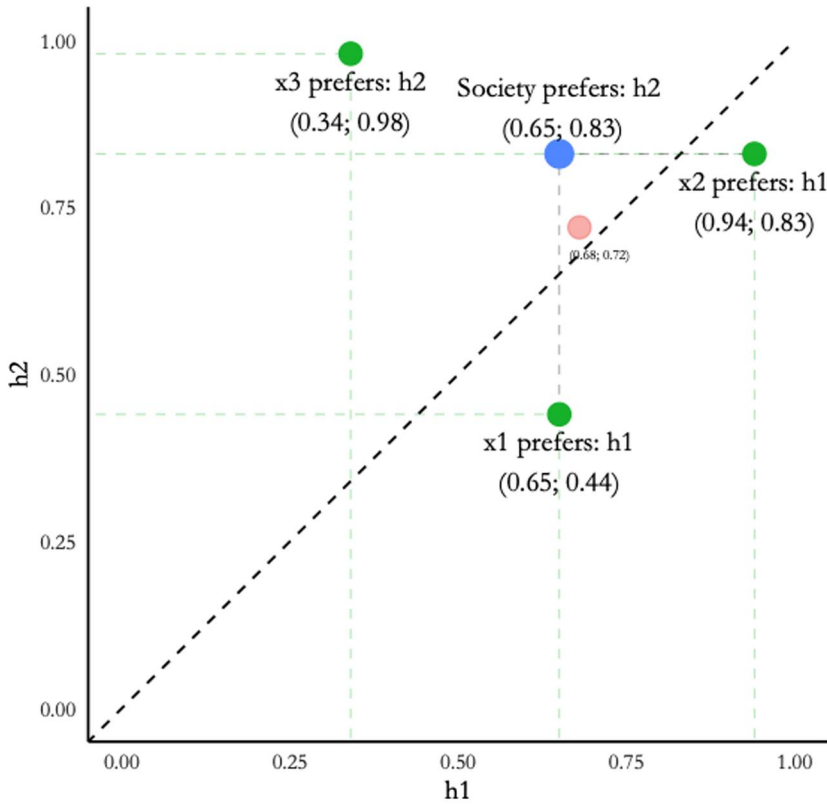


FIGURE 3 The “median health state paradox.” Even though a majority of individuals (green dots) prefers health state h_1 over state h_2 , based on median (blue) or geometric median (red) health state values, the group prefers h_2

