

What really matters for cancer care - Health systems strengthening or technological innovation?

Modern medicine has long been characterised by a relentless focus on innovation and the expansion of biomedical and scientific boundaries, with cancer at the vanguard. The more recent advent of precision medicine has pushed boundaries even further, with genomic advances allowing us to decipher the innate biology of a cancer and expand the repertoire of targets amenable to systemic therapies. However, this 'pharmaceuticalisation of cancer care' [2] risks being highly reductionist in our pursuit of improving outcomes, pivoting research and public sentiment away from the evidence-based reality that early diagnosis as well as high quality surgery and radiotherapy underpin better cancer outcomes for populations. The new generation of precision cancer medicines, especially immuno-oncology, are expected to contribute to 70% of total cost of active care by 2025 [3], while at the same time nearly 50% of the global population has little or no access to diagnostics [4] or palliative care, and up to 80% have no access to timely, safe and affordable surgery and radiotherapy, let alone basic generic chemotherapy [5, 6].

An emphasis on precision medicine, also risks reinforcing the notion that achieving the best patient outcomes can be simply addressed by ensuring cutting edge technologies are available [7], ignoring the wider social and economic contexts within which people live and that will ultimately influence their outcomes [8, 9]. Accumulating evidence shows that novel treatments tend to deliver value at the margins at best and do not contribute significantly to cancer mortality reduction at the population level [10]. Investing more in biomedical research and technologies alone is therefore unlikely to result in progress in cancer survival globally without addressing the health system barriers to optimum cancer care delivery [11] [12].

It is health systems which fund, organise and deliver cancer care and the wider political, economic and societal context within which they are embedded that define the accessibility, affordability, equity and outcomes of cancer control interventions [1, 13]. Both these aspects set the parameters for policies and strategies that help protect people's health (e.g. legislation on unhealthy commodities), define options for early detection and prevention (e.g. HPV vaccination), when and how people seek care, what treatments are available, who gets these treatments, the cost and cost-effectiveness of the treatment, and the quality of care delivered. It also frames the science that is being produced by defining research ecosystems and prioritisation of what it is believed will drive through the greatest improvements in outcomes [14].

Health systems, and the cancer services and systems within them are complex, as highlighted in Figure 1. To address the myriad factors which ultimately influence patient outcomes at the individual and population level we need a more balanced research portfolio which prioritises health systems

research. This would enable a much deeper understanding of the multiple factors acting at different levels, their interconnections, and the priorities, agency and power of the various actors within and across systems that influence cancer outcomes. [11]. This requires bringing together a wide range of scientific disciplines, from political science to applied health services research, implementation science to epidemiology, geography to economics and anthropology to behavioural psychology.

However, most cancer research funders do not consider these domains a priority for funding, potentially because the impact that investment in cancer systems and policy research would have at a national and international level is not immediately visible to clinical and patient communities. By way of introduction, we consider five major health system themes that exemplify the results of a strategic imbalance in funding and policy, and how investment could serve to address this imbalance, which is leading to a devaluation of global cancer care due to a focus on marginal gains.

Finance

Cancer is one of the most expensive disease domains both from a direct healthcare costs perspective (e.g. treatments) and the indirect impact on patients and families (e.g. out of pocket expenditures) [15, 16]. Balanced against this is the reality that premature mortality and morbidity due to cancer is a growing burden on economies due to productivity losses [17]. All countries have, in principle at least, signed up to universal health coverage, where one of the key vectors is to reduce the out of pocket expenditure for care [18]. However, for many countries, particularly in the Low-middle income (LMIC) category, the political decision to allocate less than the mandatory 5% of general government expenditure to health and the failure to develop either social insurance protection models has in essence condemned over a billion people to catastrophic impoverishing expenditures if they receive a diagnosis of cancer. One of the most critical policy changes is the need for the cancer community to advocate for a minimum GDP expenditure on public healthcare. Without this any notion of progress for global cancer outcomes is doomed to failure. This impact falls disproportionately on the most deprived sectors of society.

