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Education and Health Behaviour of Indigenous Australians: evidence from the 1994 National Aboriginal and Torres Strait Islander Survey (NATSIS)

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Abstract

Strong relationships between education and health outcomes have been identified in most countries of the world, with children of more educated parents having more favourable health and a better chance of survival. However, there has been little research on this relationship among Indigenous peoples living as minorities in First World countries. This paper reports on an analysis of data from the National Aboriginal and Torres Strait Islander Survey of 15,700 people conducted in Australia in 1994. The analysis focused on the actions that respondents reported they had taken concerning their children's health. After controlling for the effects of reported health conditions and health status on people's health behaviour, we examined whether any significant relationship remains between education and health behaviour. The analysis showed that this relationship was more complex than originally anticipated. Relatively high levels of health action are taken for two groups of children - those whose mothers had the least education and those whose mothers had the most education. The same was found to be true when access to health services and a range of other variables were taken into account. This suggests that some unobserved factor is influencing what would otherwise be a linear or ordinal relationship, and raises many questions. While the paper concludes with some suggestions of other factors that might be operating, this takes us into areas beyond the reach of statistical analysis. The data collected in national surveys and censuses needs to improve in value for analyses such as these. It is important to supplement statistical studies with more qualitative surveys and ethnographic study at regional and community level, with relevant Indigenous organisations having maximum input into their design.

Introduction

For over two decades, international population health research has been exploring the links between education levels and health outcomes. In particular this research has looked at the impact of the levels of mothers' education on the health of their children. Australia has been home to the major centre for this international research effort, but apart from one small study done over a decade ago (Gray 1988), no efforts have been made to relate these findings to the poor health status of Indigenous people in this country. If the same relationships between education and health do exist for Indigenous people in this country, then education levels within the Indigenous community should be of immediate concern to policy makers and Indigenous health organisations trying to achieve some improvement in the health situation. Indigenous people have levels of education that are far lower than in the community generally; apparent retention rates to year 12, for example, are currently only 32.5 per cent nationally for Indigenous students, compared with 75 per cent for non-Indigenous students. These rates, which are estimates of the proportions of students who remain at school until year 12, are much lower again in the Northern Territory and in rural and remote areas generally (Schwab 1999).

Several papers presented at a conference in Darwin in 1995, Aboriginal Health: Social and Cultural Transitions (Robinson 1995), put these issues on the agenda. Researchers in the Indigenous Health and Education Program of the new Commonwealth Government funded Cooperative Research Centre for Aboriginal and Tropical Health (CRCATH) took up the challenge to look at them. CRCATH currently supports two Indigenous-led research teams who are investigating community perceptions of education-health links through qualitative action research in Northern Territory communities in Central Australia and the Top End. The CRCATH also initiated the exploration of these links quantitatively, and this paper reports on a preliminary analysis carried out on data from the 1994 National Aboriginal and Torres Strait Islander Survey (NATSIS). The aim was to discover what relationship if any the data revealed between levels of education and 'health behaviour'.

Health Transitions

Strong relationships between education and health outcomes have been identified in most countries of the world, with children of more educated parents having more favourable health and a better chance of survival. The most recent work strongly suggests that education also has a favourable impact on the health and survival of the people themselves (Duffy & Menken [in press]). The most prominent researcher of this relationship, Professor J C Caldwell from the Health Transition Centre at the Australian National University, has observed that the context of the link is still poorly understood:

> The success achieved by demographers in examining the relationship between parental education and child survival must be placed in the larger context of the nature of the society and the family, especially the autonomy of women, and the survival of persons of all ages and each sex. The basic problem is that which has always been the greatest challenge to demographers, to define and find appropriate measures of aspects of society which pose greater problems than the duration of education, or the position of women. Unfortunately, demographers are prone to conclude that a phenomenon does not exist if they can find no satisfactory way to measure it. (Caldwell 1996, 331)

Nevertheless, it is logical to suggest that through their own actions and through their ability to access and respond to the services available in their communities, Indigenous people who are more educated might be better able to meet their own health needs and those of their children.

Hobcraft's review of the international literature identified a number of possible 'pathways' through which mothers' education could enhance child survival:

> a shift from 'fatalistic' acceptance of health outcomes towards implementation of simple health knowledge; an increased capability to manipulate the modern world, including interaction with medical personnel; and a shift in the familial power structures, permitting the educated woman to exert greater control over health choices for her children. (Hobcraft 1993, 159)

The more sophisticated studies acknowledge that the effect of education on health is best understood not just in terms of individual behaviours but also in relation to characteristics of the society overall. These include greater female autonomy in the society as a whole, a religious or cultural orientation valuing education, a greater commitment to egalitarianism and a radical political tradition (Caldwell 1986; Caldwell 1992; Caldwell & Caldwell 1995). This work, however, refers largely to Third World countries; the complex issues surrounding any adaptation of health transitions research to the 'Fourth World' situation of Indigenous Australians have been canvassed by Boughton (2000). These issues include the question of whether a theory developed for the general populations of low-income countries can be applied to a disadvantaged minority in a high-income country, especially a minority that is as heterogeneous as Australia's Indigenous population.

Gray's study of 1986 Census data found that there was a clear relationship between the level of education of Indigenous women in Australia and the survival of their children. The lowest survival (or highest mortality) was for the children of the least educated mothers. Specifically, women aged 15-34 who had left school at ages less than 14 had an 'index of child loss' about 60 per cent higher than the average. However, the lowest index of child loss was for women who left school at age 15, not for those who left school at higher ages. In the conclusion drawn from this data it was speculated that those women who were the most educated provided better, more detailed responses to the census questions, creating a misleading impression that their children were at greater risk of death (Gray 1988).

Data source

The National Aboriginal and Torres Strait Islander Survey (NATSIS) was conducted in 1994 by the Australian Bureau of Statistics (ABS) in response to a recommendation of the Royal Commission into Aboriginal Deaths in Custody (1991, Rec 49). Approximately 90 Aboriginal and Torres Strait Islander interviewers surveyed over 15,700 Aboriginal and Torres Strait Islander people using a survey form that was designed in close collaboration with Indigenous peoples organisations. The data collected has since been subject to a wide range of analysis, including analysis in relation to education and to health. However, no previous study has sought to link the two.

To the extent that the health transition model is about change, a cross-sectional data set such as the NATSIS is obviously not ideal, but it can be useful for looking at relationships between health status and reported behaviour.

The Centre for Aboriginal Economic Policy Research (CAEPR) has been one of the major users of the NATSIS education data and has drawn on it to demonstrate strong links between education and employment (Hunter 1996). It has also identified some of the determinants of educational outcomes such as retention rates, school achievement, and literacy and numeracy (Hunter & Schwab 1998). A series of analyses of health data from the NATSIS has been produced by ABS (Cunningham 1997; Cunningham & McKerras 1998; Cunningham, Sibthorpe, & Anderson 1997). While none of these directly analysed relationships between education and health, there were indirect indications of possible relationships. For example, Cunningham (1997) found that the prevalence of cigarette smoking by Indigenous people was higher among both men and women who left school at years 10 and 11 than among those with either low or high levels of education. However, the prevalence of smoking was high for Indigenous people of all levels of education, except those who were still at school.

The quality of the health data from the NATSIS has been criticised, mainly on the grounds that the data were collected in a way that could not be compared with data from surveys of other Australians (Anderson & Sibthorpe 1996). This was because the questions that were asked and the classifications of responses were modified to a form that was considered to be appropriate for Indigenous respondents. An evaluation of the health data in the survey by the Australian Bureau of Statistics (Australian Bureau of Statistics 1996, 23-4) acknowledged the validity of such criticisms. The ABS noted (ibid, 35) that although there had been a generally favourable public response to the process by which the NATSIS was conducted, this had not led to 'any detailed use of the information'. Through its own very useful set of occasional papers by Cunningham and her co-authors, mentioned above, the ABS has subsequently been the major ostensible user of the health information in the survey.

The health data was recently used by the Aboriginal and Torres Strait Islander Commission (ATSIC) Office of Evaluation and Audit (1999). ATSIC was interested in locating any influences on environmental health from the range of information on the housing, infrastructure, economic and social conditions of households and families. The findings were surprising:

> In summary, except for chest medical problems which are significantly associated with absence of toilet facilities in the dwelling, and crowded living conditions, there is no evidence that better housing and infrastructure is related to lower incidences of ill health in the indigenous population using the available set of variables in the NATSIS (ibid, 35).

