

# The Value of Screening and Health Surveillance to Employment

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Medical screening is mainly a twentieth century phenomenon; it is now a part of our Western culture, and is probably here to stay. It first became properly established when screening began to be applied systematically to recruits in the armed forces. The high levels of ill-health uncovered by this procedure, particularly during the Boer War, made a profound impact on the political reformers of the Liberal government of 1906 and screening of schoolchildren was introduced by Act of Parliament in 1907. The large proportion of recruits graded C3 during the First World War gave further impetus to these school medical services, and in 1918 screening was extended to expectant mothers. These public services, aided by considerable advances in knowledge of nutritional requirements, probably made a profound impact on the health of children.

In 1926, the Peckham Pioneer Health Centre began doing regular medical examinations on all its families as well as fostering a new and much broader base for the practice of community care (Pearse and Crocker, 1943). The lessons learned were largely ignored when the National Health Service was established in 1948. Indeed, even now, no comparable complete community service has ever been attempted, combining disease care and the promotion of the wider aspects of health in a personal community setting. Phrases such as community medicine have come to be used in a degenerate way implying simply the health care of populations.

## MODERN APPROACHES

In America in 1942 the Kaiser Foundation, which provided a medical service for longshoremen in California, began a small-scale health service plan which later included screening as part of its services. In 1964, a controlled trial within this plan was introduced to form the first proper evaluation of screening.

Thus, although some of the earliest experiments in screening were undertaken in Britain, it is the United States that has pioneered the development of this activity. Technical advances such as mass miniature radiography, biochemical auto-analysers and computer data handling have each been exploited in screening programmes and the majority of reports centre on technical ways in which screening can be accomplished, rather than any evaluation of their effectiveness in

achieving better health. Indeed, this is often assumed to be a self-evident outcome of earlier diagnosis.

## THE INDUSTRIAL USES OF SCREENING

All over the world, many industries have begun to use screening in a pre-employment and a follow-up context. The most obvious value to industry of pre-employment screening is to select people who are fit for a particular job, while continued screening or health surveillance is seen as being useful in checking that the effects of disease, ageing, or work hazard have not altered this fitness. In many instances, however, such screening examinations have come to be seen as a fringe benefit, particularly for the executive classes, screening being viewed as a valuable service to the employee for ensuring his future health. For some employments such as air-line pilots, passing a screening test has assumed a much more important status and has become an essential requirement for employment itself. In this instance the screening is also seen as a means of protecting the public and has obvious legal implications.

In the space of this article it is impossible to discuss the value of screening in each and every industry. It is clear that certain industries with special hazards such as radiation and chemicals have specific and essential screening methods for ensuring the safety of both their employees and the public, and their value will be largely determined by each individual industry. This article is concerned with the value of general health screening for all employees in all industries, irrespective of special hazards. Or more particularly, it asks what evidence exists to suggest that firms benefit from medically screening their employees and what evidence there is that employees benefit from obtaining such a screening service.

In the 1977 Annual Congress of the TUC a resolution was passed (without argument) urging the Government to bring in general screening for all workers. The proposers of this resolution seemed in no doubt that screening would be beneficial in achieving better health and social justice. They referred to the clear benefits that the miners had received from their screening services where compensation for pneumoconiosis was regularly being paid to those afflicted. However, there is great need to be more circumspect about these issues. For instance, quoting the payment of compensation to miners with pneumoconiosis as an example of social justice contains an element of irony. It is now widely known by the profession, though perhaps not by the general public, that simple pneumoconiosis is scarcely a disease, with people often living full and normal lives despite the abnormal X-ray appearances. The miner who smokes, however, might well be crippled by developing chronic bronchitis. If he is then screened and found to have pneumoconiosis, since it is impossible to separate the consequences of smoking from the effects of the dust, he will receive more compensation as a result of his own self-damaging habit than his non-smoking fellow workers. One cannot help but conclude that sometimes screening might not serve social justice,



particularly when, as in this instance, it has become politically impossible to rectify such anomalies.

