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ANALYSIS

Surge in publications on early detection

Articles in the medical literature on early detection tend to focus on benefits rather than harms, but does evidence on outcomes warrant this difference ask **Bjørn Hofmann** and **John-Arne Skolbekken**

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Early detection and treatment of disease have been part of medical practice since the early 19th century. As Chisholm wrote in 1822, "Every chance of success depends on the early detection of disease and, of course, the early adoption of the treatment which experience has proved to be the only one."[1] The opportunity to discover disease in its early development, potentially enabling reductions in morbidity and mortality, has been an incentive for doctors, and, if missed, a source of blame and litigation.[2] As lamentably expressed by Arnold in 1907, "The attitude of the general practitioner today toward thoracic aneurysm may be compared to his attitude a few years ago toward the recognition of pulmonary tuberculosis—he was satisfied to recognise the disease when it was fully developed."[3]

Since then, early detection of disease has gained considerable attention worldwide, especially in health checks and screening programmes. Improved diagnostic technology, innovations in biomarkers,[4-6] new m-health applications,[7] and "P4 medicine" (predictive, preventive, personalised, and participatory)[8] have increased this attention. The number of articles on early detection has increased exponentially since the 1970s, and most of these articles have the same message: early detection is a good thing.

More recently, however, this presumption has been challenged. Several types of early detection have been criticised for being ineffective, futile, or even harmful.[9] The same goes for health checks.[10] The presupposed benefits of early detection can lead to aggressive interventions, the benefits of which are uncertain at best. Early detection can make people ill when it causes "shifts in the perceived severity of the disease, with ripple effects on how people experience and understand their illness and risk of disease."[11] Thus, the potential harms of early detection have also gained attention.[12 13]

We scrutinised published articles about early detection and assessed whether they tackle benefits and harms equally. We searched in Ovid MEDLINE, EMBASE, PsycINFO, and PubMed (see supplement 1 in the appendix for search strategies).

When did the interest in early detection start?

We noted the year that some words and phrases related to early detection first appeared in publications registered in PubMed, as well as the total number of publications containing each term (table 1⇓). Descriptive terms (such as "early") appeared earlier and in more publications than more overtly normative terms (such as "over" and "under"), indicating that the normative language used in critiques of extended diagnostics was a late development in the medical discourse on early detection.

PubMed identified 2252 publications mentioning early detection in the 1950s (published between 1 January 1950 and 31 December 1959). In the 2000s (from 1 January 2000 to 31 December 2009) this number rose to 181 319. The average number of publications registered in PubMed per year that mentioned early detection has risen 81-fold from the 1950s (225.2) to the 2000s (18 132). This corresponds to relative growth of 0.2 per 1000 publications per year in the 1950s and 5.8 per 1000 publications per year in 2010s—a 29-fold increase. The rise in number of publications varies between databases (see table S1 in appendix). Publications on the benefits and harms of early detection have also increased in number since 1950 (fig 1⇓). But few articles cover both benefits and harms, reflecting polarisation in the medical discourse. We found a significant difference between trends for the publications referring to benefits (only) and those referring to harms (only) (interaction time*type in linear regression, P<0.001). The proportion of publications on both benefits and harms in total publications on early detection in EMBASE has increased from 1:735 in the 1970s to 1:150 in the 1990s and 1:76 in the 2010s (see table S2 in appendix).

Early detection is mentioned differently between specialties (fig 2⇓); articles on cancer contain more mentions than those on cardiovascular disease or psychiatry or psychology.

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"Surge" in early detection publications

The results of our study indicate that we are witnessing a rise in papers on early detection that is analogous to a storm surge—the onshore gush of water associated with a low pressure weather system. The severity of surges depends on the shallowness of the water body and the timing of the tides.

The early detection surge is of substantial magnitude. Taking into account that the total number of articles published has increased, the proportion of articles on early detection published each year (and registered in all databases) has risen 36-fold from the 1950s to the 2010s.

