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# Cost-Effectiveness Thresholds in Global Health: Taking a Multisectoral Perspective

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ABSTRACT

Good health is a function of a range of biological, environmental, behavioral, and social factors. The consumption of quality health care services is therefore only a part of how good health is produced. Although few would argue with this, the economic framework used to allocate resources to optimize population health is applied in a way that constrains the analyst and the decision maker to health care services. This approach risks missing two critical issues: 1) multiple sectors contribute to health gain and 2) the goods and services produced by the health sector can have multiple benefits besides health. We illustrate how present cost-effectiveness thresholds could result in health losses, particularly when considering health-producing interventions in other sectors or public health interventions with multisectoral outcomes. We then propose a potentially more optimal second best approach, the so-called cofinancing approach, in which the health payer could redistribute part of its budget to other sectors, where specific nonhealth interventions achieved a health gain more efficiently than the health sector's marginal productivity (opportunity cost). Likewise, other sectors would determine how much to contribute toward such an intervention, given the current marginal productivity of their budgets. Further research is certainly required to test and validate different measurement approaches and to assess the efficiency gains from cofinancing after deducting the transaction costs that would come with such cross-sectoral coordination.

***Keywords:*** cofinancing, cost-effectiveness threshold, economic evaluation, multisectoral, public health interventions, social determinants of health.

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## Introduction

Health policymakers across the globe are facing difficult financing decisions having to balance a large unmet and rising demand for health services, costly new drugs and technologies, ambitious international guidelines, and severely constrained health budgets [1]. To aid these decisions, a threshold is sometimes used to determine which interventions are cost-effective and should therefore be included in a prioritized package of health interventions [2]. For more than a decade, the Commission for Macroeconomics and Health and the World Health Organization's suggested threshold of 1 to 3 times a country's gross domestic product per capita per disability-adjusted life-year (DALY) averted was accepted without much debate, or theoretical basis [3,4]. Nevertheless, there is now a general consensus that this suggested threshold may not reflect the real opportunity costs of investing in an intervention and that its application may cost lives [5–8].

Recently, there have been efforts to provide clarification on what the threshold should represent, rooted in different economic traditions [6,9,10]. In a welfarist framework that accepts that the individual knows what is best and when aggregate individual utility is the maximand of public policy, a threshold could be derived from the marginal utility gained from the consumption of goods or services that produce health [7,11]. This demand-side concept may be used, alongside other criteria, to set the "health" budget, in relation to other uses of public resources. Decisions of how to then spend a constrained health budget can be better guided by an extrawelfarist framework, in which health in itself is intrinsically valued and health maximization is the decision maker's objective [12,13]. The decision rule to allocate resources to a specific intervention is then based on a supply-side threshold that reflects the marginal productivity of the health system [9,14,15].

This conventional approach that underpins many health economic evaluations often focuses on a single-sectoral payer that seeks to maximize health, typically through interventions delivered by the health care system. This approach risks missing two critical issues: first, multiple "sectors" contribute to the

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production of health, and second, some of the goods and services produced by the "health sector," or the healthcare system, have multiple benefits besides health [16,17]. There is a solid and growing body of evidence on the social determinants of health, which include poverty, education, gender inequity, housing, and transport, among many others [18–21]. In fact, some argue that population health is largely or even primarily impacted by interventions in other sectors with other payers, which are arguably not aiming to maximize health [22,23]. In the new global development agenda, these structural determinants have come to the forefront, with 17 sustainable development goals that explicitly seek to tackle socioeconomic inequalities and environmental factors hampering human development [24,25]. Global health programs will increasingly have to compete for resources with these upstream nonhealth programs, but could also stand to greatly benefit from their spillover health outcomes. Similarly, public health interventions targeting populations or communities, rather than individuals, typically have wide-ranging cross-sectoral impacts and cost implications. The spillover benefits of these interventions have gained prominence and helped to make the case for greater investments [17,26,27].

There are at present a number of ways to deal with the economic evaluation of interventions with multisectoral outcomes [17,28–30]. The first is the adoption of a welfarist cost-benefit approach that monetizes outcomes. Analysts grappling with this in the fields of social care and environmental economics are leaning toward this option [29,31]. Yet the contentious step of attaching a monetary value to life, health, and other social outcomes is part of what led to the development of and health decision makers' preference for an extrawelfarist framework [14]. Within the extrawelfarist evaluation perspective, two approaches exist that allow those in the health sector to incorporate nonhealth consequences into their decision space. Most commonly, costs are weighed against 1) composite outcome measures that incorporate broader capabilities, or 2) multiple consecutive outcome measures, with cost-consequence approaches [28,32].

