



# Reflections on Cancer/Healthcare Landscape in India on the Occasion of 75 Years of Independence: Glorious Past and a Future Filled with Pride and Optimism

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For most of the past two millennia, Bharat (India, as we know now) was an economic powerhouse with the highest GDP in the world [1, 2]. From year 1 AD to almost 1500 AD, Bharat's GDP was the highest in the world by a large measure and accounted for almost one-third of all global trade (Fig. 1). In parallel with its economic prowess, Bharat then and before was also a major contributor to the field of medical sciences [3–5]. Researchers have noted that almost 9000 years ago, prehistoric dentists in Baluchistan used drills on the teeth of a living person to cure toothache [6].

The golden age of medicine in Bharat from 800 BC to 1000 AD was also known to have produced many important treatises such as the *Charaka Samhita* and *Sushruta Samhita* [5]. The *Sushruta Samhita* discusses many aspects of anatomy, physiology, pathology, pharmacology, diagnostic medicine, pediatrics, geriatrics and obstetrics, and gynecology in 120 chapters spread out over 5 sections [7]. The *Sushruta Samhita* may be one of the earliest treatises to describe surgery/surgical procedures in an organized fashion with detailed drawings. He also described simulation (which is now considered an integral part of medical education almost 2400 years later) by performing mock operations on watermelons and clay pots. More importantly, he may have developed a code of ethics for teachers and students long before the Hippocratic oath that we all are familiar with. In addition, surgical instruments made of copper were also recovered from Takshashila [8]. Several instruments made of pure copper are displayed in the Takshashila museum which include decapitators and spatulae [8].

Successive waves of ruthless invaders and colonization over the past approximately 1400 years contracted Bharat/

India's GDP to its lowest level around the time of independence [1, 2]. It is noted by some that close to \$ 45 trillion and a yet to be determined amount of wealth was taken out of India during the recent colonial rule and prior invasions, respectively [9, 10]. Around the time of independence, India's GDP accounted for less than 3% of the world's GDP [11]. Without attributing causality, it is likely that the economic decline of Bharat may have also led to a decrease in its contributions to the field of medical sciences.

Since independence, India's GDP has started to rise again. Not surprisingly, the pace of rise in GDP was tardy for the first few decades after independence [12]. From a GDP of \$ 30.6 billion in 1950, India's GDP in 2020 stood at \$ 2.6 trillion and is predicted to rise to \$ 5 trillion by the year 2025 [12]. This reverse parabolic trend in India's economy is a testament to its resilience despite many tribulations that were tragic and ghastly by any definition. Horrific events of epochal proportions such as the partition, famines, geopolitical instability, and wars with neighbors notwithstanding, India's economy is poised to become the third largest in the world [13].

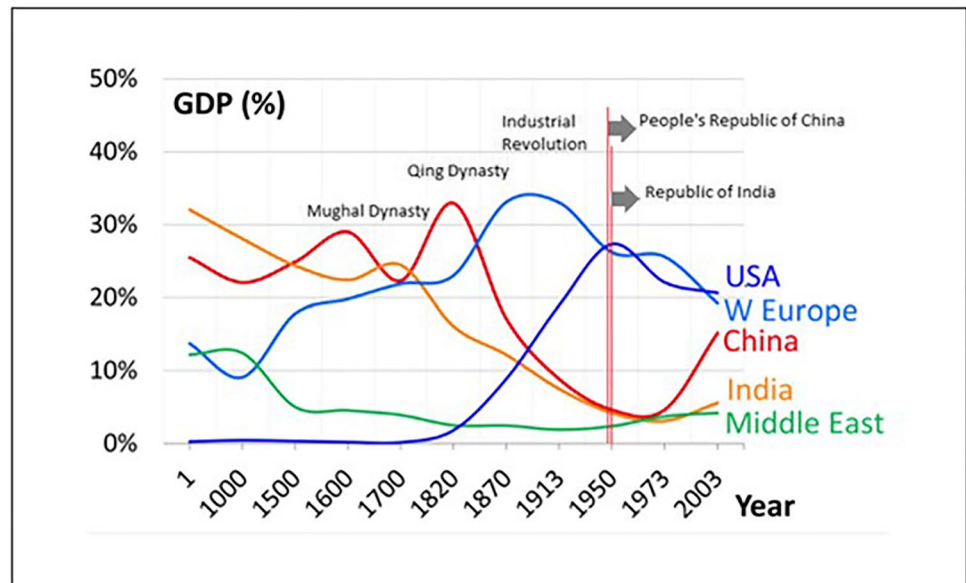
Without again attributing causality, it is likely that resurgence of economic might have contributed to improvement in many domains of life in India. The average life span in India increased from 33.94 years in 1950 to 69.27 years in 2020 [12]. Literacy rates for both genders increased from 18.3% in 1951 to 74.4% in 2018 [14]. Despite the gap between genders, literacy rates for females increased from less than 15% in 1951 to 65.8% in 2018, and girls have outnumbered boys in school education [14].