As with storm surges, we need surveillance and advanced systems for early warning. The imbalance between the number of articles on benefits and harms implies that the advantages of early detection of disease are taken for granted while reflections on harms are lagging behind. Whether the magnitude of the surge is related to the shallowness or bias of our reflection on the implications of early detection or on tides of enthusiasm in diagnostics is open to debate, as the downsides of early detection seem to have been ignored.[9-14]

The damage of the surge is unknown. We do not fully know the benefits and harms of early detection, in terms of lives saved and avoided suffering, increased health anxiety, more disease (overdiagnosis, medicalisation), and unnecessary and harmful treatment. The increased vigilance against pre-diseases might also change the way we perceive life itself, slowly transforming life into what can be characterised as pre-death. Continued ignorance about its magnitude is no longer an option. Systematic and continuous monitoring is the logical next step, as with other acknowledged side effects of healthcare.

Is the early detection surge hype?

Reductions in mortality for several diseases[15] have not been attributed to early detection.[16] Moreover, the incidence of several diseases that tend to be detected early is increasing with no corresponding reductions in mortality rate.[9] The harms of early detection are extensively reported.[13 17] Hence, the surge in attention on early detection and the focus on benefits over harms do not seem justified. Even articles that discuss both benefits and harms mention benefits more often in the abstracts.

Tip of the iceberg?

Our search strategy might have missed a wide range of articles. There are numerous ways to formulate early detection; for example, we did not include "presymptomatic diagnosis" and "inability to detect the disease before it has progressed."[18] To our knowledge, the language of diagnostics has not changed considerably over the years, which, if it had, would have provided a systematic bias in our data. Our search strategy might also miss references in books. However, a search in Ngram Viewer (Google) for "presymptomatic diagnosis presymptomatic detection 1800-2008" gave only a few additional hits and showed the same trends as other terms for early detection. These additional searches indicate that our results represent a minimum. Our results might also include irrelevant articles; we analysed a random sample of references, which indicated that our searches were appropriate (see supplement 2).

The meanings of the search terms we used could vary between studies. Despite differences in context, presuppositions of the value of early detection exist, namely that there is something to detect, that it will inevitably develop into something serious, and that the purpose of early detection is to avoid suffering and save lives. This is arguably an idealised situation, bypassing many important questions, such as what counts as disease, where to set cut-off thresholds, and whether early detection always reduces suffering. Accordingly, phrases such as "early detection of disease" can be laden with value and biased, implying that early detection is a good thing.[19] The ideological bearings of "early detection" are outside the scope of this paper, but the literature on early detection and cancer seems to be a prudent case for further analysis aimed at enabling better illuminated discussions of one of the most longstanding truths in medicine; the uncontested benefits of early interventions.

Another important point is that we have only noted the number of articles on benefits and harms and not the quality of how harms and benefits are tackled. Studies of cancer screening indicate that harms may be underinvestigated or under-reported, despite the trials mentioning the word harms as a search term or a free text in titles or abstracts.[20] Quality assessment of the numerous studies we identified is beyond the scope of our study, but our sample analysis indicates that the imbalance between benefits and harms in the literature may be more severe than we report (see supplement 2 in the appendix). This underlines the need for further in-depth analysis of the literature.

We have only discussed early detection in relation to reduced mortality. Clearly, early detection might have other effects, such as reduced morbidity, increased quality of life, or reduced health anxiety. We acknowledge this and encourage further studies.

Summary and recommendations

A surge has occurred in publications about the early detection of diseases and in the proportion of articles discussing its benefits. It is also unbalanced, with twice as many articles mentioning the benefits of early detection as mentioning the harms. The surge seems to result from hype and unwarranted optimism, as mortality rates have not fallen.

In the past five years the ratio of articles discussing only benefits compared to those discussing only harms appears to have stabilised while the number of articles discussing both benefits and harms has increased. Hence, the bias of benefits may be diminishing, as the awareness of harms of early detection is rising. Still only every 76th article on early detection, however, refers to both benefits and harms. Thus, the early detection surge is still big and biased and should be balanced.

We need critical thinking and more studies that specifically target both the benefits and harms of early detection. We need initiatives for systematic monitoring of a wider set of benefits and harms of early detection technologies. We need better critical assessment of early detection strategies in clinical practice, in research funding, and in publication to avoid the persisting bias that early detection is only beneficial.

