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## Common Goods for Health: Economic Rationale and Tools for Prioritization

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## Research Article

# Common Goods for Health: Economic Rationale and Tools for Prioritization

Sylvestre Gaudin <sup>1</sup>, Peter C. Smith<sup>2,3,\*</sup>, Agnès Soucat <sup>4</sup>, and Abdo S. Yazbeck<sup>5</sup>

<sup>1</sup>Department of Economics, Oberlin College, Oberlin, OH, USA

<sup>2</sup>Imperial College Business School, London, UK

<sup>3</sup>Centre for Health Economics, University of York, York, UK

<sup>4</sup>Director for Health Systems, Governance and Financing, World Health Organization, Geneva, Switzerland

<sup>5</sup>Department of International Health, Johns Hopkins University, Baltimore, MD, USA

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\*Correspondence to: Peter C. Smith; Email: [peter.smith@imperial.ac.uk](mailto:peter.smith@imperial.ac.uk)  
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**Abstract**—This paper presents the economic rationale for treating Common Goods for Health (CGH) as priorities for public intervention. We use the concept of market failure as a central argument for identifying CGH and apply cost-effectiveness analysis (CEA) as a normative tool to prioritize CGH interventions in public finance decisions. We show that CGH are consistent with traditional lists of public health core functions but cannot be identified separately from non-CGH activities in such lists. We propose a public finance decision tree, adapted from existing health economics tools, to identify CGH activities within the set of cost-effective interventions for the health sector. We test the framework by applying it to the 2018 Disease Control Priority (DCP) list of interventions recommended for public funding and find that less than 10% of cost-effective interventions unconditionally qualify as CGH, while another two-thirds may or may not qualify depending on context and form. We conclude that while CEA can be used as a tool to prioritize CGH, the scarcity of such analyses for CGH interventions may be partly responsible for the lack of priority given to them. We encourage further research to address methodological and resource challenges to assessing the cost-effectiveness of CGH intervention packages, in particular those involving large investments and long-term benefits.

## INTRODUCTION

In this series of papers, the concept of Common Goods for Health (CGH) is proposed as a new construct born out of the observed failures exposed by Ebola, SARS, Zika, and other communicable diseases (CD) as well as by other health and environmental risk factors explored further in this special issue. The previous article in the special issue (by Yazbeck and Soucat) defined CGH as a cluster of feasible

interventions exhibiting two fundamental characteristics: (i) market failures due to their public good nature or the large health externalities they generate; and (ii) strong potential impact on human life.<sup>1</sup> It explained the need to adequately recognize and finance such services, which are historically underfunded within the health sector, exposing human life to large avoidable losses.

The purpose of this paper is to set out the rationale for public funding of CGH based on economic principles, and to provide a normative framework, based on standard economic tools, that can be used to identify and prioritize CGH. The framework is applied to existing public health and disease control priority lists to understand the extent to which CGH are included in these lists and potentially prioritized for funding. Of course, we do not claim that the economic perspective is the only legitimate way of framing CGH. Rather, we examine the consequences of adopting a normative economic approach towards prioritization, acknowledging that many other perspectives—as reflected in the other papers in this series—are likely to influence real-world decisions.

We first introduce the basic economic rationale for funding CGH with public funds and discuss how cost-effectiveness analysis (CEA) can be used to establish public financing priorities. The next section examines the extent to which CGH are included in existing public health frameworks and whether such frameworks are capable of distinguishing between CGH and non-CGH interventions to establish funding priorities. An empirical section then presents a public health financing decision tool and applies it to the list of cost-effective interventions in the latest edition of *Disease Control Priorities* (DCP3).<sup>2</sup> The concluding section discusses the limitations of the analysis and proposes some directions for future work.

## FUNDING CGH, THE ECONOMIC RATIONALE

Public finance principles provide a case for prioritizing public actions and resources based on the notion of market failures (i.e. conditions under which conventional markets fail to produce socially optimal levels of a good or service).<sup>a,3</sup> The concept of market failure has been commonly used to argue for public financing in the health sector.<sup>4-6</sup>

By focusing on market failure in our definition of CGH, we do not mean to suggest that non-CGH services should be provided by a conventional market. Other arguments beyond market failure, such as issues of equity and the distribution of

power and wealth, offer compelling reasons for not relying on conventional markets to provide personal health services. Indeed, these concerns are a central focus of universal health coverage (UHC), which has the effect of redistributing resources from the rich and the healthy to the poor and the sick. Such considerations are a core objective for all governments but lie outside the definition of CGHs and therefore the scope of this paper. We also do not consider market failures that arise under any form of health insurance, whether publicly or privately financed, for example, in the form of moral hazard and adverse selection. Health insurance market failures relate largely to personal services, putting them outside the scope of this paper and the special issue overall.

To understand the role that the concept of market failure plays in defining CGH, it is useful to review the principal mechanisms that lead to such failures. Market failures are usually discussed under four broad headings<sup>3</sup>:

**Public goods:** In the purest form, public goods are defined as goods or services for which utilization is “non-rival” (one person’s use does not reduce use by others) and from which users cannot be excluded (regardless of whether or not they have contributed financially).

**Externalities:** Some of the benefits (or costs) of the service extend beyond the immediate user, but are not reflected in the price of the service to the user.

**Information asymmetries:** Potential users do not have access to relevant information that would help them make optimal use of the service.

**Natural monopoly:** High fixed costs, relative to the size of the market, mean that provision by a single entity is more efficient than by multiple producers.