CAEPR's Dr Boyd Hunter examined these findings, and his commentary is included in the volume published by ATSIC (Hunter 1999). Hunter did the analysis again to verify it (personal communication), and found that the reported results were in accordance with the data. He also pointed out that there are various reasons that might explain why Indigenous people found in better housing would have worse health status, and that 'there are enough doubts about the role of migration and policy interventions that we cannot be confident that the OEA result is not an artefact of the data' (Hunter 1999, 89). In other words, if, for example, people had recently moved, their reported health history might not be related to their present housing.

In the further analysis in this paper, the warnings about the meaning attributed to people's reported health status in the NATSIS are taken very seriously. In fact, reported health status will be taken to mean no more than what people say is wrong with them in response to survey questions that may or may not have been answered 'correctly'. The focus will be more on what respondents to the survey said they did in relation to health problems they reported.

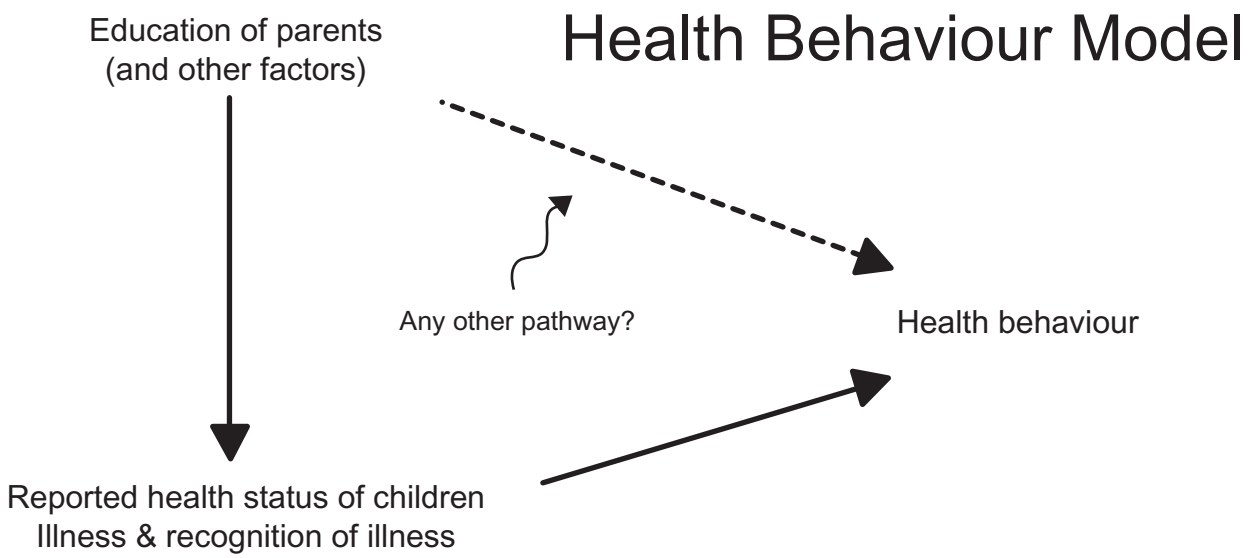
Two other aspects of the data regarding health status should be recorded. One is that the data relates to survivors - that is, people who have not died as a result of a recent illness, and who might have endured serious illnesses at various times in the past but have pulled through. This tends to introduce analytical bias, favouring explanations that apply to people who have a greater capacity to survive. The second aspect is that the data reported for children less than 13 years old was supplied by adults on their behalf.

Method

This analysis examines the evidence concerning Indigenous children's health. Much of the work which has been done internationally on links between education and health outcomes has been done on data relating to children. For children, the education of their mothers and fathers is the important factor, with the majority of the previous research focusing on mothers. The aspects of children's health which are usually examined are survival (mortality) and nutritional status, although analysis of parental use of health services ('health-seeking behaviour') has also been undertaken. There are no comparable outcome variables in the NATSIS data, and for reasons discussed in the previous section it seems best to avoid taking the health status variables in the NATSIS as measures of prevalence of ill health. Therefore, the analysis focused on the actions that respondents reported they had taken concerning their children's health.

For this analysis a health behaviour model has been used, illustrated in Diagram 1, in which the records of children are linked with those of their parents. This link is not available automatically in the NATSIS data set. To enable replication of our results, we give an explanation of the linking procedure in Appendix 2.

DIAGRAM 1



The model takes into account possible differences in the respondents' reporting of the health status of their children in accordance with the educational levels or other characteristics of the respondents; however, it does not attach any importance to such differences as they may be misleading. This relationship is shown as the downward-pointing arrow from 'education' to 'health status' on the left of the diagram. The more important question is: after taking into account any actual differences in health status, are there any other ways in which the education of parents influences their behaviour with regard to their children's health? These possible pathways are indicated by the dotted line from 'education' to 'health behaviour'. For example, where parents see that their child is ill, educated parents might react more quickly and be more likely to use the services of health institutions. If this is the case, then we would anticipate that for children with a particular reported health status, their parents' education levels will influence the amount (and/or kind) of health actions (action by parents on perceiving their child is ill) they take.

There are many measures of health behaviour in the NATSIS. The ones which are most useful for this report are the reports of any 'health-related actions' in the two weeks before the survey. 'Health-related action' refers to the following types of behaviour:

- visited emergency/outpatients clinic
- was admitted to hospital
- consulted a doctor
- consulted an Aboriginal health worker
- consulted a nurse
- used medication
- used bush medicine
- had days of reduced activity

These types of behaviour fall naturally into three groups: curative behaviour, consultative behaviour and self-treatment. The first two categories in the list refer mostly to curative behaviour, the next three to consultative behaviour, and the last three to self-treatment. In a more comprehensive analysis, the sequence in which such activities were undertaken, the ways in which they were combined, and delays in taking action would be important topics for loo at. With the NATSIS data, however, although it does allow an examination of the combinations of actions undertaken, without knowing to sequence in which they were undertaken, such an examination is of little analytic use. For example, a respondent who reported both consulting a doctor and taking medication could possibly have taken the medication before seeing a doctor, to delay seeking other treatment, or else could have taken a prescribed medication after seeing a doctor. The same combination of reported actions, therefore, can refer to completely different types of behaviour. Because of this, it is preferable with this data set to look at such types of behaviour as simply representing 'health behaviour' in general. At most we can consider the data according to the three groups of behaviour - curative, consultative and self-treatment - rather than examining each 'action' separately or in their many combinations.

The strategy we have used in this analysis is to control for the effects of reported health conditions and health status on people's health behaviour and then examine whether any significant relationship remains between education and health behaviour. If there is any significant relationship that is not related to measures of health status, then it would be reasonable to conclude that people behave differently, according to the level of their education, when they perceive their children to be ill.

In the lead up to the analysis, the broad characteristics of the various factors in the analytical model are examined separately and thoroughly. For instance, in the case of parents' health behaviour in relation to their children, the nature of the reported illness is examined first, then the nature of the reported health behaviour. After the main relationships between reported illness, behaviour and parental education are examined, the analysis goes on to examine the relationship between the educational level of parents and their behaviour, 'controlling' for reported illness. Finally other factors which could influence the relationship are also controlled to see whether they provide an explanation of the pathway by which (the way in which) education influences behaviour.

Results of analysis: Health status of children and parental behaviour related to children's health

Health status was reported in the NATSIS in several different ways. First there was an informal classification of current illnesses, using common descriptions of illness. The prevalence of the various illnesses reported for children of different ages is shown in Table 1.

Table 1. Prevalence rates of specified current illnesses (informal classification), Indigenous children (<15 yrs), NATSIS, 1994

	Age 0 4	Age 5 9	Age 10 14	Total
N (weighted)*	**2,468**	**2,197**	**1,831**	**6,496**
Asthma	15.8%	18.9%	16.8%	17.1%
Diabetes	0.2%	0.3%	0.2%	0.3%
Heart problems	1.7%	2.2%	1.9%	1.9%
Chest problems	5.9%	4.1%	4.3%	4.8%
Skin problems	10.3%	6.7%	8.3%	8.5%
High blood pressure	–	–	0.1%	0.0%
Ear/hearing problems	7.7%	12.1%	11.0%	10.1%
Eye problems[a]	1.7%	1.8%	2.4%	1.9%
Kidney problems	1.1%	1.6%	1.5%	1.4%

* weighted to sample total
- no cases recorded (0.0% indicates very small number of cases)
[a] not corrected by spectacles or contact lenses

The table shows that 17.1 per cent of Indigenous children were reported as having asthma, 10.1 per cent as having ear and hearing problems, and 8.5 per cent as having skin problems. The only other condition of note was chest problems, which was reported for 4.8 per cent of children. In a sample of this size, the age-specific variations for these four types of condition are statistically significant, although they are very weak.