Several current guidance documents also stipulate a variation of the latter approach, whereby the nonhealth costs and effects of interventions are to be reported and disaggregated by sector of the economy or by payer, including the Gates Reference Case for economic evaluation in global health, the National Institute for Health and Care Excellence's guidance for local government decisions in England and Wales, and the second US panel's recommendations on cost-effectiveness analysis in health and medicine [33–36]. The latter has even recommended the standard reporting of two reference cases for every economic evaluation: one from a health care sector perspective and the other from a broader societal perspective, with the use of an impact inventory to comprehensively report consequences beyond the formal health care sector [36]. Following the same logic, evaluations of nonhealth interventions should similarly consider non-negligible health consequences. Nevertheless, even with impact inventories for interventions across sectors, current guidance remains silent on how a health payer should value consequences outside the sector to decide on the most judicious allocation of its resources.

Although the second US panel "recommends that analysts should attempt to quantify and value non-health consequences," it also acknowledges that "there are no widely agreed upon methods" for this and it remains unclear as to how to apply a threshold based on opportunity cost to nonhealth impacts to support investment decisions [36]. In the United Kingdom, the National Institute for Health and Care Excellence's guidance further points out the lack of a standard method to apportion costs when more than one government department or local government is involved in delivering an intervention or is reaping its benefits [34,37].

In this article, we examine how efficient current cost-effectiveness thresholds are in dealing with interventions with multisectoral outcomes, implemented within and outside the health sector, and how this could be improved. We propose an approach that retains the extrawelfarist perspective (that may also apply to payers in other social sectors) and the principle of opportunity cost to maximize each sector's objectives, recognizing that each sector has its own budget constraint and real opportunity cost. We start by illustrating how the current thresholds could result in health losses, before proposing a potentially more optimal second best approach. We then discuss some of the associated measurement and application challenges and highlight areas for future research.

## Approaches to Resource Allocation: What Are the Consequences of a Unisectoral Approach?

Culyer [38] has recently proposed a bookshelf metaphor to resource allocation in health, whereby each book represents a health care intervention (see Fig. 1). The height of the book indicates its effectiveness in terms of health benefit, and its thickness captures its total cost. These books can be ranked in order of their height, from left to right, and included in a national health care package up to the point at which the health budget is exhausted, similar to the league table approach [3,5]. The last intervention to be included therefore represents a threshold of health productivity per unit of expenditure ($t_h$), or the inverse of the common cost-effectiveness ratio. It is the least productive intervention provided, and any intervention that would be considered to be added to the package would have to be at least as productive to avoid a loss of population health. The threshold is a direct function of the productivity of health interventions and the size of the health budget.

If such a unisectoral approach is to achieve health maximization, one must make a number of assumptions, including 1) that the health budget reflects the allocation of public resources to health care rather than to health; 2) that the cost of any health-producing intervention under consideration is fully borne by the health budget; and 3) that the merit of any intervention is solely determined by its impact on population health. A health-producing intervention delivered outside the health sector (or a public health intervention) is, however, likely to have other nonhealth benefits, and thus other payers that are willing to allocate part of their budgets to it. We suggest and illustrate how, in such cases, these underlying assumptions may result in health losses. From here on, we refer to "nonhealth interventions" as interventions with nonhealth primary objectives and spillover health outcomes, whereas "public health interventions" will have public health as a primary objective and spillover nonhealth outcomes.

