Ethical Considerations for Global Health Decision-Making: Justice-Enhanced Cost-Effectiveness Analysis of New Technologies for *Trypanosoma brucei gambiense*

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We sought to assess formally the extent to which different control and elimination strategies for human African trypanosomiasis *Trypanosoma brucei gambiense* (Gambiense HAT) would exacerbate or alleviate experiences of societal disadvantage that traditional economic evaluation does not take into account. Justice-enhanced cost-effectiveness analysis (JE-CEA) is a normative approach under development to address social justice considerations in public health decision-making alongside other types of analyses. It aims to assess how public health interventions under analysis in comparative evaluation would be expected to influence the clustering of disadvantage across three core dimensions of well-being: agency, association and respect. As a case study to test the approach, we applied it to five strategies for Gambiense HAT control and elimination, in combination with two different other evaluations: a cost-effectiveness analysis and a probability of elimination analysis. We have demonstrated how JE-CEA highlights the ethical importance of adverse social justice impacts of otherwise attractive options and how it indicates specific modifications to policy options to mitigate such impacts. JE-CEA holds promise as an approach to help decision makers and other stakeholders consider social justice more fully, explicitly and systematically in evaluating public health programs.

Introduction

In 2010, the World Health Organization (WHO) published a Roadmap to Elimination for several neglected tropical diseases (NTDs) (WHO, 2012). It was endorsed by global donors who signed the London Declaration targets for 2020 NTDs elimination (Uniting to Combat Neglected Tropical Diseases, 2012). Since then, committed decision makers have struggled to assess formally the feasibility, costs and consequences of eliminating or eradicating a target disease. In 2012, an investment case was proposed for three NTDs—onchocerciasis, lymphatic filariasis (LF) and human African trypanosomiasis (HAT)—to serve as a

comprehensive analysis of clinically efficacious, feasible pathways to disease elimination or eradication, including required resources and operational investments (Tediosi *et al.*, 2013). This initiative deployed the eradication investment case (EIC) framework, developed expressly to support the use of traditional techniques of health and economic assessment in deliberations about whether to undertake elimination or eradication of candidate infectious diseases (Cochi and Dowdle, 2011; Thompson *et al.*, 2011; Walker and Rabinovich, 2011; Walker and Lupp, 2012). EIC components related to probability of elimination and cost-effectiveness have been assessed for onchocerciasis, LF and HAT, but methods have been lacking to

guide comparative assessment of broader social impacts across candidate elimination and eradication scenarios as called for by the EIC designers (Thompson *et al.*, 2011: 140; Walker and Rabinovich, 2011: 154, Box 11.2; Tediosi *et al.*, 2013: 4; Sutherland *et al.*, 2017).

The EIC designers' conception of broader social impacts encompasses not only effects on intergenerational justice and global health equity (Emerson, 2011; Tediosi *et al.*, 2013: 4) but also forms of psychological, psychosocial and social impact that primarily affect people as subjects of personal life experience (Muela and Hausmann-Muela, 2013; Tediosi *et al.*, 2013: 4). We focus here on the need for a method to assess the latter, experiential forms of impact in the EICs for NTDs. In an effort to fill this gap in the context of EICs for LF and onchocerciasis, Bailey and colleagues (2015) first presented a method of ethical analysis informed by theories of social justice. As a pilot case, however, their discussion considered mainly the impacts attributable to the diseases, not to interventions, and did not attempt a finer-grained comparison among different pathways toward the goal of disease elimination or eradication.

Zwerling and colleagues (2017) have built upon Bailey and colleagues' approach in developing an innovative methodology called justice-enhanced cost-effectiveness analysis (JE-CEA). They have presented an initial proof-of-concept illustration, using a hypothetical example (and moving outside of the NTD EICs discussion) specifically to suggest how JE-CEA might be used to compare novel *vs.* standard treatment regimens for multi-drug-resistant tuberculosis (Zwerling *et al.*, 2017). The justice enhancement (JE) component of JE-CEA is intended to assess, alongside the results of cost-effectiveness analysis (CEA), the compared options' expected impacts upon patients' experiences of societal disadvantage, such as 'stigma, shame, social isolation, loss of agency and family strain' (Zwerling *et al.*, 2017: S70). In the present article, operating for the first time with a completed CEA and probability of elimination analysis (Sutherland *et al.*, 2017), we explore the adaptation of Zwerling and colleagues' JE-CEA methodology for use in the economic assessment of pathways to the elimination or eradication of NTDs, taking human African trypanosomiasis *Trypanosoma brucei gambiense* (Gambiense HAT) as a salient NTD example.

Human African Trypanosomiasis *Trypanosoma brucei gambiense*

Gambiense HAT is one of 10 NTDs targeted for elimination by 2030 (Uniting to Combat Neglected Tropical Diseases, 2012; WHO, 2012, 2013). Gambiense HAT,

often called 'sleeping sickness', is an insect-borne parasitic infectious disease with at-risk areas spanning 24 African countries. Cases are currently being reported from 13 countries (Franco *et al.*, 2014). Gambiense HAT is most prevalent in low-income countries with the areas at risk encompassing mainly the poor rural population (Simarro *et al.*, 2012). It has two clinical manifestations, as it progresses from a less acute to more severe stage. Stage 1 is a febrile illness; Stage 2 brings more severe symptoms, including disruption of the sleep-wake cycle, seizures, paralysis, weakness, confusion, psychosis and eventual progression to coma and death if untreated (WHO, 2013). Historically, disease control measures have focused on treatment of human cases to reduce the parasite reservoir, and, in some areas, vector control programs to reduce transmission (Bennett *et al.*, 2016).

A recent modeling study has compared the most promising Gambiense HAT elimination strategies in terms of cost-effectiveness and probability of reaching elimination (Sutherland *et al.*, 2017). Although the disability-adjusted life-year (DALY) measure used in the CEA captures some disease-associated disability and mortality, the potential impacts of elimination strategies on the distribution of intervention-induced disadvantages like stigma and social exclusion have yet to be assessed (Sutherland *et al.*, 2017).

Normative Approach

CEA is a prominent form of economic evaluation, a set of methods for comparative analysis often used to help prioritize budget-constrained resource allocation for public health program options (Drummond *et al.*, 2005; Walker *et al.*, 2011: 734). Norms of distributive justice are pervasively implicated in health-related uses of economic evaluation, starting with the concern to consider opportunity costs in allocating limited public resources (Brock *et al.*, 2017: 320). To deliberate on what would constitute an optimal use of resources in public health decision contexts, however, it is necessary also to consider (*inter alia*) other applicable norms of distributive justice.