These characteristics give rise to a “market failure” because a good or service that would be socially beneficial is either not provided or is under-provided by a natural market mechanism. In each case, and particularly when large numbers of individuals are concerned, some form of government intervention is often necessary to offset the market failure in order to maximize social welfare.<sup>7,8</sup> This intervention might take the form of direct service provision, a financial subsidy to either the supply side or the demand side, or some sort of regulation.<sup>3,9,10</sup>

The definition of CGH focuses on market failures that arise from public goods and large externalities, but this does not mean that the other types of failures are ignored. In fact, all of the categories of market failure presented above have relevance to CGHs given that the intervention needed to correct the failure is usually some sort of government action, such as information provision, taxation or regulation.

In their purest form, public goods have two characteristics that are likely to induce market failure: non-rivalry in consumption and non-excludability.<sup>9,11</sup> Non-rivalry describes when consumption by one person does not reduce availability to others; for example, information provision is often non-rival, as consumption of information rarely depletes its availability for other users. Exclusion is the ability to restrict consumption, as through some rule of entitlement or charge; for example, the reduction of air pollution in a city can usually be enjoyed by all citizens regardless of their circumstances, and is therefore non-excludable. If a good is non-rival and it is impossible to exclude users whether or not they have contributed to its finance, it is a pure public good.<sup>b</sup> In practice, both characteristics exist on a spectrum and are not strictly binary in nature.<sup>3</sup> Market failures associated with some aspects of the two characteristics typically affect many goods and services that are only partially rival and/or excludable. The notion of public goods is therefore generally extended to include goods and services that feature low levels of rivalry or excludability.<sup>12</sup>

A fundamental reason why public goods are not provided in an optimal form by a conventional market is the capacity for “free riding” by users, in that utilization is possible without payment. On the demand side, this means that potential users may be reluctant to voluntarily fund the service if they know they or others can free ride on its provision. Suppliers, in turn, will be reluctant to provide such services unless they can be assured of adequate revenues from independent sources, such as governments or external donor funds.

The issue of free riding becomes particularly relevant when it comes to financing global CGH that involve costs and benefits reaching beyond national borders (see articles by Yamey and colleagues as well as Lo and colleagues in this special issue for examples).<sup>13,14</sup> Beyond free riding, and even in cases when exclusion is feasible, the non-rival or quasi non-rival nature of a public good often renders exclusion inefficient, since additional benefits can be gained at no additional cost.<sup>3</sup>

While empirical evidence indicates that markets are in fact capable of providing some public goods, regulatory and legal environments need to be favorable and private benefits (including indirect benefits) need to be sufficiently large to justify private investment.<sup>15(pp424-425)</sup>

In the health sector, interventions that may be characterized as public goods include: regulation and oversight of markets, knowledge development (including medical

research and development of protocols), disease surveillance, and information dissemination. Many of these public good interventions are in fact aimed at addressing market failures, most notably information failures and imperfect competition. Information failures are responsible for inadequate supply of and/or demand for many private goods and services in the health sector. The typical public policy response to such information failures is not to finance provision but rather to address the information gap. This may be done through activities such as health promotion campaigns, compulsory labeling, maintenance of public information sites, and public reporting of provider performance, all of which are government-supported interventions that potentially qualify under the CGH criteria. Similarly, government interventions aimed to correct market failures from natural monopolies are also potential CGH candidates. Through proper regulation and oversight, governments can ensure that a monopoly does not restrict access through high prices and produces high-quality products in spite of the lack of competitive pressure.

Externalities arise when an individual's decision as to whether or not to use a service fails to take account of the broader social consequences of that decision, whether positive (beneficial) or negative (harmful). Externalities lead to a market failure because private demand/supply takes into account only private benefits. By ignoring the broader social consequences of private decisions, externalities lead to under- or over-provision from a social welfare perspective. The most obvious examples of externalities in the health sector relate to decisions concerning the prevention or early treatment of an infectious disease that may provide additional benefits to broader society, in the form of reduced spread of infection, as well as creating benefits for the individual being treated. Another example is smoking, which gives rise to a negative externality through the health effects of passive smoking. Externalities often occur in relation to personal goods or services, and policy responses are therefore directed towards changing private consumption decisions.

As in the case of public goods, market failures arising from large externalities can be addressed through a variety or combination of public policy instruments, including financing, delivery, taxation, subsidies, mandates, information, and behavior change interventions. A typical policy instrument in the presence of externalities is the use of taxation (e.g., tobacco taxes) or financial subsidies (e.g. financing contraception patches). However, technical feasibility and the availability of cost-effective interventions may constrain public sector responses.

## ESTABLISHING FUNDING PRIORITIES USING ECONOMIC TOOLS: COST-EFFECTIVENESS

To inform whether or not to take public action on a market failure, and what form that action should take, economists developed the tool of cost-benefit analysis (CBA).<sup>17,18</sup> CBA seeks to determine whether the aggregate social benefits of implementing an intervention outweigh the aggregate social costs. If so, society would in principle wish to implement the intervention in question. In practice, it has proved immensely challenging to make CBA operational, because of the complexities of tracking all the social consequences of a planned course of action and expressing all costs and benefits in a common metric (usually money). The latter is particularly difficult, controversial, and subject to wide variations when valuing health gains. Health economists have therefore developed cost-effectiveness analysis (CEA) as a more practical normative tool for comparing alternative uses of available funds within the publicly funded health sector.<sup>19</sup>

CEA is particularly relevant when the sector is seeking to optimize the use of resources subject to a fixed budget constraint. It assumes the primary goal of the health system is to improve health, and therefore seeks to promote the maximization of health improvement with available funds. CEA usually takes the form of a performance measure—such as cost per disability-adjusted life year (DALY)—that enables comparison of radically different uses of health-sector funds using a uniform cost-effectiveness (CE) metric. It is also possible to augment CE calculations with distributional considerations, using approaches such as extended cost-effectiveness analysis, which disaggregates the costs and benefits of an intervention by social group.<sup>20</sup>

