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Health transition research in the control of morbidity and mortality from Acute Respiratory Infection

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Abstract

The essence of health transition research is its multidisciplinary character and openness to broad theory. Theories of health transition provide the context in which classic epidemiological studies can, most effectively, contribute to population health improvement. Acute respiratory infections are a leading cause of morbidity in all countries, and a major cause of premature death in countries where mortality is high. The international ARI control program in childhood sponsored by the World Health Organization is built on conventional biomedical foundations.

Health systems in Australia and Pakistan continue to be driven by this conventional model which has contributed to changes in mortality but probably not exclusively. A health transition approach forces us to step back, and place the gains of the biomedical model in a social and historical perspective. Using that perspective to move public health policy forward in the modern nation state requires adventurous lateral thinking. We review here the problem of acute respiratory infections in Australian and Pakistani children. In Australia, we focus on the large differences in respiratory infection severity and outcomes between Aboriginal children and Caucasians. We also draw attention to our current ignorance on what differentiates children who are prone to respiratory infections from those who are not. In Pakistan, we highlight the problem of refocusing a health care system that is already seriously underfunded for the biomedical task. A major challenge for social scientists is to become involved more directly in the medical care system and devise health care interventions that can address social inequities, and can provide a better integration between social and biomedical views of the world.

The increasing involvement of social scientists in health care systems around the world is evidence that the social, cultural and behavioural issues are gaining greater recognition in health care practice. Jack Caldwell's seminal contribution on the role of female literacy and autonomy in demographic change has been reflected in the recommendations of the World Bank's 1993 report *Investing in Health*.

In this paper we contrast the insights, processes and application of modern biomedical research and the newly emerging area of health transition research, and argue for greater integration across the two paradigms. Whereas biomedical research has become more and more reductionist in its approach to the explanation of disease, health transition research goes 'system wide' seeking its explanations in social movements and cultural and behavioural mores. Epidemiology provides a set of tools which can be used to explore the distribution and determinants of disease in human populations. Conventionally, epidemiologists have been drawn from the biomedical paradigm and they see disease predominantly in reductionist terms. Their task is to relate causal exposures to disease outcomes, and the inferences they draw about causality form the basis on which public health interventions are developed. Increasingly however, as epidemiologists broaden their frames of reference to whole nation

states and the differences in cause-specific morbidity and mortality that are evident across cultures, they are being forced to acknowledge the poverty of an approach that is exclusively reductionist. There is need to elongate the causal chain to encompass broader social processes. It turns out that variables which represent socio-economic class are emerging as the most important explanatory variables for a wide range of health outcomes in many countries. This has led to growing pressures from social scientists to focus on the socio-economic variables rather than biomedical parameters. We argue here that both kinds of insights are vital and complementary, and we ask: how will the broadening insights which health transition researchers can provide, translate into world health improvement? As two medical epidemiologists who have been heavily influenced by Caldwell's work (Douglas 1991), we describe a problem which has major public health consequences both for Australia and Pakistan, and ask 'How can disease and death rates from acute respiratory infection in childhood be changed by health transition research in the future?'

These infections are a leading cause of medical consultation and hospital admission in childhood, and are the reason for huge sales of over-the-counter and prescribed drugs. The average child worldwide experiences five to eight infections per year in the first years of life and at least three million children die annually in the developing world from the serious consequences of these infections (Pio, Leowski and Ten Dam 1984; Leowski 1986).

The biomedical view of the problem of ARI in childhood

A large number of infecting agents are involved. They include viruses, bacteria and a range of parasitic agents. While death rates from these infections have declined profoundly in countries which have passed through the health transition, primary attack rates are not greatly different between developed and developing countries. As a consequence of intense biomedical research efforts there are a number of effective vaccines and a large range of antibiotic agents for prevention and therapy. Incidence rates of upper respiratory disease are quite similar in the First and Third Worlds, and viruses are considered to be the principal initiating agents. On the other hand, acute episodes of lower respiratory illness occur ten to fifty times more frequently in developing countries where the assumption is that susceptible individuals become superinfected by bacteria (Pio et al. 1984).

Seventy to eighty per cent of ARI-related deaths are caused by pneumonia. Viral agents which cause most acute upper respiratory illness probably pave the way for invasion of the lower respiratory tract by bacterial organisms which are present in the upper tract of most children, perhaps in greater profusion in circumstances of poor hygiene and nutrition. Most childhood pneumonias are caused by two bacteria, *Haemophilus influenzae* and *Streptococcus pneumoniae*, and this is true especially where ARI mortality is high (Pio et al. 1984).

