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References


Commentary: Sir James Mackenzie (1853–1925): An ambiguous pioneer for research in primary care

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Sir James Mackenzie is generally accepted as the founder of research by general practitioners in Great Britain, studying their own patients where and how they actually live. His pioneering work on arrhythmias was a foundation for modern cardiology, consolidated by his pupil Thomas Lewis, Britain’s first full-time clinical researcher for the Medical Research Council. Mackenzie became a dominant figure in public imagination, more widely celebrated than any later generalist. At the clinical research institute he founded at St Andrews in 1919, he hoped to set in train a permanent and growing body of longitudinal clinical research outside hospitals, by community generalists studying their own patients. This article tries to explain the failure of this project: how it influenced later research by general practitioners and others in primary care after creation of the National Health Service (NHS) in 1948 and its relevance today to primary care research policy. Such research is now becoming an urgent necessity, for the British National Health Service to survive as a public service and as a foundation for democratic development of biosciences.
Introduction

Up to the early 19th century, most outlines for modern thinking about human disease were drawn by general practitioners (GPs) serving local populations. They had opportunities to observe and record the natural history of illnesses over lifetimes, not just a few days or weeks of end-stage illness. Between 1788 and 1791, five English rural GPs (including Edward Jenner), meeting regularly at the Fleece public house in Gloucestershire, first connected angina pectoris to coronary atheroma, and mitral stenosis to acute rheumatic fever. Because they were community generalists, following their patients for decades, they were able to link early causes to later (but not immediate) consequences, as grander doctors in London teaching hospitals were less likely to do.

The huge diagnostic and prognostic advances made by French hospital-based doctors for 3 decades after the revolution of 1789 were based on linking symptoms and signs recognized in life to late consequences recognized at autopsy. Such opportunities for GPs to try to perform all clinical functions finally disappeared only with advent of the NHS in 1948, completing a division of clinical medicine between hospital-based specialists and community generalists, which had begun in the late 19th century.

This division occurred much earlier, and more completely, in Britain than in any other developed economy—most notably, the USA. There is an obvious reason for this. Britain was the first fully industrialized country, with most doctors making their living from care of industrial workers and their families, usually from registered, listed populations, rather than a free market. Practice for more affluent customers was better regarded and better rewarded, but provided a much smaller market. By the late 19th century, most workers in basic industries such as mining, shipbuilding and textiles had developed their own prepaid care systems. In 1911, these were nationalized by the state and extended to all industrial workers below supervisory grades. In 1948, they were extended further to the entire population, adding planned distribution of hospital-based specialist care. These capitation systems, with stable and listed populations, were potentially available (though almost entirely unused) for research in primary care, studying event numerators in relation to defined population denominators.

A conservative revolutionary

More than any other major medical figure in his times (and there were many of those), James Mackenzie worked at the centre of this historical development. Leaving rural Scotland and his humble beginnings as a dispenser, he worked from 1879 to 1907 as a GP in Burnley, a Lancashire town that had become the world capital of cotton spinning, weaving and machinery. Attending 60–70 patients each day from a population with an infant mortality rate of 196 per 1000 live births in 1901 (more than three times that in India today), he somehow made time as a lone researcher to study the lifetime progression of rheumatic heart disease and the nature of different cardiac arrhythmias, and to follow their world literature. He thus laid foundations for what became ‘the new cardiology’, ending decades of stagnation in this field, and winning a level of public adulation and honours surpassed only by Alexander Fleming. He has been worshipped ever since, not only as a founding father of GP research but also as badly needed support for the value and dignity of generalists in an age when specialists came close to monopolizing public conceptions of what best doctors were and did.