In principle, all uses of health system funds can be ranked using the chosen CE metric in order to identify the best use of limited funds. However, that is usually infeasible given uncertainty and ranges in CE estimates and cross-country heterogeneity. Economists, therefore, recommend that CE estimates for any proposed new intervention should be gauged against a country-specific CE “threshold” that depends on the given health system’s resources. The CE threshold, in theory, indicates the opportunity cost of alternative uses of health-sector funds at the margin; projects with a CE ratio (such as cost per DALY saved) below the prevailing CE threshold should be accepted for implementation. The threshold levels in low- and middle-income countries (LMICs) are likely to be much lower than those enjoyed by high-income countries because of the lower levels of funds available, although estimation of operational threshold levels has hitherto proved challenging.<sup>21</sup>

In all decisions based on cost-effectiveness, additional contextual factors must also be considered, as part of a properly informed deliberative process. But from a public finance perspective, cost-effectiveness is a coherent theoretical criterion for guiding priorities for the use of public health system funds. Note that the CE criterion can also readily be applied to intersectoral projects. From a health system perspective, the important consideration for such projects remains whether the *health* benefits secured are sufficient given the opportunity costs *to the health system*, regardless of costs and benefits that accrue to other sectors.<sup>22</sup>

## ARE CGH INCLUDED AND PRIORITIZED AS CORE PUBLIC HEALTH FUNCTIONS?

In addition to public finance economics, the field of public health has provided significant guidance to help countries prioritize actions within the health sector in ways that are consistent with the societal goal of maximizing welfare. However, unlike in economics, a public health approach is not derived through conceptual first principles. Instead, public health relies on a combination of empiricism and expert opinion to produce lists of critical functions focused on collective and individual responsibilities in the service of social justice and population health. We examine in this section the extent to which a public health approach is compatible with consideration of CGH.

A variety of lists of core public health functions, and the corresponding responsible actors, have been published by different organizations. (Martin-Moreno and colleagues give a compendium of lists developed worldwide between 1994 and 2015 for use in public policy).<sup>23(pp339–40)</sup> Recent efforts sought to combine these lists into a single international standard, but to date, none has secured complete agreement.<sup>16,24</sup> While the lists may differ in the specific actions and activities they include or in the way these actions are clustered, the criteria for inclusion are generally based on common broad principles, including collective responsibility, whole population coverage, prevention orientation, socioeconomic determinants and risk factors, multisectoral drivers and approaches, and partnerships with the population.<sup>25,27</sup>

Wagstaff and Claeson’s synthesis of different lists resulted in a list of public health responsibilities and core functions that has the advantage of being comprehensive yet compact.<sup>6</sup> It is presented in Table 1 with examples of notable CGH and non-CGH interventions for each core function. All major CGH interventions highlighted in this special issue fit within the categories of core public health functions. A few of the actions noted (namely those related to information, water,



Core public health functions	Actions/Activities included	Notable CGH	Non-CGH examples
1. Policy development	<ul style="list-style-type: none"> <li>Public health regulation and enforcement.</li> <li>Evaluation and promotion of equitable access to necessary health services.</li> <li>Assurance of the quality of personal and population-based health services.</li> <li>Health policy formulation and planning.</li> <li>Financing and management of health services.</li> <li>Pharmaceutical policy, regulation, and enforcement.</li> </ul>	<ul style="list-style-type: none"> <li>Health security and environmental risk national policies and strategies</li> <li>Market signals through health taxes</li> <li>Planning and management of emergency response</li> <li>Health Technology Assessment</li> </ul>	<ul style="list-style-type: none"> <li>Provider payments policy</li> <li>Digital health policy</li> </ul>
2. Collection and dissemination of evidence for public health policies/strategies/actions	<ul style="list-style-type: none"> <li>Health situation monitoring and analysis.</li> <li>Research, development, and implementation of innovative public health solutions.</li> <li>Provision of information to consumers, providers, policymakers, and financiers.</li> <li>Health information and management systems.</li> <li>Research and evaluation.</li> </ul>	<ul style="list-style-type: none"> <li>Disease surveillance</li> <li>Risk surveillance including antimicrobial resistance (AMR), chemicals and radiation, etc.</li> <li>Human and animal disease, environmental, and risk (e.g. AMR, chemicals and radiation) surveillance</li> <li>Research, communication and dissemination</li> </ul>	<ul style="list-style-type: none"> <li>Actuarial monitoring</li> </ul>
3. Prevention and control of disease	<ul style="list-style-type: none"> <li>Surveillance and control of risks and damages in public health.</li> <li>Management of communicable and non-communicable diseases.</li> <li>Health promotion.</li> <li>Behavior change interventions for disease prevention and control.</li> <li>Social participation and empowerment of citizens in health.</li> <li>Lessening of the impact of emergencies and disasters on health.</li> </ul>	<ul style="list-style-type: none"> <li>Sewage treatment and control</li> <li>Vaccination</li> <li>Vector control</li> <li>Regulation of safety of medicines and medical devices</li> <li>Medical and solid waste management</li> <li>Information</li> <li>Community engagement</li> </ul>	<ul style="list-style-type: none"> <li>Personal hygiene</li> <li>Self-care</li> <li>Production of manufactured products</li> </ul>
4. Intersectoral action for better health	<ul style="list-style-type: none"> <li>Environmental protection and health, including road safety, indoor air pollution, water and sanitation and disease vector control in infrastructure, management of medical wastes, tobacco legislation, school health, and education.</li> </ul>	<ul style="list-style-type: none"> <li>Regulation of roads, energy and food systems</li> <li>Coordination and planning of emergency response</li> <li>Environmental regulations and guidelines (e.g. for biodiversity and water and air quality)</li> <li>Land use and city planning for better health</li> </ul>	<ul style="list-style-type: none"> <li>Production and provision of healthy food</li> <li>Management of water adduction</li> </ul>
5. Human resource development/capacity building for public health	<ul style="list-style-type: none"> <li>Development of policy, planning, and managerial capacity.</li> <li>Human resources development and training in public health.</li> <li>Community capacity building.</li> </ul>	<ul style="list-style-type: none"> <li>Accreditation of health facilities and providers</li> <li>Development of protocols and best practice related to CGH activities</li> <li>Capacity building related to CGH</li> </ul>	<ul style="list-style-type: none"> <li>Training related to non-CGH activities</li> <li>Incentives for provision of individual services</li> </ul>