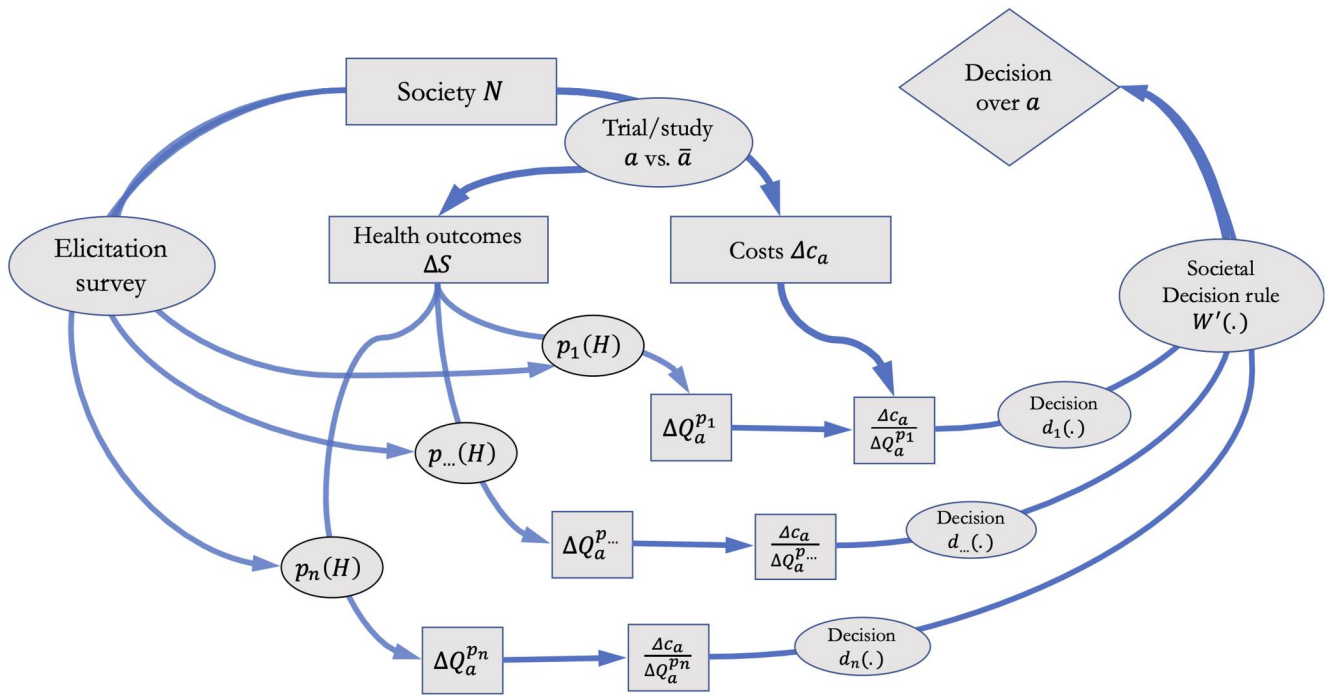


FIGURE 4 A democratic reformulating of the social tariff as a majority voting system [Colour figure can be viewed at wileyonlinelibrary.com]

$$d_i(a) = \begin{cases} 0 & \text{if } \frac{\Delta c_c}{\Delta Q_a^{p_i}} > \theta \\ 1 & \text{if } \frac{\Delta c_c}{\Delta Q_a^{p_i}} \leq \theta \end{cases}$$

Subsequently, the societal decision rule could be reformulated as a majority voting system: individual decisions $d_1(a), d_2(a), \dots, d_n(a)$ could be summed up, and a should be adopted by society, if a majority of individuals ‘voted’ for it. The modified societal decision function W' is given below.

$$W'(a) = \begin{cases} 0 & \text{if } \frac{n}{2} \leq \sum_{i=1}^n d_i(a) \\ 1 & \text{if } \frac{n}{2} > \sum_{i=1}^n d_i(a) \end{cases}$$

If more than two health programs are evaluated at the same time, majority voting has important limitations, and alternative voting rules should be considered (e.g., Brandt et al., 2016 provide a contemporary overview).

It should be stressed that the proposed change would only affect the level and the method of aggregation, while the source (the general population) and the objects (hypothetical health states) of preferences remain the same. Conceptually, however, this method offers a clear advantage over the current system: it would give all individuals equal weight in the decision. Furthermore, it would also be more transparent, in terms of how many individuals do and do not support a given policy decision. Thereby, the voting system might not only be more democratic, but also easier to understand than an average societal health state tariff. Nevertheless, one might rightly object that the informational demands of this system would be significant. Detailed primary data on the health outcomes, as well as individuals' health state preference functions would be required. Moreover, it should be emphasized that majority voting is insensitive toward individuals' preference intensities. The principle of “one person, one vote” means that any preference for program a counts as one (and any preference against as 0), regardless of how strong or weak the preference is—minuscule benefits to a small majority may thus outweigh any losses to a large minority. Finally, if the threshold of θ is assumed to be based on the marginal opportunity costs, each individual could, in principle, have a different threshold, depending on how many QALYs are currently being generated in the health care system from their perspective (i.e., according to their individual preference function).

4 | DEMOCRATIC REPRESENTATIVENESS

From a democratic perspective, it is not sufficient to address the question *how* preferences should be aggregated. It also needs to be determined *whose* preferences should count. Even if *the public* is to be accepted as the source of preferences, it has not been established what practical implications this may have for health state valuation studies. In the following, I make some recommendations for aspects that should be considered.