In 1921, 4 years before his death, Mackenzie wrote a definitive article, arguing that ‘The opportunities of the GP are essential for the investigation of disease and the progress of medicine’, derived from a lecture to Sir Almroth Wright’s Institute of Pathology and Research at St Mary’s Hospital Medical School. He made an apparently incontrovertible case for longitudinal research by polymath generalists living and working within the community, observing patients for decades rather than days or weeks in hospitals, and the beginnings as well as the endings of major disease:

If the conditions which predispose to, or provoke disease, are to be recognised, the investigator must have the opportunity for seeing the circumstances which led up to the invasion of the disease. It is manifest that neither the laboratory worker nor the hospital physician, who are the persons mainly concerned with research, have this opportunity. The early stages of disease are, as a rule, insidious, and are indicated mainly by subjective sensations. The patient, becoming conscious that there is something amiss with him, does not, as a rule, seek help from the hospital physician, but from his family doctor. The bulk of patients in the early stages of disease are never seen by those who are systematically engaged in its investigation.

As this stood, it was obviously true. Other than by Mackenzie, research into the natural history of health and disease by community-based generalists had virtually ceased. Concentration of all clinical research in specialized hospital departments and laboratories was self-evidently bound to produce a grossly incomplete and distorted understanding of the subject, with negative consequences for application of medical science to population health.

However, in this and many other articles, he went on to pursue two entirely different targets: the growing influence of laboratory diagnosis, technology and research in the simplified situations of hospital care, and even to question the very existence of specialism.

These were clearly the growing points for virtually all
new and useful medical knowledge. That they need not have been the only growing points was true. If Mackenzie had understood that specialism, technology and laboratory methods were potential allies in his cause, he might have succeeded in restoring primary care as a site for serious research. Instead, he made them his enemies. From then on, once public sentimentiality was exhausted, he was bound to fail, not because he was too ambitious but because he was wrong. His vision of longitudinal cohort research into the natural history of health and illness in real communities as they actually lived and worked was revolutionary; but in every other way, he looked backward, to a style of care already vanishing. He failed to see the possibilities opened up by new developments beyond the scope of GPs in their cottage industry, not only by specialist technologies but also by state organization of care with a population rather than market base.

Specialists and generalists

In practice, nascent medical technologies, and specialists able to use them, largely justified their rising public esteem. For Thomas Lewis (1881–1945), whom Mackenzie had mentored, he remained a hero, even when he dismissed Enthoven’s invention of electrocardiography as no more than a research tool, as Lewis used it greatly to extend Mackenzie’s own study of arrhythmias. Lewis coined the term ‘medical science’ and became the UK’s first clinical scientist and director of the Medical Research Council.

However, many more specialists were simply pursuing another, and increasingly more profitable, way to earn a living. Organizing medicine as a trade, specialists expanded throughout the 20th century, according to population needs but to whatever the market could bear. In USA, the extreme case, community generalists almost disappeared, pushing health care into ultimately unsustainable crisis. Barbara Starfield found that by the end of the 20th century, mortality was lowest in states with a higher proportion of primary care doctors, and in patients with a generalist rather than a specialist as their personal doctor. Hospitalization rates were inversely associated with access to primary care doctors and their numbers, areas with better primary care resources had higher life expectancies and lower all-cause mortality from major causes of death, even after controlling for income inequality and major socio-demographic characteristics associated with health, and there were fewer disparities in health between socially advantaged and disadvantaged population groups. She even found that average technical quality of care from generalists was better than from specialists, even for a major illness. But recruitment to primary care continues to fall, although specialists concentrate in affluent cities and desert entire states where patients are unprofitable.

Within UK public service, specialism grew more slowly and much closer to population needs. As much by accident as by design, roughly half of all doctors in the British NHS were and still are community generalists, gatekeepers to specialist care. This fact was largely responsible for keeping UK health care costs <6% of Gross National Product from 1948 until the onset of NHS marketization in the 1980s. In that context, GPs could, and eventually did, develop new, non-competitive relationships with specialists, to the immense advantage of both. To re-integrate and co-coordinate their work, they have still a long way to go, even where marketization is now starting to be rolled back—as in Wales, Scotland, and Northern Ireland, which have rejected division between purchasing and providing functions. When this renationalization process is achieved, rational integration of primary with secondary care will at last become possible.

‘Getting better, but feeling worse’: too much science, or too little and too narrowly defined?

Arguments that medical science and technology impede rather than promote human health and happiness, by a dehumanizing influence on care, existed before Mackenzie, and have continued ever since. Mackenzie put it this way:

The advances that have been made in special branches, particularly those pursued in laboratories, and by the use of mechanical devices, are all reflected in the field of clinical medicine. In an attempt to be up-to-date physicians use the methods of these auxiliary branches, so that clinical medicine toils laboriously in their rear, and to a great extent becomes subservient to them. It should be realised, and should be strongly and persistently insisted upon, that all these special methods fall far short of the ideal of what is wanted in clinical medicine, and that the pursuit of clinical medicine involves problems, peculiar to itself, which none of these methods can ever hope to solve. There is not a single mechanical or laboratory method ever introduced but has had an extremely limited sphere of usefulness.

The impression that the results obtained by a mechanical method are more reliable and more scientific than those obtained by the use of the unaided senses, is but a belief based on a false analogy. It is assumed that because the experimentalist obtains certain records which are capable of demonstration, that these are of more value than the information developed by the doctor from questioning the patient, or by the use of his own senses trained by long experience. Those who reason thus unconsciously compare unequal things. In laboratory experiments, it is
impossible to obtain any information from the great field of subjective impressions. In man this is the most important field, and far outruns the field for mechanical exploitation in giving us information as to the nature of disease. The laboratory worker obtains his results by a delicate mechanical contrivance. The physician has to train his senses, and this can only be done by a long process of education, only capable of being acquired by the constant contact with the patient.  

Essentially the same arguments were used earlier by clinicians against Pasteur’s bacteriology and Claude Bernard’s physiology, leading to despair of clinicians ever embracing science, rather than using it as and when it suited their interests. Since then, these arguments have been used by a wide range of people with reasons to fear extension of scientific scepticism beyond what they see as safe limits. Despite spectacular advances in health, longevity, average physical health and techniques for repair, they see material advance but spiritual decline—‘getting better but feeling worse’. By the end of the 20th century, this was coming close to a dominant view, in policy-making sections of society. It even threatens to dominate thought among precisely those most opposed to the worldwide drive to thrust public health services back to the marketplace, and to return health care to commodity status. At an even deeper level, this is part of a renewed, more general cultural retreat from the Enlightenment, back to anti-science and mysticism—the prospect we faced in the 1930s.  

In a classic article, Leon Eisenberg presented convincing evidence that profound and growing dissonance between what medicine tries to do, and what it actually does, arises not from too much science, but from too little, and too narrowly conceived. As for specialism, even doctors in primary care who most fully and effectively accept their responsibilities as generalists must in fact specialize, in their own generalist knowledge and skills. They form only one specialized part of a wider group of health workers, all necessary to maintain and promote optimal health. If we measure effectiveness and efficiency by hard outcome measures such as age-standardized all-causes mortality, no single part of this broad alliance, whether patients, parents, teachers, public service broadcasters, political activists or many occupations other than doctors and nurses, can act effectively by itself. These have to find new ways to work co-operatively, following neither a master–servant nor an industrial model.

### Industrialization of care and research

Industrialization of medical care threatens effective and efficient application of science to health problems not because it uses technology, but because it uses technology within the assumptions of commodity production: to produce a larger volume of care, using a smaller and less-educated workforce, replacing human judgements by algorithmic machines. It has even been seriously suggested that taking a medical history could, with economic advantage, be delegated to cheaper labour incapable of educated judgement:

...with the rapid growth in new diagnostic technologies there is now a suggestion that it is more efficient and cost-effective to employ a technician to undertake a battery of investigations rather than have an expensive clinician spending time listening to patients.  

Like anything else offering new possibilities for profit, this is no longer unthinkable. The threat comes not from technology itself, but from reducing the status of health care from a social gift to a commodity. This idea was beginning to retreat before advancing public service in Mackenzie’s time but is rapidly returning in our own. Even where care remains a non-profit public service, a culture of industrializing commerce dominates thought. Studies of real consultations have shown that a mean of ~85% of final diagnoses derive from listening to an oral history, only 5% from diagnostic investigations. Even for coronary heart disease, in which technology certainly provides essential information, 90–95% of correct diagnostic hypotheses are formed during history taking and physical examination. For optimal effectiveness and efficiency, clinical judgements of probability at this stage determine choice of investigations. Obviously, technical investigations are important, but they should follow and be subordinated to human judgements, and these need to be formed by an interaction between professional staff and patients, each sharing their own body of evidence. This requires time and continuity, the chief determinants of quality in primary care.

Though very aware of the social conditions of his Burnley patients and how these might cause disease, Mackenzie never seems to have thought that the potentially changeable nature of society might be relevant to his argument. It is hard to understand, in so great a clinical scientist, his belief that the earliest stages of illness would eventually be perceptible to the skilled professional eye with greater precision than was promised by the new technologies he opposed. Symptoms of early, minor impairments of health are almost always non-specific. At this stage, they are possibilities, not probabilities. A high proportion of most beginnings of illness never go further. Well-nourished, well-housed and contented people are extremely resilient. They usually get better from most of their ailments, as Mackenzie well knew. In this, he seems to have clung uncritically to the past, with none of the scepticism essential to science,
although science was central to the research institute he set up in St Andrews in 1919, to which he devoted the last 5 years of his life, and which was intended to carry forward his legacy as a centre for community-based longitudinal research. Soon after his death, it virtually ceased to produce any significant new work.22

Persons and populations

By remarkable coincidence, birth of the NHS roughly coincided with a huge rise in the power of medicine not just to observe and predict the course of illness, but to change it. For centuries, meaning well had been sufficient support for a noble profession. With the advent of effective treatments, it at last became necessary to do well, and prove it. That transition, from clinical medicine honoured but unmeasured, to verifiable production of the highest of all use values, has yet to be fully recognized to care as public service.

Mackenzie arrived at the very beginning of this historical process, when for the first time, a serious and common disease (syphilis) had become treatable with measured outcomes, and public services had begun to deal with it—the first ‘magic bullet’. This breakthrough for one single disease fired imaginations about the whole of medical care, but for clinicians at least, this does not seem to have included perception of any need to relate what they observed in individual patients to what they might find in the whole populations from which they came. This was understandable for hospital-based specialists, who virtually monopolized research. Few of them had well-defined catchments, so they had no means of knowing either the extent of ascertainment or how many patients were referred elsewhere. It is more curious for GPs, who, because of Britain’s early development of prepaid care, were long accustomed to registered lists. With relatively little modification, these could have been used as defined populations for epidemiological research, but in fact this hardly ever happened, at least until the 1960s. Mackenzie worked to accumulate case series. Because he never related these to defined source populations, he was never able accurately to compare patients who had a disease with people who had not. This was the basic reason for failure of Mackenzie’s project.

It still affects research in primary care today. At a Wellcome Foundation Witness Seminar on research in general practice a few years ago, the only examples of research on randomly sampled populations in either general practice or hospital care were Prof. Ann Cartwright’s books, produced in the teeth of professional opposition.23 Up to the 1980s, virtually no GPs thought in epidemiological terms, as this would have entailed recording data from patients at risk they did not see, when it was already hard enough to record all necessary data from those they did see, and because few of their colleagues were ready to expose their work to critical examination. Even John Fry,24 who did produce a great deal of pioneering numerator/denominator data, assumed that one way or another, he saw everyone at risk, without organizing any proactive search for the problems he tried to study. For hypertension, gender distribution of cases he found reflected gender differences in consultation rates, not in the known distribution of arterial pressure.

Considering that he saw 60–70 patients each day, many at their homes, and that he set himself high clinical standards, it is a miracle that Mackenzie did any research at all. Without far greater staff resources and external funding, there was no way he could have added observations of well people to his observations of sick people. This has been true ever since, for every GP working either in areas of heavy industry in the past or of post-industrial dereliction and demoralization today. Progress cannot depend on superheroes who somehow contrive not just to survive but to thrive at what Graham Watt25 calls ‘the deep end’, often with their families and colleagues compelled to share the costs, in both time and money. In a society moving forward to a higher civilization, this necessary work would be closely associated with university medical schools, funded and supported by the community as a whole, by the fairest system so far devised—income tax.26 Development of this sort may be starting in Wales at Merthyr Tydfil’s Keir Hardie Health Park.27

A hero for our time?

Mackenzie’s achievements, in the circumstances wherein he worked, were hugely impressive. He fully deserved the reputation he eventually gained, but like all real heroes and every genius, he was in some ways flawed.

He always accepted, as did outstanding hospital-based physicians like Osler and Allbutt, that the aims of medicine should be set by public health; in fact, that clinical medicine should be a subset of public health, rather than the other way round. Public health includes many disciplines other than medicine, a hard pill for clinicians to swallow.28 If all three of these giants failed to insist that public health aims should lead practice at all levels, this was not because they did not understand this aim, but because they too readily accepted a professional market, which made it impossible to achieve. Then as now, the only ‘real world’ accepted in educated discourse was the surreal world of the marketplace. Then as now, clinicians paid lip service to prevention but saw it as beyond their own responsibility in practice.

Heart disease, of one sort or another, has always been a major cause of premature death. For most of Mackenzie’s working lifetime, the cause was valvular heart disease caused by acute rheumatic fever caused by throat infections with haemolytic streptococcus
Group A, usually ending either in embolic stroke or heart failure with atrial fibrillation, Mackenzie’s special subject. He saw new cases of rheumatic fever every week. In 3 years as a hospital house physician and in 5 years as a GP in a slum area of London in the 1950s, I saw two cases, and another three in my first 2 years as a GP in South Wales. For the next 29 years, I saw none. That dramatic change seems to have had almost nothing to do with clinical medicine as then defined. It probably had almost everything to do with an end to whole families living in one room, leading to changes in streptococcal virulence as its patterns of transmission changed. My mother, from an affluent family, died in her 50s from an embolic stroke, caused by mitral stenosis. The health of affluent populations will always be vulnerable to the sickness of poor populations. Concentration in ghettos is fortunately not equivalent to containment. Nobody deserves their sickness.

Mackenzie himself died from the next mass killer from heart disease, coronary atheroma and thrombosis. Like rheumatic valvular disease, premature mortality from coronary heart disease and early evidence of coronary atheroma in general populations of young men, followed trajectories consistent with both the rise and fall of cigarette smoking, and with Forsdahl’s hypothesis of childhood underfeeding followed by overfed maturity. It did not follow the trajectory of surgical interventions, however ingenious. Human biology includes human behaviour and human environments. Such an ecological approach needs to be included in teaching and supported in primary care practice. In a fully civilized society, doctors would act as leaders of local action and opinion. We are beginning to succeed for smoking, why not for exceptional heroes. Extension of research to include a vast expansion of networked multigenerational cohort studies, aided by clinicians intimately familiar with their subjects and willing to work collectively with colleagues from many other disciplines, could profoundly change many aspects of clinical science now accepted as final.

Charged with impertinence when he suggested that his conception of physics might come closer to the truth than those of Sir Isaac Newton, Gilbert N Lewis, who first proposed our present model of molecular bonding in chemistry in 1916, replied:

It will not be the first time in the history of science that an increase in the range of observational material has required modification of generalizations based upon a smaller field of observation.

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Conflict of interest: None declared.

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