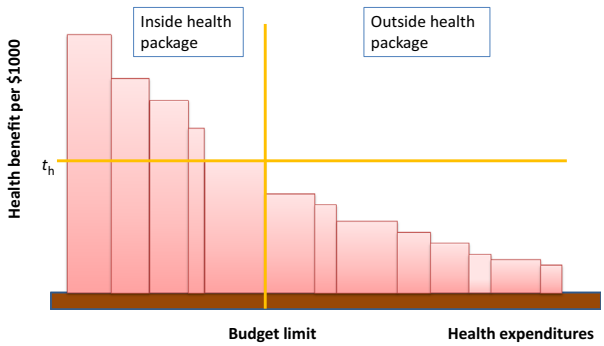


**Fig. 1 – The bookshelf of health care resource allocation [38].**

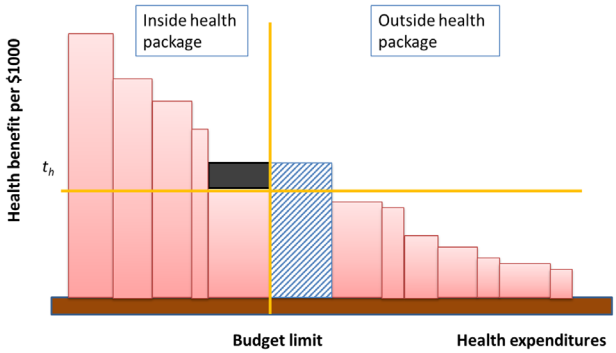


**Fig. 2 – Health loss from exclusion of nonhealth interventions.** *Note. Pink-filled books are health care interventions, while striped books are nonhealth interventions. The black area represents the health loss from the exclusion of the latter in the prioritisation process.*

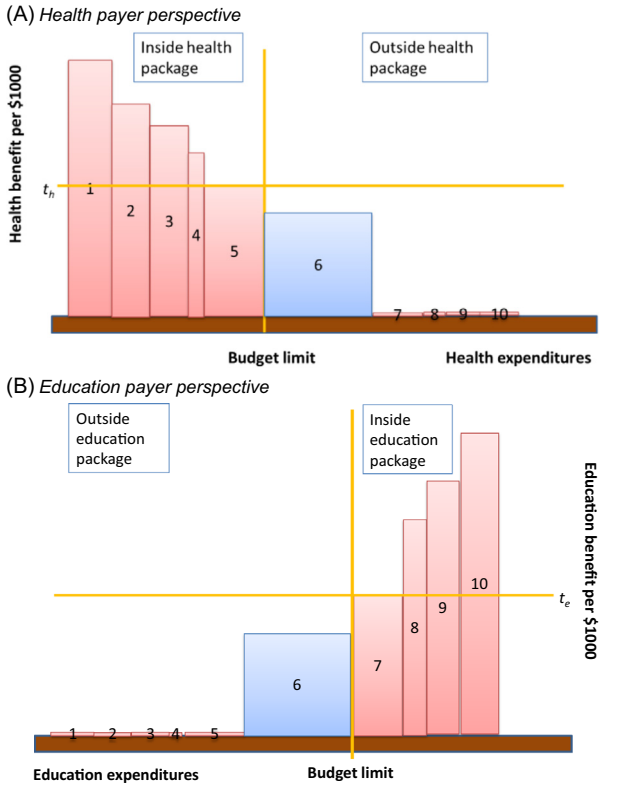


**Fig. 3 – Potential undervaluation of interventions with multisectoral benefits. (A) Health payer perspective. (B) Education payer perspective.** *Note. The books numbered 1–5 are health care interventions, and the books numbered 6–10 are education interventions. The horizontal axis in (A) should be read from left to right and that in (B) should be read from right to left.*

First, we examine what the "bookshelf" would look like if the health budget is provided to a payer maximizing health, but that can fund only health care services to do so. We consider a stylized case in which the exogenous government budget is split between two sectors or payers: a health payer and an education payer. We also assume that the education payer does not have health maximization as an objective, and would need to fully fund any intervention if it were interested in its education benefits. It would follow a similar prioritization approach as the health payer, with its own books ranked on a bookshelf according to education productivity. In this case, any intervention that improved health but was not provided within the health care system, even if more efficient, would not be prioritized, unless its education benefits were sufficient to justify the education payer fully funding it (e.g., the striped bar in Fig. 2). If not, this would be at the cost of lives and/or quality of life (as represented by the black area in Fig. 2). In reality, there may be specific activities or tweaks of interventions in other sectors that would optimize their positive health externalities, or mitigate their negative health externalities, that would be better value for money than certain existing health care interventions [16]. For example, adding health modules in schools' life skills curricula or providing micronutrient supplementation in schools could be relatively low-cost interventions with significant education, health, and economic benefits, but they have not always been embraced by the health sector [39].