One of these other norms is social justice. The concept of social justice invokes a 'moral imperative to avoid and remediate unfair distributions of societal disadvantage' (Dukhanin *et al.*, 2018: 27; *cf.* Faden and Shebaya, 2016; Powers and Faden, 2006; Wolff and de-Shalit, 2007). Social justice as a moral consideration is of major importance to public health and, in the economic evaluation of public health program options, it can

either converge with or present trade-offs with comparably important moral considerations like the maximization of aggregate health benefit (Kass, 2001; Childress *et al.*, 2002; Faden and Shebaya, 2016; Brock *et al.*, 2017). Different conceptions of social justice vary in their accounts of what societal disadvantage is and what makes for inequitable distributions of it. JE-CEA is an analytic technique designed for use by economic evaluators who seek to apply to the decision context at hand a certain conception of social justice, which is centered on *protecting and relieving people from severe societal disadvantage in multiple dimensions of well-being*. Like other normative approaches to justice in public health, this conception of social justice can be explicated in terms of its position along each of two normative axes featuring, respectively, objects of distribution and distributive principles (Dukhanin *et al.*, 2018; Persad, 2018).

Objects of Distribution: Multidimensional Metrics of Well-Being

Whereas the object of distribution for traditional CEA is aggregate health benefit, typically assessed by summary measures like DALYs averted, alternative techniques enable users to consider other objects as well. JE-CEA is meant to help users apply to health-related economic evaluation the normative proposition *that health is one among other core dimensions of well-being holding fundamental ethical importance* as ‘basic determinants of the character and quality of human life’ (Bailey *et al.*, 2015: 631). This proposition is common to a family of theories of justice grounded in multidimensional metrics of well-being, whose defining members are capabilities theories and well-being theories. Each theory in its own way focuses the requirements of justice on societal obligations to enable people to exercise core capabilities or to function in core dimensions of well-being (Powers and Faden, 2006: 16; Wolff and de-Shalit, 2007: 106, 107; Nussbaum, 2011: 32–34).

We do not aim here to add new substantive argumentation to the cumulative case that proponents of these theories have already made for regarding other dimensions of well-being as comparable to health in fundamental ethical importance. Because of the importance of social justice as a moral consideration in public health, it is ethically preferable for the methodological repertoire of health-related economic evaluation to encompass the full range of leading conceptions of social justice, and so, with respect to objects of distribution, to include techniques for assessing the impacts of compared options on people’s experiences of disadvantage in multiple

dimensions of well-being (Dukhanin *et al.*, 2018). Expanding the methodological repertoire in this way still leaves it up to users and their stakeholders to determine whether, under what conditions, and for what reasons the use of such techniques is warranted.

Distributive Principles: Prioritization Norm

JE-CEA belongs to a family of techniques designed for use by people who seek to temper the maximizing distributive principle familiar to users of traditional CEA (Johri and Norheim, 2012; Norheim *et al.*, 2014; Cookson *et al.*, 2017). The purpose of the JE component is to enable users to apply a prioritization norm that is broadly consistent with prioritarian, egalitarian and sufficientarian distributive principles, and which we articulate here as ‘to protect and relieve people from severe societal disadvantage’. This norm is of comparable concern to prioritarians aiming to uplift the worst off in society (Wolff and de-Shalit, 2007), egalitarians aiming to avoid and redress undue inequalities and sufficientarians aiming to avoid and remediate each person’s experience of shortfalls from sufficient levels of, for instance, capability (Nussbaum, 2011) or functioning (Powers and Faden, 2006). Again, we do not aim here to make additional arguments in support of these non-maximizing distributive principles. Rather, our point is that so far as it is ethically preferable for the methodological repertoire of economic evaluation to be able to accommodate the full range of leading conceptions of social justice, it should include techniques for applying this prioritization norm to relevant forms of program impact.

JE-CEA is meant to help users apply this prioritization norm in the first instance to certain dimensions of well-being besides health. The JE component is designed to assess the impacts of compared public health program options in multiple *non-health* dimensions of well-being, and to do so alongside the CEA component, which retains its traditional maximizing distributive principle with respect to its traditional target object, aggregate *health* benefit. One might ask, why not also modify the CEA component internally? That is, if health is comparable to other dimensions of well-being in ethical importance, and is thus one among other sites of societal disadvantage potentially subject to the prioritization norm, why continue to assess program options’ health impacts only in terms of traditional CEA? While we acknowledge that this question must be addressed in due course, we have chosen to bracket it at the present early stage in JE-CEA’s development. Our starting point is the fact that traditional CEA is in wide use, and indeed

has been used in preparing the EIC for Gambiense HAT, presenting a timely real-world occasion to explore the use of JE-CEA. Too, whereas there is already a robust scholarly literature on internal modifications to CEA, a recent systematic review finds relatively little work on how to complement economic evaluation with assessment of the comparably important moral concern about the impacts of health interventions on people's experience in multiple non-health dimensions of well-being (Dukhanin *et al.*, 2018). What we explore here is a decidedly incremental approach, attempting to make methodological progress one step at a time, holding CEA's traditional normative bearings constant and supplementing it with JE.

Structure of JE-CEA

Even holding CEA internally constant, there might be many ways to design an analytic technique that would fill the identified methodological gap. By demonstrating the use of JE-CEA as overlaid onto a completed CEA in a specific decision context, we hope also to advance the discussion of kindred techniques for which JE-CEA might serve initially as a foil. The longer-term goal is to strengthen methodological capacity in the field of health-related economic evaluation to represent the relevant conception of social justice. As we outline the structure of JE-CEA, then, we describe key methodological choices in the awareness that other designers might reasonably choose differently. Zwerling and colleagues construct the JE component of JE-CEA as a more formal expression of the method of ethical analysis that Bailey and colleagues first developed to extend the EIC framework. The structure of that precursor method responds to a set of desiderata, derived from the EIC literature, on meeting the need for a method to assess psychological, psychosocial and social impacts in the NTD EICs (Bailey *et al.*, 2015: 630, 631):

Ideally, this method should strengthen EIC-supported deliberations by (1) delineating ethically important categories of benefits and burdens not otherwise captured in the EIC framework, (2) assessing aspects of distributive equity and fairness not otherwise captured, (3) recognizing widely varying life circumstances among people affected by the diseases and interventions, and (4) ethically interpreting the evidence base concerning disease-specific psychological, psychosocial, and social impacts.