First two columns adapted from Table 8.1<sup>6(p133)</sup>

**TABLE 1.** Examples of CGH and Non-CGH Interventions in Public Health Core Functions

and air quality) are almost pure public goods. Others have very large externalities and therefore also need to be considered when prioritizing public sector actions to promote health. What becomes clear is that CGH, including

intersectoral actions such as environmental regulation, are embraced by the conventional core public health functions framework, and therefore should in principle be included among options for action by decision makers.

However, the fact that CGH are indeed included as core public health functions does not imply that they are successfully prioritized. Table 1 gives examples of non-CGH interventions under different core public health functions. Many of these are essential governmental functions but do not exhibit the public good or externality characteristics of CGHs; thus they do not suffer from the same risk of inadequate prioritization. Given that there is no specific tool to prioritize across or within core functions in the public health framework, it may, therefore, be the case that CGH interventions do not fare well when they compete with non-CGH interventions in budget processes. In fact, the concept of core public health functions has become very broad, including all functions that the public health community sees as the role of governments in early twenty-first century systems. This role has broadly become synonymous with expanding health coverage for all as part of the UHC agenda. As demand has increased for broad-based public financing of personal UHC services, CGH have not always remained as priorities.

One way to ensure that CGH fare better in the competition for public funding is to combine public health frameworks with public economics principles. Since public economics allows us to be selective in the types of market failures that are most relevant for CGH (namely public goods and large externalities), it can serve the objective of priority setting more effectively than working only with core public health functions. Specifically, we can start with larger lists of core public health functions or interventions considered for public funding; then identify CGH activities within the applicable list and separate them from non-CGH activities (as is done in Table 1); and finally, prioritize within CGH interventions (or packages of interventions to address CGH) using CEA tools. This is demonstrated in the next section.

### APPLYING THE PUBLIC FINANCE DECISION FRAMEWORK TO IDENTIFY CGH INTERVENTIONS

We propose a modification of Musgrove's public finance decision framework for health to separate CGH interventions from other public health priorities.<sup>28</sup> We then apply the modified framework to a widely disseminated list of interventions recommended for public funding in order to assess the importance of CGH in such lists. The exercise also highlights some grey areas that may motivate future refinements of the framework to improve its practical application.

We focus on specific interventions rather than broader public health functions for practical reasons. In principle, we would wish to evaluate the entire portfolio of interventions

provided within a function, rather than individual interventions, because the benefits and, more importantly, the costs of a proposed intervention may be highly dependent on the public health infrastructure already in place. However, CEA has hitherto found such evaluation challenging and research has only recently offered practical tools for adopting a functional approach to evaluation.<sup>29</sup>

### Transforming Musgrove's Decision Tree to Focus on CGH

Musgrove proposed a practical framework to assess whether an intervention qualifies for public sector financing based on nine criteria grouped in three categories: (i) economic efficiency (public goods, externalities, catastrophic cost, and cost-effectiveness); (ii) ethics (poverty, horizontal and vertical equity, and the rule of rescue); and (iii) political (what people collectively want).<sup>28</sup> Our question is whether the market failure criteria can be examined independently of the welfare and equity impacts of private provision; this is indeed possible using Musgrove's decision tree since conditions related to catastrophic costs (individual welfare issue) and poverty status of beneficiaries (equity issue, rule of rescue) come into consideration only after it has been established that there are no significant externalities.<sup>c</sup> A simplified Musgrove tree may thus be used to sort through activities considered for public financing on the grounds that the market fails to produce the socially optimal outcome (Figure 1).

The identification of CGH interventions for public financing requires careful consideration of all relevant features of the interventions, namely: whether it fits under the qualification of public or quasi-public good (social good); whether it permits the realization of large social externalities (in particular, it needs to provide benefits to a significant number of people beyond the person who directly benefits from the intervention); whether the expected effect on human health is large; and whether greater health benefits could be obtained using more cost-effective interventions. As discussed earlier, the fundamental rationale for using CEA when establishing funding priorities is to prevent less cost-effective interventions from squeezing out more cost-effective ones. If less cost-effective interventions are funded, the aggregate benefits to human health are lower than the alternative use of funds. For this reason, Musgrove's decision tree places the CE criterion as the overarching normative hurdle in the decision process.