First, the surveyed group of individuals should be representative of the society for which a decision is to be made. This means, participants should be selected randomly. After the data are collected, all reasonable efforts should be made to retain representativeness throughout subsequent analyses. This implies that incomplete cases should not be excluded, nor should missing values be ignored. The exclusion of 399 (12%) participants from the in the MVH study (1994) because of missing values appears disconcerting in this regard. Missingness is unlikely to be (completely) random, and appropriate imputation methods should be considered (Rubin, 1976). Moreover, seemingly irrational preferences—for example, assigning the same value to all health states (Lamers, Stalmeier, Krabbe, & Busschbach, 2006)—should also not automatically be removed. Preferences might be consistent with some underlying beliefs, and researchers should not presume to make judgments about them (N. Devlin et al., 2017).

Second, democratic representativeness also commands that only those individuals are considered in the tariff, who are members of the very society, for which decisions are to be made. Health preferences vary across different regions and cultures (Gerlinger et al., 2019). NICE's decision to use a UK-wide, instead of an English tariff, to value health outcomes seems problematic in this regard, as it might well be the case that the four UK countries also have distinct preference profiles. One could take this a step further and argue that local authorities should also consider the use of local tariffs to evaluate local health programs. However, eliciting preferences and constructing social tariffs takes time and resources. The derivation of local, more accurate QALY estimates might thus only be worthwhile, if health preferences and subsequent policy decisions differ significantly between local communities. However, due to the scale of health care budgets, wrong decisions, based on biased estimates, could have significant opportunity costs.

Finally, it seems self-evident that an individual's participation in collective, democratic decisions needs to be intentional and deliberate. First and foremost, this means that participants in health state valuation studies need to be informed about the (potential) purpose of the survey (Israel, 2015). Using participants' stated preferences to inform policy decisions without obtaining informed consent for doing so does not only violate the autonomy of the participants, but it also seems utterly undemocratic. Given the potential impact their responses may have on health policy decisions, some individuals may want to give their answers more thought, and some may also prefer to abstain from participating. Notwithstanding, informing participants about the purpose of health valuation study may also invoke strategic behavior. Even though it seems unlikely that participants are able to foresee the effects their responses will have on any particular decisions, they may try to exaggerate their preferences in order to tilt the social tariff in the desired direction. Hausman (2010) further proposed that societal decisions should not be based on individuals' "private" health state values at all. Instead, public deliberations would be required to derive an adequate information basis for economic evaluations. I would argue that, at the very least, participants in health state valuation studies should be given the opportunity to reflect on their responses and to seek additional information about the health states they are not familiar with (N. J. Devlin, Shah, Mulhern, Pantiri, & van Hout, 2019; Gansen, Klinger, & Rogowski, 2019).

5 | HOW TO MOVE FORWARD

I have outlined research gaps related to the use of social tariffs in health economic evaluations. Considering their significance for health policy decision-making, further conceptual work is warranted to establish a sound and coherent theoretical foundation for social health state values. Before more appropriate theories and methods can be developed, it will be the responsibility of the decision makers to determine what social value sets are supposed to represent (e.g., utilities? indices of health?) and how they are to be derived (N. Devlin et al., 2017). I use the term "decision maker" here to include not only politicians and civil servants, but also members of the general public. Health economists can support the search for more appropriate preference aggregation methods and social welfare function by translating normative value judgments into corresponding decision rules. To this end, Dewitt et al. (2017) proposed a deliberative approach for eliciting meta-preferences from decision makers—that is survey how do they think preferences should be aggregated. In a first step, relevant ethical norms and societal values are identified from decision makers. Potential social tariffs are then constructed and subsequently presented to the participants. The preferences over the aggregation procedures (i.e., their meta-preferences) are then elicited in an iterative process.

6 | CONCLUSION

Under the assumption that the social tariff represents a major instrument of democratic participation, this study raises several critical questions and challenges the conceptual foundation of the current framework. Although the practical implications are still to be determined, a democratic (re)interpretation of the social tariff would undoubtedly have important consequences for population-based health state valuations. A new line of research is proposed to establish a conceptual basis for social tariffs from a democratic perspective.

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CONFLICT OF INTEREST

The author has declared that he has no conflict of interest.

DATA AVAILABILITY STATEMENT

Data sharing not applicable to this article as no datasets were generated or analyzed during the current study.

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