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Table

Table 1| Appearance and number of publications in PubMed containing words and phrases related to early detection, up to 15 July 2016

Term	First appearance	Total number
Early detection (diagnosis)	1868	327 928
Early treatment	1882	581 152
Early prevention	1911	104 483
Early intervention	1927	62 454
Overtreatment	1929	9441
Futile treatment	1952	4057
Underdiagnosis	1966	1426
Undertreatment	1969	1897
Overdiagnosis	1970	8798
Overdetection	1985	77

Figures

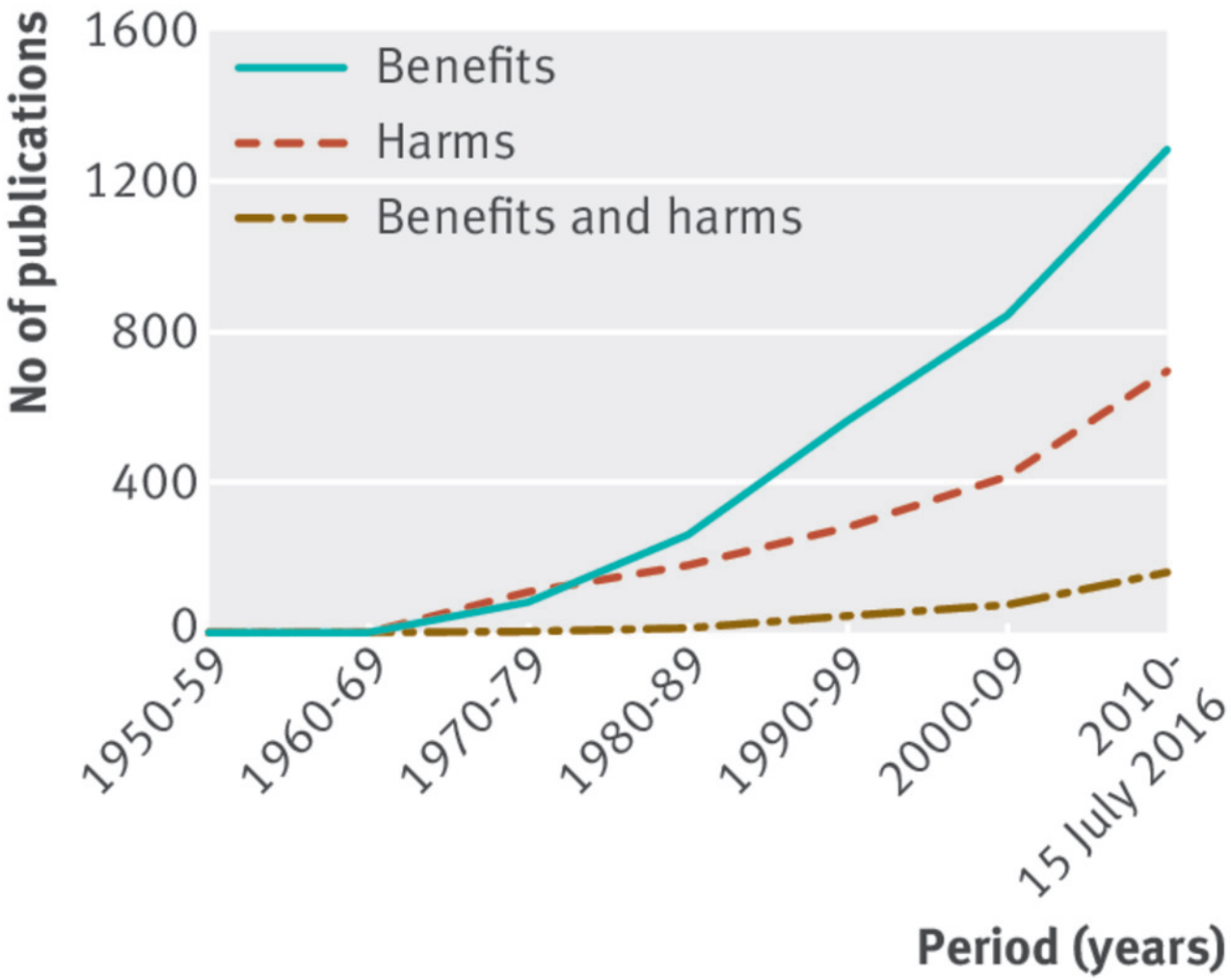

Fig 1 Number of publications on early detection that refer to benefits, harms, and both benefits and harms per million publications registered in MEDLINE for each 10 year period.