Even for those notionally able to pay, the risk of financial toxicity due to rising out of pocket treatment costs continues to increase in most countries [19-23]. From privatised cancer systems such as the USA, socialised systems such as Italy, to LMICs such as Kenya, out of pocket expenditure is one of the most serious issues holding back progressive universalism. In the USA, some 50% of cancer survivors experienced financial distress associated with their cancer [24, 25]. The solutions, championed by such countries as India [26] and until recently Mexico [27], require the introduction of strong social insurance systems, coupled to well governed cancer services and systems which we

address below. In this regard, research on developing new and sustainable financing solutions is critical to ensuring financial protection to individuals suffering from cancer.

Governance

Fiscal policy aside there remains too little insight and capability in understanding the political economy of cancer, in particular the conditions which shape cancer service's development within wider macroeconomic and political contexts. Such deficits in research and policymaking are mirrored at the most basic level with a failure to integrate properly designed cost effectiveness analyses (CEA) into clinical studies of new health technologies [28, 29].

There is an emerging understanding of political economy and its importance to ensuring equitable, and efficient cancer care delivery and sustainable funding e.g. Health Technology Assessment (HTA), commissioning and reimbursement systems, and pharmaceutical regulation [30]. However, the benefits with respect to outcomes, affordability and equality achieved by implementing multi-layered governance from mandated clinical practice guidelines through to sophisticated HTA mechanisms coupled to pricing and reimbursement models is not being universally replicated across all high income countries (HICs) or LMICs [31, 32]. Some major economies, notably India [33] have started to address the governance of it's complex private-public mosaic health system through the creation of a National Cancer Grid [34] and embedded processes towards HTA (e.g. Choosing Wisely) [35]. But such examples remain the exception and without a better understanding of how the policy environment influences access and affordability to proven innovations, systems will continue to miss opportunities for delivering greater value in the delivery of services [36-38].

The critical solution to governance is political and clinical cancer leadership at all levels of the system to underpin and sustain improvements in cancer survival, particularly the critical role of clinicians for translating policy into action [39]. But with such leadership comes a need for building experience and expertise in the tools for delivering good governance; political science, health economics, policy, etc. The assumption that clinical excellence equates to good leadership and governance is as flawed a belief in cancer as it is in healthcare per se.

Human resources and Infrastructure

Deficits in human resources are now a universal feature of global cancer, albeit on different scales when comparing HICs and LMICs. The Organisation for Economic Co-operation and Development (OECD) metrics <https://data.oecd.org/health.htm> allow us to understand how disparities exist across high income countries in the provision of core health and cancer care services from staff (nurses, primary care practitioners, secondary care specialists) to beds, and imaging facilities, including

staggering equipment shortfalls even in highly socialised high income systems [40, 41]. Deficits in LMICs are even more stark; multiple, self perpetuating deficits from pathology to surgery compound systems weaknesses [42]. Without addressing these basic shortfalls in workforce and equipment needed to deliver evidence based care –manifest as lengthening of waiting lists or reduced access - health outcomes will continue to stagnate or worsen.

Evidence is crucial to effect change. Modelling research, for example in understanding the deficit in surgical workforce for cancer care, has been instrumental in informing policy [43]. Likewise, health systems research on cancer pathways around the world examining deficits in human resources leading to diagnostic and treatment delays has been a major foundation for post pandemic systems planning [44]. Policies to support research capacity building (given the deficits in LMIC led research compared to those from HICs) are necessary, to avoid the “one size fits all” approach to cancer control based on HIC systems and infrastructure [45].

Quality assurance and Health service delivery

Health systems research seeks to achieve two major aims. Firstly, to provide evidence to reduce the “gap” between the worst and best outcomes. Second, to raise the overall quality bar. The foundations of delivering high quality care in any cancer system irrespective of development level is the measurement and evaluation of three major components of the health service [46] – 1. The structure of services (i.e. hospital attributes including staffing ratios and equipment availability) 2. The process of care delivery (e.g. procedures volume, waiting times, pre-operative care) and 3. The outcomes actually delivered by providers i.e. the effect on the patient (e.g. reduced mortality).