Second, we examine a situation in which the health budget is provided to a payer maximizing health, which can fund any health or education intervention to do so. We assume that the education payer still does not have a health objective, interventions are indivisible [40], and one payer must bear the full cost of an intervention. In this case, some interventions may not be funded, because they do not generate sufficient return in either sector (e.g., book 6 in Fig. 3A,B).

Let us take the example of an education reform in Botswana. In 1996, the government reformed the grade structure of secondary schooling, effectively extending it by a year. Through a natural experiment, De Neve et al. [41] found that this led to 0.79 additional years of secondary schooling among the affected cohorts, with each added year reducing HIV risk remarkably by 8 percentage points. From the health payer's perspective, at a cost per HIV infection averted of US $27,753, this would have been a less good investment than other HIV interventions, such as male circumcision or treatment as prevention (ranging from US $550 to US $8,375) [41], and it would not have been prioritized. Although in this case it was actually implemented by the education sector, one could imagine a scenario in which there could have been more efficient education policy options to achieve the same educational impact, and even the education payer may have chosen an alternative investment without health spillovers.

Nevertheless, if we drop the assumption of indivisible costs and allow multiple payers for one intervention, then the health care cost (or contribution) could be lower than the total intervention cost. The health productivity of an education intervention per health dollar spent would therefore increase, as would its education productivity. For example, if the cost of intervention 6 would be shared equally, then its health and education productivity (per unit of expenditure) would double, making it better value for money than health intervention 5 in Figure 4A and education intervention 7 in Figure 4B. This would allow both payers to prevent losses of health and education outcomes (depicted by the black areas in both figures). As a consequence, both sectors' thresholds would shift up from $t_h$ to $t_{h'}$ and from $t_e$ to $t_{e'}$ (in Fig. 4A,B) in terms of health/education gain per dollar spent, reflecting the previous inefficiencies in each sector.

A real-life example of this is a US $110,000 cash transfer intervention in Malawi targeting girls of school-going age to keep them in school, which was found to have a range of health, education, and gender outcomes (including averting 94 HIV DALYs) [42]. The initial analysis that took only the perspective of HIV impact, indicated that it would not have been cost-effective and the HIV budget holder would not have paid the full

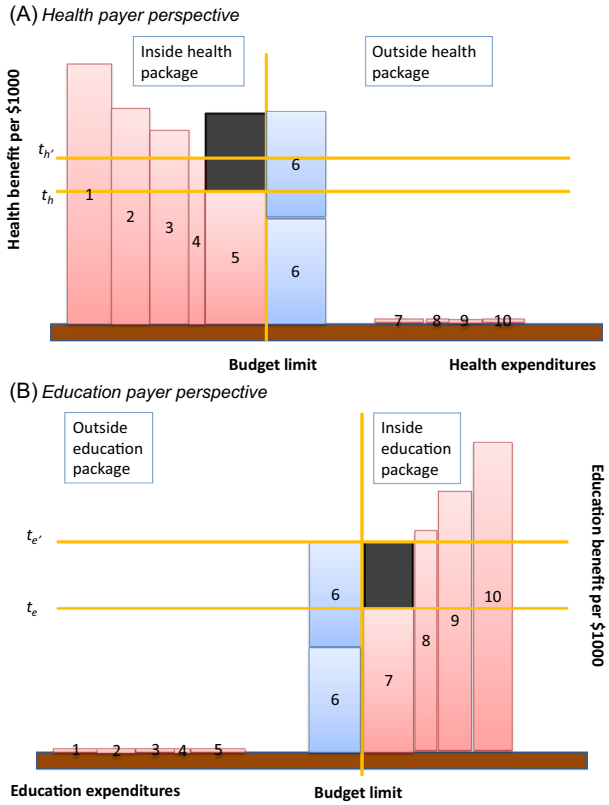


**Fig. 4 – Health and education losses from measuring productivity as a function of total costs instead of health or education costs. (A) Health payer perspective. (B) Education payer perspective.** *Note. Pink-filled books are interventions with single sector benefits, while the blue book (number 6) is an intervention with multi-sectoral benefits. The area in black represents the health/education losses of not allowing for cost-sharing. The horizontal axis in (A) should be read from left to right and that in (B) should be read from right to left.*

cost. However, after incorporating the other outcomes and payers' cost-effectiveness thresholds, the HIV sector was found to only need to allocate up to US $29,000 to the intervention, bringing its HIV productivity up from about US $1,170 per HIV DALY averted to US $339 [43]. Such a "book" would become taller in this scenario and excluding it from the health budget could result in a loss of health (as represented by the black area in Fig. 4A).