The sampling scheme used in the NATSIS produces quite large differences between weighted and unweighted tabulations of the cases[1]. In the tables presented in this report, weighted data have been adjusted to the original survey sample size, so as to retain some sense of the scale of the estimates which are shown. In other words, the totals ('N') shown at the top of the columns in Table 1 have been adjusted in scale so they are close to the sample counts of unweighted cases.

The nature of illnesses was also reported in considerably greater detail to describe conditions for which treatment had been sought in the previous two weeks. This classification followed the categories for the International Classification of Disease, and is shown in Table 2. This classification gives prominence to respiratory system diseases - which would include asthma and many 'chest problems'; to diseases of the nervous system and sense organs - which would include hearing and ear problems; and to skin diseases. This is quite consistent with the informal classification of current conditions in Table 1. Note that the next largest class is the 'supplementary' class, which refers to services such as check-ups, counselling and immunisation rather than illnesses.

Table 2. Conditions for which health-related action was taken in the previous two weeks, Indigenous children (<15 yrs), NATSIS, 1994

	Age 0 4	Age 5 9	Age 10 14	Total
N (weighted)*	**2,468**	**2,197**	**1,831**	**6,496**
Infectious & parasitic diseases	3.5%	3.0%	2.7%	3.1%
Neoplasms	–	0.0%	–	0.0%
Endocrine etc. diseases	0.7%	0.8%	0.6%	0.7%
Diseases of the blood	0.2%	0.2%	0.3%	0.2%
Mental disorders	0.3%	0.3%	0.2%	0.3%
Diseases of nervous system, sense organs	12.3%	15.1%	13.7%	13.6%
Circulatory system diseases	1.7%	1.7%	1.6%	1.7%
Respiratory system diseases	29.8%	24.8%	21.5%	25.7%
Digestive system diseases	5.0%	2.1%	1.7%	3.1%
Genitourinary system diseases	1.5%	1.4%	1.5%	1.5%
Pregnancy etc.	n.a.	n.a.	n.a.	n.a.
Diseases of skin and subcutaneous tissue	10.5%	8.1%	7.3%	8.8%
Diseases of musculoskeletal system etc.	0.6%	1.1%	1.9%	1.1%
Congenital anomalies	0.2%	0.1%	0.0%	0.1%
Symptoms, signs and ill-defined conditions	4.5%	3.9%	6.8%	5.0%
Injury & poisoning	2.8%	3.2%	4.0%	3.3%
Disability n.e.c.	0.2%	0.4%	0.0%	0.2%
Supplementary[a]	9.9%	4.6%	4.0%	6.4%

* weighted to sample total
- no cases recorded (0.0% indicates very small number of cases)
n.a. not applicable
[a] services while healthy (e.g. check-up, counselling, immunisation)

Besides the main classifications of ill health, Table 2 reveals a considerable amount of treatment for infectious and parasitic diseases, for digestive system diseases (which, as would be expected, are most prominent for the youngest children), for injury and poisoning, and for the catch-all category of symptoms, signs and ill-defined conditions.

There are more general measures of health status available from the NATSIS data. One of the more useful measures was given by respondents in answer to a question on how they rated their own health or that of their children. The data are shown in Table 3, with 35.4 per cent of children reported as having 'excellent' health and 36.9 per cent of children reported as having 'very good' health. The proportion of older children with 'excellent' health is much lower; this decline in health status from 38.0 per cent of children aged less than 5 to 32.5 per cent of children aged 10-14 is highly significant statistically. Only small proportions of children were rated as having 'fair' or 'poor' health. As will be seen below, this general measure corresponds quite well with the reported occurrence of illnesses, which have occurred more frequently with progressively worse categories of health status.

Table 3. Health status as assessed by parents, Indigenous children (<15 yrs), NATSIS, 1994

	Age 0–4	Age 5–9	Age 10–14	Total
N (weighted)*	**2,468**	**2,197**	**1,831**	**6,496**
Health status: Excellent	38.0%	34.9%	32.5%	35.4%
Very good	33.9%	38.5%	39.1%	36.9%
Good	24.0%	23.0%	24.7%	23.8%
Fair	3.1%	3.5%	3.4%	3.3%
Poor	1.0%	0.2%	0.3%	0.5%

* weighted to sample total

There are four sample cases excluded because they are missing the information on self-assessed health status

Another general measure of health status can be obtained by calculating the proportion of children for whom any illness, handicap or recent treatment was reported. This proportion declines from 57.7 per cent of children aged less than 5 years to 51.5 per cent of 5-9 year-olds and 52.9 per cent of 10-14 year-olds. (These figures are not included in Table 3.) According to health status as reported by parents, the proportion having any reported condition was:

Excellent health status	40.6 per cent
Very good health status	56.0 per cent
Good health status	65.9 per cent
Fair health status	88.8 per cent
Poor health status	100.0 per cent

(Spearman correlation 0.24, p<.000005)

Although the concepts of health status embodied in the two measures discussed above are different, interpretation of the Spearman correlation coefficient[2] is that the correspondence between the two measures is highly significant and quite strong.

Measures of health behaviour are shown in Table 4. The most common type of health behaviour for all age groups is the use of medication and the next most common behaviour overall is to consult with a doctor. For children aged 5-9 years and 10-14 years, the most common health behaviour after medication is to have days of reduced activity, rather than consult a doctor. In general, and for all age groups, it is more usual to self-treat than consult any type of health worker. Curative behaviours involving visits to emergency or outpatients departments, and in many cases subsequent admission to hospital, are also quite common, given that these behaviours relate mainly to illnessess at the more serious end of the spectrum.

As noted earlier, the value of these findings would have been enhanced considerably if the sequences in which the different behaviours occurred had been investigated and questions had been asked about any delays that occurrred before treatment was obtained. This information would assist considerably in describing and characterising the different forms of health behaviour.

Table 4. Health behaviour for Indigenous children (<15 yrs), NATSIS, 1994

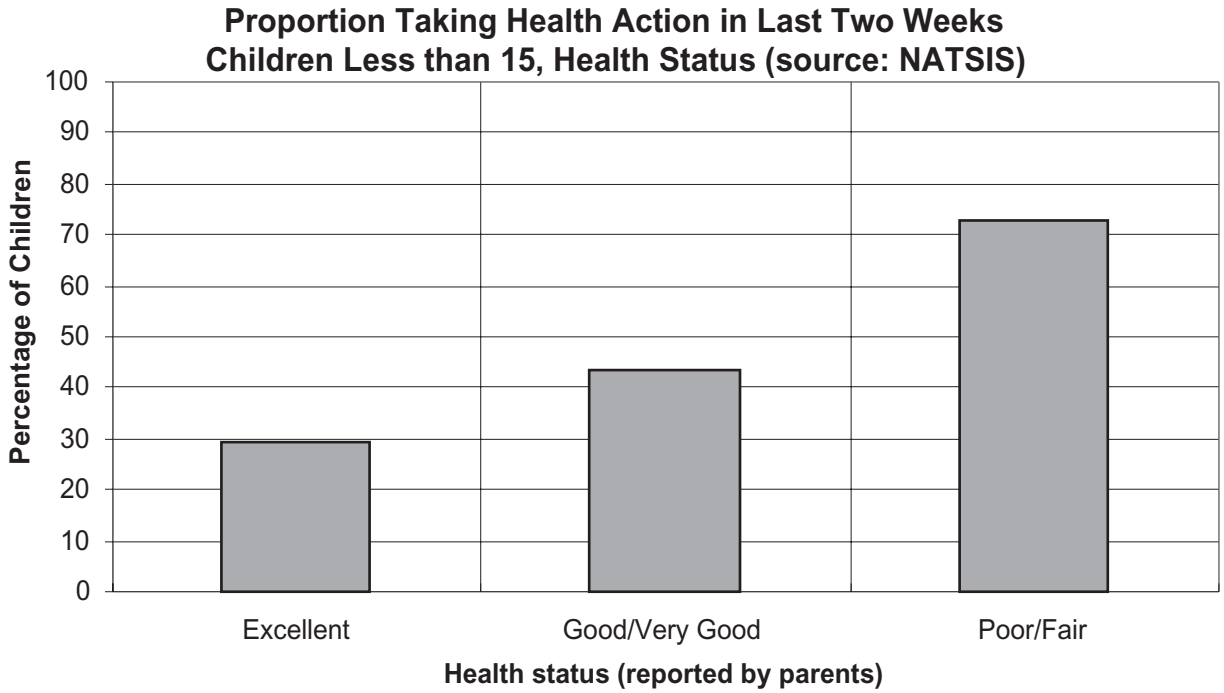
	Age 0–4	Age 5–9	Age 10–14	Total
N (weighted)*	**2,468**	**2,197**	**1,831**	**6,496**
Any health behaviour	**47.1%**	**34.3%**	**35.9%**	**39.6%**
Visited emergency/outpatients	8.1%	6.5%	5.6%	6.8%
Admitted to hospital	3.0%	2.0%	0.8%	2.0%
Any curative behaviour	*8.8%*	*6.8%*	*5.8%*	*7.3%*
Consulted a doctor	24.5%	13.8%	12.7%	17.5%
Consulted Aboriginal health worker	8.0%	5.4%	4.0%	6.0%
Consulted nurse	8.1%	3.9%	3.3%	5.3%
Any consultative behaviour	*32.2%*	*19.5%*	*16.7%*	*23.5%*
Used medication	33.9%	22.2%	22.5%	26.7%
Used bush medicine	2.4%	2.0%	2.1%	2.2%
Had days of reduced activity	7.7%	13.9%	16.2%	12.2%
Any self-treatment	*36.3%*	*28.2%*	*31.0%*	*32.1%*

