Social determinants of oral health: conditions linked to socioeconomic inequalities in oral health in the Australian population

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Abbreviations

ABS	Australian Bureau of Statistics
AIHW	Australian Institute of Health and Welfare
DSRU	Dental Statistics and Research Unit
GDP	Gross Domestic Product
NDTIS	National Dental Telephone Interview Survey
NHMRC	National Health and Medical Research Council
NMES	Non-milk extrinsic sugars
OECD	Organisation for Economic Co-operation and Development
OHIP-14	Oral Health Impact Profile (short-form)

Symbols

ns	not statistically significant at the 5% threshold
se	standard error

Prologue

Pick up any document about population health and you will find reference to the social determinants of health – the root causes of disease and health inequality in populations. Social determinants are the material and social conditions of a society that decisively influence opportunities and life chances of population groups, their quality of life and ultimately their life expectancy. Prominent among these conditions are income and income distribution, education, employment status, housing and social integration.

The potency of social determinants to differentially affect population health status is influenced by the organisation of society and the ways in which society allocates resources through social service infrastructures including its health care system. Resource allocation is itself determined by the degree to which society views health as a collective public good, active responses to social policy, the balance with which it reconciles the dual objectives of maximising overall population welfare and reducing inequalities in health between social groups, and the economic philosophy it embraces in the belief in state responsibility for social expenditure versus promotion of the free market, competition and individual choice.

Intriguingly, despite the wealth of evidence for the primacy of social determinants of health, public policy does not generally take action on them. Somewhere between recognition of their role and the setting of public policy, attention to the social determinants is lost. Frequently the determinants of health are reduced to behavioural risk factors such as smoking and alcohol consumption, physical inactivity and poor nutrition. Yet behaviours are not the primary determinants of health as lifestyle choices are severely restricted among disadvantaged population groups.

This report describes the social distribution of oral health status in the dentate Australian adult population at one point in time and draws associations between a selection of social determinants and oral health status. It looks at material factors (reimbursement mechanisms for health care, household income, and education), psychosocial factors (personal control, psychological stress, social support) and behavioural factors (personal practices, utilisation of dental services) and their associations with oral health status. It attempts to answer the questions, 'What matters most for oral health status?' and 'Why do some groups have greater exposure to risk factors than other groups?' For those in the labour force it looks at associations between socially produced work conditions and the effect of home and home strain on oral health status. It looks at social and psychosocial conditions that people report retrospectively about their childhood and attempts to draw associations between these conditions and contemporaneous outcomes. This report is primarily concerned with comparisons between socioeconomic groups but also takes into account variation between males and females, between different age groups, and between capital-city dwellers and those who live in other areas.

The Australian Institute of Health and Welfare's Dental Statistics and Research Unit (DSRU) obtained cross-sectional data for this report through two consecutive cross-sectional National Dental Telephone Interview Surveys (NDTIS) conducted in 1999 and 2002. Further data were obtained from a self-completed questionnaire mailed to adult interviewees immediately after each of these two interviews. The NDTIS is conducted periodically by DSRU to provide information on the dental health of Australians and their use of dental services.

Summary of findings

The 1999 and 2002 National Dental Telephone Interview Surveys and their accompanying self-complete questionnaires were conducted in all states and territories. Findings were representative of the national population, and are reported here for dentate adults aged 25 years and older. Emphasis is placed on socioeconomic variation in oral health and its social determinants throughout this study.

Social inequality in oral health

Profound differences in tooth loss, the social impact of oral conditions and subjective oral health were found between social groups in the Australian dentate adult population. Adults with lower levels of household income and educational attainment suffered greater tooth loss, greater social impact of oral conditions on quality of life and worse subjective oral health. Inequalities were exacerbated by reimbursement mechanisms for dental care. Fewer adults with low income had purchased private health insurance, leaving them reliant on public dental care or obliged to pay the fixed price of services in the private sector at point of use from out-of-pocket expenditure.

The onset of oral morbidity occurred earlier in life for groups with less ability to pay for dental care. For example, by age 35–44 years uninsured adults eligible for public dental care had lost 5 teeth while their insured counterparts of the same age had lost 3 teeth, irrespective of whether or not they were eligible for public dental care. And inequalities increased with increasing age. By 55–64 years an absolute difference of 6 teeth was evident between uninsured adults eligible for public dental care compared with non-eligible insured adults, representing a twofold difference in tooth loss. The latter group had lost 6 teeth on average, while the former had lost 12. In retirement uninsured adults eligible for public dental care had lost 15 teeth on average, leaving them below the critical threshold of 20 natural teeth required for satisfactory chewing function and adequate oral health related quality of life. Their non-eligible insured counterparts in retirement had lost 8 teeth, clearing the critical threshold.

Inequalities in oral health were by no means limited to differential experience of tooth loss. The severity with which problems with teeth, mouth or dentures hindered normal function and daily activity varied markedly between groups with differing levels of income. There was an almost fourfold relative difference in prevalence of severe impact on quality of life between groups with household income up to $20,000 (27.9%) and groups with income of $80,000 or more (7.5%). Here greatest morbidity was not compressed into the later years of life but was evident at all stages of adulthood. Irrespective of age or sex, adults with lower income experienced substantially greater severity of impact of oral conditions on their quality of life.

There was no evidence that adults with limited access to material resources held lower expectations for their oral health. Had this been the case, adults with low income would rate their oral health in ways similar to more advantaged adults. Instead an inverse linear gradient between income and oral morbidity revealed a twofold difference in prevalence of average, poor or very poor self-rated oral health, ranging from 35% of adults with income up to $20,000 to 15.2% of adults with income of $80,000 or more.

Explaining health differentials

These health differentials are not inevitable and can not be accounted for by natural biological variation, ageing or freely chosen behaviour. Instead, differences arise as a consequence of factors that are largely out of the control of population groups. Such factors include differential opportunity to access social and material resources including dental services and differential exposure to unhealthy aspects of social environments. The common factor underlying these inequalities is the position occupied by groups in the social hierarchy. Socioeconomic position influences exposure and response to virtually all environmental, behavioural and psychosocial risk factors. The steeper the social hierarchy, the greater the magnitude of inequalities in health. This report highlights associations between a discrete set of factors regarded as social determinants of health and the oral health status of groups at different positions in the social hierarchy.

Socioeconomic differentials in health are mediated along behavioural and psychosocial pathways possibly stemming from familial influences in childhood then consolidated or ameliorated by exposures in adulthood home and workplace environments. The statistical significance of risk factor associations with socioeconomic position and oral morbidity are summarised in Table 1, with further commentary throughout this report.

Conclusion

In conclusion, findings showed that population oral health status followed precisely the same gradient as social and material conditions of Australian society. Where these conditions were excellent, oral health status tended also to be excellent. Where these conditions were poor, oral health likewise was poor. It was argued that this occurred because population oral health was socially determined.

The challenge remains to identify an appropriate response if these social inequalities are deemed unjust. The short-sighted approach is to focus attention on factors most closely located to disease along the causal pathway. This typically gives rise to efforts to target risk behaviours. Such an approach separates behaviour from its context and treats behaviour as a motivational failure of the poor rather than an effect of upstream causes. The more visionary outlook is to focus on the antecedents of risk behaviour. While changing individual behaviour is the goal, the means to achieve it is best addressed at higher levels, removed from individual consequences. The most beneficial interventions invest resources early in the life course. The most consequential decisions influence the allocation and distribution of social and material resources in the population. Only then are the root causes of inequality in conditions, and ultimately oral health outcomes, addressed.

Table 1: Summary of risk factor associations with socioeconomic position and oral health

	Household income	Education	Tooth loss	Severe impact on quality of life	Low self-rated oral health
Reimbursement mechanisms					
Private dental insurance	P<0.05	P<0.05	P<0.05	P<0.05	P<0.05
Government concession card	P<0.05	P<0.05	P<0.05	P<0.05	P<0.05
Behavioural					
Infrequent tooth brushing	P<0.05	P<0.05	P<0.05	P<0.05	P<0.05
No interdental cleaning	ns	ns	ns	ns	ns
High consumption of NMES	ns	ns	ns	P<0.05	ns
Current smoker	P<0.05	P<0.05	ns	P<0.05	P<0.05
Attends less than biennially	P<0.05	P<0.05	P<0.05	P<0.05	P<0.05
Usually visits for a problem	P<0.05	P<0.05	P<0.05	P<0.05	P<0.05
Psychosocial characteristics					
Low personal control	P<0.05	P<0.05	P<0.05	P<0.05	P<0.05
High psychological stress	P<0.05	P<0.05	ns	P<0.05	P<0.05
Poor emotional support	P<0.05	P<0.05	ns	P<0.05	P<0.05
Poor appraisal support	P<0.05	P<0.05	ns	P<0.05	P<0.05
Poor instrumental support	P<0.05	P<0.05	P<0.05	P<0.05	P<0.05
Poor informational support	P<0.05	P<0.05	P<0.05	P<0.05	P<0.05
Working conditions					
Working <20 hours	P<0.05	P<0.05	P<0.05 (F)	ns	P<0.05 (F)
Risk to job security	P<0.05	P<0.05	ns	P<0.05	P<0.05 (M)
Risk of skill obsolescence	P<0.05	ns	ns	P<0.05 (M)	P<0.05 (M)
Work home strain	P<0.05 (R)	P<0.05 (R)	P<0.05 (F)	P<0.05 (F)	ns
Childhood circumstances					
Paternal occupation not UWC[(a)]	P<0.05	P<0.05	P<0.05	ns	P<0.05
Maternal occupation not UWC[(a)]	P<0.05	P<0.05	P<0.05	ns	P<0.05
Parents did not cohabit	P<0.05	P<0.05	P<0.05	ns	P<0.05
Negative rearing style	ns	ns	P<0.05	P<0.05	ns

ns P>0.05 (Chi-square test or Fisher's exact test).
(M) A significant risk factor for males but not for females;
(F) a significant risk factor for females but not for males.
(R) Reverse direction: Work home strain was positively associated with household income and education.
(a) UWC refers to occupations classified as upper white collar: managers, administrators, professionals, paraprofessionals.

