Chapter 19. The inverse care law: overutilization of health services and overdiagnosis

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Summary of key points

- The inverse care law describes how the availability of and access to effective medical services and good social care is inversely related to the needs of the population served.
- Individuals and populations with lower social conditions are known to experience higher mortality rates from cancer, because of limited access or a lack of access to health systems; there is also growing evidence that individuals, populations, and countries with higher social conditions may experience the negative effects of too much medical care.
- Overdiagnosis of cancer exposes people to the risk of major adverse effects and the health system to substantial financial costs, with minimal, or no, benefits. This paradoxical situation occurs in many health systems today, some of which are facing relevant resource constraints.
- Failure to manage the problem of overdiagnosis affects all citizens. Resources and efforts are focused on unnecessary practices and potentially harmful treatments, instead of being available for the prevention and treatment of more threatening cancers and diseases, therefore precluding the reduction of social inequalities in cancer and the sustainability of health systems.
- The impact and magnitude of overdiagnosis in a population can be so large that it visibly affects the incidence rates of a cancer; the case of thyroid cancer is an example.

Introduction

Individuals and populations with lower social conditions (a broad descriptor encompassing access to shelter, warmth, clean water, freedom from war, and education) are known to experience higher mortality rates from cancer, because of limited access or a lack of access to health systems (see Chapters 3, 7, 10, and 15);

there is also growing evidence that individuals, populations, and countries with higher social conditions may experience the negative effects of too much medical care (Hart, 1971). Fig. 19.1 depicts how people may be disproportionately subject to overdiagnosis, which is defined as the identification and treatment of cancers that would probably not have gone on to cause symptoms.

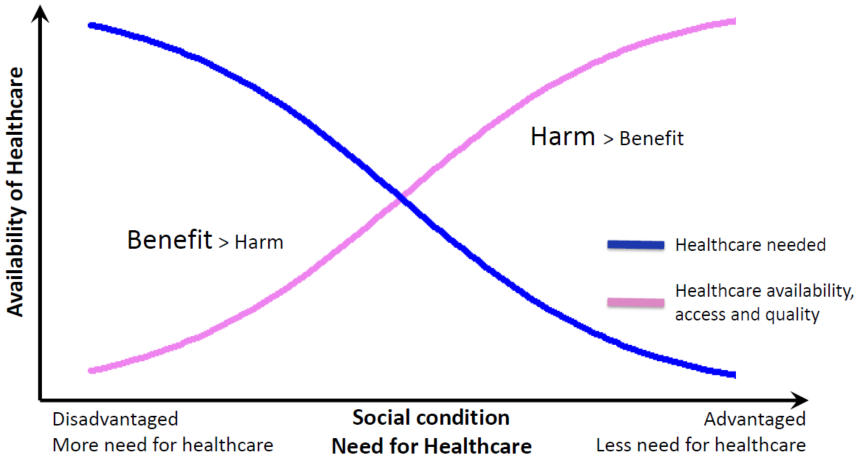

Fig. 19.1. A graphical depiction of the inverse care law, as described by Hart (1971). The availability of and access to effective medical services and good social care is inversely related to the needs of the population served. Source: compiled from Hart (1971).

A cancer that is overdiagnosed exposes people to the risk of adverse effects of treatment without any benefit, because treatment was not needed. In addition to undergoing unnecessary surgery, radiation, and chemotherapy, all of which carry toxicity, and often lifelong therapies, patients can suffer psychological consequences as a result of the diagnosis; there are also financial costs to the individual and the health system associated with treatment. This paradoxical situation occurs in many health systems today, some of which are facing relevant resource constraints. The causes of overdiagnosis are multifactorial. First, compared with less affluent groups, wealthier people generally have greater access to care, because they have greater mobility to get to care locations and the ability to pay (Welch and Fisher, 2017; Brodersen et al., 2018). Second, in some settings, non-indicated screening services are offered to those who can pay, despite the fact that there is no evidence that the benefits outweigh the harms. Third, there is an increasing use of imaging or other advanced technologies in medicine more broadly, for both indicated and non-indicated uses (see Chapter 17). Failure to manage the problem of overdiagnosis affects all users of the health-care system, whether wealthy or not; if resources and efforts are focused on unnecessary practices and potentially harmful treatments, they are not available to invest in the prevention and treatment of more threatening cancers and diseases, therefore precluding the reduction of social inequalities in cancer and threatening the sustainability of health systems.

The impact and magnitude of overdiagnosis in a population can be so large that it visibly affects the incidence rates of a cancer. Among the cancers particularly affected are breast cancer, prostate cancer, melanoma, and thyroid cancer (Lim et al., 2012; Morris et al., 2013). The case of thyroid cancer is used in this chapter as an example of the impact of overdiagnosis in cancer.

In the past decades, several high-income countries (HICs) have reported large increases in the incidence of thyroid cancer, particularly of small papillary carcinomas. Countries where large increases have been observed include France, Italy, and the USA, but it is in the Republic of Korea where the incidence has risen most rapidly: thyroid cancer incidence increased from 12 cases per 100 000 in 1993–1997 to 60 cases per 100 000 in 2003–2007 (Davies and Welch, 2006; Ahn et al., 2014; Vaccarella et al., 2016). Within only a few years, thyroid cancer became the most commonly diagnosed cancer in women in the Republic of Korea. In contrast, thyroid cancer mortality rates have been largely stable at very low levels or even declining in most of the countries where increasing incidence rates of the disease have been reported. There is no evidence of exposure to new thyroid cancer risk factors. The contribution of known and potential risk factors, including radiation exposure before the age of 20 years, excess or deficit intake of iodine, excess body mass, and dietary factors, cannot explain the sudden rise in thyroid cancer incidence rates and the strong variations observed even between neighbouring countries and regions where risk factors are similar (Vaccarella et al., 2016).

This increasing incidence of thyroid cancer was attributed to opportunistic thyroid screening in the setting of nationally sanctioned screening programmes for breast cancer and other cancers in the Republic of Korea, and to the increased medical surveillance and scrutiny of the thyroid gland in other HICs. These activities, particularly the use of ultrasound, have uncovered a substantial amount of subclinical disease existing in the thyroid gland. Asymptomatic papillary thyroid cancer of small dimensions is found in approximately 10% of autopsy series (Harach et al., 1985; Furuya-Kanamori et al., 2016), and incidental thyroid nodules are found in approximately 16% of computed tomography and magnetic resonance scans in the USA (Yoon et al., 2008). The so-called epidemic of thyroid cancer can be largely explained by overdiagnosis, which has been estimated to account for up to 60–90% of the diagnosed thyroid cancer cases in some HICs (Vaccarella et al., 2016).

Although this phenomenon initially concerned HICs, high incidence rates have also recently been observed for the period 2008–2012 in countries transitioning to a higher level of Human Development Index, particularly in some areas of Brazil, China, and Turkey (Bray et al., 2017; Lortet-Tieulent et al., 2018) where surveillance of the thyroid gland and use of advanced diagnostic techniques are becoming increasingly common. At the country level, a strong positive correlation exists between thyroid cancer incidence (but not mortality) and the average level of development. Fig. 19.2 shows that higher thyroid cancer incidence rates are found in countries with higher average levels of socioeconomic development than in those with lower average levels of socioeconomic development. However, thyroid cancer mortality rates are approximately similar between countries, or only slightly lower in countries with higher levels of socioeconomic development than in those with lower average levels of socioeconomic development.

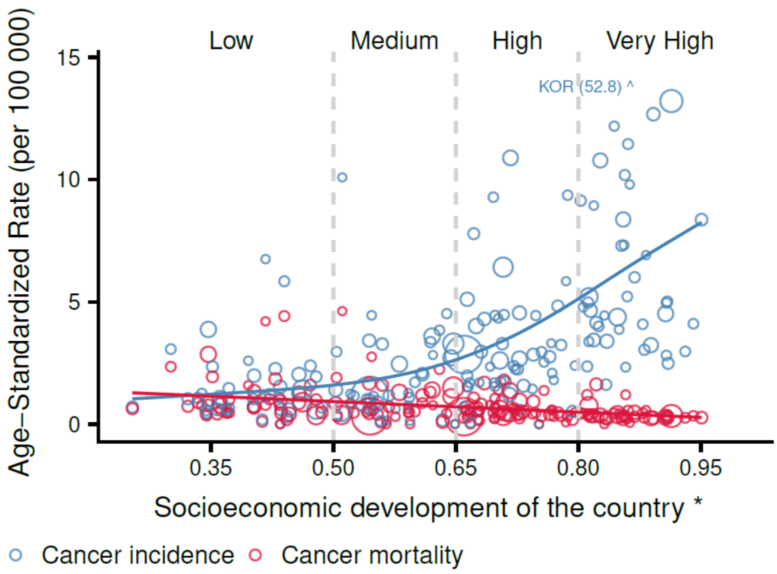

Fig. 19.2. Age-standardized incidence rates of thyroid cancer, in both sexes, by average level of socioeconomic development in 2012. Socioeconomic development of a country is usually measured by the Human Development Index (UNDP, 2018), which is a function of life expectancy, education, and income. However, life expectancy is not an appropriate marker of socioeconomic development if used as an independent variable when cancer mortality is the dependent variable (although thyroid cancer mortality is generally very low and its inclusion would not substantially change the results). To measure average level of socioeconomic development, we have therefore used only education and income to create an index that we refer to as the education and income index (EDI). EDI is a dimensionless variable of value between 0 and 1 and, for the purpose of this analysis, we defined four categories of socioeconomic development: low (EDI ≤ 0.5), medium (0.5 < EDI ≤ 0.7), high (0.7 < EDI ≤ 0.8), and very high (EDI > 0.8). Circles are proportional to the population size of the country. KOR, Republic of Korea.

Further evidence of the role of overdiagnosis is provided by the fact that, in both HICs and low-income countries, the highest rates of thyroid cancer incidence are observed where examination of the thyroid gland is easily accessible and unregulated, that is, in countries and urban areas where health services are mainly private and market-oriented, and technologies such as ultrasound and needle biopsy services are available (Brito and Hay, 2017). The great between-country and within-country variability in the incidence of thyroid cancer (Francis et al., 2017) certainly reflects the different intensity of surveillance in the different areas and local practices. A strong correlation between thyroid cancer incidence and the density of endocrinologists and ultrasound machines has been reported in the USA (Boscoe et al., 2014; Udelsman and Zhang, 2014). Within countries, there is evidence that individuals and populations with higher socioeconomic status (SES) and with greater access to health care have a higher incidence of thyroid cancer and are likely to suffer more from thyroid cancer overdiagnosis and overtreatment compared with groups with lower SES (Lim et al., 2012; Morris et al., 2013; Altekruse et al., 2015).

The consequences of overdiagnosis and overtreatment are significant for patients, with the majority of them undergoing total thyroidectomy and many also having lymph-node dissection and radioiodine treatment. Hypoparathyroidism and nerve injury are among the most common consequences of unnecessary thyroid surgery. Large geographical differences have been reported in thyroidectomy rates in the USA, suggesting a major role of local customs in the identification and treatment of thyroid cancer (Francis et al., 2017). The economic costs of thyroid cancer overdiagnosis are likely to be very high. A study in the USA (Aschebrook-Kilfoy et al., 2013) estimated the cost for a hypothetical cohort of patients; the lifetime cost to patients with thyroid cancer was approximately US$ 35 000 for those without metastasis and approximately US$ 59 000 for those with metastasis. The annual total cost of thyroid cancer in the USA is expected to reach approximately US$ 2.4 billion by 2019. Similarly, Lubitz et al. (2014) estimated the cost of thyroid cancer to the United States health-care system to be US$ 1.6 billion in 2013. In the Republic of Korea, US$ 1.7 billion was spent on thyroid cancer treatment in 2010.

In summary, there is a growing recognition that a large fraction of the thyroid cancer epidemic is due to overdiagnosis and that, in addition to an unnecessary burden for each of the diagnosed patients, this may represent a major economic cost to the health system. Overdiagnosis is likely to affect other cancers, for example, melanoma and cancers of the breast and prostate, which are subject to intensive surveillance and screening. Unnecessary identification and treatment should be avoided. Human and economic resources should not be directed towards the detection and management of low-risk cancers, the treatment of which is likely to provide more harm than benefit; instead, resources should be directed towards the provision of high-quality and equitable health care for all individuals and populations.

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