* weighted to sample total

The health behaviour described by the NATSIS does not necessarily correspond with the views Indigenous people hold on health practices. While 'bush medicine' is mentioned, consultation with the traditional practitioners (ngangkari) who are found in some areas is not mentioned at all. Nor are aspects of Indigenous health practice such as a preference for community-controlled health services explored. (Use of 'Aboriginal medical services' is investigated at household level without any analysis of preferred services.) While such deficiencies do exist, it is nevertheless valuable to examine the interface between health services and Indigenous clients, and the behaviour measures provided by the NATSIS are certainly relevant.

Diagram 2 demonstrates a strong relationship between health status and health behaviour. Children whose health status was described as 'excellent' were least likely to have been involved in any type of action of the types listed in Table 4, although some type of health behaviour occurred for 29.5 per cent of these children. Children who were described as having 'very good' or 'good' health status were involved in health behaviour on their behalf in 43.4 per cent of cases, while 72.6 per cent of children whose health status was described as 'fair' or 'poor' were involved in health-related action. This progression from low to high levels of health action is seen with all of the various measures of health status that have been discussed.

DIAGRAM 2


Proportion Taking Health Action in Last Two Weeks
Children Less than 15, Health Status (source: NATSIS)
Percentage of Children
100
90
80
70
60
50
40
30
20
10
0
Excellent
Good/Very Good
Poor/Fair
Health status (reported by parents)

Results of analysis: Education levels and health behaviour

We turn now to the issues concerning education. This is as difficult a concept to measure as health status, perhaps more difficult in some respects. There are two types of measure in the NATSIS. One - for those people who are no longer attending school - refers to the age at which respondents left school; the other refers to the highest level of education respondents have obtained.

There are both theoretical and practical issues involved in using these indicators as 'proxies' for education. Often when people use the term 'education' they mean something far more abstract than either of these measures. They could be referring to a certain level of knowledge obtained from educational courses, or skills learned. On the other hand, people with little formal schooling might be considered highly knowledgeable or skilled, in other words 'educated', without necessarily having achieved formal qualifications or even attended courses up to a particular level. By the same token, people with plenty of schooling and certificates to put on the wall might still be considered 'uneducated' if they appear to have acquired little in the way of worthwhile knowledge or skills. It is very difficult to measure education in this abstract sense, or even to define it precisely. Moreover, depending on how old they are, people will have had different educational opportunities, and encountered different educational systems and standards of teaching and achievement in the formal educational institutions, even though on the two measures above they might show similar results.

The 'proxy' measures of education given by censuses and surveys should therefore always be used with extreme caution. This is even more so in the case of colonised Indigenous and/or minority peoples in education systems designed and staffed largely by the majority colonial power, as is the case in Australia (Boughton 2000; Christie 1998).

In the context of health, there are various possible ways in which education can influence behaviour. It is almost certainly not true that most forms of education could give people specific knowledge about health that would influence their behaviour. What knowledge would that be, and where can it be found in the educational curriculum? And how does such knowledge influence behaviour? Generally speaking, the only people who would obtain this type of knowledge would be students doing health science courses of some type.

One way that the international research has explained the apparent influences of education on health behaviour is that it gives people the confidence and other personal attributes, including general life skills such as literacy, that make it easier to access and utilise the services available in their communities. For this to be the case, education would need to give these people a status in their communities that gave them the confidence to say what it is they want. In a community study in Nepal, Joshi (1994) concluded that

> Schooling provides basic literacy and language skills which are then used in 'modern' health settings. These skills also help women acquire and absorb new information through the media. It is not difficult to see how a widening base of practical knowledge concerning medical situations would give mothers more confidence as well as fluency or competence when interacting with modern health institutions. The acquisition of such skills and knowledge also acts synergistically with a new identity to help create 'psychologically modern' … individuals. Such women identify with the whole modern system, including health centres and recommended treatments…

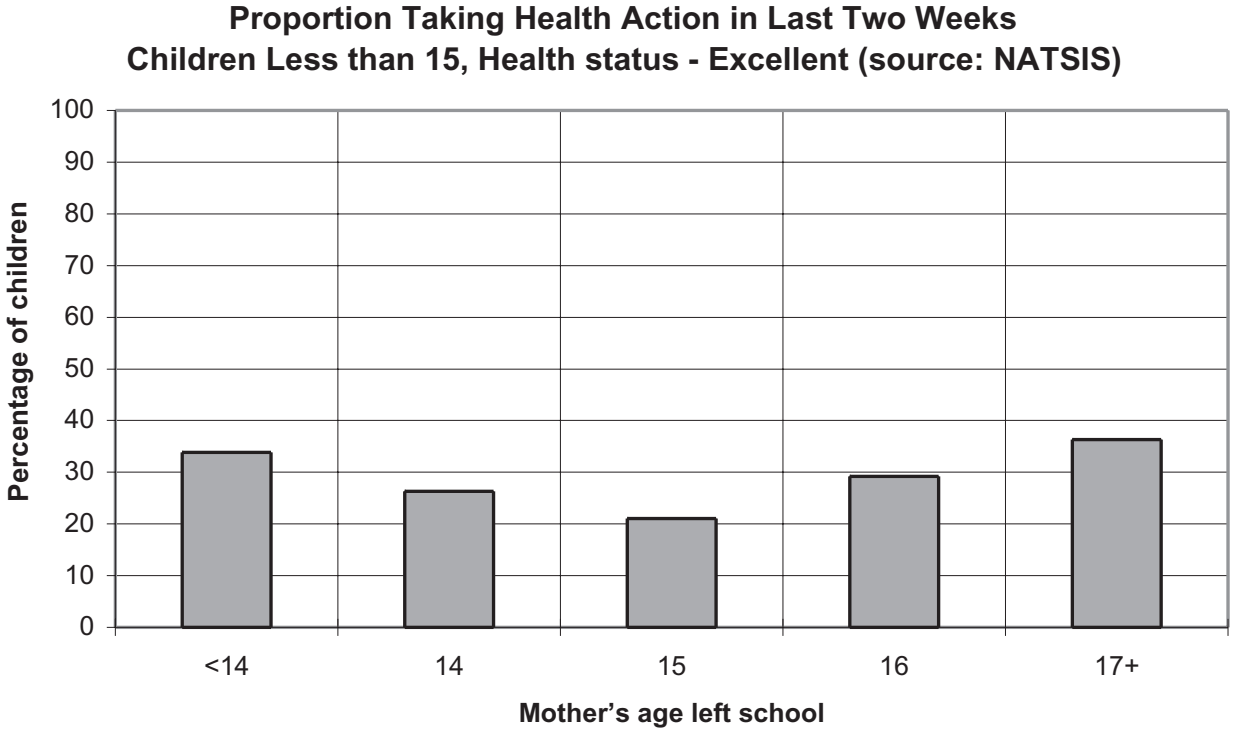
Indigenous Australians with relatively high levels of education do not, however, necessarily have what are considered high levels of education within the non-Indigenous community, nor, indeed, high status in their own. Explaining the benefits of education via status therefore requires detailed ethnographic analysis, on top of the kind of work we report here. Health-seeking behaviour is also conditioned by the attitudes and practices of the health service personnel. Strong and inclusive outreach programs operated by the health services could nullify any advantage that more educated members of the community would otherwise have had.