In addition to an increase in the life span, we have witnessed a change in the leading causes of death in India. The leading causes of death in India now are not only due to communicable diseases and maternal/neonatal mortality, but also include non-communicable diseases [15]. Ischemic heart disease, chronic obstructive pulmonary disease, and stroke are some of the leading causes of death in India [15].

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**Fig. 1** Share of the world's GDP from 1 to 2003  
AD. <https://www.rug.nl/ggdc/historicaldevelopment/maddison/releases/maddison-database-2010>



While these improvements are laudable, we need to be conscious of changing disease patterns that need to be addressed proactively. One non-communicable disease that is alarmingly on the rise in India is cancer. Smith et al. analyzed the trends in cancer burden in India from antiquity to the twenty-first century and documented an increase from 49,536 (1901) to 406,608 cases (2011) in Indians older than 60 years of age [16]. More recent data from the GLOBOCAN 2020 database and the National Institute of Cancer Prevention and Research (NICPR) (under the aegis of the Indian Council of Medical Research (ICMR)) paint a similarly alarming picture [17–19].

As per GLOBOCAN, the number of new cancer cases will increase from 1.32 million in 2020 to 2.09 million in 2040 [17]. Cancers involving the breast, lip/oral cavity, cervix uteri, lung, and colorectum are the top 5 cancers by incidence in India. Similarly, the cancer-related mortality is expected to rise from 852,000 to 1.38 million deaths in 2040 [17]. Cancers of the breast, cervix uteri, lip/oral cavity, lung, and esophagus account for almost 43% of all cancer-related deaths in India [18]. The NICPR [19] has noted similarly alarming figures with a prevalence of 2.7 million cases in India for the year 2020.

The cancer burden in India is likely to rise exponentially due to the burden of risk factors. Despite some documenting a declining trend in smoking and smokeless tobacco usage in India, [20] tobacco use is a major problem in India [21]. With a smoking rate of 10.7% and tobacco use rate of 28.6%, there are 267 million tobacco users in India [21]. India stands second in the world with regard to number of tobacco users, second only to China [21].

Obesity, another risk factor for many cancers, is also on the rise in India due to alteration in dietary habits

(high-caloric processed foods) and an increase in sedentary lifestyle [22, 23]. Luhan et al. noted that the prevalence of obesity will triple among Indian adults (20–69 years) between 2010 and 2040 [23]. The rates of overweight and obesity will reach 30.5% (27.4–34.4%) and 9.5% (5.4–13.3%) for men and 27.4% (24.5–30.6%) and 13.9% (10.1–16.9%), respectively [23].