Desideratum (3) provides the rationale for Bailey and colleagues' choice to draw on theories of justice derived

from multidimensional metrics of well-being (Sen, 1999; Alkire, 2002; Powers and Faden, 2006; Wolff and de-Shalit, 2007; Crocker, 2008; Ruger, 2010; Nussbaum, 2011; Venkatapuram, 2011).

In attributing fundamental ethical value to each of the basic dimensions of well-being that affect the quality of human lives across widely varied conceptions of the good life, this approach... has fair claim to support a maximally broad consensus among people with different national, cultural, and personal backgrounds. Breadth of consensus is a matter of great importance in the EICs and for related global policy choices about eradicable infectious diseases considering the wide range of individuals and groups who stand to be involved or affected.

While some of these theories in themselves identify as many as 10 or 14 core dimensions, Bailey and colleagues focus on four points of convergence or overlap identified in virtue of their robust endorsement across multiple theories: three core dimensions of well-being that ought to be protected and promoted by socially just health policies, and one core prioritization norm.

The supposition behind the choice to focus on points of convergence or overlap across the theories is not the implausible expectation that each theory, taken in its entirety, would deliver the same result in the EIC decision context, but rather that the few elements on which the theories converge or overlap, in virtue of their plural theoretical grounding, have 'more robust stability and salience for ethical assessments' than would the other, 'relatively more controversial elements... that lack plural grounding in multiple theories' (Bailey *et al.*, 2015: 631, citing Sen, 2009 for this form of argument). These four elements form a core framework of social justice, embodying a distinct specification of the more generic conception of social justice (*protecting and relieving people from severe societal disadvantage in multiple dimensions of well-being*) discussed farther above.

Specification of Normative Proposition about Objects of Distribution

In response to EIC Desideratum (1), *agency*, *association* and *respect* are the core categories of benefits and burdens (besides life and health, which are otherwise captured in the EIC framework by traditional assessment techniques like CEA) that Bailey and colleagues identify as points of convergence or overlap among the contributing theories of justice. They characterize *agency* as 'the ability to lead one's own life and engage in activities one finds meaningful'; *association* as 'the ability to

engage in a full range of intimate, familial, friendly, community, economic, and civic relationships with other people'; and *respect* as 'the recognition, by others and oneself, of one's equal moral value, worth, and dignity as a person' (Bailey *et al.*, 2015: 631, 632; see 631, 632 for detailed derivations from contributing theories).

We explicate here a corresponding specification of the more generic normative proposition—that *health is one among other core dimensions of well-being holding fundamental ethical importance*—entertained farther above about objects of distribution, namely, *that, whatever non-health dimensions of well-being hold fundamental ethical importance, agency, association and respect are the least controversial candidates for representation among potential objects of distribution that users of health-related economic evaluation ought to have the methodological capacity to assess*. This specification does not deny that other dimensions of well-being might also be worthy candidates; rather, it selects agency, association and respect as dimensions that it makes the most sense to start with in building the methodological capacity to assess non-health dimensions. Bailey and colleagues (2015: 631, 632) justify the selection of agency, association and respect by appeal to distinctively robust inter-theoretical agreement on their 'core' status. This selection might be challenged by disputing the choices to include or exclude certain theories of justice in the set of contributing theories and by reexamining the contributing theories to confirm or disconfirm the identified loci of convergence/overlap. Either or both forms of challenge could generate variant sets of 'least controversial candidate' dimensions of well-being, with corresponding variations in the structure of JE-CEA. Even so, the overall approach of identifying such focal points remains viable as a means of seeking the least controversial normative grounding for JE-CEA. For the sake of simplicity in the initial stages of JE-CEA's methodological development, Zwerling and colleagues follow Bailey and colleagues' selection by focusing the JE component of JE-CEA on agency, association and respect. We do the same in our exploration of JE-CEA in the Gambiense HAT EIC decision context.

Specification of Prioritization Norm

In response to EIC Desideratum (2), Bailey and colleagues (2015: 631, *italics added*) find that theories of justice using multidimensional metrics of well-being converge on the following core prioritization norm, which picks out aspects of distributive equity and fairness not otherwise captured in the EIC framework: *that 'it is a priority and duty of justice to avert and alleviate*

clusters of disadvantage in multiple dimensions of well-being'. For purposes of the present discussion, we read this as a specification of the more generic prioritization norm discussed farther above (*to protect and relieve people from severe societal disadvantage*). The key normative commitment defended in the contributing theories' explicit supporting arguments for the specified prioritization norm is to protect and relieve already-disadvantaged people from vicious cycles whereby personal setbacks caused by adverse impacts in some dimensions of well-being expose them to adverse impacts in other dimensions, making them even worse off (Powers and Faden, 2006; Wolff and de-Shalit, 2007; Venkatapuram, 2011). This commitment has heightened salience for public health programs addressing health problems to which people are disproportionately exposed through pre-existing disadvantages such as severe poverty and social marginalization (Faden and Shebaya, 2016: 28). The intent of JE-CEA is to focus on just such decision contexts, NTDs being a prime example (Azoh, 2014).

In response to EIC Desideratum (4), Bailey and colleagues (2015: 632–634) propose to interpret the evidence base on disease-specific psychological, psychosocial and social impacts by first examining the empirically known impacts on each of the three selected core dimensions of well-being, then asking 'how those impacts might create or exacerbate' cross-dimensional clustering of disadvantage, and finally comparing the scenarios under analysis in terms of the revealed patterns of impacts on disadvantage by the lights of the prioritization norm. They use this method chiefly to analyze the evidence about disease-attributable impacts of LF and onchocerciasis (*oncho*), with the aim of informing the ethical rationale for investing global health resources in programs to control, eliminate or eradicate LF and *oncho*. For each of these NTDs, neither of which is fatal in short order if untreated, the evidence indicates many distinctly disadvantageous impacts of the disease itself upon agency, association and respect, impacts that stand in need of distinct assessment by means over and above the traditional measures that can already assess impacts on life (survival) and health.

By contrast, because of Gambiense HAT's catastrophic morbidity and rapid progression to fatality if untreated, the disease's adverse impacts on life and health as assessed by traditional measures are largely coextensive with its disadvantageous impacts on agency, association and respect. For this reason, our background assumption is that effective interventions used in the Gambiense HAT disease control and elimination strategies will themselves avert and alleviate

disease-attributable adverse impacts on pre-existing clustered disadvantage as experienced by individual members of the at-risk population. The distinct purpose of JE-CEA, as we are exploring its use in the Gambiense HAT EIC decision context, is to compare the candidate disease control and elimination strategies with respect to how far they might worsen (or not) any pre-existing clustered disadvantage through adverse impacts attributable to people's undergoing the public health *interventions* that the strategies deploy. That is, relative to a population baseline of pre-existing clustered disadvantage, some interventions in themselves may have the effect of worsening that clustered disadvantage, whereas others under comparison do not—for example, diagnostic testing for Gambiense HAT by means of lumbar puncture conducted in public *vs.* a rapid diagnostic test (RDT) that can be done in private.