## Potential Solutions to Enabling Multisectoral Synergies

In a "first best" situation, we would imagine a central purchaser of social welfare (including health and education gains) with perfect information. This payer could choose all the most efficient interventions to maximize social welfare, regardless of which sector they were implemented in. The efficiency gains illustrated in Figures 4A and 4B would be realized by allocating "health resources" across sectoral budget holders (ministries) bearing their interventions' spillover benefits and costs into account. This would result in the budgets allocated to each sector shifting accordingly: the health sector budget would shrink (pushing out intervention 5 in Fig. 3A), and the education budget would grow to include intervention 6 (after excluding intervention 7 in Fig. 3B).

In reality however, there is often no perfectly coordinated and informed central decision maker. Overall sectoral budgets are set, and then public investments in one sector tend to be evaluated independently from investments in other sectors, which are taken as "given." This is known as the "second best" constraint of real-world public sector decision making [44,45]. In practice, governments are therefore more likely to allocate their health outcome-earmarked budget in full to the Ministry of Health with the mandate to maximize population health. Institutional mandates and policies thereafter tend to constrain ministries of health to allocations to health care alone [13,44,46].

Accepting the second best scenario, a pragmatic option to achieve a more optimal allocation is that the health payer (Ministry of Health) could redistribute part of its budget to other sectors, in which specific nonhealth interventions achieved a health gain more efficiently than the health sector's marginal productivity (opportunity cost) hereafter referred to as a "cofinancing" approach. Likewise, nonhealth sectors could transfer part of their budgets into a cofinancing mechanism where public health programs generate benefits that they are also interested in. This cofinancing approach recognizes the opportunity costs of different payers, but at the same time enables additional improvements in both health and other sectors, and a means to finance often highly efficient upstream nonhealth or public health interventions [43].

Although we focus on benefits here, a similar approach could be taken for interventions that impose costs on other sectors or reduce their benefits through negative externalities. For example, if a specific health intervention led to an increase in the costs of an education intervention, the education sector could end up foregoing education benefits from having to keep a now "thicker" book on its shelf, and drop a more productive one. We could think of the inclusion of a health education subject in the curriculum, whereby schools may hypothetically have to divert teachers and available school hours away from other important subjects, negatively affecting students' learning in those areas. If these negative spillovers were taken into account, the education sector could potentially be compensated through a larger share of the budget, if the resulting health losses from a reduced budget were valued less than the education losses.

Although not widespread, in practice, this cofinancing approach is not unheard of. In some high-income countries, such as the United Kingdom and Sweden, there have been initiatives to pool budgets between health and social care for the management of chronic health problems and disabilities in particular, to overcome narrow sectoral interests and achieve efficiency savings [26,47]. In certain global health programs, investment plans have been developed that include multiple sectors and health-producing interventions outside the health sector, as well as large-scale public health interventions with wide-ranging effects. For example, the global strategic investment framework for HIV identified structural interventions as integral components of effective responses, including community mobilization, social protection, and education programs, alongside basic HIV program activities such as condom programming and antiretroviral therapy [48]. Specifically, the South African HIV/Tuberculosis Investment case has included partial funding for child-focused cash transfers and school feeding, among others, even though these would be implemented in other non-HIV sectors [49].

## Challenges and Areas for Future Research

At its core, any cofinancing approach requires a clear identification of a range of intervention outcomes and the sectoral payers benefiting from the intervention. The second US panel's recommendation of a multisectoral impact inventory can be highly

useful in this respect. It would provide analysts from other sectors the required information to support decisions on what they may be willing to pay for "their" share of benefits generated by a health intervention, and it would encourage those within the health sector to explore cofinancing arrangements to enable such transfers. The same would be true for nonhealth interventions. For example, in low- and middle-income settings, in which resources may not be sufficient to cover large-scale social programs such as universal primary education, analytical and institutional approaches that do not highlight and value multiple benefits may have particularly high opportunity costs.