Parental education is measured in this report by the age at which respondents left school. Years of schooling is a proxy measure of education which tells us little about the education received, and it also suffers from the drawback that it has different meanings in different parts of Australia. While highest level of education is also available in the NATSIS, a substantial proportion of respondents were found to have reported post-school qualifications. Without deprecating the value of these qualifications, it is difficult to compare them or determine their level, since national standardisation of such qualifications is a very recent phenomenon. As a result, highest level of qualification may tell us even less about the education received than age of leaving school.

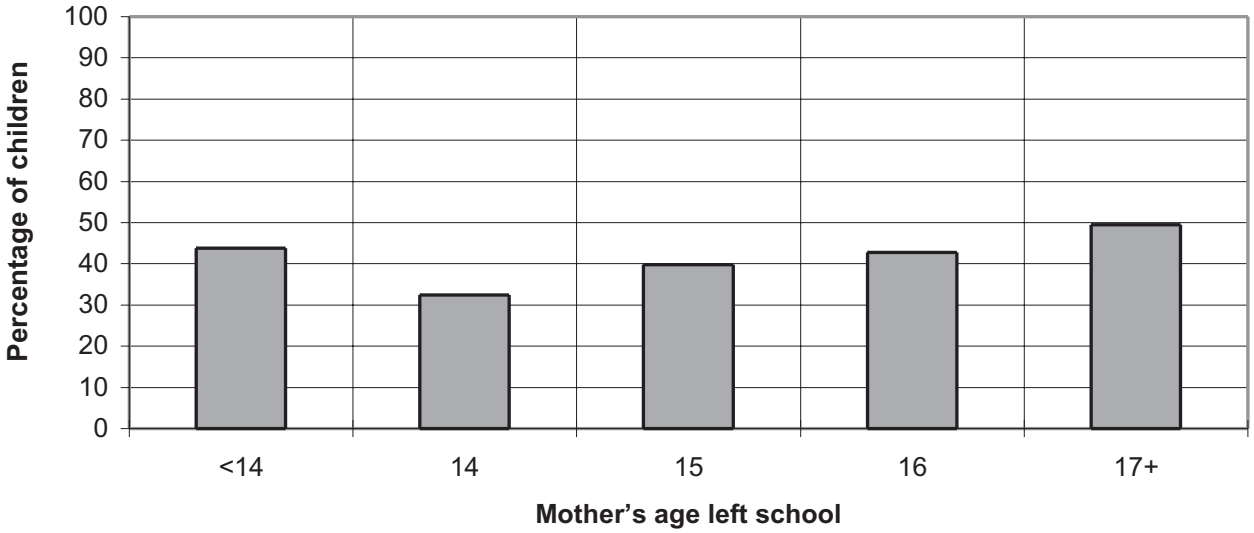
The data reveal a typical pattern in the relationship between parental education, measured by age of leaving school, and health behaviour. It is illustrated in Diagram 3 by showing the proportions of children involved in any health action during the previous two weeks, classified by the age at which their mothers left school. Because of the strong known relationship between health status and health behaviour, the relationship is examined in three panels, controlling for the effects of self-assessed health status, as explained earlier. The first panel shows children who were described as having excellent health, the second panel shows children whose health was described as good or very good, and the last panel shows children whose health was described as fair or poor. (See Appendix 1, Table A.1, for the percentages on which the diagram was based.)

The first two panels both clearly show the typical education/behaviour pattern. In the typical pattern, the proportion of children for whom health action was taken was highest for the children of women who left school at a relatively high age (17 or over) and was the next highest for children whose mothers left school before the age of fourteen. Though still visible in the third panel, the pattern is slightly confused, tending to disappear because of very small numbers of children with poor or fair health status. The evident conclusion is that relatively high levels of health action are taken for two groups of children - those whose mothers had the least education and those whose mothers had the most education.

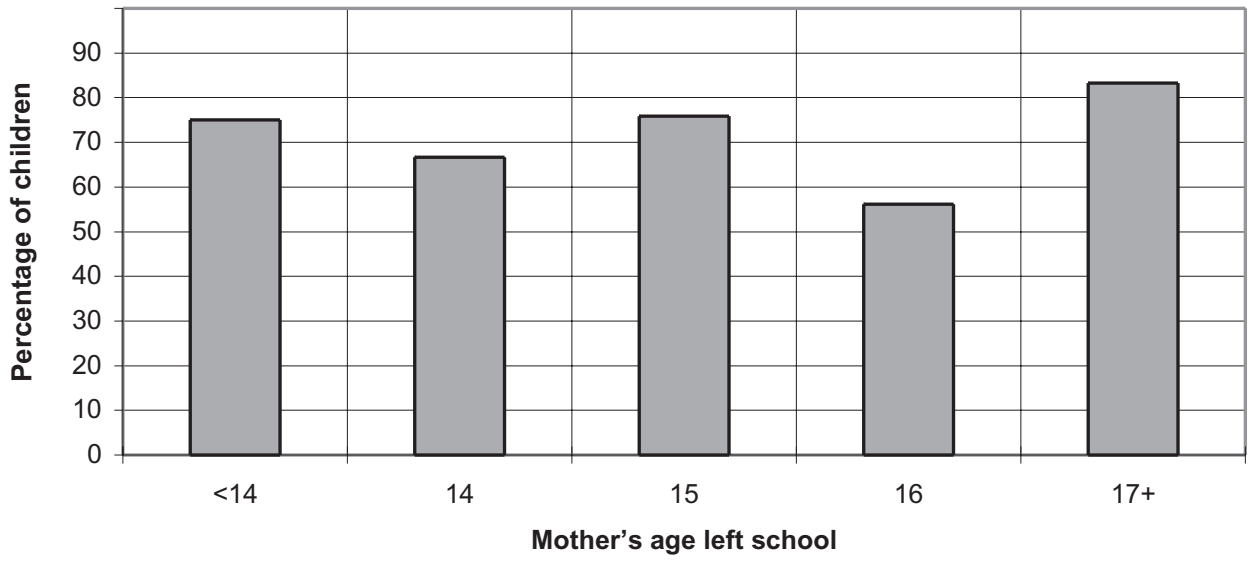
DIAGRAM 3



Proportion Taking Health Action in Last Two Weeks
Children Less than 15, Health status - Good/Very Good (source: NATSIS)



Proportion Taking Health Action in Last Two Weeks
Children Less than 15, Health status - Poor/Fair (source: NATSIS)



Separate analysis of curative health behaviour, consultative health behaviour and self-treatment would result in the same conclusion, with minor variations - that is, the children of the least educated and most educated mothers have the highest levels of health actions taken for them. Because the patterns for all of these groups are so similar, they are not shown separately.

Within the group whose mothers left school before the age of 14 there is a small group of children whose mothers never attended school, and this group has a relatively low proportion of health action taken for them. This group cannot be separated out properly here because of the very small numbers involved, which can produce large fluctuations in the size of proportions that are not significant statistically. The actual proportions for this group separated out are shown in Appendix 1, Table A.1.

Clearly this typical pattern in the results challenges explanation. During consultations and meetings undertaken for this project, many plausible causes were suggested. Some of these possible explanations have been examined, while others cannot be examined from the data. Among the untestable explanations is the possibility (suggested by a reviewer) that mothers who are less educated are more likely to report their children as having good health when in fact they do not, but the children are nevertheless treated if they become ill. Among the testable explanations, the result might be explained in terms of the difference in levels of access to health services at different levels in accordance with the attention given to health service delivery for different communities. In this explanation, some of the least educated Indigenous people would live in places where outreach of health services would provide them with relatively good access.

The NATSIS contained a large amount of information about access to health services at household level. An exhaustive search for any data in relation to access which could explain the typical pattern associated with maternal education was not successful. Because it was more likely to be the constellation of services which was important, rather than individual components, a factor analysis[3] of the information on access to services was undertaken. The first factor summarising the information could be interpreted as a scale of access to services; and the next factor identified the important variation in access between visiting services and fixed services. These two factors were scaled as scores ranging from 0 to 10. (See Appendix 1, Table A.2, for information on the relationship between these scales and the service access information.)

Table A.3 in Appendix 1 shows that service availability is highest for capital city locations, with an average score of 8.7 on the scale from 0 to 10. Other urban areas have an average score of 8.2, while rural and remote areas have an average score of 5.7. The scores indicate a wide dispersion of service availability in rural and remote areas compared with capital cities. Table A.4 shows the visiting services index, which has the highest mean values for rural and remote areas. Rural and remote areas have the highest degree of dispersion for this index as well. The first index has a low average value and the second index has a high average value, but they are actually uncorrelated; that is, they measure completely different concepts.