The scope of application for the prioritization norm in JE-CEA is given by the prior scope of the policy question addressed by the CEA component (Zwerling *et al.*, 2017: S71). In the context of deciding on optimal strategies for control and elimination of Gambiense HAT, the scope of the relevant CEA component is restricted to populations whose members are, largely because of the pre-existing clustered disadvantage that they are likely to have in common, at risk of Gambiense HAT in endemic areas. With reference to the population inside the scope of the policy comparison, the ideal social justice outcome is for *no one* to experience worsened clustering of disadvantage through their experience of undergoing the interventions; short of the ideal, it is better for *as few people as possible* to experience worsened clustering of disadvantage, and for those who do to experience *as little of it as possible*. For this reason, the principal attribute on which the JE component of JE-CEA is meant to help users to evaluate the options under comparison is the extent to which each option might worsen pre-existing clustered disadvantage by imposing adverse intervention-attributable impacts.

This emphasis is in keeping with the analytic orientation of traditional CEA, which is designed to compare options partly in terms of incremental differences in units of effectiveness (such as DALYs); similarly, JE-CEA is designed to present alongside CEA an additional comparison of the same options, in terms of incremental differences in their impacts on people's experiences of disadvantage. JE-CEA takes empirical findings as input 'to track the occurrence, magnitude, and breadth of cross-cutting impacts on the three core dimensions of well-being' where, '[u]sing three impact levels, the social justice assessment for a given scenario under analysis could be either "expected not to worsen ...,"

"may worsen ...," or "expected to worsen ...," the pre-existing clustering of disadvantage (Zwerling *et al.*, 2017: S71). These assessments can then be examined alongside the results of CEA, and any other applicable forms of evaluation of interest to decision makers, as performed for the same set of options.

The contributing theories of justice that converge on JE-CEA's specified prioritization norm use the idea of clustered disadvantage for various purposes. One of these theories, that of Wolff and de-Shalit (2007: 107), uses it to solve 'the indexing problem' of identifying who is among the least advantaged in society at large: with the answer being 'groups of people who appear towards the bottom in several important categories of disadvantage, whose functionings in these categories are at a low level or very insecure'. Within JE-CEA's scope of application in the types of decision contexts for which it is designed, we take the indexing problem to have been pre-solved by the restriction of programmatic scope to a disease, like Gambiense HAT, to which people are typically exposed by conditions likely to impose multidimensional disadvantage (e.g. being both impoverished to the point of curtailed agency and marginalized to the point of curtailed association). The guiding ethical concern for users of JE-CEA, given that the compared program options' intended beneficiaries are likely already among the worst off in those terms, is to give some priority to not exacerbating the prior clustering of disadvantage in non-health dimensions of well-being as an unintended consequence of health-promoting interventions. An intervention-attributable adverse impact in any one of JE-CEA's core dimensions—agency, association, or respect—might exacerbate prior clustering of disadvantage even by compounding a person's prior disadvantage only in that one dimension, so far as they were already disadvantaged in one or two of the other core dimensions too, making the post-intervention cross-dimensional pattern even more disadvantageous than the pre-intervention pattern. Intervention-attributable impacts that cross two or three core dimensions add further clustering in themselves. Nonetheless, variants on JE-CEA, or kindred techniques, might specify differently the generic prioritization norm, for instance by somehow weighting impacts on the selected core non-health dimensions, without using the idea of clustering either to describe the prior baseline of disadvantage or to make the social justice assessment in evaluating the compared program options. Again, for the sake of simplicity in the initial stages of JE-CEA's methodological development, Zwerling and colleagues retain Bailey and colleagues' specified version of the generic prioritization norm, and we do the same here.

Whereas Zwerling and colleagues illustrate the use of JE-CEA in conjunction with a decision tree technique for CEA comparisons (Zwerling *et al.*, 2017), our adaptation will instead illustrate it in conjunction with a dynamical transmission modeling approach for CEA comparisons, as is more appropriate for the Gambiense HAT decision context (Steinmann *et al.*, 2015; Sutherland *et al.*, 2017). In addition, whereas Zwerling and colleagues confine their discussion of JE to its conjunction with the main CEA analysis in their example of novel *vs.* standard multi-drug resistant tuberculosis regimens, we consider in the Gambiense HAT decision context the conjunction of JE not only with CEA but also with a probability of elimination analysis.

JE-CEA for Gambiense HAT Control and Elimination Strategies

Overview of Methods

In our proposed adaptation for the Gambiense HAT disease control and elimination decision context, JE-CEA proceeds in three phases (Box 1). Phase 0 is to identify the options to be evaluated. Phase 1 is to construct social justice assessments, drawing on the best available evidence, corresponding to people's experiences of disadvantage under each option. Phase 2 is to represent these assessments along with the CEA to demonstrate JE-CEA. We will also extend the JE technique of social justice assessment to the probability of elimination predictions for Gambiense HAT.

Box 1. Overview of methods for JE-CEA as applied to Gambiense HAT test case

	Description
<i>Phase 0</i>	Identify options of interest and articulate them in a form suitable for evaluation
<i>Phase 1</i>	Construct social justice assessments corresponding to people's experiences of disadvantage under each option
	<i>Step 1. Assess quality of people's experiences in core dimensions of well-being</i>
	<i>Step 2. Assess impact on clustering of disadvantages across core dimensions of well-being</i>
<i>Phase 2</i>	Combine social justice assessments with CEA

Phase 0: Identify Options of Interest

CEA compares health interventions in terms of their incremental cost-effectiveness ratio (ICER). The ICER is defined as the incremental cost of implementing a given intervention relative to the next best intervention (the difference in cost between the two) divided by the incremental effectiveness of implementing it relative to the next best intervention (the difference in effectiveness between the two). Traditionally, effectiveness has been measured in terms of health, using health measures such as DALYs averted. The ICER can be expressed as the incremental cost per DALY averted. An intervention is 'dominated' when another intervention costs less and has better outcomes relative to it.