On the broader issue of whether general health check-ups do any good in industry, no proper scientific evaluation has ever been publicly reported. But since so many industries have introduced pre-employment and follow-up screening, cost-benefit analysis may indeed exist.

It is, however, much more likely that the value of screening is simply considered self-evident. It is felt that it must produce a healthier work force who will consequently take much less time off work. Evidence from Canada suggests that this may be a dangerous assumption. When screening for high blood pressure was undertaken in a co-operatively owned steel mill in Ontario, a considerable number of men (155) were, as a consequence, newly labelled as hypertensive. Professor Sackett (1977) examined the amount of time taken off sick by these men, and found that they immediately began to take over three times as many days off sick compared with the year before screening. The difference amounted to a whole working week and was, in his opinion, economically significant both in terms of lost pay to the workers and lost production to the steel mill. Perhaps the saddest point of this story is that it is still far from certain that these men will even benefit medically from being screened (D'Souza *et al.*, 1976).

#### THE EVALUATION OF PRESCRIPTIVE SCREENING

Surprisingly, one of the earliest attempts at scientific evaluation of prescriptive screening came from the world of insurance. In 1921, Knight produced evidence that such screening might be effective in saving lives. He reported that over a five-year period only 217 deaths had occurred where 303 would have been expected in an uninsured population of 6,000 having periodic health screening, a death rate 28 per cent less than expected. A similar study was reported by Roberts *et al.* in 1969 on a population of 20,648 executives who were having 'employer-sponsored' periodic health examinations. These authors also reported a favourable ratio of actual to expected deaths, but were more cautious in their interpretation and recommended well controlled prospective studies on the question.

Caution is, of course, appropriate, for such studies can rarely be considered satisfactory because they are so dependent on the suitability of the comparison groups used to calculate expected death rates.

The scientific assessment of whether screening does any good to the individual is beset with difficulties. Feinleib and Zelen (1969) and Sackett (1973) have pointed to at least three ways in which false conclusions can be reached. First, regression towards the mean, or the natural tendency for high or low readings on one occasion to be nearer their mean level subsequently, may easily be erroneously interpreted as clinical improvement in longitudinal screening follow-up studies. Secondly, the increased survival of, say, a cancer patient after detection by screening might be interpreted as benefit of early diagnosis, but in fact might be

a reflection of the so-called 'lead-time', i.e., the total duration of the disease process has itself remained unchanged but as the diagnosis was made earlier the patient appears to survive longer from the time of diagnosis. Finally, there is the danger that the net of any screening process will tend to select the more chronic and least severe diseases which would, by definition, have a more favourable clinical course, again tending to suggest falsely that screening was beneficial.

Careful controlled trials should be able to overcome many of these difficulties. Indeed, taking these issues into consideration, Shapiro *et al.* (1973) in a huge controlled trial appear to have successfully demonstrated that it is possible to reduce the mortality from cancer of the breast in women over 50 years old by a mass screening programme. However, the capital and manpower used to achieve this success are beyond the resources of most countries, though I understand that one well-known department store has introduced breast-screening for all its workforce.

In the field of general health check-ups, only four controlled trials have so far been attempted; one in Yugoslavia, one in Great Britain and two in the United States. To date, only the results of the two United States and the British studies have been published. The Yugoslavian study will be of great interest as it has been undertaken on a random sample of the town of Titograd where initial results of screening have revealed a relatively high prevalence of tuberculosis. Although this might mean that its results will have less relevance to more developed countries, it should reveal whether screening does help in regions of high TB prevalence.

#### THE KAISER PERMANENTE STUDY

The screening service undertaken by the Kaiser Permanente Group in California was evaluated some 10 to 15 years after it began. By that time, screening had become an accepted part of a commercially successful middle-class medical service, and any evaluation ran a danger of being biased in favour of screening.