Change in lifestyle and cultural habits has also led to an increase in sedentary lifestyle [24, 25]. Anjana et al. studied the physical activity patterns of 14,227 Indians from four regions of India (Tamil Nadu, Maharashtra, Jharkhand, and Chandigarh) and noted that a large percentage is inactive with fewer than 10% engaging in recreational physical activity [24]. Podder et al. investigated the patterns of physical activity in India as part of a multicenter pan-India cluster sampled trial (Niyantrita Madhumeha Bharata 2017) [25]. After analyzing the data for 233,805 individuals, they documented that 57% of the surveyed population did not meet the physical activity requirements proposed by the World Health Organization [25].

While it is evident that there is a looming increase in the cancer burden, India needs to bootstrap itself and tackle this challenge proactively. India has shown that it can eradicate some diseases and is continually working to eradicate others [26, 27]. India can take the same approach to deal with the rising burden of cancer. While there may be many challenges to address the rising cancer burden, India also is equipped in many ways to its benefit.

Some suggested steps that can be taken are highlighted below. While not all inclusive, nor in any order of importance, it provides a broad guide to some of the measures that can be taken to address the challenge of rising cancer burden in India. Some of these include:

- Analyze environmental risk factors native to India. For example, analyzing the reasons why females in the Gangetic plains harbor the highest risk for gallbladder cancer in the world could help with prevention if possible.
- Assess, quantify, analyze, and promote research (clinical and translational) and develop strategies to address some of the well-established lifestyle risk factors unique to India such as betel nut chewing. Similarly, it is known that alcohol can increase the risk of breast cancer [28]. With the rising incidence of alcohol consumption by women in India, campaigns to increase awareness of the risks and its association with breast cancer can be helpful.
- Be prepared to deal with the introduction of dietary risk factors/habits from outside of India (processed, packaged, and non-nutritious foods), which can contribute to obesity, which in itself is a significant risk factor for cancer. Identify and address/modulate socio-cultural factors that increase the impact of dietary risk factors such as urbanization, long work hours, transition to western diets that replace home-cooked Indian diet, and perceptions of an elevated status related to consumption of processed food [29].
- Address and tackle the social taboos associated with the diagnosis of cancer [30, 31]. This in combination with awareness that campaigns can help to identify cancers at an early stage, which in some patients can be the difference between cure and palliation.
- Promote efforts to tackle infections with propensity to lead to cancer such as HPV (by vaccination), *H. pylori* (gastric cancer), and *Fusobacterium* (oral cancer). With the high rate of infections in India, targeting them could translate to significant benefits.
- Improve the availability of affordable diagnostic methods (pathology, radiology, and laboratory tests) and allow incorporation of newer methods such as liquid biopsy with a resource-stratified approach.
- Increase the affordability of expensive drugs, particularly the newer agents (biologics, checkpoint inhibitors).
- Ensure access to safe, timely, and affordable cancer surgery for all those that need surgical care.
- Increase the availability of newer equipment to deliver all modalities of radiation
- Develop appropriate treatment guidelines locally that take into account contextually relevant factors such as biology and stage of presentation,
- Implement strategies to ensure consistency of treatment practices as much as possible regardless of the geographic location or practice setting.
- India has an excellent educational system with robust training programs for oncology. Having said that, these educational programs and systems need to be modernized to develop new curriculae (that emphasize current aspects of oncology throughout medical training) that incorporate the advances in cancer biology and care.
- English is considered the language of the elite in India by some. But, depending on the source, few people (~10% of India's population) can speak, read, and write in English proficiently [32]. These numbers are even lower in rural areas, where a large portion of Indians reside. Despite this, most of the medical education in India is in English, which the majority of patients in India are either not proficient with or feel inferior about due to their inability to converse in it. Consideration should be given to initiating medical school education in native Indian languages (other than in English or co-exist with English) that are spoken by wide swaths (hundreds of millions) of the Indian population. Patients should be able to seek care in an environment where they are not only conversant but also comfortable and not feel inferior due to their inability to converse in English. More of the medical literature targeted towards patients (awareness, screening, eliminating taboos, advances in cancer care, etc.) should also be developed in the native Indian languages. All of these efforts may actually encourage more patients to seek care more readily. The inglorious irony of penning this letter in a language that a large swath of Indians cannot read or write fluently (even several centuries after the arrival of English to India), but are most likely to benefit from its message is not lost on the author.
- The current training paradigms for oncologists tend to be long. Explore the possibility of right-sizing the training paradigm without comprising quality, which will allow India to address the workforce shortages in a shorter period of time.
- Explore the possibility of creating a non-physician cadre of ancillary healthcare workers with appropriate training and skills sets with short training time frames. This workforce can not only assist oncologists (whose training is longer), but also fan out into rural areas and other remote parts of India, where a majority of Indians still reside.
- Identify, quantify, and address workforce shortages in all areas of oncology (medical, surgical, and radiation oncology, anesthesiology, pain and palliative care, plastic surgery, etc.)
- Identify, quantify, and address workforce shortages in all ancillary personnel (nursing, physiotherapy, occupational therapy, speech therapy, home care personnel, etc.)
- Tap into the demographic dividend that India is blessed with. India has one of the youngest populations in the world and is home to a fifth of world's youth population. This youth population with the right training can help to address the shortages of healthcare workers [33].
- Ensure that the cancer care ecosystem is prepared as India's transitions to affluence-related cancers while still