Our application of JE-CEA builds on a prior CEA study that modeled cost-effectiveness and probability of reaching elimination of Gambiense HAT for several strategies featuring different combinations of standard approaches and emerging technologies for HAT diagnosis and treatment over 30 years (2013–2042), using a dynamical transmission model (Sutherland *et al.*, 2017). These strategies are composed of varying scenarios previously described, where each scenario is characterized by its availability between 2013 and 2042; its approaches to case identification, diagnosis and treatment; and whether vector control is included as an additional method to prevent transmission (Steinmann *et al.*, 2015). A major aim of the prior modeling study was to assess the value of investing in novel Gambiense HAT technologies vis-à-vis the goal of reaching elimination.

The objects of analysis in the prior CEA study by Sutherland and colleagues (2017), and correspondingly in our illustration of JE-CEA, are the strategies considered as each would be implemented over the full 30-year time horizon. It is important to distinguish between the cost of investing in a strategy over that full 30-year time horizon and the annual cost per case found, which may fluctuate from year to year, and which for elimination strategies will increase over time as disease prevalence declines. Whereas the CEA highlights the value for money of investing in each strategy relative to its comparators over the 30-year time horizon, the annual cost per case relates instead to the annual budget for carrying out the selected program (which would be assessed differently in the decision-making dossier).

For purposes of illustrating JE-CEA, we focus on the five strategies most important to consider for areas where transmission risk is low (Figure 1) (Sutherland *et al.*, 2017). The first strategy continues the current paradigm. The other four strategies, which deploy

Figure 1. Strategies for control and elimination in low-risk transmission areas*.

varying combinations of novel technologies, were shown to dominate all other alternatives to the current paradigm on grounds of *either* probability of elimination *or* cost-effectiveness, *or* both (Sutherland *et al.*, 2017).

The *Control* strategy (Strategy A in Sutherland *et al.*, 2017) depicts the current Gambiense HAT treatment paradigm. The term *Control* in this analysis refers to a form of *disease control* program in the sense of a public health intervention strategy intended to ‘control’ the disease, that is, to reduce its ‘incidence, prevalence, morbidity or mortality to a locally acceptable level as a result of deliberate efforts’ with the understanding that ‘continued intervention measures are required to maintain the reduction’ (Dowdle, 1998: 23). (This is by contrast with ‘control’ in the experimental sense of a neutral, non-intervention, no-impact baseline, and by contrast too with ‘control’ in what is perhaps a colloquial sense of merely observing the status quo while taking no deliberate action to influence future disease parameters.) Thus, the Gambiense HAT *Control* strategy, like all the other strategies under comparison in our analysis, is an active public health intervention that must be assessed for its potential adverse impacts on pre-existing clustered disadvantage. During *Control*, in low-transmission settings, WHO advises that patients seek out treatment (passive surveillance) (WHO, 2013). Suspected cases undergo blood serum tests (card agglutination test for trypanosomiasis, or CATT) to find antigens in response to parasite presence. To determine the stage of the

disease, lumbar puncture at a health facility is required to draw cerebrospinal fluid for parasitological confirmation. Confirmed cases are referred to specialized treatment centers. People in Stage 1 of the disease require 12-day intravenous treatment in hospital with pentamidine. People in Stage 2 require 14 days of nifurtimox–eflornithine (chemotherapy) in hospital.

Control with tiny targets (Strategy B in Sutherland *et al.*, 2017), a potential strategy for elimination, combines the current treatment paradigm (*Control*) with novel vector control interventions called ‘tiny targets’: small flag-like traps colored to attract tsetse flies and covered with insecticide to kill them (Steinmann *et al.*, 2015).

Accelerated technologies (Strategy D in Sutherland *et al.*, 2017) maintains *Control* until 2016, when new diagnostics become available. Local health centers could then use a RDT (HAT Sero K) instead of CATT and use loop-mediated isothermal amplification of DNA (LAMP) for parasitological confirmation. Lumbar puncture would still be required at a health facility for staging. Stage 1 treatment remains the same, but patients in Stage 2 can take a 10-day oral regimen of fexinidazole. Then in 2019, a novel 1-day oral tablet, oxaborole SCYX-7158, is expected to become available to treat both stages of the disease, rendering differential diagnosis unnecessary, so that a RDT alone would suffice with no lumbar puncture for staging. The all-oral treatment for both stages could also mean that patients no longer need to leave their village for treatment.

Accelerated technologies with biannual surveillance is the same as *Accelerated technologies* except that screening is conducted every 2 years ('Strategy D+' in Sutherland *et al.*, 2017). Because surveillance teams conduct open screening campaigns in villages, the diagnostic procedures, including lumbar puncture for staging, would all be done publicly, until the oral oxaborole treatment arrives for both stages in 2019.

Accelerated technologies with tiny targets (Strategy E in Sutherland *et al.*, 2017) is the same as *Accelerated technologies* except that it simultaneously deploys vector control with tiny targets.

Phase 1: Construct Social Justice Assessments

Phase 1 is to construct social justice assessments corresponding to people's experiences of disadvantage for each option under evaluation (Bailey *et al.*, 2015: 632; cf. Zwerling *et al.*, 2017: S71, S72). Step 1 is to assess people's experience in core dimensions of well-being under each option. Step 2 is to assess the impact of each option on the clustering of disadvantage across core dimensions of well-being.

Step 1. Assessment of people's experience in core dimensions of well-being

Because all untreated cases of HAT are debilitating and fatal, any safe and effective preventive or therapeutic intervention that people willingly accept is clearly better than none in terms of agency, respect and association. But the standard and novel interventions deployed under different Gambiense HAT control and elimination strategies may themselves vary in the nature, intensity and distribution of their impacts on core dimensions of well-being. The point of constructing social justice assessments is to estimate the 'price' in mal-distributed disadvantage imposed by the current paradigm (i.e. *Control* as an ongoing public health intervention strategy) as compared with alternative strategies.

Step 1 is to ask whether and, if so, how people experience adverse impacts on agency, respect or association because of their exposure to the specific health interventions deployed under each strategy. To find out, primary qualitative data collection would be ideal (Zwerling *et al.*, 2017: S72). Future qualitative studies are required for the development and refinement of JE-CEA methodology for use in any specific decision context, including the Gambiense HAT context. For purposes of the present analysis, however, we drew on a systematic review of empirical literature about people's experiences of standard HAT diagnosis and treatment interventions

(Muela and Hausmann-Muela, 2013). Table 1 relates the most striking findings from this literature to the strategies under analysis.