Cofinancing also requires changes in public finance mechanisms to ensure that interventions can be funded from different sectors. Although Claxton et al. [13] demonstrated that public health interventions with multisectoral costs and benefits should be funded if other sectors could compensate the implementing sector *in principle*, in practice this compensation would need to be real and a mechanism would need to be in place to allow for it. Moreover, it is worth noting that while we simplified each sector to a single payer, there are likely to be more payers with similar objectives, but separate budget constraints. In low- and middle-income countries, for example, where there is significant external development assistance for health, there would be separate health payers, namely, a national public payer and donors, each with their own thresholds. Even within government, it may be relevant to consider the various levels of resource allocation, especially where local governments are increasingly managing decentralized and often unearmarked budgets [34,50].

Capturing and measuring multiple program outcomes is a significant challenge given data scarcity, with many evaluations of global health interventions focusing on within-sector primary outcomes, rather than exploring a range of sectoral outcomes. It would also come at a cost, and would be warranted in as far as the additional nonhealth consequences are significant enough to affect the results of the analysis, as has been recommended in the second US panel [36]. In addition, the cofinancing approach requires the determination of thresholds for different sectors in order to estimate each payer's potential contribution [43]. The application of thresholds varies by sector, with some having cost-effectiveness thresholds and others adopting cost-benefit approaches [29]. Two empirical approaches are presently being explored in health and could be applied to other sectors. The first approach is to search for this threshold through econometric analyses of health care expenditures and health outcomes to estimate marginal productivity [9]. The other approach is to search for the threshold by identifying the least cost-effective intervention included in the package and the most cost-effective intervention excluded, on the basis of published literature [38]. Although both approaches are promising, they require substantial data, and may be difficult to apply in some sectors with less developed economic evaluation frameworks, and where a critical mass of economic evaluations is not available [29,51,52].

Given the importance of financing multisectoral interventions, analysts may also consider using more pragmatic approaches to estimate these thresholds, possibly exploring willingness-to-pay (WTP) elicitation from decision makers, and expert-informed threshold searching. Eliciting decision makers' WTP for a gain in a unit of outcome from the production of a service requires the assumption that this is their best estimate of the opportunity cost. Nevertheless, such a measure is likely to incorporate more than the criterion of efficiency, and may be higher than the marginal productivity of the existing service package, because decision makers will have imperfect information, and would rightly have other criteria that determine their WTP in practice, such as equity [53,54]. Their estimate of WTP is at best likely to conflate these aims, and thus overestimate the threshold, or be more aspirational [7]. Another potentially more promising approach would be to use decision makers as experts to identify the perceived least efficient intervention they are currently implementing, and the most efficient intervention they are not implementing, as a starting point, and then review evidence on their cost-effectiveness. Nevertheless, both these methods need further exploration and validation against the range of empirical approaches currently being developed.

## Conclusions

Good health is a function of a range of biological, environmental, behavioral, and social factors. The consumption of quality health care services is only a part of how good health is produced. Although few would argue with this, the economic framework used to allocate resources to optimize population health is applied in a way that constrains the analyst and the decision maker to health care services. As a result, lives and quality of life may be lost. We propose a second best approach to decision rules for health-producing interventions in nonhealth sectors, and public health interventions with multisectoral effects, that could bring a health decision maker closer to maximizing population health in general, rather than through health care alone. This would require the health payer to cofinance such interventions with other sectors, on the basis of its cost-effectiveness threshold. Likewise, other sectors would determine how much to contribute toward such an intervention, given the present marginal productivity of their budgets.

The cofinancing approach is embedded in the prevailing extrawelfarist framework of health economic evaluation. It does not fundamentally question the framework but provides a theoretically consistent mechanism to bridge the health evaluative space with other evaluative spaces, thereby going beyond a single health outcome to bring allocations closer to the general equilibrium that is sought in a welfarist framework. It fully aligns with the decision maker's perspective, whereby the focus is on societal objectives (such as population health) rather than on aggregate individual utility [12,14,15,53].

Nevertheless, the data and analytical demands of estimating cost-effectiveness thresholds across multiple payers may hamper the realization of such an efficiency-enhancing cofinancing mechanism. Further research is called for to test and validate various measurement approaches, to support the optimal allocation of resources to global multisectoral and public health interventions going forward.

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