However, the reality is that at present most health systems across all income settings, despite the billions invested in biomedical research and new technologies, do not have the integrated data architectures or reporting platforms to be able to understand the quality of care delivered at a hospital or population level [47]. Without this level of transparency there is no way of understanding the “gaps” between high-and low- level performance, or the necessary incentives to create the quality improvement culture that can support improvements in quality at low cost and to scale, as well as support timely reimbursement and adoption of effective innovations [48].

In this respect the solutions are clear. Improving quality and efficiency in cancer systems requires public reporting programmes and audit, encompassing all three major treatment domains of surgery, radiotherapy and systemic therapies [49, 50]. Central governance is required to fund and mandate data collection on incidence, outcomes and key quality metrics in the public and private sectors with the level and granularity being proportional to the complexity and level of systems

development. Without this foundation, health systems strengthening, particularly in LMIC through a quality agenda is liable to fail.

From a health services perspective, we still do not know how we should best organise care. Patients are increasingly moving across borders to seek care and multiple providers mean most countries have complex and parallel pathways of care in private and public sectors [51]. Whilst some countries have a plurality of providers to support patient choice and hospital competition to drive quality improvement, others public sector systems are moving towards greater consolidation of cancer services to fewer high-volume centres e.g. UK, China [52-54]. Evidence for a volume outcome relationship exists for some cancer surgical procedures, but there is little evidence in radiation and systemic therapies and there is very limited research to support how and where services should be centralised within a health system to improve quality and prevent the inequities in access that have been observed [55, 56]. Clearly understanding this trade-off in a context specific manner will ensure that the organisation of services will protect the most vulnerable and act to reduce access disparities [57].

Research and Implementation

No innovation improves patient care and outcomes without first navigating its way through the health system. Health care systems determine the breadth and extent of innovation by creating the environment for translational and clinical research. Implementation and scale up, both intrinsic aspects of health systems strengthening, further determine whether any innovation is affordable and pro-equity. Yet in a system where you pay to play, global cancer research largely focuses on basic science and systemic therapies and is increasingly funded by industry [58, 59]. A recent analysis reviewing publication outputs in lung cancer found that 60% of research focused on systemic therapies and basic science research compared to 8% of outputs on radiation research, 4% on early diagnosis and 2% on screening research [60]. What gains could potentially be made for the population from a greater research emphasis on early diagnosis and more effective curative loco-regional treatments? Additionally, improving our understanding of how to minimise disparities in access to care through health services research, could make a huge difference to population level survival, yet only 2% of radiation research is devoted to this area [61]. This speaks to the urgent need for the worlds' cancer research funders, particularly federal and philanthropic to re-assess the balance of their research portfolio investments and their overall strategic direction.

Healthcare systems are faced with the continual challenge of ensuring that the high quality basic science and applied research influences practice [62]. It can take 17-20 years to get clinical innovations into practice and fewer than 50% of clinical innovations ever make it into general usage

[63]. The answer for improving this damning statistic is through a greater investment in implementation science – the second translational gap - which seeks to test strategies to enhance the usage of clinical innovation, by considering the health system dynamics and multiple actors (patients, clinicians, providers, policy environment, industry) which could impede or facilitate evidence adoption [64]. Put simply, we can't afford to waste the science that can and should make a huge difference to outcomes.

Avoiding the Zero Sum game

The five domains outlined provide key health systems strengthening areas to support improvements in cancer outcome. This will require greater clinical leadership from the oncology community with the relevant skill sets in addition to high quality applied health systems and policy research. It is critical to avoid a zero sum gain where by we pivot completely to one area or another. Instead, a balanced portfolio of research is needed to support the effective functioning of the health systems into which interventions are embedded, and to maximise their impact. It is also imperative to ensure research funding addresses the needs of cancer patients at both the population and individual level to deliver improvements in outcome.

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