Our application of JE-CEA in this article deals only with low-transmission areas, where case identification is limited to passive surveillance undertaken in more private clinic settings under four of the five strategies considered: *Control*, *Control with tiny targets*, *Accelerated technologies* and *Accelerated technologies and tiny targets*; thus, for each of those four strategies, the literature indicates that social justice impacts would occur mainly through treatment experiences. Under one of the five strategies considered, namely, *Accelerated technologies with biannual surveillance*, the literature indicates that standard approaches to active surveillance for HAT, because they occur in public, bring embarrassment and shame (especially for those who need lumbar puncture to determine their stage of a stigmatized disease), and thereby infringe significantly on *respect* (Mpanya *et al.*, 2012). In the Discussion section, we will return to this point and consider the need for more private and dignified approaches to active screening.

Regarding treatment technologies, the most marked impacts on disadvantage under both strategies deploying standard treatment (*Control* and *Control with tiny targets*) are experienced by patients at disease Stage 2, and they arise from the 6+ months' post-treatment prohibitions on patients' activities. For example, qualitative studies conducted in the Democratic Republic of Congo report that communities commonly uphold prohibitions on heavy labor and sexual intercourse during the 6+ month post-treatment period (Robays *et al.*, 2007; Mpanya *et al.*, 2012, 2015). The prohibition on heavy labor amounts to 'forced inactivity' (Robays *et al.*, 2007: 294) that severely restricts the patient's *agency*. The prohibition on sexual intercourse stirs up 'marital problems and conflicts' (Robays *et al.*, 2007: 295), a critical setback in *association*. Moreover, 'a strong element of social control' and victim-blaming in the event of '[t]reatment failure and other complications' arise from the widely held perception that patients' adherence to post-treatment prohibitions—which also preclude smoking, drinking alcohol, eating hot food and walking in the sun—is key to recovery (Mpanya *et al.*, 2012: 7). As one focus group participant said, 'A person must be near at all times to keep an eye on him, to make sure he avoids all these things' (Mpanya *et al.*, 2012: 7, Table 3). Such intense social monitoring and potential victim-blaming are setbacks in the domain of *respect*. JE-CEA is precisely intended to represent these sorts of adverse impacts on agency, association and respect, over and

Table 1. Impacts of interventions on core domains of well-being

Strategies	2013–2015	2016–2018	2019–2042
<i>Control</i> (Strategy A)	Agency Post-treatment rest period limits the ability to perform meaningful daily activities for 6+ months Respect Beliefs about specific prohibitions to be enforced during post-treatment rest period to social control by ‘patient’s entourage’ and victim-blaming if treatment fails Association Prohibition on post-treatment sexual relations strains family ties and marriages		
<i>Control with tiny targets</i> (Strategy B)	Same as ‘Control’	Same as ‘Control’	Same as ‘Control’
<i>Accelerated technologies</i> (Strategy D)	Same as ‘Control’	No expected clustering of disadvantage from current evidence	No expected clustering of disadvantage from current evidence
<i>Accelerated technologies with biannual surveillance</i> (Strategy D+)	Same as ‘Control’ Respect Public shame through screening campaign staging procedure (lumbar puncture)	Respect Public shame through screening campaign staging procedure (lumbar puncture)	No expected clustering of disadvantage from current evidence
<i>Accelerated technologies and tiny targets</i> (Strategy E)	Same as ‘Control’	No expected clustering of disadvantage from current evidence	No expected clustering of disadvantage from current evidence

above the costs already measurable by existing evaluation techniques.

We hypothesize that the substitution of novel diagnostic and treatment technologies would remove the specific adverse impacts of standard approaches without introducing comparable new ones. By contrast, the addition of ‘tiny targets’ as a vector control intervention would not in itself change the quality of people’s diagnostic and treatment experiences but would rather serve to reduce HAT incidence over time, so that fewer people are exposed to HAT diagnosis and treatment.

Wherever novel diagnostic and treatment technologies are implemented in the future, their successful implementation will require ongoing community consultation, and empirical research would be needed to test our substitution hypothesis. As noted by Mpanya and colleagues, the intensive post-treatment prohibitions that presently take the form of taboos originated in communities’ uptake of past communications with healthcare providers trying to manage HAT treatment with a relatively toxic drug (melarsoprol) (Mpanya *et al.*, 2015; see also Kovacic *et al.*, 2016). Even where

the use of less toxic drugs makes such prohibitions no longer medically necessary, they might still be believed necessary by the community. Under those circumstances, on one hand, the possibility arises for public health interventions to facilitate the evolution of community norms through respectful dialogue and education in collaboration with community opinion leaders; on the other hand, if community norms do not evolve for whatever reason, the social justice impacts resulting from enforcement of the prior norms might carry over to new treatment modalities.

Step 2. Assessment of impact on clustering of disadvantage across core dimensions of well-being

The next step is to assess the impact of each strategy on the clustering of disadvantage. At least three assessment levels are possible. For ease of visualization when considering social justice impacts alongside results from other forms of evaluation, Zwerling and colleagues proposed a color-coding scheme representing three levels of expected impact (Zwerling *et al.*, 2017). We propose a

Strategy	2013 - 2015	2016 - 2018	2019 - 2042
Control (Strategy A)	Orange	Orange	Orange
Control with tiny targets (Strategy B)	Orange	Orange	Orange
Accelerated technologies (Strategy D)	Orange	Turquoise	Turquoise
Accelerated technologies with biannual surveillance (Strategy D+)	Orange	Yellow	Turquoise
Accelerated technologies and tiny targets (Strategy E)	Orange	Turquoise	Turquoise

Figure 2. Summary of ‘clustering of disadvantage’ across well-being by color.

similar color-coding scheme (adjusted for readers with color-blindness) as follows:

- Orange: ‘Expected to worsen the clustering of disadvantage’,
- Yellow: ‘May worsen the clustering of disadvantage’ and
- Turquoise: ‘Expected *not* to worsen the clustering of disadvantage’.

While finer, intermediate gradations are possible in principle, their definition requires further development of JE-CEA methodology. Meanwhile, JE-CEA can still reveal striking contrasts among the social justice impacts of different strategies under analysis (Figure 2).¹

Because standard treatment for Stage 2 of HAT tends to impose post-treatment burdens in all three core dimensions of well-being (Table 1), the *Control* and *Control with tiny target* strategies warrant an assessment of ‘Expected to worsen the clustering of disadvantage’, relative to the pre-existing clustered disadvantage shared by the population at risk of Gambiense HAT. By contrast, the *Accelerated technologies* and *Accelerated technologies with tiny target* strategies, under their component scenarios that roll out post-2016, promise to avoid imposing comparable post-treatment burdens (Sutherland, 2016), and so they warrant an assessment of ‘Expected not to worsen the clustering of disadvantage’. *Accelerated technologies with biannual surveillance* continues to impinge on respect through the screening campaigns that will require public lumbar puncture for staging until a treatment for both stages arrives in 2019. Because social justice impacts are attributable to this strategy in only one

core dimension of well-being, it is assigned an assessment of ‘May worsen the clustering of disadvantage’ (depending on the extent to which this impact might compound pre-existing disadvantages in the experiences of people affected).