Dental risk behaviour

Interpreting the relationship between behaviour and oral health requires recognition that behaviour is not always freely chosen but is shaped by social circumstances. Groups that occupied a low position on the social hierarchy, as indexed by their levels of household income and educational attainment, exhibited a behavioural profile that placed them at higher risk for poor oral health.

Infrequent tooth brushing was inversely associated with income and education. There was a threefold difference in prevalence of infrequent tooth brushing between groups with household income up to $20,000 (11.7%) and those with income of $80,000 or more (3.7%). The effect was not entirely attributable to income. Among low income adults eligible for public dental care who also held private dental insurance, prevalence of infrequent tooth brushing was 3.7%. Yet among their uninsured eligible counterparts, prevalence was 12.2%. Prevalence of retention of less than 20 teeth was 13.4 percentage points higher among people with infrequent brushing (25.6%) compared with people who brushed at least once daily (12.2%). An absolute effect of 22.8 percentage points was found in prevalence of severe impact on quality of life between infrequent brushing (36.7%) and brushing daily or more often (15.0%). The absolute effect on low self-rated oral health was 19.4 percentage points between those with infrequent brushing (38.8%) and daily brushing (19.4%).

A similar relationship was observed for smoking prevalence; among insured adults eligible for public dental care prevalence was 11.0% compared with 24.0% among their uninsured eligible counterparts. Prevalence did not differ between groups with secondary (22.3%) or vocational (21.4%) levels of education, but was significantly lower among tertiary graduates (14.9%). Among current smokers, the condition of their teeth, mouth or dentures inflicted significantly greater impact on their quality of life (24.6%) than for non-smokers or former smokers (14.5%). A significantly larger proportion of smokers (31.8%) compared with non- or former smokers (18.4%) rated their oral health as average, poor or very poor.

Two other personal risk behaviours were not associated with socioeconomic position. These were high daily consumption of non-milk extrinsic sugars and avoidance of interdental cleaning during the week before the survey. High consumption of non-milk extrinsic sugars was not associated with significant variation in any one of these three oral conditions. In addition, the practice of interdental cleaning was not significantly associated with significant variation in any of these three oral conditions, although a relationship with tooth loss was borderline.

The relationship between dental attendance and oral health status is complex since utilisation depends on the accessibility and affordability of care, need and demand for dental care. Among factors to do with utilisation of dental services, infrequent attendance was elevated more than twofold among the uninsured compared with the insured. Yet among insured adults, visiting periodicity did not differ on the basis of eligibility for public dental care. This strengthens the argument that episodic attendance is a function of ability to pay rather than a function of willingness to seek care. Attending dental services less often than biennially was associated with greater oral morbidity. For self-rated oral health the absolute effect was 15.3%. While 17.7% of adults who attended dental services at least biennially rated their oral health as average or worse, prevalence was 33.0% among adults who attended less often.

Psychosocial characteristics

The benefits of material resources extend beyond the capacity to acquire material goods. Through both income and education, individuals develop a sense of agency, (i.e. control) over their lives. They develop mechanisms to effectively cope with threats such as psychological stress and they acquire the means to build and utilise stocks of social ties and networks. This report looked at the role of personal control, psychological stress and social support in influencing oral health status.

Strong inverse associations were found between personal control and socioeconomic resource. Relative differentials exceeded twofold for household income and reimbursement mechanisms. Nearly half of all adults with low income up to $20,000 had low personal control beliefs compared with only one in five adults with income greater than $50,000.

Prevalence of tooth loss decreased from 17.1% among adults with low control to 10.0% among adults with control scores in the high tertile range. A twofold relative difference in prevalence of severe impact on quality of life was found between adults with low control (25.9%) and high control (12.7%). A similar difference in magnitude between low (32.4%) and high (16.3%) control scores was observed for low self-rated oral health.

Monotonic gradients in psychological stress scores revealed that perceptions of stress were inversely related to income and educational attainment. Levels of psychological stress were not significantly associated with tooth loss. There was a threefold difference in prevalence of severe impact on quality of life between adults with low (10.2%) and high (32.1%) levels of perceived stress. A similar but flatter stress gradient in self-rated oral health was observed, with a twofold relative difference between adults with low levels of stress (17.8%) and high stress (33.5%).

Each of the four dimensions of social support—emotional, appraisal, instrumental and informational—were less available to groups with lower levels of socioeconomic resource. Socioeconomic gradients tended to be flatter for emotional and appraisal support and steeper for instrumental and informational support. Only 6.4% of tertiary graduates were unable to access instrumental help compared with 14.7% of persons with secondary education.

Emotional and appraisal dimensions of social support were not significantly associated with tooth loss. Yet both were strongly associated with the severity of impact on quality of life and subjective self-rated oral health. Prevalence of severe impact was 16.8% among adults with accessible emotional support and 29.5% among adults without this resource. Prevalence of low ratings were 23.6% among those with ready access to emotional support and 30.4% among those with less ready access.

Prevalence of tooth loss was higher by 4 percentage points among adults who could not readily access instrumental support (12.2%) compared with those who could (16.2%). Instrumental support was associated with an absolute difference in prevalence of severe impact on quality of life of 12.1 percentage points, ranging from 17.3% for those who could access this support to 29.4% among those who could not. The absolute difference in prevalence of low self-rated oral health was 10.4 percentage points and varied from 23.4% for those who could access this support to 33.7% for those who could not.

Workplace environment

Restructuring of the labour market in Australia through policies of economic rationalism began with the Hawke-Keating government and accelerated with the Howard government. These policies have altered several features of the labour force. Working hours have tended to increase and the proportion of workers with long hours has increased. Fluctuations in perceived job security have coincided with growth in gross domestic product. Organisational downsizing and job creation schemes have spurred a need for retraining programs and professional development to maintain a skilled workforce. Coinciding with these changes, the female labour force participation rate has increased and yet family support has not kept pace with the need to balance work and home demands. The impact of the workplace environment is likely to affect occupational groups unequally and, particularly in times of rapid change, it is reasonable to expect that these effects are evident in oral health status.

Tertiary graduates occupied 48.1% of upper white collar occupations and only 13.2% of tertiary graduates worked in blue collar occupations. Retention of fewer than 24 teeth was less prevalent among upper white collar occupations for males (9.6%) and females (8.4%) than among blue collar workers for males (15.3%) and females (12.9%).

Males worked longer hours than females but the length of working hours was not significantly associated with oral health status among males. For female workers, longer working hours were associated with better oral health. High levels of tooth loss were greater among females working more than 40 hours (7.7%) compared with those working less than 20 hours (14.5%). Prevalence of low self-rated oral health was 15.1% among females working more than 40 hours compared with 26.5% among those working less than 20 hours.

One in two adults (53.3%) with household income greater than $50,000 perceived some risk to job security compared with three in four adults (75.9%) with household income up to $20,000. Perceptions of job security were not associated with tooth loss for either males or females. A twofold elevation in the experience of severe impact on quality of life was found among males with insecure job prospects (21.8%) compared with males who felt secure in their employment (10.1%). The effect was borderline for females. Prevalence of low self-rated oral health among males in insecure employment was 29.1% compared with 22.8% among men in secure employment.

Perception that skill obsolescence was probable or certain was perceived by 36.1% of workers with household income up to $20,000 and by 18.2% of workers with income greater than $50,000. For those facing skill obsolescence, prevalence of severe impact on quality of life among males at risk of skill obsolescence was 26.3% while among males not facing this risk prevalence was 14.4%. Likewise, prevalence of low self-rated oral health among males at risk of skill obsolescence was 40.2% compared with 23.1% among males without risk.

Contrary to other factors, socioeconomic position was positively associated with work and home strain such that prevalence among those with income up to $20,000 (16.0%) was lower than those with income greater than $50,000 (51.8%), representing an effect size greater than threefold. The experience of work and home strain was not associated with oral morbidity in males. For females work and home strain was associated with lower levels of tooth loss (9.5%) than for those without this strain (17.5%). Yet work and

home strain accompanied a greater severity of impact on oral health related quality of life (24.0%) than that experienced by females without strain (18.5%).

Childhood environment

The literature shows that risk factors in childhood set in train consequences for compromised health in later life. Proponents of the life course explanation for health inequalities argue that contemporary risk factors alone are not sufficient to understand health status. Rather, health in adulthood reflects the embodiment of accumulated exposures throughout life. Aspects of childhood environment were reported retrospectively to clarify pathways over the life course that may predict oral health status in later life. Childhood conditions were specifically investigated for their associations with psychosocial profile in adulthood as psychosocial factors were posited as pathways leading to social differences in oral health status.

Prevalence of tooth loss in adulthood was significantly associated with childhood socioeconomic position indexed by parents' occupational group. There was a twofold difference in prevalence of retaining less than 20 teeth between adults whose father had been in upper white collar work (7.2%) compared with other work (15.1%). Prevalence of low self-rated oral health was lower among those whose mothers had been in upper white collar work (17.2%) compared with those whose mother had not (25.3%).

