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EDITORIAL
SCREENING FOR HEALTH RISKS I
A SOCIAL SCIENCE PERSPECTIVE

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ABSTRACT

Health screening promises to reduce risks to individuals via probabilistic sifting of populations for medical conditions. The categorisation and selection of 'conditions' such as cardiovascular events, dementia and depression for screening itself requires prior interpretive labour which usually remains unexamined. Screening systems can take diverse organisational forms and varying relationships to health status, as when purported disease precursors, for example 'pre-cancerous' polyps, or supposed risk factors such as high cholesterol themselves become targets for screening. Screening at best yields small, although not necessarily unworthwhile, net population health gains. It also creates new risks, leaving some individuals worse-off than if they had been left alone. The difficulties associated with attempting to measure small net gains through randomised controlled trials are sometimes underestimated. Despite endemic doubts, bibliometric analysis of published papers shows that responses to health risks are coming to be increasingly thought about in terms of screening. This shift is superimposed on a strengthening tendency to view health through the lens of risk. It merits further scrutiny as a societal phenomenon.

Key words

Bibliometric analysis
Health conditions
Health risks
Health risk management
Risk thinking
Screening

Short title

Screening for health risks

EDITORIAL SCREENING FOR HEALTH RISKS

Bob Heyman

Health screening may be defined as an organised activity designed to reduce mortality and morbidity in populations by targeting those at higher risk of selected conditions. Screening provides a quintessential exemplar of late modern risk-thinking, claiming to proactively reduce the prevalence of future diseases by means of probabilistic scanning in populations. This form of attempted prevention addresses future or presently unknown 'conditions', a term which raises often unexamined prior classificatory issues. Probabilistic risk assessment requires variations within a disease category and similarities between cases and non-cases to be ignored, so that the chance of a 'condition' occurring can be enumerated. Once a category has been embedded into a screening system, the homogeneity and distinctiveness of the phenomena to which it refers tend to become taken for granted, their diversity lost sight of in the rush to quantify probabilities. Thus, McCormack, Levine and Rangno (1997) defined '*cardiovascular events*' to include '*angina, unstable angina, myocardial infarction or death from coronary artery disease*' as a precursor to discussing their probability assessment for screening purposes. The distinction between depression and sadness remains contentious (Robertson, 2008), but depression cannot be screened for unless the two states are differentiated. Similarly, the difficulties arising from defining a diverse range of phenomena as dementia are discussed by Milne (2010) in the present special issue. Screening systems address a selected, pre-packaged sub-set from the indefinite number of ways in which health can go wrong, numerically underestimated by Shakespeare's Hamlet as the '*thousand natural shocks that flesh is heir to*' (Hamlet, Act III, Scene i). Their rationality relies on inductive reasoning. Multivariate statistical analysis is used to predict the probability of a particular categorised outcome occurring. There is no limit in principle to the range of 'conditions' which might be chosen as screening targets because a set of variables offering at least moderately accurate prediction in combination can always be found.

Screening can take a variety of organisational forms, and relate to health problems in different ways. The private sector sells predictively dubious genome screening which claims to profile customers' chances of experiencing a range of serious diseases in the future. Opportunistic screening, e.g. for cardiovascular disease, may be offered haphazardly to eligible patients who turn up at the GP surgery for other reasons. Formal screening of entire populations may be delivered nationally in compliance with tightly defined specifications, as with the colorectal cancer screening programme recently rolled out in the UK for people aged 60-69. (Nationally standardised screening can be organised most easily in societies which have developed 'socialised' healthcare provision.) The preventative goals of screening can be attempted in various ways which need to be carefully distinguished: enabling earlier, possibly more effective, interventions to be initiated for patients who already have an undiagnosed condition; treating putative disease precursors like colon polyps and abnormal cervix cells; reducing purported risk factors such as high levels of low density lipid 'bad' cholesterol; providing options for weeding out fetuses with serious, incurable conditions; and buying time for adaptation to unstoppable disease trajectories such as those of dementia and Huntingdon's disease, discussed in this

issue (Leontini, 2010; Milne 2010). The utility of second remove forms of prevention tends to be contested. For example, the value of removing 'pre-cancerous' colon polyps has not been firmly demonstrated, or even their definition agreed (Raffle and Gray, 2009, p. 64). Hann and Peckham (2010) argue in this special issue that although 'bad' cholesterol has become a risk object in its own right, its relationship to future health remains debatable.

The question of who benefits from screening also merits careful analysis. Preventative endeavours are usually oriented towards net health gains for the screened population. Nevertheless, some healthy individuals will end up harmed by screening itself, for instance when colonoscopy inflicts a potentially fatal bowel perforation, or amniocentesis causes a spontaneous abortion. Some types of screening, which might be more accurately labelled surveillance, are concerned at least as much with the safety of others as with that of the screened population: for example, with respect to TB and HIV screening at national borders; in child protection work, considered by Parton (2010) in this special issue; and in relation to the risk of mental health service users becoming violent, reviewed by Joan Langan (2010) in the next edition of *Health, Risk & Society*. The question of **who** is being protected becomes particularly contentious when pregnancy termination is the main preventative response. In such cases, 'benefits' may be considered with respect to the parents, the fetus/baby and/or taxpayers. Screening creates a new role, that of possessing higher risk status (Heyman *et al.*, 2006) which incumbents may be enjoined to manage responsibly, i.e. in socially prescribed ways. Gross (2010) explores this issue in the present publication with respect to the meaning of giving birth to a child with Down's syndrome after screening at higher risk.

Despite variations in purpose, organisation and the directions of anticipated benefits, screening systems often, but not always, process individuals through four stages. Firstly, a population of screening candidates who might be affected by a delineated condition are marked out for preventative attention. More accurately, to become screening candidates, individuals must be assigned to a population considered to face a probability of developing the condition in question which is high enough to merit preventative attention, itself a complex and problematic matter of judgement. In the absence of additional information, each screening candidate is deemed to 'carry' a probability of the condition in question equal to its overall rate in the population to which she or he has been assigned. Secondly, screening candidates will be invited to undergo biomedical tests which, often combined with other predictive indicators such as age, lifestyle or family history as appropriate, allow these 'prior' probabilities to be adjusted up or down in individual cases. Thirdly, those whose post-screening probability exceeds a pre-defined level will be offered more accurate but also more invasive diagnostic tests. Finally, medical interventions will be offered to the proportionately tiny sub-sub-population who turn out to definitely carry the actual condition in question.

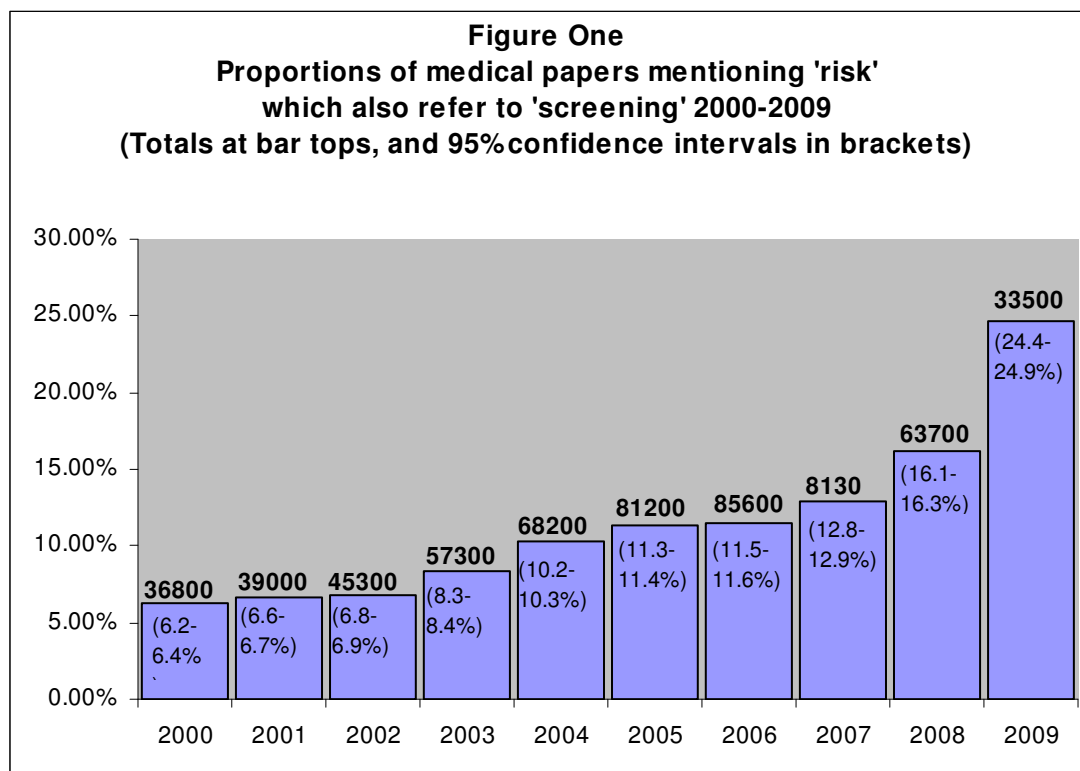
This four stage risk assessment architecture is not inherent to screening, but is merely necessitated by technological limitations. For example, if the much promised but presently undelivered diagnostically accurate maternal blood test for fetal chromosomal anomalies (Chiu, Cantor and Lo, 2009) ever materialises, pregnant women could be screened diagnostically for chromosomal anomalies in a safe single step. Unfortunately, there appears to be a general truth that predictive accuracy has

to be traded against economic and iatrogenic costs. Screening systems designed to accommodate this variant of Sod's Law generate three states of risk knowledge: prior to screening, post-screening and post-diagnosis. Assessing the predictive accuracy and risk-reducing value of such systems requires clear understanding of a plethora of statistical concepts such as sensitivity, selectivity and positive/negative predictive value. Screening candidates who do not grasp these arcane matters cannot make informed choices about their navigation of screening mazes. They may not appreciate how small the risk-reducing benefits of participation can be. For example, one systematic review of mammography screening (Gøtzsche and Nielsen, 2006) concluded that, over a 10 year period, one woman out of every 2000 invited for screening will have her life prolonged, 10 will endure unnecessary treatment and new risks, whilst 200 will have to cope with the psychological effect of a 'false positive', i.e. exceeding the probability threshold for further investigation. Because screening systems, including follow-up invasive diagnostic tests and medical interventions, invariably bring about numerous, qualitatively different consequences which vary in their chance of occurrence, assessing their net health gains requires complex summative judgements. The claim of health economics to be able to robustly perform this multi-attribute evaluative task requires more critical scrutiny than it sometimes receives (Carr-Hill, 1989; Peterson, 2007).

Even at a descriptive level, the rationality of service level decision-making about screening provision is undermined by the limitations of randomised controlled trials (RCTs). Unfortunately, conclusive RCTs are **both** indispensable **and** difficult or impossible to deliver, a predicament which the more ardent proponents of evidence-based healthcare sometimes fail to acknowledge. On the one hand, the costs/benefits of screening can only be soundly evaluated through RCTs of actual system performance. Neither uncontrolled comparisons of future disease rates among the screened and unscreened, or of population incidence before/after a screening system has been introduced, can demonstrate its utility for a host of reasons. In particular, screening brings forward the average time point of diagnosis in the disease trajectory, creating 'lead time bias', and identifies 'pseudo-disease' which would not otherwise have been noticed during the lifespan. Screening would appear to reduce the risks arising from a condition for these reasons even if it yielded no real health gains whatsoever. Furthermore, disease-specific comparisons cannot identify new risks created by screening and the medical interventions which it motivates. RCTs of overall mortality/morbidity address such issues. This evaluative methodology ensures, within the limits of sampling error, that those who were and were not offered screening did not differ on average before the intervention took place. (For randomness to be sustained, study participant allocation to the screening and control groups must be carried forward into the analysis regardless of whether individuals actually received screening or not.) On the other hand, the inherent and practical limitations of RCTs in this, and many other, contexts tend to be under-recognised, perhaps because their acknowledgement challenges the claims of evidence-based healthcare. At least three of these limitations are inescapable. Firstly, screening trials cannot be double-blinded. Secondly, the robustness of their conclusions is undermined by the potential for differential losses of information about the intervention and control groups. And, thirdly, generalisation of findings requires a conceptual leap from particular design specifications and organisationally embedded manifestations of screening to conclusions about their generic utility.

Even if these unavoidable methodological flaws are not considered fatal in relation to the detection of statistically tiny health gains, modernist claims about screening rationality have to confront a practical brick wall. The sheer expense and time demands of conducting interpretable prospective trials which are large enough to detect small effects over the required multi-decade timespan severely limit the scale of their implementation. This constraint make it inevitable that the explosive growth of screening, documented below, and capacity to evaluate its effectiveness through RCTs will continually run away from each other. Inescapable knowledge gaps abound, and should be regarded as generally endemic even if particular *lacunae* can eventually be filled. For example, the net clinical value of prostate cancer screening has not yet been established (Dragan *et al.*, 2007). Similarly, (see Hann and Peckham (2010) in this special edition), the relationships between high levels of 'bad' low density lipoprotein cholesterol, statin use, coronary heart disease, and overall mortality/morbidity remain unclear (Hayward, Hofer and Vijan, 2006). Healthcare providers have to confront rationing of the at best flawed informational resources which they need in order to arrive at rational decisions about which screening services to provide.

Despite these constraints, the influence of the esoteric architecture of screening is now growing rapidly, as Castel (1991) predicted nearly two decades ago. Comparisons across time of academic references provides one indication of such shifts (Skolbekken, 1995). The 'Googlescope', i.e. word searches through Google Scholar within the health-related literature, shows up a remarkably well-ordered increase in the proportion of papers mentioning 'risk' over five year periods from the 1950s to the present day (Heyman *et al.*, 2009, p. 4). Estimation of the proportions of papers discussing 'risk' which also refer to 'screening' allows the relevance of screening **within** risk thinking to be quantified in a rough and ready fashion. No clear trend appears until the present century. However, over the last decade, an accelerating tendency for papers which mention health 'risk' to also refer to 'screening', illustrated in Figure One below, can be observed.



1

2009 data incomplete - collected 5/11/09.

Researchers appear to have been tugged by a steadily strengthening force over the last four decades which has impelled them to view health increasingly through the lens of risk. More recently, over the last decade, a further pressure has pushed scholars who are thinking about health risks to also consider screening. It is not unreasonable to speculate that this trend reflects not merely academic fashion, but also wider societal change in the organisation of responses to selected risks. The social sciences have contributed directly to this body of work, mostly through studies concerned with the meanings to participants of their encounters with particular screening systems. However, questions about the wider social significance of the shift towards screening can easily be lost sight of on account of its scale and diversity.

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