Phase 2: Consider Social Justice Impacts with CEA

Figure 3A shows the results of the prior CEA study for the five strategies we considered here. The *Control* strategy would cost \$3 (\$2.52) and incur 0.04 DALYs per person at risk in a low-transmission area and is dominated by *Accelerated technologies*, which costs approximately the same (\$2.97) but incurs 0.01 DALYs less than the control (ICER = \$160/DALY averted). Scaling up surveillance in low-transmission areas to once every 2 years (*Accelerated technologies with biannual surveillance*) would cost a total \$20 per person at risk but would incur only 0.004 DALYs resulting in an ICER of \$654 per DALY averted. *Control with tiny targets* and *Accelerated technologies and tiny targets* are both dominated.

Accelerated technologies with biannual surveillance and *Accelerated technologies* would be considered cost-effective. However, some influential global health funders consider \$300 per DALY averted as a threshold of cost-effectiveness for investments in low-income countries (NICE International, 2014). With that constraint, *Accelerated technologies* would be the only option.

When we overlay our social justice assessments onto the prior CEA results (Figure 3B), the social justice assessments and CEA results are concordant. *Accelerated technologies* is cost-effective, and in the long run is not expected to worsen clustering of disadvantage.

Figure 3. Economic evaluation in low-risk transmission areas of Gambiense HAT.

Figure 4. Probability of elimination in low-risk transmission areas of Gambiense HAT.

An Applied Extension of Phase 2: Social Justice Impacts Alone Considered Alongside Probability of Disease Elimination (Separate from CEA)

In a previous analysis of elimination targets, the probability of elimination (Figure 4A) appeared to be highest under *Accelerated technologies with biannual surveillance*, *Accelerated technologies with tiny targets* and *Control with tiny targets* (Sutherland *et al.*, 2017). Therefore, in the absence of social justice assessment, we would conclude that these three options would be the best for elimination in a low-transmission area. But when we overlay our social justice assessments onto these same outcomes (Figure 4B), *Control with tiny targets*, in addition to performing worse than the other two strategies with respect to probability of elimination, has the major drawback of being expected throughout its course to worsen the clustering of disadvantage for people exposed to Stage 2 treatment. As for *Accelerated technologies with biannual surveillance*, although it has the highest probability of leading to elimination at the quickest rate, it also has an interim time when it may worsen the clustering of disadvantage for people exposed to active surveillance. Thus, *Accelerated technologies* and *Accelerated technologies with tiny targets*, under which the Gambiense HAT interventions that people would experience are not expected to worsen clustering of disadvantage for them, are preferable in terms of social justice impacts attributable to interventions.

Discussion

Although *Accelerated technologies* is cost-effective and not expected to worsen the clustering of disadvantage, it is unlikely to lead to elimination. The low probability of elimination under *Accelerated technologies* thus presents a trade-off *within* social justice so far as ongoing residual disease incidence would impose future social justice impacts attributable to the disease (Bailey *et al.*, 2015)—impacts that could be averted with eventual elimination under *Accelerated technologies with biannual surveillance*, but at the risk of exposing people to other social justice impacts attributable to active screening, at least until 2019 when the oral oxaborole treatment suitable for both disease stages would remove the need for public lumbar puncture to determine disease stage. Under *Accelerated technologies*, with the permanent prospect of residual disease incidence, all three core dimensions of well-being could remain precarious for anyone

at risk of Gambiense HAT (because all untreated cases are debilitating and fatal), except so far as they could count on timely diagnosis and treatment. From this standpoint, however, the saving grace of *Accelerated technologies* is the rollout of increasingly simplified diagnosis and treatment that would be expected to avert disease-attributable social justice impacts while refraining from imposing intervention-attributable social justice impacts. This prospect suggests that *Accelerated technologies* might be favored on social justice grounds over *Accelerated technologies with biannual surveillance*, even taking into account the residual disease incidence under *Accelerated technologies*. The social justice assessments and CEA results (setting aside for a moment the probability of elimination analysis) converge on recommending *Accelerated technologies*, given the prevailing cost-effectiveness threshold among global health funders. If that threshold were to increase, however, to the point of admitting *Accelerated technologies with biannual surveillance*, it could present a trade-off between cost-effectiveness of *Accelerated technologies with biannual surveillance* and the superior protections against treatment-attributable social justice impacts afforded under *Accelerated technologies*. This may truly be an option, as low- and middle-income countries may consider cost-effectiveness thresholds near \$1000 per DALY based on their gross domestic product (Santatiwongchai *et al.*, 2015). Indeed, the global health commitment to Gambiense HAT elimination may require a cost-effectiveness threshold of around \$700 per DALY averted, to accommodate increased active surveillance in low-transmission areas (Sutherland *et al.*, 2017). Another reason why increased active surveillance may be necessary to reach elimination is that the current prevalence of HAT is unknown. Less than 10 per cent of the at-risk population has been screened.

Putting all these considerations together, the value that JE-CEA ultimately adds to deliberation in the Gambiense HAT decision context is to underscore the ethical importance of flagging adverse social justice impacts of otherwise attractive options, so that opportunities to mitigate those impacts can then be explored. In this case, JE-CEA renders highly salient the need to devise approaches to active screening that protect people's privacy, confidentiality and dignity better than the current standard procedure. Of course, the ethical importance of such protections is a reason, independent of the public health decision context surrounding Gambiense HAT elimination, to develop a more respectful active screening approach. So far as the global health commitment to NTD elimination is motivated by considerations of social justice, consistency

and coherence require stakeholders to pursue pathways toward the goal that best avert or alleviate adverse social justice impacts for members of at-risk communities along the way. If the most attractive option in terms of probability of elimination and cost-effectiveness turns out to be *Accelerated technologies with biannual surveillance*, JE-CEA reveals that it is ethically preferable to avoid active screening procedures that require public diagnostic procedures. A more progressive solution to the trade-off identified above, between bringing future disease incidence to 0 and protecting people actively screened along the way, could be to develop a modified strategy incorporating more private and dignified active screening, *Accelerated technologies with biannual surveillance**. On the other hand, the time it would take to develop, pilot and scale up this improved screening procedure might run through 2019, at which point the projected availability of oral oxaborole treatment would permit active screening to be done without the need for public diagnostic procedures. This raises the possibility of a differently modified strategy, *Accelerated technologies with biannual surveillance*** that would involve delaying the start of biannual surveillance pending the availability of oral oxaborole. Both modified strategies would need to be re-assessed under the other forms of evaluation (probability of disease elimination and CEA).