There is almost no relation between service availability, as measured by these scales, and the health behaviour measures for children. Table 5 shows the correlations that are significantly different from zero. All are very weak and most of them are negative.

Table 5. Correlation analysis of access to services and health behaviour, Indigenous children (<15 yrs), NATSIS, 1994

Health behaviour	Service availability scale	Visiting services scale
Any health behaviour	No significant relationship	Weak negative relationship r = -0.08
Curative health behaviour	Weak negative relationship r = -0.03	No significant relationship
Consultative health behaviour	Weak negative relationship r = -0.03	Weak negative relationship r = -0.03
Self-treatment	Weak positive relationship r = +0.05	Weak negative relationship r = -0.08

The interpretation of this result is that Indigenous parents take health-related actions for their children whether or not the services are available and accessible to them. This is also true when the individual components of the two summary scales of access are considered; that is, if the original 21 variables are used instead of the two factors that summarise them. The concept of 'access' considered here, namely whether services of different types are available and how far away they are, is no doubt different from the perception of access each individual has, and it is likely that this perception is more important than the physical presence of services. A more qualitative approach would be necessary to obtain information on access defined in relation to such perceptions.

There are many other factors which are weakly or strongly related to health behaviour, as indicated at the top left hand corner of the health behaviour model under the heading 'Education of parents (and other factors)' in Diagram 1. A logistic regression[4] was carried out to determine how these other factors influenced health behaviour, controlling for the health status variables. The factors included in the assessment were:

Education factors:
* Mother's age of leaving school
* Mother's highest educational qualification
* Father's age of leaving school
* Father's highest educational qualification

Other factors:
* Geographical location (capital city, other urban, rural/remote)
* Service availability scale
* Visiting services scale
* Age of mother
* Age of father
* Mother's work status (working or not)
* Father's work status (working or not)
* Mother's Indigenous origin
* Father's Indigenous origin
* Mother's language
* Father's language

Health status controls:
* Any current or recent condition
* Health status assessed by respondent

Other controls:
* Age of child
* Presence of mother
* Presence of father

After entering the health status controls and other controls into the logistic regression, only three of the education and other factors were included in a forward, step-by-step procedure that excluded variables with no significant separate relationship with the health behaviour outcome. These three variables were geographical location, age of mother and mother's age of leaving school. The variations in health behaviour related to children associated with these three variables are shown in Table 6, in the form of odds ratios (see explanation below). Appendix 1 Table A.5 contains more detail of the logistic regression model.

Odds ratios more than 1.00 show a relatively high level of health behaviour and odds ratios less than one show a relatively low level. Each explanatory factor has a base category (capital city for geographical location, age 14 for mother's age of leaving school, and ages less than 20 for mother's age). The odds ratio for each base category is set at 1.00. Odds ratios that are significantly different from 1.00 are shown in bold type in the table.

Table 6. Odds ratios for taking any health action for Indigenous children (<15 yrs), NATSIS, 1994

Factor	Odds ratio
Geographical location	
Capital city [base category]	*1.00*
Other urban	**0.71**
Rural or remote	0.81
Age of mother	
<20 [base category]	*1.00*
20–29	**0.44**
30–39	**0.46**
40+	0.55
Mother's age of leaving school	
<14	**1.55**
14 [base category]	*1.00*
15	0.87
16	1.13
17+	**1.40**

Odds ratios significantly different from 1.00 ($p<.05$) are shown in bold

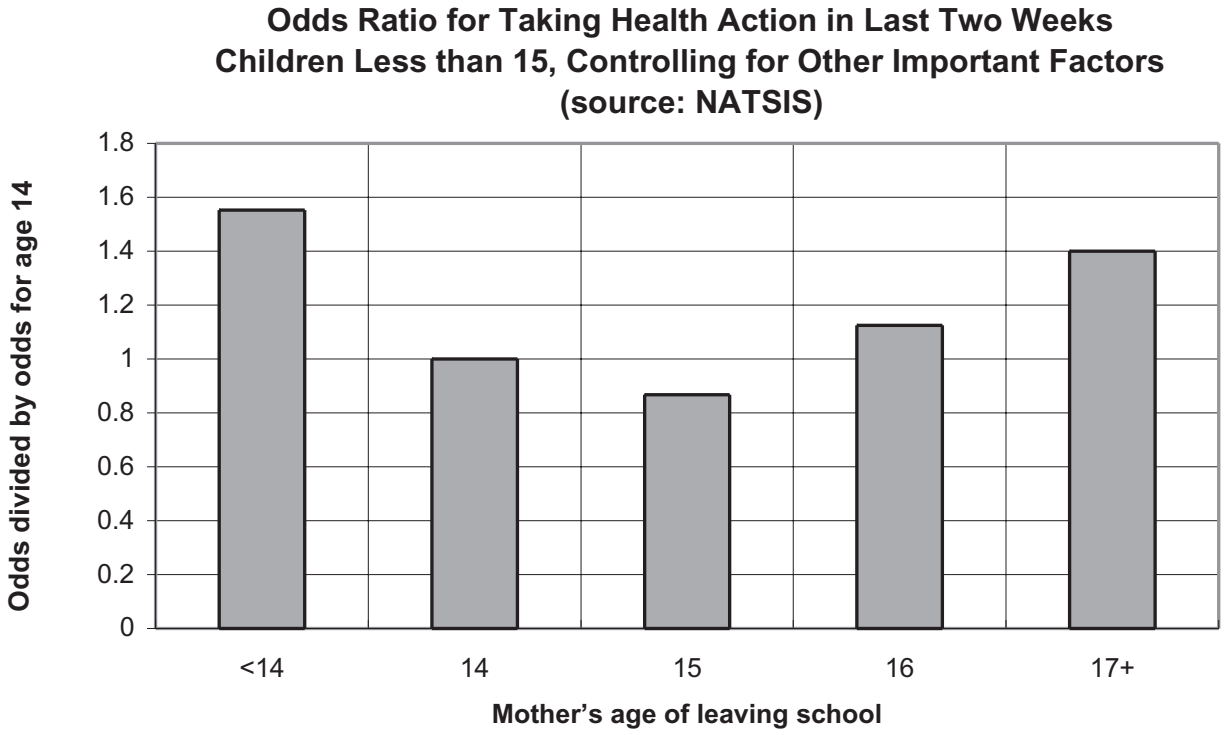
For example, the odds ratio of 0.71 for 'other urban' geographical locations is shown in bold type and shows that health behaviour for children in other urban areas is significantly lower than for children in capital cities. The same cannot be said for children in rural and remote areas even though the ratio is less than 1.00, because the result could have occurred by chance in a sample the size of the NATSIS. Similarly, health behaviour for children of women at ages above 20 years is lower than for younger women, but the difference is not significant for women aged over 40.

For mother's age of leaving school, we see again the typical pattern that was seen in Diagram 3. The children whose mothers had the most or the least education are the most likely to have health action taken for them. It should be emphasised that the result is obtained controlling for the factors listed previously as control variables, and for the other factors shown in Table 5. This means that the explanation for the difference cannot be found by referring to any of these factors, such as the age of the child, the child's health status, or the age of the mother.

Among the control variables, mother's absence has a very significant depressing influence on health behaviour, with an odds ratio of 0.31. This means that children whose mothers are not present in the household are much less likely to have health action taken on their behalf than children whose mothers are present. No significant difference occurs in the case of fathers.

The odds ratios of health behaviour for mother's age of leaving school are shown in Diagram 4, to demonstrate the strength of the pattern which appears consistently in the data.

DIAGRAM 4



It is safe to conclude the analysis at this stage by observing that the general pattern shown in Diagram 4 is a sound representation of the relationship between education and health behaviour among Indigenous Australians.

Discussion and Recommendations

Since its outset the CRCATH Health and Education Research Program has adopted an action research model that engages directly with the Northern Territory's Indigenous community, especially through its own Indigenous community-controlled organisations (Boughton 1999; Tsey 1999). The ensuing discussion therefore draws on consultations the authors undertook following the quantitative analysis. The question asked in the analysis was basically this: 'After we control for the effect of education of parents (among other things) on the recognition and reporting of illness, is there still an effect of education of parents on health-seeking behaviour?' The answer is, yes, there is an effect, but not the effect that would be expected. The expected effect, the one we might have predicted from the international literature, is that the more highly educated mothers would have higher levels of health behaviour related to their children. They do, but so do the least educated mothers.