In order to allow prioritization based on cost-effectiveness, one needs to examine interventions starting from the most cost-effective. Considering cost-effectiveness



upfront is important if we consider that costs and benefits are country-specific. Thus the set of cost-effective interventions that can be implemented in a given country will always be specific to the health system under scrutiny and the aggregate amount of funding it has available. Figure 2 summarizes the methodology that we use to identify and prioritize CGH within the list of cost-effective interventions for health.<sup>d</sup>

Because implementation of CEA requires considerable data, skills, and time, individual countries and donors generally depend on the availability of international research to evaluate the health benefits and costs associated with interventions examined for public funding. Several international organizations and national institutions have engaged in providing publicly available CEA estimates, either by producing new estimates or reviewing and compiling results from academic research worldwide. WHO has assembled CE evidence to identify “best-buy” interventions for non-communicable diseases (NCDs) and to build an investment case for public health preventive activities.<sup>30,31</sup> The OECD has reviewed cost and benefits of policies to address environmental health issues.<sup>26</sup> And the UK’s National Institute for Health Care Excellence has compiled CE analysis results for all interventions in its guidelines.<sup>32</sup> However, the most comprehensive lists of recommended health interventions

suitable for countries of different income levels based on CE estimates are in reports produced by the DCP network.<sup>33</sup> Such lists of cost-effective interventions compiled from international evidence are themselves global public goods that may be used as evidence to argue for public funding of health-sector interventions at the national level. These lists could, therefore, be used as a tool to promote investment in CGH. In the following section, we assess the extent and importance of CGH in the current version of the DCP, the DCP3.

**Identifying CGH in the DCP3 List of Interventions with CE Estimates**

We apply the methodology described above to the latest DCP3 list of recommended health-sector interventions.<sup>34,35</sup> We chose the list of interventions with CE estimates (ref. 1, ch. 7) rather than the longer list of essential UHC interventions (ref. 1, ch. 3) because the latter does not include CEA estimates, which we have argued are central in public financing decision and prioritization processes. The DCP3 list is selected over other lists of cost-effective interventions (e.g. WHO-Choice) because it is the most recent, most comprehensive, and provides comparable CE estimates across interventions and disease categories. The DCP3 list is used as

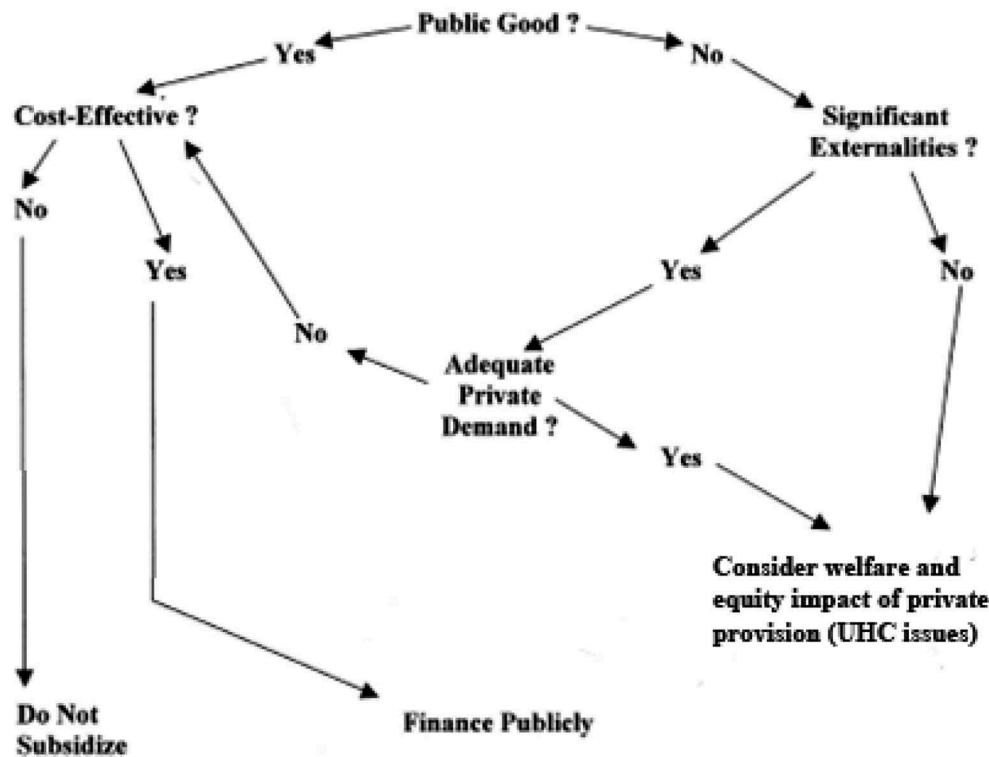
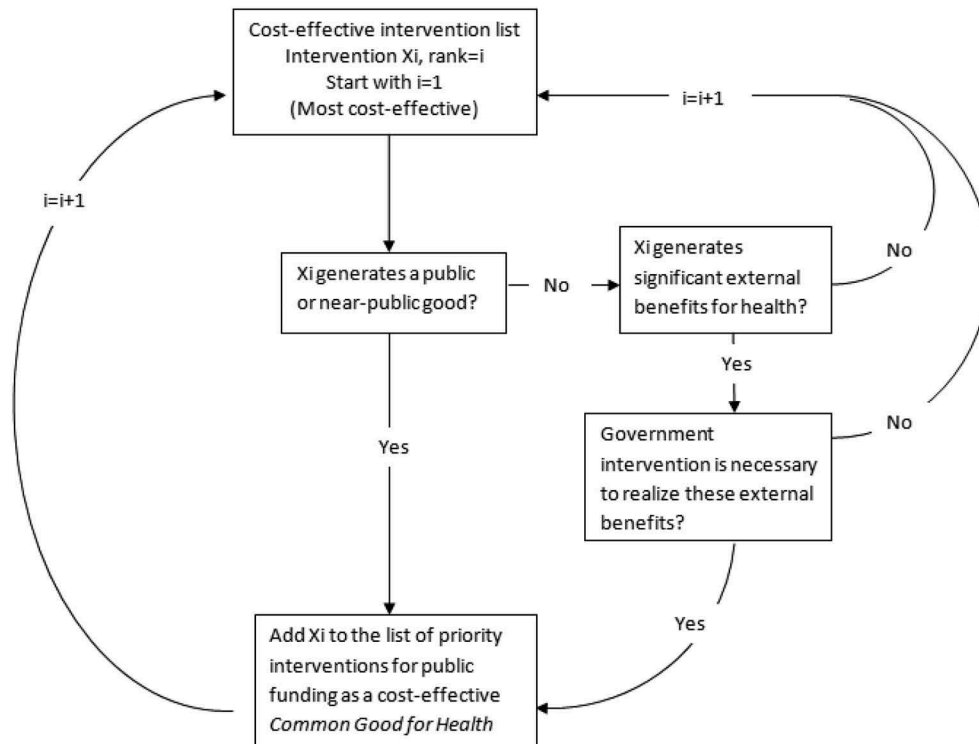