There was a twofold difference in the proportion of participants whose parents did not cohabit across household income categories, ranging from 5.4% of those with highest income to 10.8% of those with lowest income. The socioeconomic relationship was further substantiated with a significant educational gradient in adulthood associated with parental cohabitation status, ranging from 5.9% among tertiary graduates to 9.1% among those with secondary education only. Differences in prevalence of tooth loss approached twofold among adults whose parents had not cohabited when the respondents were children (21.5%) as among adults whose parents had lived together (12.0%). Although differences did not reach the statistical threshold for significance, a higher proportion of adults who now rated their oral health poorly had lived with one parent in childhood (27.9%) compared with those who lived with two (24.4%). Differences in severity of oral impact on quality of life were also non-significant.

Study participants held favourable views about the parenting style of their primary caregiver, with 86.3% describing it as positive and supportive. Perceptions of rearing style were not patterned on socioeconomic indicators. Prevalence of tooth loss was higher among adults whose rearing had been in a positive style (13.3%) compared with adults whose rearing had been negative (8.3%). Prevalence of severe impact on quality of life was higher among those with negative rearing (27.5%) than positive rearing (17.7%).

Strong associations were found between conditions of childhood and the psychosocial profile of participants in adulthood. In summary, father's occupation was associated with levels of personal control and psychosocial stress and the availability of emotional support. Mother's occupation was associated with personal control and the availability of emotional, appraisal and instrumental social support. Parental cohabitation status was associated with emotional, instrumental and informational forms of social support and psychological stress. A negative and unsupportive parenting style was associated with low levels of personal control; inadequate access to emotional, appraisal, instrumental and informational forms of social support; and high psychosocial stress. Moreover, social disadvantage in the family of origin was associated with greater prevalence of episodic and problem-oriented use of dental services in adulthood.

1 Introduction

Social determinants of health are the material and social conditions of a society that influence the health status of its members. The quantity and quality of these material and social resources and the fairness of their allocation between population groups is anchored in a set of values and expressed in a course of action through public policy.

1.1 A historical synopsis

Scientific interest in the material and social determinants of health can be dated from the 17th century in England when, in their analysis of the Bills of Mortality, John Graunt (1620–1674) and William Petty (1623–1687) observed that mortality was patterned by age, sex and geographic location.

The developing field of public health flourished in the 19th century. Notable among contributors was William Farr who, in his 40-year tenure as Complier of Abstracts in the General Register Office in England, appended his annual reports with detailed guidelines on possible uses of census data and birth and death register information to address questions about health status. Farr is attributed with advancing the method of age standardisation to examine mortality data and with testing social hypotheses about social class patterns of disease. While Farr was advancing statistical methods from the 1830s, Edwin Chadwick published the highly influential report 'The Sanitary Conditions of the Labouring Population' in 1842, where he argued that disease was directly related to living conditions. He also developed the Public Health Act and secured its passage through parliament to legislation in 1848. In the same year Verchow, a pathologist, identified workplace conditions in factories as a determinant of health and noted that 'medicine is a social science' and 'physicians are the natural attorneys of the poor, and the social problems should largely be solved by them'. Some six years later in 1854, John Snow plotted the location of cholera deaths identified the source of the cholera outbreak as the Broad Street pump.

Social science in medicine took a back seat in the latter part of the 19th and the first half of the 20th centuries with the emergence of major scientific advancements in chemistry and physiology, and disciplines as pharmacology, bacteriology and immunology. It was into this context that the theory of focal infection emerged and was widely adopted in dentistry. The theory was based on the assumption that systemic diseases arose as a consequence of chronic dental infections. In direct response, full mouth extractions were commonplace from 1920 to the late 1940s as a way to eliminate the source of infection found in heavily restored dentitions. Dussault and Sheiham (1982) have argued that one reason the theory was so readily accepted among dentists in Britain was that it fitted their professional objectives. It coincided with dentistry's campaign for credibility as a profession and its need to increase demand in an over-supplied market where practitioners were untrained and able to practice without registration. Thus the profession of dentistry itself was shaped by material and social influences.

By 1950 the theory of focal infection had lost favour and the rise in prevalence of chronic diseases heralded a resurgence of interest in social medicine. Walt and Gilson (1994) summarised events that brought about change in this period:

> … by the late 1960s the medical paradigm was increasingly challenged from both within and outside the profession. Past policy which had emphasized disease treatment in centres of excellence was questioned by historians, epidemiologists and economists, who showed that much illness was poverty related (Abel-Smith and Leiserson 1978), that drugs which had appeared to be 'magic bullets' had many unintended consequences (Illich 1975), and that teaching hospitals served a small proportion of the population but swallowed large proportions of the health budget (King 1966). Social scientists increasingly encroached on the policy domain of medical professionals, raising questions about the effects of culture on health behaviour and the relative costs of different health care activities among other things. (P.357)

While evidence for the social determinants of health has grown dramatically over the last quarter of a century in Europe, Australia and the United States, there remains a gap between the evidence and the policy responses. Policy commitment peaked at the 1978 international conference on primary health care at Alma-Ata. Among its 10 declarations it claimed, 'The existing gross inequality in the health status of the people particularly between developed and developing countries as well as within countries is politically, socially and economically unacceptable and is, therefore, of common concern to all countries,' and 'Governments have a responsibility for the health of their people which can be fulfilled only by the provision of adequate health and social measures.' Since then government initiatives have stumbled under pressures of neo-liberal philosophy.

1.2 Social determinants of health

When differences in health are observed between individuals, the tendency is to apply individualised remedies rather than collective approaches or changes in public policy. Examination of the social determinants helps to redirect attention to the root causes of health inequality.

Where public spending is lower, where income transfers do not redistribute income from rich to poor, where residual welfare targets only the destitute, where social safety nets are weaker, where a lower proportion of health care expenditure is allocated to public health, and where groups are systematically deprived of adequate resources—these adverse material and social conditions generate stressful circumstances for day-to-day living. Deprivation is translated into factors such as high levels of income inequality between the wealthiest and poorest segments of society; high rates of child poverty; high unemployment; high rates of school drop-out; costly housing; insecure employment; inadequate licence-regulated childcare facilities; insufficient community services to support migrants, the elderly and people with disabilities; unsafe neighbourhoods; restricted availability of affordable nutritious foods; inadequate public transport; poor quality built environment and low coverage of public health care. Taken together these conditions reduce quality of life and limit opportunity for population groups to attain optimal levels of health.

Put simply, differences in health result from the fact that people live very different lives in their social context. People in the worst material and social conditions experience the worst health status. Importantly, these groups have very little personal

control over the conditions in which they live and cannot be held personally accountable for these conditions or their health outcomes.

Reductions in health inequalities, then, require reductions in the material and social differences that people experience in their day-to-day lives. One way to address this is to ensure greater equity in the allocation of resources within a population. Not only will this produce better health in general but it will also lead to better oral health status. Social determinants that affect life expectancy and rates of disease are shown in this survey to be important for oral health status too.

Inequalities in oral health status cannot be explained by differences in lifestyle and behaviour. These are not the root determinants of health, but are themselves determined by material and social conditions of society. Rather oral health status is profoundly affected by factors such as the distribution of income, the conditions of the work environment including stability of employment, and the circumstances of childhood.

In this report it is suggested that deprived material and social conditions undermine people's control over their lives, reduce opportunity for supportive relationships and produce ongoing psychological stressors that undermine their capacity to cope adaptively. Psychosocial factors such as control, social support, and stress and coping may act as mediators by which different material and social conditions convey an effect on oral health status.

This introduction serves to highlight two goals for population oral health—one is to improve the oral health of the population as a whole and the other is to reduce inequalities that exist between population groups. Until recently attention to the latter goal was overshadowed by the challenge of achieving gains for the population. This is now changing with increasing recognition that inequalities in health are undesirable for the society as a whole, even for those with best access to material and resources. This report examines inequalities in the oral health status of the Australian adult population. It reveals an unequal distribution of material and social conditions that is responsible for the inequalities in oral health status.

Specifying primary social determinants

Various publications have sought to identify a set of social determinants of population health that have a broad impact over a wide range of health conditions. A high level of consensus is found among these documents. The World Health Organization Regional Office for Europe initiated an inquiry to summarise the evidence on the principle social determinants of health to guide public policy. Ten social determinants were identified and published as 'The Solid Facts' (Wilkinson & Marmot 1998) namely, the social gradient, stress, early life, social exclusion, work, unemployment, social support, addiction, food and transport. The social gradient refers to society's social hierarchy or social ladder. People who occupy positions midway up the social hierarchy have better life expectancy and health outcomes than people further down the hierarchy but fare worse than people who occupy higher positions than themselves. Stress refers to psychological challenges that people judge to exceed their resources to manage effectively. It is generally accepted that persisting stress is more adversive than stress of short duration, even when the latter is more intense. Early life is a determinant of health as the foundations for adult health are laid early—either in childhood, or even in prenatal life. Social exclusion refers to the inability of certain groups to participate

fully in society. Groups may be excluded on the basis of deprivation, ethnicity, disability or discrimination. Work can differentially determine health status by affecting opportunities for promotion and income generation, job security, and the level of autonomy and skill discretion. Although physical aspects of work are also important, these are not generally regarded as social determinants of health. Supportive networks and ties supply people with the emotional and practical resources that they need. These factors are all addressed in this report.