Generally speaking, a curved relationship like this would suggest that some unobserved factor is influencing what would otherwise be a linear or ordinal relationship[5]. In other words, whatever produces the upward slope in the relationship for women who left school at higher ages is unlikely to be related to whatever produces the downward slope for women who left school early. So, the analysis raises as many questions as it set out to answer.

If we assume that the upward curve demonstrates that more education equips mothers with attitudes, skills, behaviours or status which enable them to use health services more effectively, what is it about low levels of education that also encourages a high level of health action concerning children? It is not possible, using the NATSIS data, to test the possibility that less educated mothers are more likely to report their children to have good health when in fact they do not, but the children are nevertheless treated when they become ill. This possibility could be tested in the field using a qualitative approach.

Another possible set of explanations relates to access to health services. However, since we have controlled for access measured objectively by the service availability data from the NATSIS, the effect is more likely to be due to less evident, perceptual issues of access to services. Such issues include outreach activities from service providers to people seen to be the most disadvantaged. In other words, what we may have measured is not so much the health-seeking behaviour of the 'clients' of health services, as the 'client-seeking' behaviour of these services.

There are, however, other possibilities, which relate to the ambiguous nature of education for 'fourth world' peoples. We may be witnessing a variation on the old adage that a little education is 'a dangerous thing'. Young women who have left school at the age of 14 or less have probably only had a basic primary education, whereas those who stay beyond that will have gone into the secondary system. One of the major characteristics of secondary education in relation to Indigenous people has been its propensity to 'fail' them - the majority of Indigenous young people fare poorly in this system. Has this experience of 'failure' effectively disempowered people, making them less willing or able to take action on behalf of their children, whereas those who have experienced educational 'success' - those who do continue or those who only attend primary school - remain more confident and able to act? One might expand further on this, with particular reference to the impact that schooling has on Indigenous people as they reach puberty, a time when the demands of both 'western' schooling culture and their own Indigenous cultures become much greater, but tend to pull them in quite different directions. Those who have already left school by this time are perhaps more likely to remain strong and confident about their own identity than those who persevere but nevertheless still drop out; on the other hand, recent evidence suggests that those young people who stay beyond age 15 are able to do so because they have learned ways to balance these competing demands (Russell 1997). This obviously takes us into areas beyond the reach of statistical analysis, which is why it is so important for studies such as this to be supplemented, as they have been in the international health transitions literature, with more qualitative surveys and ethnographic study at regional and community level.

Conclusions

This exploratory study demonstrates that there is a relationship between mothers' education, measured by age of leaving school, and the propensity to take action in relation to children's health, but it tells us very little about the nature of that relationship. What it does is to highlight the importance of more in-depth investigation of the so-called health transition hypothesis: that child health improves with increases in the education provided to parents, and in particular to young women. Such investigation needs to engage actively with Indigenous people themselves, and can occur on a number of levels. In the first instance, in any future national surveys it should be possible to work with national Indigenous health and education organisations and agencies (for example, NACCHO, ATSIC, FIAEP, DETYA) to design further questions which might help elucidate this link. It may also be useful to explore the NATSIS data further, such as the variables reporting language use and qualifications obtained. With the support of those organisations, it might also be useful to revisit the question of the impact of maternal education on child survival via the population census, which due to changes in data collection has not been possible since 1986.

However, in the short term what might prove more fruitful would be some finer-grained analyses of data collected within some specific communities. Following overseas examples, this might entail combining community censuses, household surveys and analysis of health clinic data with more detailed ethnographic observation of participants. Work already underway in another CRCATH project in a Central Australian community (Hall, Ewald, & Franks 1999) provides one clear opportunity for such a study.

Both kinds of work - national surveys and censuses, and community-level studies - are unlikely to succeed unless they are designed with maximum input from relevant Indigenous peoples organisations, and it might be useful for this work to begin with focus group discussions both of the findings presented above, and of what we know already from the international literature. Such discussions should seek to generate from Indigenous people themselves their own hypotheses as to why the 'least educated' people in their communities are as likely to take health action for their children as the most educated, and why a greater amount of schooling in the early teenage years tends to be associated with less propensity to take such action. Such discussions will add flesh to an otherwise fairly sterile and uninformative discussion, in which the education which helps people to achieve better health for themselves and their children is reduced to simple indices such as years of schooling.

It would be beneficial for future analyses of health action/behaviour data, which for several reasons are preferable to analyses of self-reported health status, if some deficiencies in the scope of the information collected in 1994 were overcome. In designing future surveys, the Australian Bureau of Statistics, which is responsible for NATSIS, should be encouraged to give some attention to aspects of behavior not investigated in 1994, such as:

- sequences of health behaviours;
- investigation of delays before going for treatment;
- objective investigation of seriousness of conditions at the time of treatment (description of signs and symptoms);
- inclusion of Indigenous forms of health behaviour, including preferred use of Indigenous health services.

Should this prove impractical, then these questions will need to be pursued in the community-level studies. It might also be possible, with the support of Indigenous health organisations and State/Territory health systems, to include questions about education levels in routine statistical collections, such as for patient clinic records and hospital separation data. All manner of other data is collected in this way, with much less theoretical justification in terms of its capacity to help us understand the determinants of health.

The extreme ill-health of 'fourth world' populations - Indigenous peoples living in impoverished conditions within developed first world societies - is one of the continuing unsolved problems of public health. The concept of 'health transition', which focuses on the social, cultural and behavioural determinants of health improvements, is only now being considered relevant to this problem (e.g. Bjerregaard & Kue Young 1998). This brief and preliminary study has now helped to identify some of the directions in which further work in Australia could usefully go.

Endnotes

[1] To contain the cost of the survey, the NATSIS oversampled rural areas relative to urban areas. All individuals in the survey are assigned a weight - less than the overall average in areas that are oversampled, and more than the overall average in areas that are undersampled - so that when they are added together the weights yield estimates from the survey that are representative of the Indigenous population.

[2] The Spearman correlation coefficient measures the degree to which two ordinal variables correspond with each other on a scale from -1 (perfect negative correlation) to +1 (perfect positive correlation). 0 means no correlation. An ordinal variable is one that has an order from lowest to highest or vice versa, but the distances between successive categories are not necessarily the same.

[3] The information in a set of variables describing a group of cases can be statistically transformed into an equivalent number of new variables (factors or 'components') that are not correlated with each other and are arranged in order from the factor containing the most information about the cases to the factor containing the least information. The way in which the factors are constructed can be utilised to identify the concepts that they summarise and often the first few factors can be used to summarise most of the information contained in all of the original variables (in this instance, 21 variables).

[4] A logistic regression is a procedure for constructing a mathematical model of the relationship between a set of explanatory variables and a dependent variable that takes only two values.

[5] See explanation in endnote 2 above.

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Appendix 1. Additional and Detailed Tables

Table A.1. Any health action taken in last two weeks, by age mother left school, Indigenous children (<15 yrs), NATSIS, 1994

Age mother left school	Health status – Excellent	Health status – Good/Very Good	Health status – Poor/Fair
<14 (inc. never attended)	33.8%	43.8%	75.0%
14	26.3%	32.4%	66.7%
15	21.1%	39.8%	75.9%
16	29.2%	42.8%	56.2%
17+	36.3%	49.5%	83.3%
Never attended[a]	*27.3%*	*35.6%*	*33.3%*

[a] The category 'never attended' contains a very small numbers of cases as a separate category

Table A.2. Rotated factor matrix, access to services, first two of five selected factors from principal component analysis, households, NATSIS, 1994

		Service availability	Visiting services
Use nearest hospital	Sometimes	0.00	-0.04
	None near here	**-0.17**	**0.40**
	No	0.09	-0.10
Use nearest AMS	Sometimes	0.01	0.00
	None near here	**-0.18**	**0.15**
	No	**0.21**	**-0.15**
Use community health centre	Sometimes	0.01	0.01
	None near here	**-0.16**	0.09
	No	**0.24**	-0.12
Distance to nearest hospital	11–25 km	-0.05	0.00
	26–50 km	**-0.16**	0.03
	51–100 km	**-0.30**	**0.27**
	101–250 km	**-0.23**	**0.20**
Distance to community health centre	11–25 km	-0.10	**0.19**
	26–50 km	**-0.20**	-0.03
	51–100 km	**-0.25**	0.04
	101–250 km	**-0.24**	0.00
Distance to chemist	11–25 km	**-0.26**	**0.16**
	26–50 km	**-0.24**	0.01
	51–100 km	**-0.34**	0.07
	101–250 km	**-0.19**	**0.16**
Distance to birthing centre	11–25 km	-0.01	0.01
	26–50 km	-0.10	0.02
	51–100 km	**-0.26**	**0.27**
	101–250 km	**-0.19**	**0.24**
Distance to detox centre	11–25 km	**0.15**	-0.12
	26–50 km	0.00	-0.02
	51–100 km	-0.11	**0.18**
	101–250 km	**-0.18**	**0.23**