The study design was that of an approximate controlled trial. About 10,000 people were chosen at random from the 46,000 who were Plan members in 1964 and they were then randomly divided equally into control and treatment groups. The 'treatment' consisted of urging people to attend for annual screening and approximately 60 to 70 per cent did respond every year. Unfortunately, being Plan members, the control group were also entitled to screening and some 20 per cent of these were also screened annually.

The screening itself was fairly comprehensive, consisting of questionnaires, laboratory and clinical tests, and thorough medical examinations (Cutler *et al.*, 1973). After the first seven years of the study a comparison was made between control and treatment groups on a variety of health measures.

The overall death rates in the screened population showed no significant change. But certain specific causes of mortality in particular age groups did appear



to be significantly improved in the screening group. However, some 60 significance tests were performed on this data and only three were reported as significant, two in favour of screening and one against it. This is approximately the same outcome that one would expect purely by chance, and it is a pity that the authors fail to make this point more clearly in their discussion of their results.

Measures of ill health such as doctor consultation rates and hospital admission did not differ significantly between the two groups. The only other statistically significant findings were a slight decrease in partial disability among the older males in the screening group, and a decrease in time lost from work. These data were obtained from mailed questionnaires and their precise significance is hard to determine.

The overall picture emerging from this large study is that even if some benefit can be achieved by such elaborate screening, it is certainly not very impressive.

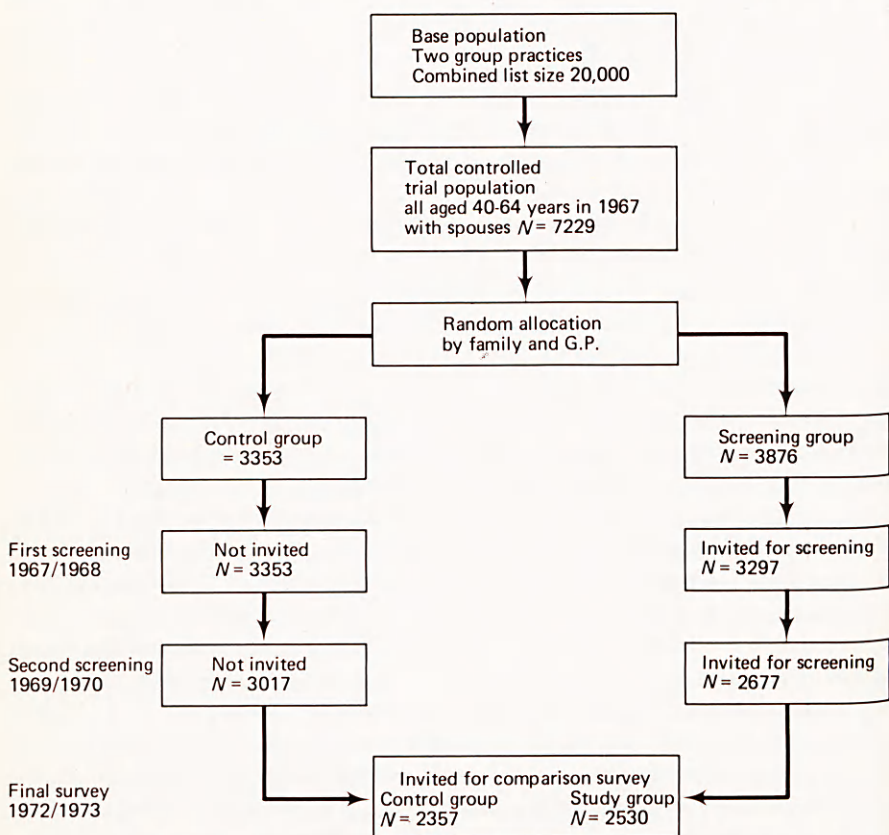


Fig. 1. The South East London Screening Study — design. *N* is the total number at a particular point in time, the loss being due to deaths or departures from the area, or administrative difficulties (D'Souza *et al.*, 1976; Courtesy *The Lancet*).