Limitations and Directions for Future Work

There are still many refinements to be considered as JE-CEA develops. Primarily, JE-CEA is not meant to be a decision algorithm. It does not itself resolve ethical tensions or trade-offs but rather articulates them explicitly: Is it better to delay elimination until more equitable tools are available? Or should we pursue elimination and try to improve the mitigation of social justice impacts along the way? Can we increase our cost-effectiveness threshold for this decision? While we have indicated in the Discussion section the beginning of a possible deliberative pathway informed by JE-CEA, it is up to the stakeholders involved to work through these ethical trade-offs. The main normative contribution of JE-CEA is to identify and make salient the social justice impacts of options under analysis. The experiential nature of the impacts highlighted by JE-CEA suggests that the involvement of patient and community representatives and local NTD activists is of utmost importance. For instance, NTD activists belonging to at-risk communities could decide to lead a de-

stigmatization campaign alleviating the current social justice impacts of *Accelerated technologies with biannual surveillance*, so that it could be implemented as is. To facilitate the emergence of community-led solutions, JE-CEA could help to organize systematic stakeholder deliberation using multiple criteria decision analysis frameworks (Thokala and Duenas, 2012) or Delphi panel approaches (Assasi *et al.*, 2014).

Concerns remain regarding our hypothesis that the substitution of novel Gambiense HAT diagnostic and treatment technologies would remove the specific adverse impacts of standard approaches without introducing comparable new ones. Local perceptions of novel technologies are currently unknown and will need to be assessed by medical anthropologists and other social scientists. Outdated post-treatment taboos might evolve in synch with the appearance of safer treatments on the market (Mpanya *et al.*, 2015). There is evidence that RDTs for a disease with a symptomatic profile like that of Gambiense HAT (Bisser *et al.*, 2016) are considered acceptable if the communities feel confident in the health-care workers providing the services (Mukanga *et al.*, 2010; Mushi *et al.*, 2016); the supply of RDTs is maintained (Diggle *et al.*, 2014) and the cost to the community is minimal (Cohen *et al.*, 2015).

The initial version of the JE-CEA framework proposed by Zwerling and colleagues (2017) focuses on capturing the ‘worsening of disadvantage’ for interventions under assessment. The thought here is that it is of paramount moral importance to expose and avoid unintended consequences whereby health interventions might worsen further the position of people ‘who were already relatively badly off before enactment of the policy, and who may have come into the line of fire of adverse policy impacts through the very pre-existing circumstances by which they were already disadvantaged’ (Zwerling *et al.*, 2017: S71). There is also a potential, however, to consider the positive impacts of new technologies so far as they might protect and relieve intended beneficiaries from severe societal disadvantage by promoting “‘fertile functionings’ (i.e. those functionings the securing of which is likely to secure further functionings)’ (Wolff and de-Shalit, 2007: 10). For instance, there is emerging evidence that including women in vector control campaigns (tiny targets) and elimination programs for Gambiense HAT may lead to female empowerment and increase community engagement (Kovacic *et al.*, 2013; Kovacic, 2015). Further research toward the more complete development of JE-CEA and kindred techniques should explicitly account for how positive and negative components interact when

assessing the clustering of disadvantage in Phase 1 of the social justice assessment.

There is also the need to evaluate these results in the context of uncertainty. For instance, even in well-funded screening campaigns, systematic bias and social exclusion preference may occur, as local campaigns may prioritize urban areas that are more feasible to reach, leading to unintentional geographical isolation of rural communities in hard-to-reach areas. To take into consideration such situations or other scenarios that deviate from the assumptions in the main analysis, the JE-CEA assessment could be conducted for each area separately, so that decision makers can infer how distributions of social justice impacts vary by region. This form of sensitivity or scenario analysis is common practice in CEA modeling, and hence the uncertainty analyses for JE-CEA are highly recommended in further applications.

The approach to conjoining justice-enhancement with traditional techniques of economic evaluation may also require refinement. In this study we used the DALY as the main outcome, but other health-related quality-of-life values use indices that ask patients about their ability to conduct everyday activities. Hence impacts on agency may already partly be captured by such measures. Further applications of JE-CEA may need to ensure that ‘double-counting’ for components of well-being is ruled out.

Conclusion

Zwerling and colleagues (2017) have presented JE-CEA as a novel methodology based on the method of ethical analysis that Bailey and colleagues (2015) had earlier proposed as suitable to inform public health decision-making in EIC decision contexts for NTDs. In this article, we have tested the use of JE-CEA in the context of the Gambiense HAT EIC, demonstrating how JE-CEA can help global health decision makers and stakeholders to evaluate not only the economic consequences but also the social justice impacts of different pathways toward disease control and elimination.

In the Gambiense HAT decision context, the structure of JE-CEA as an ‘alongside’ method allows its JE component to be applied not only to CEA but also to probability of elimination analysis. In principle, given its structural flexibility, JE-CEA is transferable to similar decision contexts for other kinds of public health programs, where decision makers commonly evaluate clinical effectiveness, safety, value for money (i.e. cost-effectiveness), budget impact and ethical considerations.

JE-CEA could help to articulate as part of the overall evaluation the sorts of ethical considerations that might otherwise end up in a dossier paragraph summarizing available literature on social disparities. Motivated by social justice as a moral imperative to avoid and remediate inequitable distributions of societal disadvantage, and resting on a normative basis derived from the family of capabilities and well-being theories of justice, JE-CEA can be further developed to assess explicitly the expected social justice impacts of the options compared. In addition to broadening the evidence base available to stakeholders and decision makers, JE-CEA also offers a promising approach to including the voices and experiences of people whom public health programs are intended to benefit.

Note

1. Our analysis departs here from the originally proposed JE-CEA approach (Zwerling *et al.*, 2017) in that we do not use length of colored bars to highlight the number of people impacted, because our extension of the Phase 2 social justice assessment to the probability of elimination analysis will indirectly highlight the number of people potentially impacted over time.

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Conflict of Interest

None declared.

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