Similar determinants of health were identified by Health Canada (Raphael 2004). This group identified: early life, education, employment and working conditions, food security, health care services, housing, income and its distribution, social safety net, social exclusion, unemployment and employment security. The Swedish National Institute of Public Health declared that the overall aim for population health was, 'to create social conditions which ensure good health for the entire population' (Agren 2003: p3). Their 11 objectives for public health showed considerable overlap, with the inclusion of participation and influence in society, economic and social security, secure favourable conditions during childhood and adolescence, healthier working life, good eating habits and safe food, and health and medical care that more actively promotes good health.

When inequality is inequitable

Not all inequality is inequitable. Le Grand (1987) stated that equality is a descriptive term and equity a normative one that calls upon value judgments. Inequity implies differences that are beyond individual control, that are unfair and unjust. It has moral and ethical dimensions. In terms of access to health care, Whitehead (1992) explained that equal access for equal need 'implies equal entitlement to the available services for everyone, a fair distribution throughout the country based on health care needs and ease of access in each geographical area, and the removal of other barriers to access' (p.221). So, based on this understanding, inequality in oral health care is inequitable when the social hierarchy results in systematic penalisation of certain social groups from fair and equal opportunity to reach and maintain optimal levels of oral health.

Social inequality in health in Australia

There are profound social inequalities in health in Australia. In their review of more than 200 published studies documenting Australian evidence, Turrell and colleagues (1999) noted that health inequalities spanned the life course from birth to late life. Those living in disadvantaged circumstances experienced worse health for almost all outcomes. Several leading reports have contributed to the body of knowledge in Australia. The 1992 National Health Strategy noted considerable differences in mortality, morbidity and risk factors between the most and least advantaged. Not only was there a health gap between the most disadvantaged and the rest of society, but a clearly defined gradient spanned the entire socioeconomic distribution, with decreasing proportions of adults rating their general health poorly with increasing levels of advantage. Running parallel with this gradient was a similarly graded distribution in health related behaviour. Men with low income were more likely to smoke than their more affluent counterparts, and men living in the most disadvantaged areas were more likely than other men to be physically inactive. Similarly, women with low educational attainment were more likely to be overweight than those with higher educational attainment.

Poor health is not confined to vulnerable groups in society such the older aged. Mathers (1994) observed that among adults of working age, those with greater socioeconomic disadvantage had poorer health for age-standardised death rates, serious chronic illnesses, disability, recent illness and self-rated general health. Other research has shown that working males in the lowest occupational prestige group had twice the mortality from all causes of death of those in the highest group, after adjusting for other factors (Health Targets and Implementation Committee 1988).

There is also geographical patterning in the distribution of health in Australia. Mathers and colleagues (1999) reported that the 20% of Australians living in the most disadvantaged areas had 35% more years of life lost than the 20% living in the least disadvantaged areas. Even greater differences were observed in the distribution of disability-adjusted life-years. Areas with a high proportion of adults with little formal education also had higher proportions of unskilled workers, women on sole parent pensions and families on income support, as well as higher fertility rates. Areas with a high proportion of residents who rated their health less favourably had high levels of socioeconomic disadvantage; low female labour force participation; and high proportions of public rental dwellings, disability support pensioners, unemployment beneficiaries and dwellings with no motor vehicles. In addition, these areas had higher standardised death rates, hospital admissions and morbidity.

Widening socioeconomic inequalities in health

Evidence of health inequalities in Australia is consistent with findings in almost every country for which data are available. Some evidence suggests that the socioeconomic health gradient is becoming steeper. In an extension of Mathers' earlier analysis, Turrell and Mathers (2001) examined age-standardised trends in mortality rates over the period 1985–87 to 1995–97 using an area-based measure of disadvantage and the Gini coefficient* as the level of inequality.

Findings revealed that despite overall reductions in age-standardised death rates over the period, mortality inequalities remained, and the size of the mortality gap between the most and least disadvantaged areas (indicated by the rate ratio) had increased for some conditions.

Walker and Abello (2000) drew similar conclusions with time-series analyses from the Australian Bureau of Statistics National Health Surveys conducted in 1977–78, 1983, 1989–90 and 1995. Analyses of trends in relative income and health for Australians aged 0 to 69 years revealed that the health gap between the two lowest income quintiles and the most affluent quintile significantly increased over this period for each outcome measured. Evidence that socioeconomic differentials in mortality and morbidity may be widening over time rather than narrowing or becoming static has been reported elsewhere (Dalstra et al. 2002; Schalick et al. 2000; Preston & Elo 1995).

To compare wealth and health distributions across countries, Clarke and Smith (2000) developed an index that quantified the distribution of health by equivalised income. Equivalised income adjusts household income for the number of household occupants and the age of children. In a cross-national comparison study of self-rated health status in 10 countries, Australia's level of health inequality was similar to that of Britain and

* The Gini coefficient is a measure of the degree of income inequality in a population.

the United States, but significantly higher than that estimated for the seven European countries.

Among factors thought to be contributing to the widening of the health gap, increasing income inequality has been identified as important.

Income inequality and poverty in Australia

Some commentators have argued that beyond a certain standard of living, inequality in the distribution of income is more important to population health than absolute per capita affluence. Certainly, there is evidence of a widening income gap in Australia. Analyses of trends in income inequality over 20 years demonstrate that the scale of income differences is rising (Harding & Greenwell, 2001; Saunders, 1993, 2002). In the Australian context, individuals at the lowest end of the scale of incomes do not live in subsistence poverty but rather in 'relative' poverty. Such people are socially marginalised because a lack of material resources precludes patterns of consumption and participation in what is seen as the Australian way of life. According to the definition of relative poverty as income less than half the national median, current estimates by the Centre for Independent Studies are that 1 in 12 Australians live in poverty (Saunders 2002).

The sociodemographic profile of Australians in poverty has altered over the past two decades because of changes in population demographics, family structures, social security priorities and workforce participation. King (1997) has described the changing face of poverty as a shift in burden from the elderly to other groups, including sole parents and younger single adults. Thus, new groups may be emerging as vulnerable groups in Australian society.

In summary, a weight of evidence has revealed that the relationship between social conditions and health is linear rather than threshold, with progressively better health encountered with each step up the social hierarchy. However, it is not plausible that socioeconomic resource directly affects health. Explanations for health inequalities must contain a plausible connection between material or social conditions and the behaviours or biological causes of disease and illness.

1.3 Explanations for health inequality

Until comparatively recently, inquiry into social inequality in health was descriptive, with efforts aimed at documenting rather than explaining variation. Early explanatory attempts viewed inequality in health as a constellation of problems associated with poverty. This inferred a threshold relationship separating the poor from the rest of society, and implied that if poverty were addressed the health gap would be resolved. It is now understood that a gradient in health extends well into the upper tiers of the social hierarchy. Each unit increase in socioeconomic resource is linked to a corresponding improvement in health status.

Interest in explaining socioeconomic health inequalities was stimulated by the 1980 publication of a review of health inequalities in Britain known as the Black Report. This report highlighted the persistence of health inequalities despite the introduction of the National Health Service that made health care freely accessible. It also advanced a framework of explanations for health inequalities – statistical artefact, selection, material deprivation / structural, and cultural / behavioural.

Since 1980 the weight of evidence for socioeconomic inequality in health has resulted in the rejection of the artefactual explanation. This argued that apparent social class inequalities in mortality were merely an artefact of the measuring systems used. Similarly, health selection has been discounted. This explanation implies that there is a greater chance for ill people to suffer a decline in socioeconomic position. Evidence from prospective cohort studies that have measured socioeconomic position and health at multiple points in time have shown that health inequalities are not, in the main, driven by selection mechanisms (Power et al. 1996; Rahkonen 1997). In addition, because completion of education usually precedes the onset of illness in adulthood, and because educational status does not decline with health status as is possible with income or occupation, the likelihood of selection effects is further discounted.

The cultural / behavioural explanation has also retained favour among some researchers. This explanation asserts a class-determined preference for health related behaviours. For example, that groups lower on the social hierarchy choose to smoke, exercise less, eat less healthy diets and consume alcohol in risk levels compared with group that occupy higher positions on the social hierarchy. The tendency inherent in this explanation to blame disadvantaged groups for their risk behaviours is softened somewhat by the inclusion of the 'cultural' terminology. This implies that prevailing social and material circumstances of society

The fourth general explanation of the relationship between social position and health recognised the role of economic factors and associated socio-structural features of society that differentially establish conditions of living for different social groups. The 1980 Black Report represented a government-sponsored initiative to translate the evidence of health inequalities into policies to improve the conditions of life for disadvantaged groups and to reorientate health and social service provision.