The other American controlled study carried out on smaller numbers and over only three years failed to show any measurable benefit in favour of screening. This study remarked on the very small amount of intervention carried out by the physician consequent to screening, although the only statistically significant result was an increase in 'nights hospitalised' for the screened subjects (Olsen *et al.*, 1976).

Our own study at St Thomas's has just been published. This was a ten-year controlled trial carried out in two South London group general practices (South East London Screening Study Group, 1977).

The general plan of this study is shown in Fig. 1. The main results are shown in Tables 1-4. As can be seen, the population offered screening showed no measurable improvement over the controls in terms of mortality or morbidity. Extensive and detailed multivariate analyses were undertaken to make quite sure that these negative results were not due to hidden bias, and the general conclusion of the research team was that, in view of their manifest failure to produce any health benefits, such general health check-ups do not warrant any expenditure of scarce resources.

Table 1. Some measures of morbidity - Screening *vs* Control groups at the concluding Health Survey in 1972-73, five years after the initial screening.

	Control group N = 1950 (max)*	Total screening group N = 1978 (max)*
<i>A. Questionnaire measures of general health</i>		
1. Percentage claiming to have good or excellent health in the fortnight preceding the survey	56.5	53.6
2. Percentage admitting to any major disability	1.8	2.5
3. Percentage showing downward social mobility	27.4	27.4
<i>B. Cardiovascular disease</i>		
1. Percentage with evidence of angina on questionnaire	22.4	21.9
2. Percentage with raised diastolic blood pressure $\geq 105$ mmHg (Ph V)	3.1	2.8
3. Percentage with ischaemic changes on ECG	16.6	17.9
<i>C. Respiratory disease</i>		
1. Percentage still smoking	50.8	52.3
2. Percentage complaining of any bronchitic symptoms (MRC 1966)	30.6	29.0

\* Largest denominator used.

**Table 2.** Average annual G.P. consultation rates for subjects in the study for more than one year: control *vs* screening

	Men		Women	
	Control	Screening	Control	Screening
<i>Consultation rate by diagnostic group</i>	N = 1,244*	N = 1,321*	N = 1,486*	N = 1,523*
Overall consultation rate	3.1 (S.E. = 0.09)	3.2 (S.E. = 0.09)	3.8 (S.E. = 0.09)	4.0 (S.E. = 0.09)
Neoplasms	0.07	0.08	0.06	0.06
Selected endocrine and metabolic diseases	0.03	0.04	0.07	0.09
Mental, psycho-neurotic diseases	0.22	0.27	0.49	0.52
Central nervous system diseases	0.21	0.20	0.21	0.22
Cardiovascular diseases	0.13	0.14	0.12	0.08
Respiratory disease	0.51	0.52	0.42	0.43

\* N.B. Since we have restricted this table to those who were in the study for more than one year, the numbers are smaller than the total seen.

It is of real interest to inquire why there was little or no benefit observed in these studies. The whole truth is still uncertain. However, I feel that there are three clear reasons which go a long way to explain why what seemed commonsense truth to so many people has been confounded. Firstly, screening is not very good at picking up the really important diseases. In one study in America, over half the people dying of cancer and heart attacks had been declared completely fit at their previous annual check-up (Schor *et al.*, 1964). Secondly, when many diseases are discovered on screening, doctors do not believe there is much useful medical aid to be offered. Finally, even for those conditions such as raised blood pressure for which useful treatments do exist, many patients find that sticking to treatments over long periods of time is more than they can stand and they often seem to prefer to take their chance with fate.

However, irrespective of any reasons why these trials have failed to show much success, I feel that the results speak for themselves and the paucity of real medical benefit derived from such a huge outlay in human effort is, to say the least, disappointing. It supports those doctors who feel that most screening in adults is not yet sufficiently advanced for them usefully to spend time on it. It supports health administrators who feel that the benefits to be derived from such screening do not match the costs. Therefore, if decisions to commit public or private money or medical time to such screening activities have to be made, this evidence should weigh heavily against any such commitment. It is important to recognise, however,



Table 3. Hospital admissions control vs screening, 1967-76.

	Control group (N = 3,132)	Screening group (N = 3,292)
Number of people admitted once or more 1967-76	862	944
Rate per 1,000 man/years at risk	49.6	50.7
Total number of admissions per 1,000 man/ years at risk	70.7	73.4

*Hospital admissions by some of the principal diagnoses  
Admission rate per 1,000 man/years at risk*

<i>Principal diagnoses at admission</i>	Control group	Screening group
Neoplasms	9.1	10.0
Central nervous system	4.3	4.2
Cardiovascular disease	9.5	9.6
Respiratory disease	3.8	3.2
Digestive disease	8.6	9.0
All other diagnoses	21.3	18.8

\* N.B. These rates have been calculated using different times at risk, because once a particular event occurs the individual is no longer at risk for that event. This means that the time the individual will be at risk depends on the event in question; obviously for total admissions the individual is at risk until he dies or is lost to observation.

Table 4. Death rates by cause control vs screening 1967-75

Cause of death (first certified)	Death rate per 1,000 man/years at risk	
	I.C.D. 1957	
	Control group (N = 3,132)	Screening group (N = 3,292)
Neoplasms	2.6	2.5
Central nervous system	0.7	0.9
Cardiovascular disease	2.8	4.3
Respiratory disease	2.0	1.4
All other causes	1.1	0.9
Total deaths (all causes)	9.2	10.0

N.B. Time at risk is less than for previous analyses due to delays in ascertaining cause of death.

that since new screening methods and treatments are being developed each year, the position will require periodic review by further trials. At the present time the general screening methods used in all these studies have not been superseded in any significant way and if their protocols were written now no important change would be made.



A much more difficult issue is whether such screening should be judged only on its success in improving health. Clearly, there is considerable public demand for screening. The question arises as to whether doctors, governments and firms should satisfy such demands, irrespective of the results of controlled trials. (Certainly it cannot be claimed, for example, that our existing social services have much established scientific support for their effectiveness.)

Arguments in favour of this viewpoint look upon medicine as a business which provides a consumer service, a service that is part essential and part luxury. Screening can be viewed within such a service as a useful source of reassurance that should be evaluated only in terms of its market appeal. Apart from the fact that there is no strong evidence to support the idea that screening allays more anxiety than it causes (for example, terrifying women who have only benign breast lumps), such an argument must be seen as retrogressive and out of keeping with the spirit of informed medical concern. While it can be readily observed that the predominantly urban societies of the developed world exhibit high levels of anxiety for which they often seek technological solace, the provision of impersonal screening clinics would at best be merely palliative and at worst distinctly meddling. It would seem much more sensible to try to prevent such anxiety by searching for ways of creating more self-supporting personal communities within our cities, similar to that attempted by the Peckham experiment. Meanwhile, until good evidence can be found of its medical usefulness, such screening should assume the status of a low priority superfluous service.

## CONCLUSIONS

At the present time there is insufficient evidence to support the idea that general health screening by industry will benefit anyone. There is evidence that it may well, at least temporarily, increase absenteeism, and for a few unfortunate people generate unnecessary anxiety, and I have not even discussed its dangerous potential for invading privacy.

Screening is a developing technology, and research must go ahead. The development of new methods for improving the monitoring of health and safety at work is obviously of great importance. However, any new methods so developed must be rigorously tested by controlled trials before being extensively and expensively applied to our work force on the whim or enthusiasm of the well-meaning.

The use of the controlled trial in this context is perhaps our most important advance in technology and the best way of evaluating such areas of concern. Despite the fact that these trials are difficult and costly to perform they do provide evidence of a far more reliable quality than can be obtained in any other way. Indeed, one wonders why they are not applied more generally in other areas of political controversy. When, as now, we have the results of controlled trials, we should not be too hesitant to act upon them; this implies that existing pro-

grammes for general health screening in industry should not be extended and all new ventures in this area should be, by design, quite deliberately experimental.

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