FIGURE 1. Simplified Decision Tree to Inform the Decision on Financing CGH. Adapted from Musgrove (1999) with permission<sup>28</sup>



**FIGURE 2.** Decision Diagram to Extract CGH from Lists of Cost-Effective Health-Sector Interventions

a way to work through specific examples and document the extent of CGH covered by current evidence, rather than as a means to create a new ranking of cost-effective interventions to be used in decision-making. Indeed, there are important limitations, highlighted in the DCP3 report, concerning how the interventions are selected. For example, CEAs carried out for the international community may not be directly transferable to a particular country context given that costs and benefits vary across countries with varied input prices, health risks, existing infrastructure, etc.

DCP3 examined interventions to cover six disease areas. Their CE estimates are based on 149 published studies checked for quality. A total of 93 interventions are included in the DCP3 list but some differ only because different contexts yield different CE estimates. After removing such duplicates, we are left with 88 “unique” interventions (a few are still similar but involve different comparators as opposed to the “do-nothing” alternative).

In order to demonstrate the breadth of potential CGH, each intervention is identified by disease category and by the function it serves in health systems and policy. The comparators used to establish CE estimates are clearly identified when they are not “do nothing.”<sup>e</sup> We then identify whether the intervention fits under the public good definition or whether it is likely to realize significant health and non-

health externalities. When designation as CGH depends on contextual factors or on a specific form of the intervention, we term such restrictions “qualifiers.” Depending on these and the reported range of CE estimates, the intervention is designated as either qualifying, not qualifying or possibly qualifying as a cost-effective CGH intervention. Appendix 1 (online supplement) includes descriptions of the 88 interventions examined and provides details about the application of the methodology, including some notes and questions for discussion on the fundamental characteristics of CGH.

The designation of “public good” was usually assigned to interventions related to improving legislation (in particular when the improvements aim to facilitate private provision and reduce market failures such as information failures), most knowledge development and dissemination (including the development of guidelines and protocols), broad behavior change communications and outdoor vector control activities (such as spraying insecticides and improving water infrastructure).

The presence of significant health externalities (large social benefits) included interventions for control of CD (in endemic situations), some worker development (training), and education and knowledge dissemination activities. In determining whether an intervention qualified as CGH under the “large externality” criterion, we questioned

whether the benefits generated would extend to others well beyond the direct recipient. For example, when considering treating water, there are possible interventions at the level of the community and at the level of homes. The intervention “Household water treatment in LICs,” included in DCP3 as a cost-effective intervention for children (Figure 7.4 in Horton, 2018),<sup>35</sup> is described as chlorination for safe drinking water. Personal water systems are generally restricted to use by one household, with few immediate externalities, so it is defined as a private good that may qualify for public financing on poverty/equity grounds but not as CGH. On the other hand, building or upgrading a community rural or urban water system, also included in the same list, qualifies as a cost-effective CGH intervention.

Restrictions placed on the designation as CGH (qualifiers) are presented in Table A1 (online supplement). CGH qualifiers are either context-specific or relate to the form in which the intervention is delivered. Most qualifiers are based on the size of the externality as it relates to a country’s specific situation, in particular for CDs, where the large externality only applies to endemic countries. Qualifiers were also recorded when an intervention could not be clearly classified as CE, in particular when CE estimates were calculated on restricted samples and/or were difficult to transfer to other areas.

Beyond CGH, we identified some interventions worth highlighting for consideration by other sectors or in cross-sectoral funding based on large external benefits generated in sectors outside of health and not considered in the CE denominator (a “DALYs-saved” metric). Examples of externalities outside health include labor market/trade effects, environmental externalities, rural development issues (through outreach), security, and population externalities. (Population externalities include creating an environment conducive to child-bearing or/and population control, an area that is strongly connected to the health sector.) Treatment of externalities beyond the health system lies outside the scope of this paper, but may be an important contextual factor to consider alongside CE evidence. Lo and colleague’s paper in this series highlights connections between health and the environment that illustrate some of the issues raised when there are cross-sectoral externalities.<sup>14</sup>

Results

Overall, we find that 62 (70%) of the 88 interventions recommended by DCP3 for public funding based on CE are public goods or may generate large benefits beyond the recipient of the intervention. They are therefore potentially designated as CGH, although only seven of these qualify

unconditionally in all contexts and forms (see Table A1 in online supplement for a list of designated interventions). The remaining 26 interventions (30%) are clearly not CGH, and so public funding for these interventions should be examined solely on individual welfare/equity considerations.