Table A.2 (cont.). Rotated factor matrix, access to services, first two of five selected factors from principal component analysis, households, NATSIS, 1994

Table A.3. Service availability index, by geographical location, Indigenous children (<15 yrs), NATSIS, 1994

Index score	Capital city	Other urban	Rural and remote	Total
0	–	–	1.7%	0.6%
1	–	–	3.6%	1.3%
2	–	0.4%	4.9%	1.9%
3	–	–	8.8%	3.1%
4	–	1.0%	10.3%	4.1%
5	–	1.7%	11.7%	5.0%
6	2.0%	10.5%	14.7%	10.7%
7	1.1%	10.6%	20.3%	12.6%
8	22.1%	20.3%	15.3%	18.8%
9	72.3%	52.0%	5.8%	38.8%
10	2.5%	3.5%	2.8%	3.1%
Total	100.0%	100.0%	100.0%	100.0%
Mean score	8.7	8.2	5.7	7.4

Table A.4. Visiting services index, by geographical location, Indigenous children (<15 yrs), NATSIS, 1994

Index score	Capital city	Other urban	Rural and remote	Total
0	–	0.9%	3.2%	1.6%
1	67.7%	48.4%	14.9%	39.5%
2	27.5%	25.3%	19.4%	23.5%
3	2.0%	10.9%	24.9%	14.5%
4	0.3%	8.2%	12.9%	8.7%
5	–	2.9%	4.5%	3.0%
6	0.3%	0.8%	6.2%	2.6%
7	0.1%	1.5%	2.6%	1.6%
8	1.8%	0.9%	2.4%	1.5%
9	0.4%	0.1%	6.0%	2.2%
10	–	0.1%	3.0%	1.1%
Total	100.0%	100.0%	100.0%	100.0%
Mean score	1.5	2.0%	3.6	2.5

Table A.5. Logistic regression model for taking any health action for Indigenous children (<15 years), NATSIS, 1994

Variable	Coefficient	Standard error	Significance	Odds ratio
Mother absent	-1.1586	0.4031	0.0041	0.3139
Father absent	-0.1125	0.0819	0.1692	0.8936
Age of child				
0–4 (r)	0.0000			1.0000
5–9	-0.7431	0.0943	0.0000	0.4756
10–14	-0.6815	0.1067	0.0000	0.5058
Any illness	5.6032	0.1941	0.0000	271.2944
Self-assessed health status				
Excellent (r)	0.0000			1.0000
Good/Very Good	0.0620	0.0866	0.4744	1.0639
Fair/Poor	0.6006	0.1886	0.0015	1.8233
Location				
Capital city (r)	0.0000			1.0000
Other urban	-0.3494	0.0905	0.0001	0.7051
Rural/Remote	-0.2062	0.1063	0.0525	0.8137
Age of mother				
Less than 20 (r)	0.0000			1.0000
20–29	-0.8157	0.3425	0.0172	0.4423
30–39	-0.7821	0.3459	0.0238	0.4575
40 and over	-0.5958	0.3581	0.0962	0.5511
Mother's age of leaving school				
Less than 14 (a)	0.4403	0.1857	0.0177	1.5531
14 (r)	0.0000			1.0000
15	-0.1420	0.1069	0.1838	0.8676
16	0.1178	0.1076	0.2733	1.1250
17 and over	0.3366	0.1225	0.0060	1.4002
Constant	-3.3263	0.3924	0.0000	

(a) Includes never attended (r) Reference category
Note: Reduction in L.R. = 4,352.482, 16 d.f., p<0.00005

Appendix 2. Linkage of children and parents within families

The following SPSS syntax demonstrates the method used in this analysis for linking children with their fathers and mothers. Apart from variables created within the syntax, the variables are standard variable names used in the survey documentation.

(Please note that most of the frequencies produced in the procedure are merely to force intermediate calculations, and generally do not have any other utility.)

```
*------------------------------------------------.
* CREATE UNIQUE FAMILY NUMBER.
* ID401 IS (RANDOM) HOUSEHOLD IDENTIFIER.
* ID402 IS FAMILY WITHIN HOUSEHOLD.
* ID404 IS PERSON NUMBER WITHIN HOUSEHOLD (NOT USED).
*------------------------------------------------.

COMPUTE FAMILY=1.
FREQ FAMILY.

IF (LAG(FAMILY)>0) FAMILY=LAG(FAMILY).
IF ((ID401<>LAG(ID401)) | (ID402<>LAG(ID402))) FAMILY=LAG(FAMILY)+1.
FREQ ID404.

*------------------------------------------------.
* CREATE FAMILY-PERSON NUMBER
* - FIRST 4 DIGITS ARE FAMILY NUMBER
* - NEXT 2 DIGITS ARE PERSON NUMBER WITHIN FAMILY
* TEMP IS A VARIABLE FOR PERSON NUMBER WITHIN FAMILY.
*------------------------------------------------.

COMPUTE TEMP=1.
FREQ TEMP.

IF (LAG(TEMP)>0) TEMP=LAG(TEMP)+1.
IF (FAMILY<>LAG(FAMILY)) TEMP=1.
FREQ TEMP.

COMPUTE FPNO=100*FAMILY+TEMP.
FREQ TEMP.
SORT CASES BY FPNO (A).
FREQ TEMP.

*------------------------------------------------.
* IDENTIFY MOTHER & FATHER LINE NUMBERS
* (CHILDREN 0 TO 14).
* PSN401 IS SEX OF PERSON.
* PSN432 IS RELATIONSHIP TO HOUSEHOLD HEAD
* 1: HEAD OR SPOUSE, 2: LONE PARENT, 3: CHILD.
*------------------------------------------------.

COMPUTE MOTHER=0.
COMPUTE FATHER=0.
```

```
IF ((PSN432=1|PSN432=2) & PSN401=1) FATHER=FPNO.
IF ((PSN432=1|PSN432=2) & PSN401=2) MOTHER=FPNO.
FREQ TEMP.


IF (FAMILY=LAG(FAMILY) & LAG(FATHER)>0) FATHER=LAG(FATHER).
IF (FAMILY=LAG(FAMILY) & LAG(MOTHER)>0) MOTHER=LAG(MOTHER).
FREQ TEMP.

IF (PSN432<>3) FATHER=9.
IF (PSN432<>3) MOTHER=9.
FREQ TEMP.

COMPUTE TEMP=FPNO-MOTHER.
IF (MOTHER=0 | MOTHER=9) TEMP=0.
FREQ TEMP.
* Maximum value is 32.

COMPUTE TEMP=FPNO-FATHER.
IF (FATHER=0 | FATHER=9) TEMP=0.
FREQ TEMP.
* Maximum value is 19.

VARIABLE LABELS
 FATHER 'Line number of father'
 /MOTHER 'Line number of mother'
```

The analysis essentially identifies the head of the family or spouse as the father (if male) or mother (if female) of a child whose relationship is child of head of family. This is an approximation, not an exact method. In particular, stepmothers or stepfathers may be identified as genuine mothers or fathers in a family where the head is a genuine parent. The following table shows that nevertheless the age distributions of the mothers and fathers of children aged 0-14 are reasonable:

Age group	Mother in age group		Father in age group	
13–14 years	2	–	–	–
15–17 years	36	1%	3	0%
18–19 years	143	2%	25	1%
20–24 years	931	13%	388	8%
25–29 years	1,741	25%	914	19%
30–34 years	1,790	26%	1,209	24%
35–39 years	1,140	16%	1,046	21%
40–44 years	490	7%	598	12%
45–49 years	256	4%	341	7%
50–54 years	171	2%	192	4%
55–59 years	99	1%	118	2%
60–64 years	58	1%	53	1%
65+	71	1%	49	1%

The last row of the table shows improbable cases (mothers or fathers of children now aged 0-14, aged at least 50 when the children were born). However, these are only one per cent of mothers or fathers, and it is well to bear in mind that the recorded age of either the child, the father or the mother could be wrong rather than the identification of the relationship. For this reason no editing process was used.