Risk factors

Considerable research effort in both developing and developed countries has gone into the attempt to define those children who are at greatest risk of developing lower respiratory infection. It is clear that malnutrition is a central issue. Also, smoke in the home, whether derived from cigarettes or from combustion of biomass fuels, appears to be associated with higher pneumonia incidence (Pandey et al. 1989; Armstrong and Campbell 1991). Low rates of breastfeeding, low birth weights, and mothers in lower socio-economic groupings relate to higher rates of lower respiratory infection (D'Souza forthcoming).

The International ARI Control Program

The availability of effective antibiotic drugs offers a biomedical response to this problem and has resulted in the development of ARI control programs around the world which seek to ensure that mothers will take children to health clinics for care, and that health workers will prescribe antibiotics for those children most likely to be suffering from pneumonia (WHO 1994).

The underlying assumption is that antibiotics have contributed appreciably to the decline in First World ARI childhood mortality and that a major reduction in child mortality could result in the Third World from a rational application of simple clinical guidelines to antibiotic prescription. An international program has been promoted by the World Health Organization and UNICEF around three central interventions: the appropriate use of currently available vaccines against measles, pertussis and diphtheria as part of the expanded program of immunization; education of mothers and health workers in the recognition of signs that a respiratory infection has extended from the upper to the lower respiratory tract; and the use of standardized clinical guidelines to assist health workers in the prescription of antibiotics which can cut short life-threatening pneumonia caused by the two most common lower respiratory tract pathogenic bacteria.

Field tests of this approach to ARI control were instituted in a number of developing countries (Bang et al.1990; Pandey et al. 1991; Fauveau et al. 1992) and a recent meta-analysis of this experience evaluated in a series of quasi-experimental trials has concluded that the combined approach is associated with reduced loss of life (Sazawal and Black 1992). But this approach has been impeded by growing antibiotic resistance, difficulties of antibiotic supply in poor countries, logistic difficulties in the delivery of vaccines to eligible children, and the relatively high cost and complexity of treatment as a life-saving intervention in childhood.

Pakistan

In Pakistan where the costs of antibiotics are a major disincentive to their use and where health workers are not consistently available, high ARI mortality rates persist.

In urban slums ARI is the second leading cause of death and these deaths usually occur before the age of two years. Mortality is much greater in infants than among older children. One of the associated causes of death is malnutrition. There is seasonal variation for ARI which is highest in the winter months from November to March (Community Health Sciences Department 1992). In Pakistan and many other cultures, infants are not taken out of the house even when ill for fear of exposing them to further risks (Bang et al. 1990). A national survey in 1990-1991 showed that one in six children had suffered from the symptoms of ARI — cough accompanied by rapid breathing — during the two weeks preceding the survey. Two-thirds of the children who suffered ARI symptoms were taken to a health facility or health provider for treatment. Children most likely to have untreated symptoms were those four years of age, children highest in the birth order, children in the Sindh province, and those whose mothers had no education (Pakistan DHS 1992).

The health care delivery system in Pakistan is strained by the country's high population growth rate. The health system ranges through religious and faith healers, traditional healers, homoeopathic dispensaries, modern hospitals and specialized clinics. The conventional medical systems focus largely on the curative aspects of disease. The government is encouraging the use of Western medicine, community health workers and doctors, and large specialized hospitals are being established in the cities.

Most of the health providers, doctors, nurses and dispensers, are based in city hospitals. Rural people are left with little or no treatment or have to resort to traditional healers. Currently 70 per cent of the population live in rural areas; they are served by Basic Health Units (BHU) which refer cases to the District Hospitals. There are problems with

accessibility, quality, staffing and equipment of the health services, which are more acute in rural areas.

The treatment of ARI leaves much to be desired. ARI is often not recognized, or if recognized, not treated correctly. Poly-pharmacy is a common occurrence and irrational drug use is prevalent. In urban slums self-medication is common and mothers tend to change healers if they find no improvement in the child's condition. Pneumonia signs may be overlooked or disregarded in a female child. In Pakistan's urban areas, especially in slums, many health practitioners are quacks. Most of them reinforce the harmful practice of resorting to poly-pharmacy for a quick 'cure'. They dispense only a day's medication and often poor mothers will stretch this out to two days, and when the child does not improve they change the healer. They may then resort to traditional healers. Patients who do not get well by such means may then turn to a religious healer.

