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## Overview

## Balancing Equity and Advancement: The Role of Health Technology Assessment in Radiotherapy Resource Allocation

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## Abstract

Radiotherapy is an essential modality for effective cancer control, yet enormous inequalities in access in low- and middle-income countries (LMICs) have created one of the largest global technology gaps in medicine today. The Global Task Force on Radiotherapy for Cancer Control quantified this gap and showed that over half of patients worldwide do not have access to treatment. Governments, policy makers and the global health community have ignored this crisis due to the complexity of radiotherapy technology and its seemingly high upfront costs. However, understanding the cost of treatment in the context of a dramatic clinical benefit could help to demonstrate the feasibility of radiotherapy in diverse income settings. When there are scarce resources, such analysis is essential in order to set priorities and provide high-value interventions to large populations. Here we explore the current status of economic evaluation tools in LMICs and some of the barriers to their use. We describe how the concepts of health technology assessment, value-based care and investment frameworks can be applied to the global crisis of radiotherapy availability to guide appropriate capacity building and resource utilisation. The development of local expertise in these health economic tools can be a powerful level to improve cancer care in LMICs and to build universal global access to radiotherapy.

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*Key words:* Cost-effectiveness; global health; health technology assessment; investment framework; low- and middle-income countries; radiotherapy

## Statement of Search Strategies Used and Sources of Information

## Introduction

Radiotherapy is a highly effective treatment modality for cancer that is necessary for the management of over half of all cases and in all stages of disease [1]. Although linear accelerator (linac)-based radiotherapy platforms are a core component of treatment in all comprehensive cancer

centres in high-income countries (HICs), there is growing debate about the cost-effectiveness and affordability of rapidly advancing novel radiotherapy technologies such as magnetic resonance guided linacs and proton beam therapy [2]. The paradox, however, is that in many HICs and all low- and middle-income countries (LMICs), there is actually a serious underinvestment in basic radiotherapy [1]; this may be one of the biggest technology gaps in not only cancer, but in medicine today. This disconnect between rising incidence across the globe as countries experience their own cancer transitions and the failure to invest in public sector provision of this basic and essential modality for cancer care and control puts at serious risk national and international commitments to improving outcomes as part of universal health coverage and sustainable development goals germane to cancer.

The introduction and scaling up of radiotherapy in LMICs must take a number of factors into account. These include

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managing the tension between the cost and effort required to introduce a new and complex technology (capital expenditures and human resource development) while still ensuring universal health coverage for cancer, including investments in surgery, imaging, pathology and basic chemotherapy, all of which are required to deliver improved outcomes. Implementation of radiotherapy in LMICs also requires consideration of location-specific cultural values and the feasibility and cost-effectiveness of this modality in regions where power and basic infrastructures (e.g. water) are highly variable [1].

Although the gross domestic product of many LMICs has been increasing, assuming allocation of funding to cancer, and then to radiotherapy, is not a given when balanced against serious competing interests enshrined in sustainable development goals [3]. At such a moment, an evidence-based approach to policy-making in this area is critical in order to ensure that limited resources are most strategically allocated. This is particularly important with regards to the approval of funding for radiotherapy because of the large upfront investment in technology, education and infrastructure that is required [1]. Whether funding is domestic or from official donor assistance (or an admixture), careful and transparent economic assessments and policy planning are required.

The concepts of value-based care and health technology assessment (HTA) are important approaches to guide medical decision-making at the level of individuals, institutions and health care systems. Here we describe how these constructs can apply to decision-making regarding the introduction of radiotherapy in LMICs and how they have contributed to the development of an investment framework to accomplish this goal.

## Health Technology Assessment in Low- and Middle-income Countries

HTA is defined by the World Health Organization (WHO) as the 'systematic evaluation of properties, effects and/or impacts of health technology...to inform technology-related policy-making in health care, and thus facilitate the uptake of cost-effective new technologies and prevent the uptake of technologies that are of doubtful value for the health system' [4]. This form of analysis, which can be extended beyond technology, involves the comparison of the clinical benefit (effectiveness), toxicity (safety) and cost (efficiency) of competing treatment options [58]. HTA has been variably applied for more than 35 years in HICs by clinical and health policy decision makers to control the introduction of new medical technologies and to decide on funding and reimbursement [5,6]. However, in most organised systems of HTA, radiotherapy has yet to be included in the modalities under scrutiny.

In this regard, the project of the European Society for Radiotherapy and Oncology on Health Economics in Radiation Oncology (HERO) has begun to set the economic assessment frameworks for such radiotherapy technology reviews, as well as demand and supply calculations for

radiotherapy across Europe, which includes countries in the middle-income category [7]. However, as prioritisation based on economic factors are context-specific and shaped by social value judgements that vary across countries and regions, a model for radiotherapy HTA and investment models derived from high-income approaches may not be appropriate in LMICs [8]. For example, deliberative processes around HTA in Thailand are very different from normative frameworks in Western countries [9]. Moreover, HTA processes are heavily dependent on the quality of clinical trial and real world economic data, much of which is missing in the context of LMICs [10].

We know that there is a disconnect between health expenditures and outcomes, particularly for disease-specific expenditure such as cancer [11]. In these situations, HTA can be a useful tool for broader programmatic and pathway analysis of cost-effectiveness to help situate radiotherapy expenditure broadly across all relevant clinical areas of use [12]. Specifically, by identifying resource allocation that is ineffective, it may allow funds to be shifted to clearly effective areas of cancer control.

The practice of HTA and the need for country-level analysis has evolved more slowly in LMICs, but is now being more generally adopted, particularly in middle-income countries [13]. However, it is not enough to have an HTA process. The deliberative process, the analytical tools for economic analysis and the consultation processes must all be conducted to the highest quality and transparency standards [14]. Limited in-country knowledge of the HTA process and of the data that inform it have impeded its incorporation as a formal component of national health insurance decision-making [15]. This is unfortunate, as shown by systematic reviews of the quality of health economic research in Nigeria, Zimbabwe and South Africa, which found that a significant proportion of it was suboptimal [16–18]. This lack of understanding of how to apply and interpret HTA often leads decision-makers to focus exclusively on budget impact [19]. Also, many LMICs have relied on the transfer of knowledge from HTA paradigms established in HICs, despite differences in the social goals and epidemiological trends between HICs and LMICs [20].

It is imperative, however, that LMICs continue to incorporate HTA in health care priority setting. Research on the benefits of HTA-driven resource allocation in India showed that prioritising public funding for a series of cost-effective interventions to address the largest contributors to the overall disease burden would reduce public health spending per capita by half and decrease mortality by almost 30% [21]. Such HTA-informed decision-making for radiotherapy technology purchases in India could also help to ameliorate the large inequities that exist across the country (Box 1).

To encourage governments to engage in rational disease control planning and implementation, international organisations have started to assemble data on the cost-effectiveness of a wide range of health interventions that are applicable in low-resource settings [15]. The WHO's CHOICE project (CHOosing Interventions that are Cost-Effective) is one such example, in which a standard analytic approach is applied to assess the cost-effectiveness of a

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