*By disease category:* More than one-half of the interventions listed in the DCP3 CE list concern CDs, about 30% concern NCDs and 15% are specifically directed to maternal and child health (MCH) (see Table 2). A large majority (80%) of interventions that were designated potential CGH are for CD interventions. Most of these CD interventions were placed in the conditional category with restrictions, generally based on epidemiological factors that determine the size of the externality in a given country at a given time. All interventions under this category qualify as CGH in endemic countries or in emergency response situations.

Notable interventions that passed the CGH test for NCDs include legislation/regulation and other control activities related to tobacco, food ads, and labeling, and the development of protocols and guidelines to promote the prevention of hypertension and heart disease. In the MCH category, CGH interventions include the development of guidelines and kits, knowledge development (training and education programs), and hygiene and nutrition activities.

*By health function.* Table 3 shows interventions organized by Essential Public Health Operations (EPHO) as produced by WHO for the European region in 2014.<sup>36</sup> The EPHO framework is more detailed than the one used in Table 1 as it separates service delivery functions from the intelligence and enabling functions; the latter two categories are most likely to include public goods as defined in this paper. Out of the 26 interventions in the DCP3 that

	Total in DCP3 CE list	Cost- effective CGH	CGH with qualifiers (a)	Clearly not CGH
Communicable Diseases (b)	49	3	46	0
Mother and Child Health (specific)	13	3	5	5
Non- Communicable Diseases	26	1	4	21

(a)All types of qualifiers are considered including those linked to CE estimates. The category includes 19 CD interventions that are cost-effective CGH in endemic countries only (without other qualifiers).

(b)Interventions to prevent mother-to-child transmission of CDs are included in CDs.

TABLE 2. CGHs in the DCP3<sup>2</sup> List of Cost-Effective Interventions by Broad Disease Categories

			Total in DCP3 CE list <sup>(a)</sup>	Cost effective CGH	CGH with qualifiers <sup>(b)</sup>	Clearly not CGH
Core Functions	Intelligence	EPHO-1: Surveillance	0	n/a	n/a	n/a
		EPHO-2: Monitoring, Preparedness & Response	0	n/a	n/a	n/a
Enablers	Service Delivery	EPHO-3: Protection	19	4	15	0
		EPHO-4: Promotion	14	2	12	0
	EPHO-5: Disease Prevention	56	6	40	10	
	EPHO-6: Governance	0	n/a	n/a	n/a	
	EPHO-7: Workforce	2	1	1	0	
	EPHO-8: Funding	0	n/a	n/a	n/a	
	EPHO-9: Communication	1	0	1	0	
	EPHO-10: Research	1	1	0	0	
	Not EPHO	Health Care	20	0	2	18

(a) One intervention may include elements that fit under multiple categories, explaining why totals exceed 88. Interventions classified as prevention include tertiary prevention that generally did not qualify as CGH.

(b) All types of qualifiers are considered, including those linked to CE estimates.

**TABLE 3.** CGHs in the DCP3<sup>2</sup> List of Cost-Effective Interventions by EPHO Health Functions<sup>36</sup>

clearly did not qualify as CGH, 16 were related to treatment and therefore also do not fit into EPHO categories, while 10 included some element of prevention. As described above, over half of the interventions considered included some aspect of disease prevention and 70% were designated CGH with some qualifiers. We note the absence of obvious CGH in the DCP3 list, in particular in Intelligence functions (Surveillance and Monitoring, Preparedness & Response) and Enablers (particularly Governance activities). This is due in part to the fact that the CE list depends on the types of interventions chosen for conducting CEA in the first place. Given the cost of CEA studies, they are not usually considered necessary for either obvious public goods or activities that are traditionally financed in the public health sector. Nevertheless, the lack of CEA studies does not fully explain their absence, particularly if we consider that the longer list of essential UHC interventions in chapter 3 of the DCP3, which is not limited to those for which CE estimates are available, is also dominated by service delivery interventions.<sup>2</sup>

*By income group.* Given the limited funds available in LICs, it is often not feasible to fund all interventions that would be cost-effective in higher income countries. As explained earlier, an intervention is CE in a specific country setting only if its cost-effectiveness ratio lies on or below that country's CE threshold. Out of the 62 interventions that we found to be potentially cost-effective CGH, 7 are highly unlikely to qualify as CE in LMICs and another 8 (making a total of 15) may not qualify in LICs based on income-group-specific CE thresholds. Examples of interventions

that qualify as CGH in higher income countries but may not be recommended for implementation in LMICs based on income-specific CE thresholds are: vector control interventions for Dengue, online sex education to prevent sexually transmitted infections, and water supply/sanitation.

### Caveats and Lessons from the Exercise

Going through the list of specific interventions revealed that CGH boundaries are not always clear-cut. Classification difficulties can take a number of forms:

- uncertainty about the size of the externality;
- uncertainty about the nature of the externality, in particular, whether or not it principally affects the health sector;
- imprecision regarding the nature of the intervention, in particular in cases when a public good response could fully or partially resolve a market failure;
- uncertainty about secondary effects, in particular when public policy may disrupt partial provision through markets; and,
- uncertainties regarding cost-effectiveness.

Some of these uncertainties can be resolved only when the precise setting of the intervention is known. As this is an exploratory and illustrative paper, we have taken a pragmatic approach wherever necessary. However, some of these issues could be worth exploring further in subsequent work in order to delineate tighter boundaries for CGH.