Social and epidemiological research has identified a number of risk factors for poor outcomes of ARI in both rural and urban settings (Leowski 1986: van Ginneken 1990; Kundi et al. 1993; Hussain et al. n.d.). The risk factors include inadequate health services; low levels of health consciousness; ineffective case management by traditional healers and allopathic providers: irregular drug supplies; low nutritional levels; low birth weight; crowded living quarters (8-12 in a single room) for both cooking and sleeping; incompletely immunized children; dusty environment; biomass fuel for cooking and warmth; inadequate ventilation and environmental sanitation; lack of protected drinking water; and general poor hygiene. Fortunately breastfeeding is widespread.

There is a Federal ARI cell established by the Ministry of Health which is promoting the National ARI Control Program using the WHO (1990) recommendation for ARI control. The objectives of this program are to reduce mortality from ARI, in particular pneumonia in children under five years of age, and to reduce the inappropriate use of antibiotics and other drugs for the treatment of ARI in children. The strategy used is standard ARI case management of children under five years of age: high coverage of measles, pertussis and diphtheria immunization, promotion of breastfeeding and good nutritional practices. Immunization coverage has been quite good through the Expanded Immunization Program. The coverage for DPT immunization is around 78 per cent and measles around 76 per cent (Grant 1994).

The success of this national strategy will depend upon an educated, well supplied and disciplined health and medical workforce, and a major health education program directed towards mothers of young children. Major changes in traditional behaviour will be required to address the objectives of the national program.

Australia

In Australia, where the cost of antibiotic therapy is not a serious disincentive to the use of multiple antibiotic regimes, and where access to medical care is not problematic (Douglas 1984), mortality from pneumonia in childhood is now exceedingly low but morbidity from pneumonia remains a serious problem in Aboriginal communities (Douglas et al. 1986). It also deserves re-emphasis that the problem of upper respiratory infections continues in Australia as a major burden of morbidity and use of the health care system, and that biomedical approaches to prevention of upper tract infections have been conspicuously unsuccessful.

The decline in mortality has coincided with the widespread availability of antibiotic drugs through an increasingly equitable national health care system that is premised heavily on the biomedical model of disease. The fall in mortality has also paralleled rising community affluence, home ownership, education, female autonomy, improved community nutrition and

environmental health, decreased crowding, decreased parental smoking, and improved breastfeeding practices.

Australian mothers who have kept prospective diaries of their children's respiratory systems in the first two years of life have recorded, on average, six episodes of respiratory symptoms annually. While some of these episodes last for no more than two or three days of mild sniffles, others are associated with prolonged cough and wheeze (Douglas et al. 1994). The role of viruses and other micro-organisms in this burden is incompletely defined. Viruses are isolated from these children about 40 or 50 per cent of the time and it may be that other episodes are linked to agents which have not been identified by modern virological or microbiological techniques (Douglas et al. 1990).

The burden of respiratory morbidity is unevenly spread amongst Australian children. While some children seldom experience respiratory symptoms others have multiple episodes and prolonged symptoms when an episode occurs. A recent epidemiologic study, in which we attempted to develop a predictive regression model based on known biological and social and environmental parameters, only explained about 10 per cent of the variance in respiratory symptoms in the first two years of life.

Australian Aboriginal children have a very different experience of acute respiratory infections from non-Aboriginal children. They are more likely to experience lower respiratory tract infections and to be hospitalized for these infections. Nasopharyngeal carriage rates of pathogenic bacteria tend to be higher in Aboriginal children and they experience a particularly aggressive form of middle ear infection which results in rupture of the eardrum and chronic discharge from the middle ear. This pattern of respiratory morbidity is more like that experienced by children in developing countries than children in Australia's more affluent suburbs. The reasons for these differences in pattern are almost certainly social, environmental and economic. As a group, Aboriginal children tend to be socially, nutritionally and environmentally deprived. Their access to primary care services has been poor, and Aboriginal communities tend to be socially disrupted, dispirited and lacking in self esteem.

Thus, the challenge of acute respiratory infection control in childhood in Australia is one of uncontrolled morbidity and a socio-economic difference in severity. It is possible that if orthodox medical services were improved, irrespective of the social and environmental inequities that have existed now for over 200 years between black and white Australians, respiratory morbidity would become less serious. But such a solitary solution to the problem of Aboriginal respiratory illness is not an acceptable one. There are now strong social pressures and a national commitment to improve health care in the context of minimizing social disadvantage.

Also, if we are to improve our understanding of childhood respiratory disease in the white middle-class suburbs of Australia, where it still causes massive uncontrolled morbidity and health-care expenditures, we need to tease out the relative contributions of antidotal treatment (such as that championed by the WHO international program) from the role of the physical and social environment. There is a great need to improve our understanding of the social and environmental determinants of the incidence of respiratory infections as well as their severity.

Prevention versus cure

Worldwide, health systems are in a 'trade-off' situation in which expenditures on preventive measures, for example vaccines, are balanced against the costs of treating established illness. Both activities are seen as important, but prevention often loses out to the imperatives of managing the 'here and now' of acutely ill and dying patients. This contrasts vividly with the imperceptibility of disease that has been prevented. We have not seriously explored the proper integration of social science into either our preventive or therapeutic drugs and services.

Whereas the biomedical paradigm seeks improved diagnoses, drugs and vaccines and their optimal distribution and delivery, a health transition approach forces us to put these developments into a social and environmental perspective.

With respect to Australian Aboriginal ARI we need to ask about the relative costs and benefits of mass immunization, and improved access to treatment, on the one hand, with all the cultural and behavioural shifts that implies, against the possible impact on disease severity and disease incidence which improved wealth or physical environment could produce. These considerations are equally pertinent to the development of policy for health care in countries like Pakistan. Indeed, where per capita expenditures on health are smaller, the consequences of misallocation to ineffective interventions are greater.

The operation of health care systems

Vast expenditures are now committed to the operation of health care systems in both developing and developed countries. Administrators now demand evaluation, efficacy and outcomes as new technologies aimed at promoting community health proliferate.

This is the environment in which social scientists must compete if they are to drive health improvement. The task is not a trivial one, as the evaluative models which drive vaccine and drug licenture, and promote the uptake of new technology, are both elegant and convincing.

Time frames for health transition outcomes are much longer than those of randomized control trials, and causal inference is much more difficult. How can one compare a program of adult literacy in a Pakistani slum with a program aimed at improving uptake of antibiotics, in their relative impacts on child mortality? How will we compare the relative costs and benefits of vaccination against a common respiratory virus such as respiratory syncitial virus with a program aimed at improving self esteem of Aboriginal mothers?

How much social and cultural research should precede educational programs aimed at enhancing the capacity of mothers to identify when an infection of the respiratory tract has become life threatening? What is the family doctor's role in managing the burden of respiratory disease in his or her local community?

If health transition theory is truly to drive health improvement, sophisticated evaluative methods will need to be introduced into health care systems, that can enable cross-disciplinary communication. There is a growing recognition in the biomedical communities around the world of the need to marry biomedical insights with social science. Effecting the marriage will be no simple task. A good starting point will be for social scientists to bring their insights to problems which already trouble the biomedical policy-makers. For example, do differences in perceived prognoses influence household investment of scarce resources in medicines or practitioner visits? What signs and symptoms indicate to a mother that her child is sick? What signs and symptoms are associated in the mother's mind with the supernatural and the need for supernatural treatments? How is health-seeking behaviour influenced by household composition, female employment, education, etc? What leads to mothers being primary decision-makers while in other cultures decisions are taken primarily by grandparents or fathers? How do parental and practitioner expectations differ with respect to the desirable outcome of clinical consultations? What are the determinants of self-medication in developing-country communities and what kinds of intervention make a difference to these perceptions or attitudes?

More radical social views of health

The examples given above offer mechanisms for a greater marriage between social and biomedical sciences. But they will not satisfy the potential of health transition research in improving world health. We do not believe it will be a matter of *either* biomedical *or* social

interventions making a difference but would hypothesize that well evaluated experiments which address both areas are likely to be multiplicative in their effects on health. Social scientists need to become properly embedded in the health system infrastructure around the world, but they also need to be catalysts for broad social change that extends beyond the health system.

A more adventurous commitment to health transition theory involves us in considerations of literacy, income supplementation, housing modification, initiatives to improve self esteem and empowerment, changes in attitudes to sex, marriage, violence, use of leisure time and communication between individuals. These attributes go to the heart of culture and social behaviour, and of course go well beyond the health care system as we know it. There is growing evidence that failure to address these broader social and cultural variables is simply tinkering at the edges of health and of human survival. Whatever the success of the biomedical model (and it is difficult to be confident how much of our change in mortality is attributable to it) future developments in health are clearly going to depend on us addressing these broad social determinants of inequality in health outcomes. To structurally address these problems takes us well outside the health portfolios of governments around the world, and inevitably involves an intersectoral approach to health and welfare.

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