maintaining the ecosystem for treating infection-related cancers.

- Promote cancer research in all avenues to improve quality of care, ensure accountability, and stimulate innovation
- Lobby public health and elected officials to increase investment in healthcare and thereby cancer care
- Make cancer care as affordable as possible to prevent financial toxicity. Seeking cancer care should not put patients on a sliding slope towards financial bankruptcy, particularly in India where cradle-to-grave support systems are not yet mature. The diagnosis of cancer in itself is a source of moribund anxiety and time for many difficult decisions. Having to decide between obtaining life-saving care versus keeping the life savings intact for the family should not be one of them.
- Spur innovation by using the lower-cost supply chains in India to develop new drugs and technologies in India.

Much has been accomplished, although there is much more to be done, and time will be of the essence. Life expectancy in France increased by 16.1 years from 1950 to 2018 [34]. In a roughly similar time period, life expectancy in India increased by twice that of France (35.33 years) from 1950 to 69.27 years in 2020 [12]. The obesity epidemic in America had its beginnings almost 40 years ago in the 1980s [35]. In contrast, the epidemiological transition from malnourishment to obesity in India is happening at a much faster pace [36, 37]. The National Family Health Survey (NFHS-5) (2019–2021) report from the Ministry of Health and Family Welfare, Government of India, noted that in the 10-year period from 2005 and 2006 to 2015 and 2016, obesity rates in women and men (15 to 49 years of age) increased from 13 to 21% and 9.3 to 19%, respectively [36]. Kolkman et al. noted the transition from squamous cell carcinoma to adenocarcinoma for esophageal carcinoma in India which anecdotally seems to be happening in a shorter time frame when compared to the Western nations [38]. All of these events signify that there is “time compression” to many events and transitions happening to/in India. It is likely that cancer burden may also rise faster than other parts of the world and India cannot be unprepared despite all the warning signs.

All of this can seem daunting. But India has demonstrated time and again that it can rise through harrowing levels of adversity. Similar to its rise as an economic power after centuries of colonialism-driven decline, health metrics in India are also showing slow but bright signs of a phoenix rising. On July 22, 2022, India reached a historical milestone of unprecedented scope by administering 2 billion COVID-19 vaccines [39]. India was able to launch one of the largest healthcare protection schemes in the world with Ayushman Bharat which provides healthcare for millions of Indians [40]. With the same grit and proactive measures, India

should aim to and should be able to address all the cancer care needs for a nation of nearly 1.3 billion people over the next 75 years with optimism and pride.

## Declarations

**Conflict of Interest** The authors declare no competing interests.

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