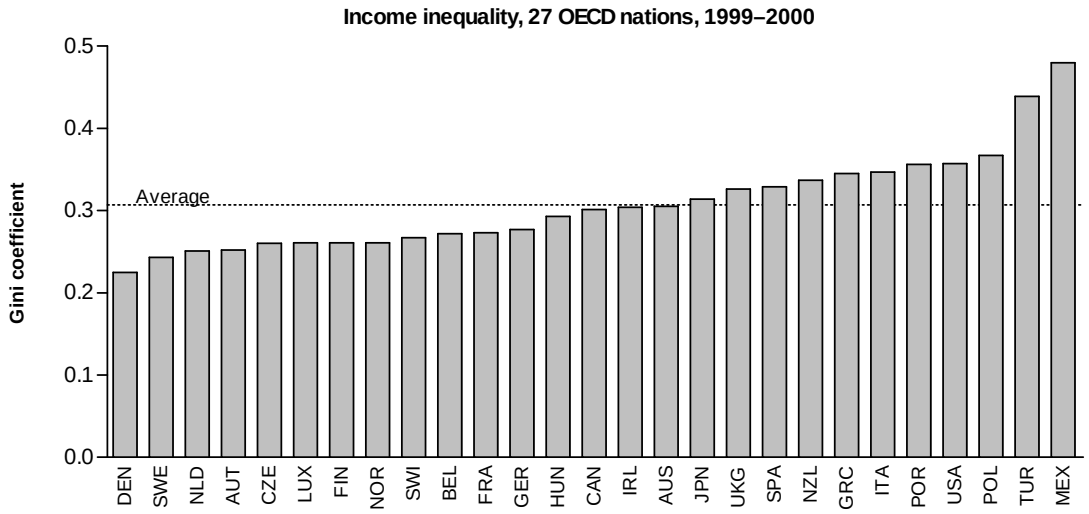
The contemporary explanations for health inequalities retain the cultural behavioural and structural materialist explanations and add the neo-materialist, and the psychosocial hypotheses. These should not be viewed as competing explanations, but rather as contributing different dimensions of the overall process.

Neo-materialist explanation

It is useful to distinguish between the materialist and the neo-materialist explanations. The former contends that material resources serve as a marker of the quality of early life, food security, adequate housing, opportunities for education and secure employment. The more control over material resources that an individual has, the better able he or she is to secure goods and services essential for better and longer life. The neo-material explanation is less focused on the material assets of individuals and more focused on how society distributes material resources among population groups. For this reason it is also less focused on absolute levels of resource, choosing to pay more attention to relative differences.

Income inequality

The Gini coefficient is a measure of the degree of income inequality in a population. A coefficient of zero denotes perfect equality and coefficients closer to unity indicate greater inequality and usually a greater proportion of the population in poverty. In 1999 the level of income inequality in Australia (Gini=0.305) was marginally below the OECD average of 0.307 but was substantially higher than that of the Scandinavian countries (Figure 1).

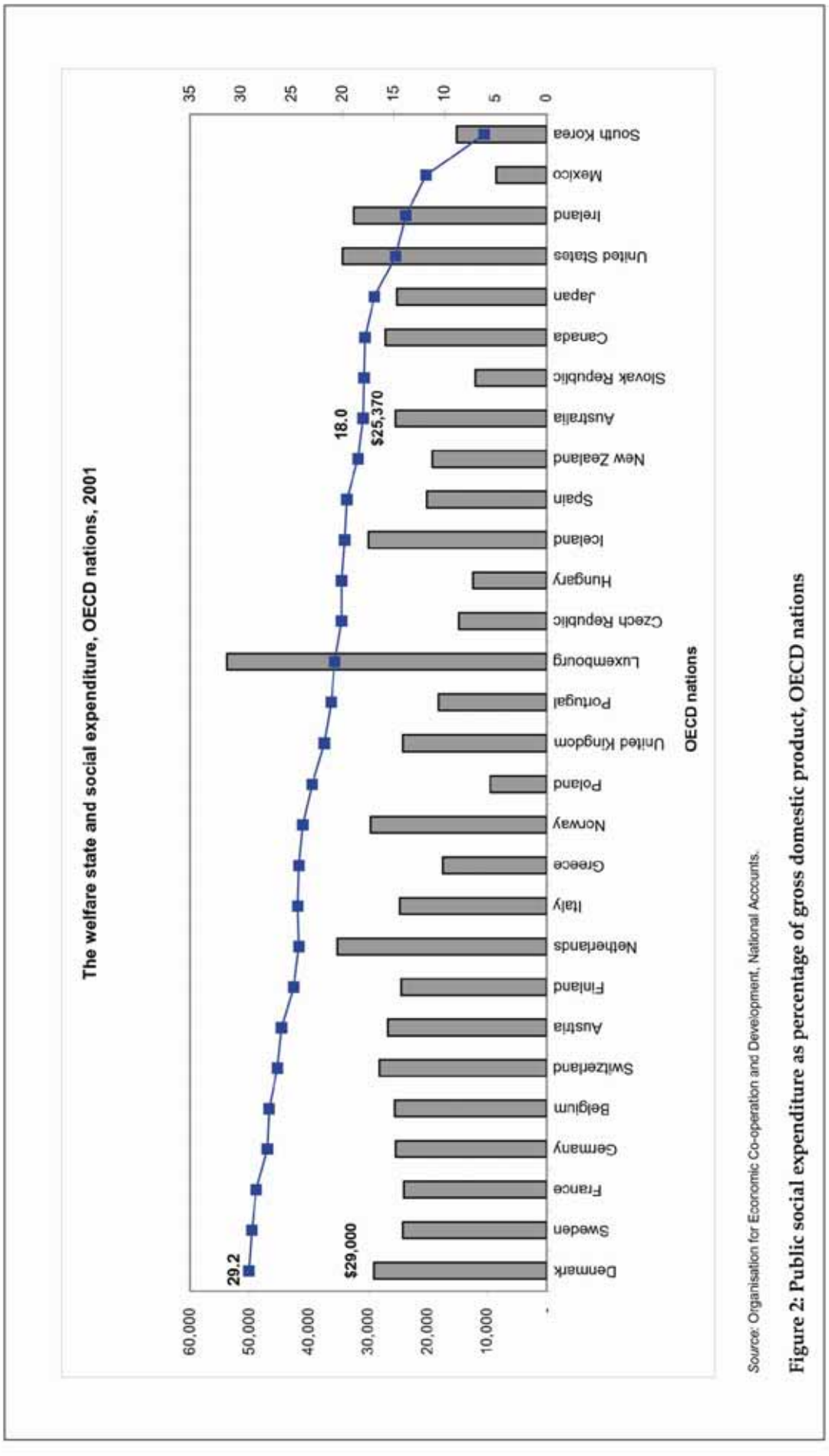


Notes:
1. Income is disposable household income, adjusted for household size.
2. Data for the year 2000 except for Australia, Austria and Greece where1999 data are used.

Source: OECD; Social and welfare statistics, 2006.

Figure 1: Income inequality among OECD nations

Figure 2 shows where Australia stands in comparison with other OECD nations in terms of the proportion of gross domestic product (GDP) allocated to social expenditure. Countries with greater social expenditure achieve greater equality. Australia increased its public social spending over the past quarter century from 11.3% of gross domestic product in 1980 to 18.0% in 2001. Yet since the average level of expenditure for the OECD23 group of nations was 22.0% of GDP in 2001, Australia's contribution is comparatively modest.



Source: Organisation for Economic Co-operation and Development, National Accounts.

Figure 2: Public social expenditure as percentage of gross domestic product, OECD nations

Psychosocial explanation

While the neo-material explanation addressed determinants at the economic level, the psychosocial explanation addresses the effect of the social environment on individuals. The explanation asserts that people attach meaning to their material and social circumstances and cognitive and emotional responses have potential to affect health status. This occurs either through biological pathways, by affecting the endocrine or immune system for example, or though behavioural pathways, by inducing risk-taking behaviour such as smoking.

In deprived conditions cognitive and emotional responses are likely to be bleak. A sense of powerlessness can lead to internalised feelings of failure and a loss of self-esteem, which undermines coping resources to deal adequately with new or continuing stress stimuli. People who are deprived materially and socially have less opportunity to participate fully in society and form supportive social bonds.

Psychosocial processes operate through the perception of *relative* deprivation. According to Davis (1959), this occurs when individuals unfavourably compare their resources with those of others in close proximity or in similar circumstances. The significance of comparison to one's own group was emphasised by Runciman (1966) in relation to the post-war British welfare state. He observed, '… reference groups of the recipients of welfare were virtually bound to remain within the broadly delimited area of potential fellow-beneficiaries. It was anomalies within this area which were the focus of successive grievances, not the relative prosperity of people not obviously comparable' (p.71). Medical sociologists have taken the relative deprivation hypothesis into health research, suggesting that these felt grievances may have psychosomatic consequences with-flow on effects such as disease expression.

It is also possible that disadvantaged groups have a future time preference, meaning that they discount future benefits in favour of immediate benefits. Under psychological stress people may value the immediate satisfaction of smoking and thereby trade-off against their future health (Hornik 1990). Smoking may relieve the immediate stress of deprivation or may substitute for reward in occupations with low levels of skill, prestige and pay. Smoking is a recognised predictor of tooth loss (Ahlqwist et al. 1989; Slade et al. 1997). Similarly, disadvantaged groups may be less likely to invest in future oral health through diligence in oral hygiene and preventive use of dental services because their coping resources may be directed towards more urgent survival needs.

Behavioural explanation

The behavioural explanation posits that poorer people have poorer health due to their poorer health behaviour.

This explanation rose in an acceptance during the 1970s when chronic conditions were recognised as the primary source of illness, and medicine had limited capacity to improve outcomes. Moreover increasing expenditure on long-term management led to diminishing returns in health gains. A second impetus for the behavioural explanation came from the 'new public health' movement that had its inception in the New Perspective on the Health of Canadians report (Lalonde 1974). In that report the Health Field Concept asserted that health outcomes were not solely a consequence of contact with the health care system, but resulted from lifestyle, environment, human biology

and health care. Although Lalonde argued that health was tied to conditions of living, the international response was to invest almost exclusively in the lifestyle (behavioural) component.

This explanation shifts the accountability for health from one of societal responsibility to one of individual responsibility, asserting that decisions are subject to personal control and rational choice and assuming equality of opportunity. A focus on individual behaviour implies that disadvantaged groups are accountable for 'choosing' adverse behaviours. Indeed, since behavioural risk factors co-vary with socioeconomic factors, and are strongly affected by influences such as health literacy, social norms and resource allocation, differences in behaviour are not solely a matter of individual choice.

Understanding why a risk behaviour is more prevalent among disadvantaged groups requires recognition that behaviours may be maladaptive coping responses to adverse social conditions and not entirely controlled by personal choice. Paradoxically, since disadvantaged groups experience the worst health outcomes, the most advantaged segments of the population benefit earlier and most from health promotion messages since they tend to be better informed about health risks or receive stronger social support to make and maintain behavioural changes. It has been suggested that adults with greater educational attainment obtain better health with fewer resources, either by better allocating resources to maximise outcomes (i.e. allocative efficiency) or by deriving greater benefit from a single resource (i.e. productive efficiency.) Furthermore, self care and a preventive use of health services are likely to be influenced by the type and amount of information an individual can access and act upon. In addition, the higher cost of healthy behaviours is a barrier to the individuals concerned.

McKinlay (1998) summarised the limitations of policies that target only the behavioural choices of individuals. He argued that 'such policies: divert limited resources away from upstream healthy public policy; blame the victim; produce a lifestyle approach to health policy instead of a social policy approach to healthy lifestyles; decontextualise risk behaviours and overlook the ways in which such behaviours are culturally generated and structurally maintained; seldom assess the relative contribution of nonmodifiable genetic factors and modifiable social and behavioural factors.'(p. 77).

The role of health care

Health is generally viewed as a social concept rather than a medical one, and this view is supported in numerous definitions of health that emphasise quality of life, well-being and the ability to lead a productive and fulfilling life. It is not surprising then that social determinants, more powerfully than other factors, predict specific disease, life expectancy and the potential of groups to lead full and fulfilling lives, as espoused by the 1948 World Health Organization definition of health. Apart from social environments, other determinants of population health include the health care system and, at the individual level, genetic endowment and lifestyle and behaviour (Evans and Stoddard 1990; Lalonde 1974).

The social science literature downplays the contribution of the health care system as a key determinant of health. Health care is seen as treating symptoms and consequences of the determinants of health in individuals, but is not seen as playing a major role in preventing disease in the population. However, when oral health is the condition of interest, the health care system warrants greater attention. In part, this is because access

to dental care is not universally available for adults in Australia. Underprivileged groups, who experience the worst oral health status, are most in need of dental care and are least able to purchase dental care services, are systematically disadvantaged in terms of access to dental care. This raises serious questions about equity in the health care system. More fundamentally, some prominent oral health outcomes, such as tooth loss, are a consequence of dental disease and its dental management.

A core activity of health care policy is to set priorities among competing demands to achieve the best possible allocation of scarce resources. Efficiency objectives allocate resources in ways that maximise gains in health for the population overall, and these are balanced against equity objectives that ensure that the allocation of resources is fair. In Australia, as in most economically developed countries, policy is committed to universal health care and the principle of equity.

A fundamental equity principle is that all social groups are entitled to equitable health care based on their need and not on their ability to pay. Horizontal equity refers to the equal treatment of equals and it is achieved when those with equal need have equal opportunity to use health services. In Australia this is promoted through Medicare, the vehicle for universal general medical care that is financed predominantly from the public purse. However, Medicare does not extend to dental care. Instead, dental care is financed predominantly by private health insurance and out-of-pocket expenses. For those on low incomes, state governments provide a program of means-tested public dental care to which users contribute a co-payment. Eligibility is not limited to those in poverty but extends to cover some 30%of the adult population. To the extent that this system might contribute to inequality in population oral health, makes health care relevant to this report.

1.4 Conceptual framework for health inequalities

So that the proliferation of social determinants can be organised and integrated, it is useful to impose the structure of a conceptual framework on these factors. This structure helps to develop a causal understanding of interrelationships between the determinants and their effects on health.

A framework based on empirical evidence and broad social science theory was developed in Australia by Turrell and colleagues (1999) and is presented in Figure 3. It organises determinants into three levels with diffuse boundaries. It establishes a sequence of factors originating in the broad global context upstream that influences the national sociopolitical environment. At this level public policy determines the nature of education, employment, occupation and working conditions, income, housing and area of residence. These contexts differentially expose population groups to environments that promote health or are harmful to it. For groups living in relatively disadvantaged circumstances, adverse health effects are mediated at the intermediate level through psychosocial processes and patterns of risk behaviour that attempt to modify or alleviate stress. Prolonged psychological stress places load on immune system response, resulting in signs and symptoms of morbidity. The health care system intervenes at this level to alleviate symptoms of morbidity and arrest their progression. Ultimately biological reactions result as a consequence of disruption to the functioning of physiological systems and the expression of overt disease. This is depicted downstream in the conceptual framework at the micro level.

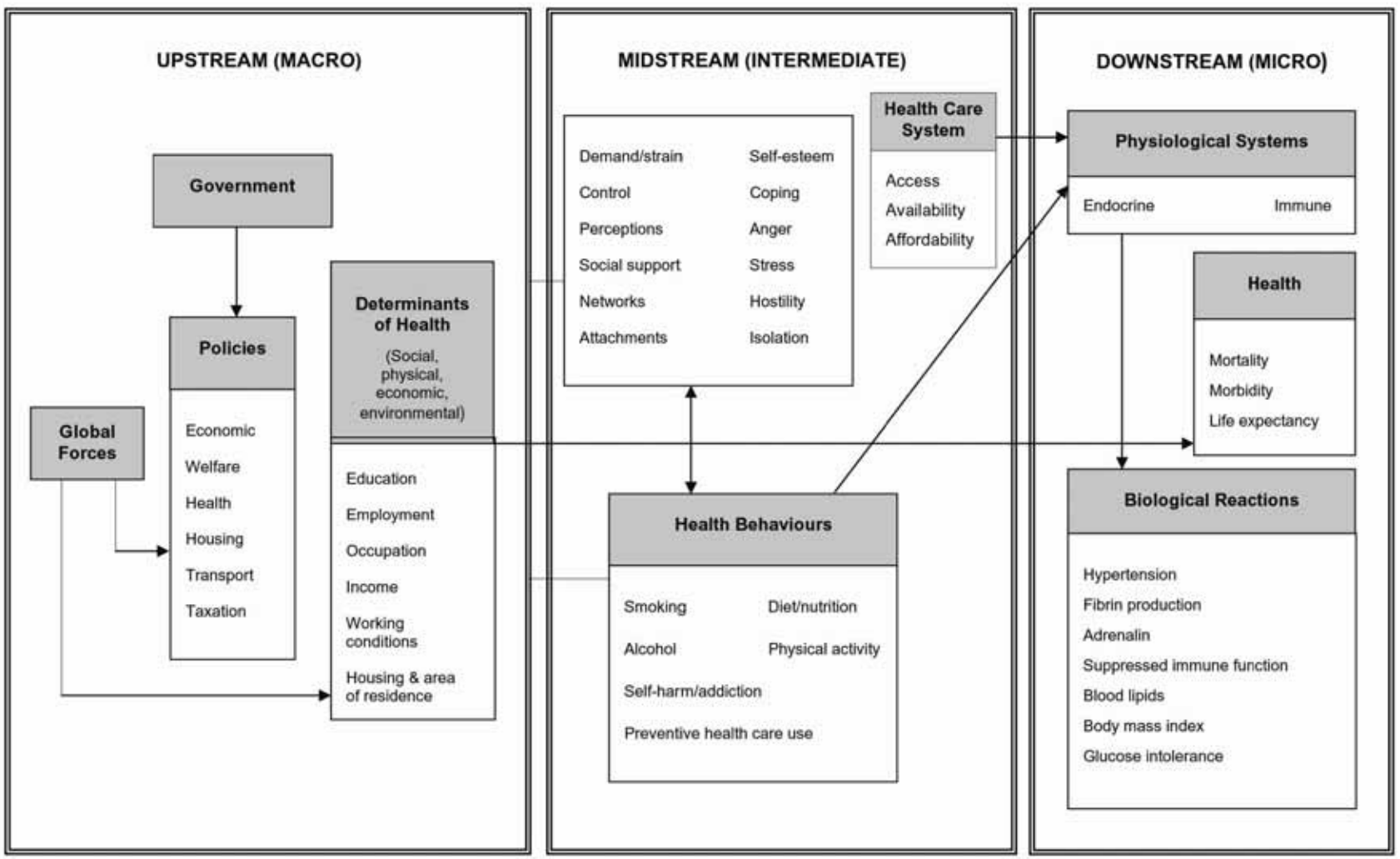
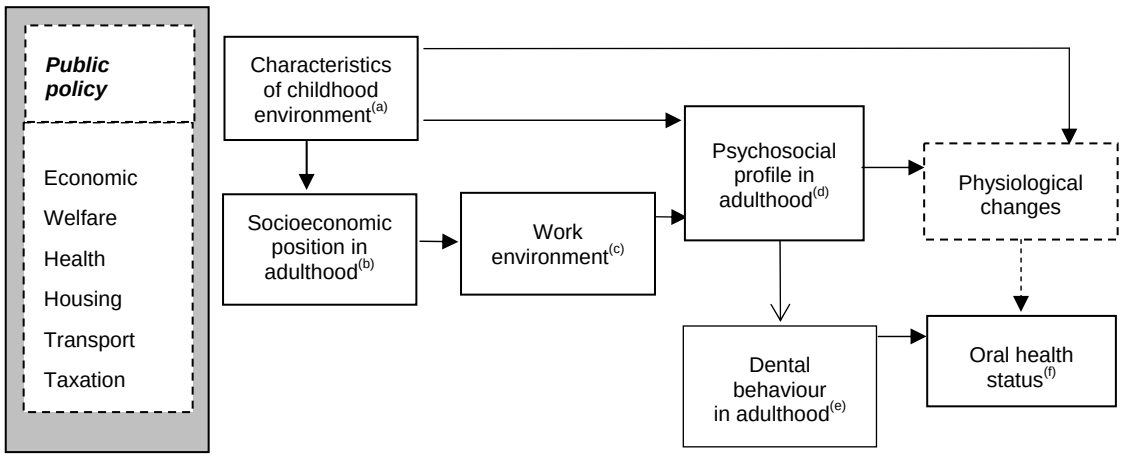


Figure 3: Framework of determinants of health developed by Turrell et al. 1999

Conceptual framework adapted for this study

The conceptual framework of Turrell and colleagues (Figure 3) was adapted for the scope of this study (Figure 4). It incorporates the policies component and acknowledges the important influence of public policy on establishing the quality of material and social conditions. It shows the childhood environment leading to socioeconomic position; psychosocial profile and patterns of dental behaviour in adulthood independently of socioeconomic position in adulthood. In turn psychosocial factors influence oral health either directly by inducing physiological changes or indirectly by shaping ways that people practice personal dental care and utilisation of dental services.



(a) Measured in this study using: parental occupation; parental cohabitation; caregiver rearing style.
(b) Measured using: annual household income; educational attainment; reimbursement mechanism.
(c) Measured using: workplace conditions; work and family balance.
(d) Measured using perceptions of: personal control; social support; psychological stress.
(e) Measured using: dental self care, diet, smoking, dental attendance.
(f) Measured using: clinical status (self-reported tooth loss); functional status (severe impact on quality of life (short form Oral Health Impact Profile); subjective status (low self-rated oral health).

Figure 4: Conceptual framework explaining socioeconomic inequality in oral health

Physiological changes were included in the framework but the dotted line indicates that they were not examined in this study. Similarly, factors operating at the public policy level were not discussed, although their importance is emphasised. The framework illustrates that the various explanations for health inequalities—neo-material, behavioural, psychosocial—can operate jointly at different levels. As indicated by the direction of the arrows, childhood circumstances influence social and material conditions in adulthood and ways in which these conditions are appraised as threatening or stressful. In turn, psychosocial responses can alleviate or moderate the potential harmful effect of stress or, alternatively, can elevate its risk through harmful health behaviour.

2 Methods

Cross-sectional data were taken from two successive National Dental Telephone Interview Surveys (NDTIS) conducted in 1999 and 2002 and their accompanying self-complete questionnaires that were mailed to interviewees following their interview. These surveys were conducted by research staff at the Dental Statistics and Research Unit (DSRU)—a collaborative unit of the Australian Institute of Health and Welfare. DSRU is situated within the Australian Research Centre for Population Oral Health at the School of Dentistry in the University of Adelaide. Further information about the NDTIS surveys is available online in technical reports (see Carter & Stewart 2002, 2003).

2.1 Study and sampling designs

The study design and sampling methods were almost identical in the 1999 and 2002 surveys. Both surveys used a cross-sectional study design and a stratified two-stage stratified sampling design to select potential households for interview. Interviews were conducted with a sole individual sampled at random from among household occupants. Information was collected from a nationally representative sample of people aged 5 years and over from each Australian state and territory using a computer-assisted telephone interview and a self-complete questionnaire mailed shortly after their interview to adult interviewees.

The sampling frames differed slightly for the two surveys. In 1999 residential telephone numbers in all Australian states and territories were randomly sampled from the national electronic white pages telephone number listings. In 2002 an effort was made to include unlisted telephone numbers in the sampling frame. Consequently, a random digit (between 1 and 9) was added to each sampled telephone number. These revised numbers were included in the sampling frame and, where possible, were compared with the electronic white pages to obtain the address of residential dwellings.

In both surveys one sample was drawn from the capital city of each mainland state and another drawn from the residual population in each of these states. Samples were also drawn from Tasmania and both territories. Overall this produced 13 separate strata.

Where sampled phone numbers were successfully matched to a residential address, a primary approach letter was mailed to that address to encourage participation. About ten days later a trained telephone interviewer called the household and randomly selected one household occupant for the interview. Proxy interviews were conducted for sampled children aged between 5 and 15 years and for adults who were unable to answer interview questions. For people whose spoken English did not permit an interview in English, interpreters conducted interviews in several other languages.

2.2 Data collection

Computer assisted telephone interview

In both the 1999 and 2002 surveys, information was obtained on opportunity to access dental care services. Interviewees were asked about their perceived need for dental services, their utilisation of dental care and the types of dental treatment they had received. Oral health status was evaluated with questions about the retention of natural teeth. People were asked to rate their oral health on a six-point ordinal scale: 'excellent', 'very good', 'good', 'average', 'poor' and 'very poor'. Sociodemographic information collected included sex, age, Indigenous status, country of birth, educational attainment, employment status, private dental insurance status, eligibility for government concession, and total household income. The interview schedule for the NDTIS 2002 appears as Appendix 1.

Self-complete questionnaires

On completion of the telephone interview survey, adult interviewees were advised that a self-complete questionnaire would be mailed to their residential address. In 1999 this consisted of a 16-page document that contained a series of established questions that measured the social impact of oral conditions, dental visiting and self-care, and psychosocial factors. Other questions asked about childhood circumstances. For adults in paid employment, further questions asked about work conditions and about the pressure of balancing work and home commitments. In 2002 the questionnaire was eight pages in length. Again it measured the social impact of oral conditions and also asked about risk behaviours for general and oral health. A third topic asked about the direct and indirect costs faced in utilising dental services. The content of the questionnaires for 1999 and 2002 appear as Appendices 2 and 3 respectively.

2.3 Oral health status

Selection of oral health status indicators was based on a conceptual classification of the three major indicators: clinical status, functional status and subjective status (refer group F in Figure 4).

Tooth loss

The clinical measure was tooth loss. Rates of tooth loss in a population quantify the accumulated burden of oral disease over the adult life course and the consequences of its treatment by dental extraction. Numbers of retained and missing teeth in each jaw were obtained in the NDTIS with the following questions:

> There are 16 teeth, including wisdom teeth, in the upper jaw. Could you tell me EITHER: the number of MISSING teeth in your upper jaw, OR the number of REMAINING teeth in your upper jaw? (*Literal response)*
>
> There are also 16 teeth, including wisdom teeth, in the lower jaw. Could you tell me EITHER: the number of MISSING teeth in your lower jaw, OR the number of REMAINING teeth in your lower jaw? (*Literal response)*

Two summary variables were constructed from this information. One was the prevalence of less than 20 retained teeth (tooth loss). This threshold has clinical and public health significance. An extensive review of the literature concluded that 20 natural teeth were sufficient for satisfactory chewing function (Elias & Sheiham 1998), diet and nutritional status (Sheiham et al. 2002). Furthermore, adults with fewer than 20 teeth are more likely to suffer impaired oral health related quality of life than adults with more retained teeth (Bedi & McGrath 2002). The second summary variable reported the mean number of lost teeth.

Social impact of oral conditions

The clinical indicator of tooth loss says very little about the impact of oral conditions on day-to-day living from the individual's perspective. Consequently the social impact of oral conditions was measured with the 14-item Oral Health Impact Profile (OHIP-14) developed by Slade (1997). This widely used questionnaire is theoretically grounded in a 1980 World Health Organization classification of the consequences of disease and disorders that was subsequently adapted for oral health (Locker 1988). OHIP-14 evaluates the frequency with which problems with teeth, mouth or dentures produce varying levels of dysfunction, impairment, disability and handicap. Responses are made on a five-point ordinal scale ranging from 'never' through to 'very often'. A measure of severity was computed by excluding impacts experienced occasionally or less frequently. Thus, prevalence reported here represents the proportion of people who had experienced adverse impacts from their oral conditions fairly often or very often in the preceding year.

Self-rated oral health

In contrast to the OHIP-14 questionnaire that evaluates multiple dimensions of social impact, the single-item global self-rated oral health question does not prescribe domains. Instead, it permits respondents to consider their own referents:

> Overall, how would you rate your oral health? ('Excellent', 'Very good', 'Good', 'Average', 'Poor' and 'Very poor').

Ordinal responses were collapsed to form a binary variable comprising categories of 'good' and higher levels versus 'fair' 'poor' and 'very poor'. Prevalence of average oral health status or worse is reported.

2.4 Socioeconomic position

Socioeconomic position at the time of the survey (refer group B in Figure 4) was assessed with gross pre-tax annual household income. This was selected as a marker of purchasing power. It affects the ability to purchase private dental insurance and dental services and acquire other material assets that promote health. In 1999 the following categories of annual household income were read aloud to interviewees:

> Up to $12,000; From 12 to $20,000; From 20 to $30,000; From 30 to $40,000; From 40 to $50,000; More than $50,000.

The list was extended in 2002 with three additional categories to include household income exceeding $80,000.

> Up to $12,000; From 12 to $20,000; From 20 to $30,000; From 30 to $40,000; From 40 to $50,000; From 50 to $60,000; From 60 to $70,000; From 70 to $80,000; More than $80,000.

A second measure was educational attainment. In 1999 the following levels of educational attainment were read out in the telephone interview:

> Completed secondary; Some university, CAE or teacher's college; Completed a university, CAE or teacher's college course; Part completed a vocational course, e.g. nursing, a trade or apprenticeship; Other; Don't know / Refusal.

In 2002 a filter question was asked first:

> Have you completed a trade certificate or any other educational qualification since leaving school?

Those who responded affirmatively were asked to indicate the highest qualification or level of education that they had completed since leaving school:

> University degree or diploma; University masters degree or PhD; CAE or teacher's college or nursing; Trade certificate / apprenticeship / vocational, e.g. TAFE, hairdressing; Certificate or diploma course, TAFE 1–2-year course; Other; Don't know / Refusal.

Reimbursement mechanisms for dental care

Linked to socioeconomic position are the arrangements that people have to be reimbursed for dental care. These arrangements are not entirely chosen by individuals. Policy decisions concerning the financing of dental care directly influence the size and distribution of the dental work force, the service infrastructure and the availability, range, quality and cost of dental services. Indirectly these factors influence the ability to gain access to needed services, the propensity to seek preventive care, the likelihood of having a usual source of care, and associated direct and indirect costs of care. In this report, two mechanisms of financing are examined: (i) eligibility for public dental care and (ii) private dental insurance status. These factors determine the relative contribution of state, insurance and out-of-pocket expenditure to the costs of dental care.

A composite variable was constructed from two questions that comprised four possible reimbursement mechanisms: (1) fully reliant on public sector financing with user co-payment and no parallel private insurance cover; (2) public sector care financing with parallel support from private dental insurance; (3) fully reliant on out-of pocket expenditure with direct payments to providers and (4) financing through private insurance purchases and not eligible for public sector coverage.

> Do you have private insurance cover for dental expenses? (Yes / No)

> Do you currently have a pensioner's concession card, a Health Care Card or a Department of Veterans Affairs card; or do you receive a pension or allowance from the Government? (Yes / No)

2.5 Determinants of oral health inequalities

Dental behaviour

In the conceptual model (Figure 4) dental behaviours are shown as group E variables. Questions in the self-complete questionnaire asked about weekly frequency of tooth brushing and interdental cleaning, daily servings of high non-milk extrinsic sugar (NMES) items and smoking status were asked. Literal responses were offered for the frequency of tooth brushing and interdental cleaning using dental floss, dental tape or an interdental brush, pick or stick:

> In the last week, how many times did you **brush** your teeth?
>
> In the last week, how many times did you clean **between** your teeth using dental floss, tape or interdental brush / pick / stick?

Each behaviour was scored to identify a risk category. Oral hygiene risk categories were defined as brushing less often than seven times a week (<1 daily) and not cleaning interdentally on any occasion in the previous week.

NMES are sugars that are not naturally incorporated into the cellular structure of foods excluding those found in milk products. Respondents indicated the number of standard serves they consumed on a usual day of: sweetened fruit drinks and juices; sweetened (non-diet) soft drinks, mineral waters, cordials and sports drinks; biscuits, cakes and puddings; table sugar; chocolate and sugar-based confectionery; syrups, jams and sweet spreads; muesli bars and health bars. They also indicated their usual breakfast cereal. Cereals were later classified according to total sugar content by weight as specified by manufacturers into low (<11%), moderate (11–22%) and high (>22%) total sugar content categories. Refer to Appendix C for the exact wording of food types under the section headed 'standard serves consumed daily and number consumed in the last hour before bed'.

Total daily consumption of NMES was calculated as the sum of food and beverage servings plus one serve for cereals with moderate total sugar content and two serves for cereals with high total sugar content. The risk category for consumption of non-milk extrinsic sugars (NMES) was defined distributionally as consumption in the highest quintile.

Smoking status was obtained with the following question:

> Which of the following best describes your smoking status? (I smoke daily; I smoke occasionally; I don't smoke now but I used to; I've tried it a few times but never smoked regularly; I've never smoked).

Occasional or daily smoking formed the risk category for smoking status:

Four questions about dental utilisation were asked in the telephone interview. Two of these asked about usual periodicity between dental visits and usual reason for a dental visit (check-up or problem). Since attendance is constrained by the affordability of services, two questions asked cost as a barrier to obtaining sought care:

> Which is your usual reason for visiting a dental professional, for check-ups or when you have a dental problem?

How often on average would you seek care from a dental professional? (Two or more times a year; Once a year; Once in two years; Less often than that; Don't know).

At most times of the year, how much difficulty would you have paying a $100 dental bill? *(*None, hardly any, a little, a large burden, don't know*).*

Have you avoided or delayed visiting a dental professional because of the cost? *(*Yes, No*).*

Psychosocial mechanisms

The choice of psychosocial factors was guided by scientific evidence of associations with health status. A combination of validated multi-item scales was used along with a series of individual items that were based on sociological and psychological theory. Validated scales assessed sense of personal control, perceived stress and life satisfaction. Social support was assessed with four items based on its four theoretical domains—emotional, appraisal, instrumental and informational support. These are presented in group D in the conceptual framework shown in Figure 4. The wording of questions and their response categories appear in Appendix B.

Personal control

A sense of personal control was measured with Lachman and Weaver's (1998) 12-item battery developed from Pearlin and Schooler's 7-item 'Personal Mastery Scale'. The scale comprises two dimensions referred to by Lachman and Weaver (1998) as personal mastery and perceived constraint. Mastery refers to an individual's beliefs concerning the extent to which he or she is able to influence outcomes and achieve goals, and perceived constraint refers to the extent to which external factors or fate determine outcomes. In computing an overall scale score, the eight negatively worded items were reverse scored and a summary score was computed as the mean of all items. Higher scores indicate higher levels of perceived control. This overall score was subsequently divided into tertiles labelled 'low', 'moderate' and 'high' levels of personal control and in this report the percentage of people with scores in the low tertile range are reported. These items are shown in Appendix B in the Mastery and Constraints Scale.

Psychological stress

The 14-item Perceived Stress Scale of Cohen, Kamarck and Mermelstein (1983) evaluates the frequency with which people appraise situations as threatening and their appraised capacity to cope with threatening situations. Each item is prefixed with the words, 'How often during the past year have you felt …' followed by a potential stressor such as 'unable to cope with all the things that you had to do?' Responses were made on a five-point scale labelled, 'not at all' through to 'very often', with a mid-point of 'sometimes'. The six items that evaluated coping were reverse scored in computing an overall summary score, so that a high score indicated high levels of perceived psychological stress. This summary score, was divided into tertiles labelled 'low', 'moderate' and 'high' psychological stress, and the percentage of people with scores in the high tertile range are reported as high stress is the hypothesised risk factor. These items are shown in Appendix B in the Perceived Stress Scale.

Social support

Social support was assessed with four items. Each item was designed to evaluate one of the four dimensions of social support theorised by House (1981) as emotional, appraisal, instrumental and informational support. Items were prefixed by the words, 'There are people in my life who …' and the items were '… pay attention to my feelings and problems', '… express appreciation of my work', '… I can get help from with certain activities if needed' and '… I can get advice from on how to handle things if needed'. Responses were made on a five-point Likert scale of agreement ranging from 'strongly disagree' to 'strongly agree' with a neutral midpoint. Since each item evaluated a separate dimension, each dimension was individually examined. Summary scores for each dimension comprised the percentage of people for whom social support was not readily available, i.e. those people who neither agreed nor disagreed, and those who disagreed that there were people in their lives who offered these forms of support. These items appear in Appendix B as the Social support items.

Work conditions and job characteristics

Individual items assessed the usual number of hours worked, perceived job security and risk of skill obsolescence. Respondents were asked to state and describe their usual occupation and to offer a brief description of their main tasks. Examples were provided. During data entry these descriptions were used to classify occupations according to the Australian Standard Classification of Occupations (First edition; ABS 1990). These are presented in group C in the conceptual framework shown in Figure 4 and the wording of questions appear in Appendix B as items pertaining to conditions of work and workplace environment.

Balancing work and home commitments

The effect of role strain resulting from balancing commitments of work and home life has attracted increasing attention in recent years. Developmental psychologists have examined effects on family life and organisational psychologists have examined the impact on work productivity.

To evaluate the possible effect of work and home strain on oral health, study participants who were currently in the paid workforce nominated their level of agreement with eight statements developed by Gutek et al. (1991). Responses were made along a five-point scale ranging from 'strongly disagree' to 'strongly agree' with a neutral midpoint. Four items addressed work interfering with home life or recreational time and four items evaluated family / personal life interfering with work:

> After work, I am too tired for leisure activities, family time or household chores.
>
> I have so much work to do that it takes away from my personal interests.
>
> My family / friends dislike how often I am preoccupied with work while I am at home.
>
> Work takes up time that I'd like to spend with family or friends.
>
> I'm often too tired at work because of the things I have to do at home.
>
> My personal demands are so great that they interfere with my work.

My superiors and peers dislike how often I am preoccupied with my personal life while at work.

My personal life takes up time that I'd like to spend at work.

Childhood circumstances

Childhood circumstances evaluated socioeconomic position, family structure and rearing style of caregiver. Socioeconomic position was measured according to the occupational category of both father and mother (or the male/female carer living in the household). