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.

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,

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).
and efforts are focused on unnec-
ecessary practices and potentially harm-
ful treatments, they are not available to
invest in the prevention and treat-
ment of more threatening cancers and
diseases, therefore precluding the re-
duction of social inequalities in
cancer and threatening the sustain-
ability 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 inci-
dence of thyroid cancer, particularly of
small papillary carcinomas. Countries
where large increases have been ob-
served include France, Italy, and the
USA, but it is in the Republic of Korea
where the incidence has risen most
rapidly: thyroid cancer incidence in-
creased 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 com-
monly 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 coun-
tries 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 ex-
posure before the age of 20 years, ex-
cess or deficit intake of iodine, excess
body mass, and dietary factors, can-
not explain the sudden rise in thyroid
cancer incidence rates and the strong
variations observed even between neigh-
bouring countries and regions
where risk factors are similar (Vaccar-
ella et al., 2016).

This increasing incidence of thy-
roid cancer was attributed to oppor-
tuneistic thyroid screening in the setting
of nationally sanctioned screening
programmes for breast cancer and
other cancers in the Republic of Ko-
rea, and to the increased medical
surveillance and scrutiny of the thy-
roid gland in other HICs. These ac-
tivities, particularly the use of ultra-
sound, have uncovered a substantial
amount of subclinical disease exist-
ing in the thyroid gland. Asymptom-
atic papillary thyroid cancer of small
dimensions is found in approximat-
ely 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 ex-
plained by overdiagnosis, which has
been estimated to account for up to
60–90% of the diagnosed thyroid
cancer cases in some HICs (Vaccar-
ella et al., 2016).

Although this phenomenon ini-
tially concerned HICs, high inci-
dence 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., 2019) where
surveillance of the thyroid gland
and use of advanced diagnostic
techniques are becoming increas-
ingly common. At the country level,
a strong positive correlation exists
between thyroid cancer incidence
(but not mortality) and the aver-
age level of development. Fig. 19.2
shows that higher thyroid cancer
incidence rates are found in coun-
tries with higher average levels of
socioeconomic development than
in those with lower average levels of
socioeconomic development. How-
ever, thyroid cancer mortality rates
are approximately similar between
countries, or only slightly lower in
countries with higher levels of so-
cioeconomic development than in
those with lower average levels of
socioeconomic development.

Further evidence of the role of
overdiagnosis is provided by the
fact that, in both HICs and low-in-
come 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.

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.