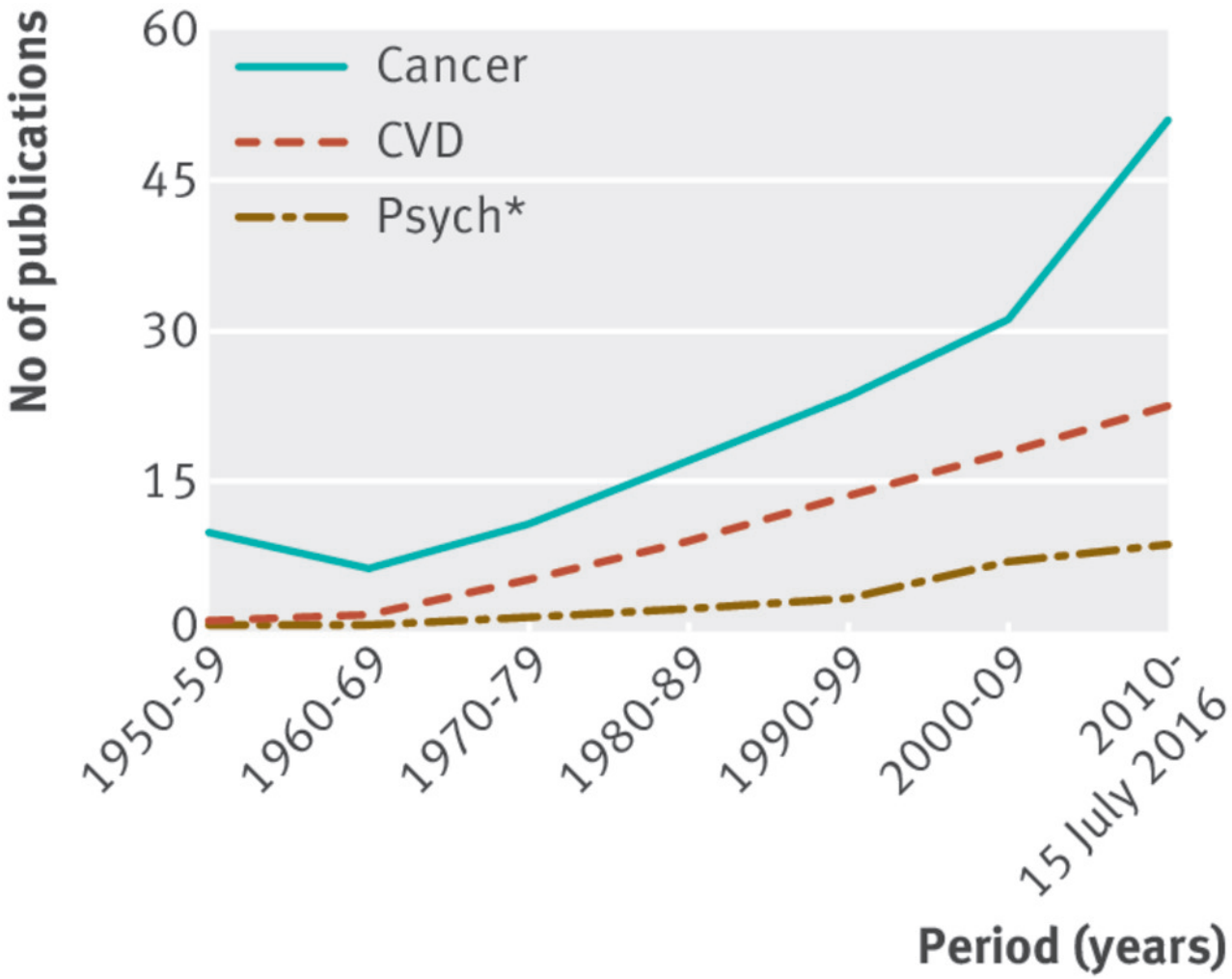

Fig 2 Number of publications on early detection and cancer, cardiovascular disease (CVD), and psychiatry or psychology (psych*) per 10 000 publications registered in MEDLINE for each 10 year period.