Furthermore, as noted earlier, there may be many CGH that should be on our list but which are excluded for lack of CE data. Given the difficulty of measuring benefits for public goods and in cases of health externalities affecting large numbers of people, it is expected that CGH interventions are excluded simply because there is currently no relevant evidence on their cost-effectiveness.

Despite such grey areas, this exercise revealed that:

- CGH can indeed be found outside of CD control activities;
- most direct health-care-related activities remain outside the realm of CGH;
- for many non-CGH activities suffering from market failure, there exist CGH interventions that can remove the source of failure without recourse to direct provision/financing of the activity by the government;
- the context is important to determine whether an intervention is CGH or not (for example, CE is likely different depending on whether a disease is endemic in a country, whether the intervention occurs in an emergency response situation, and whether the country is severely resource-constrained);
- CE intervention lists cannot provide a comprehensive list of recommended CGH; and,
- many cost-effective interventions are not CGH.

## CONCLUDING COMMENTS

The Musgrove decision tree acknowledges that CGH are not the only areas in which public funding of healthcare secures welfare gains. However, the collective nature of such goods and services means that citizens and politicians may not fully appreciate the extent of the benefits they offer. CGH are especially vulnerable to being given low priority compared with health-care interventions for which the benefits are largely confined to the individual receiving the service. Yet by definition, CGH interventions generate large social benefits with strong potential impact on human health. Goods that are non-rival in consumption (such as disease surveillance) may generate such large impacts because the number of people who benefit from the intervention is large. Likewise, if social externalities are extensive, benefits may extend to large numbers of people beyond immediate consumers of the good or service.

Subject to the availability of relevant evidence, and provided that health benefits can be estimated across the whole population (beyond those directly receiving the intervention), CGH can be assessed using the same CEA criterion as is frequently applied to more personal health services. However, many potential CGH have not yet been subject to adequate CEA, and the existing lists of recommended interventions based on published CE estimates may in part be responsible for under-provision of CGH.

Although we have advocated the use of CEA for assessing CGH, it must be acknowledged that calculating CE metrics for CGH may be especially challenging given that the benefits of CGH are likely to be distributed across a large population and difficult to measure. For example, the incremental costs and health improvement associated with infectious disease control interventions will be highly dependent on local epidemiology, existing health services infrastructure, and context. Calculating such effects requires country-specific analyses; generating these may be an important role for donors and global health agencies. Furthermore, many CGH interventions, such as reducing risk factors for NCDs, may have long-term impacts across a wide range of diseases, introducing further methodological challenges. Increasing capacity for undertaking CEA for CGH should, therefore, be a high priority in LMICs.

Even if they are deemed cost-effective, many CGH involve considerable up-front investments in new infrastructure, information systems, service delivery platforms, and/or workforce training. These investment costs should in principle be amortized over the expected lifetime of the intervention; in practice, however, they may be a serious institutional constraint to implementation. Again, the funding of investment costs may be an important role for international donors.

Finally, this paper does not consider the political failure aspect of CGH funding; the issue of government failure in relation to CGH is discussed in the paper by Bump and colleagues in this special issue.<sup>37</sup> In fact, we have implicitly assumed that government intervention is capable of generating optimal allocations. Nevertheless, one needs to consider that market failures themselves may be an important reason for political failures. Politicians may not feel popular pressure to invest in CGH because voters do not perceive the benefits of CGH as clearly when compared to those of personal health services. This lack of pressure can be attributed in large part to the same causes of market failure discussed above, public goods and externalities. Thus, the market failures and political failures may be intimately linked.



We conclude by stressing that health ministries need to take full account of market failures when arguing for CGH funding. We have in this paper sought to examine the nature of those market failures, and to demonstrate how economic principles can be used to identify and prioritize CGH. We have further argued that CEA can be a powerful instrument for demonstrating the value of CGH, just as it is for personal health services. While we recognize that evidence resources in this domain are scarce, they are increasing, and we hope that the prominence given to CGH in this series will stimulate the strengthening of that research base.

## DISCLOSURE OF POTENTIAL CONFLICTS OF INTEREST

No potential conflict of interest was reported by the authors.

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### Notes

- [a] Social optimality in economics is understood to be attained when social welfare—the sum of all benefits to all—is optimized given resource constraints, technology, and individual preferences. Social welfare maximization often assumes equal weight for all individuals and costless redistribution.
- [b] The classification of goods into rival and non-rival—or at least, the theoretical exposition of optimal provision of such goods—is attributed to Samuelson, while the criterion of being excludable or not is attributed to Musgrave.<sup>9–11</sup> The exposition combining the two criteria was first proposed by R. and P. Musgrave.<sup>3</sup> Although there are rarely credited for it, their four-way matrix has been widely reproduced and tweaked in the literature and economics textbooks.
- [c] Conversely, the tree reveals that an activity that is both rival and excludable should not be financed with public funds if the beneficiaries are not poor, as long there are no significant externalities and no risk of individuals falling into poverty due to catastrophic costs.
- [d] Given that there is considerable uncertainty in the range of CE estimates obtained for a given type of intervention, point estimates are not

generally used to prioritize across interventions with CE estimates that are relatively close. The same framework can be used when grouping interventions that are not sufficiently differentiated by CE results.

- [e] Examples of interventions with comparators other than “do nothing” include: treat severe malaria with artesunate vs. quinine; ACE inhibitor vs. no medication, heart failure, with access to treatment; Prevention of Mother-To-Child Transmission (PMTCT) Option B HIV vs. Option A, Africa; and, PMTCT Option B HIV vs. no treatment, Africa.

## ORCID

Sylvestre Gaudin  <http://orcid.org/0000-0002-9164-2302>

Agnès Soucat  <http://orcid.org/0000-0002-7779-8079>

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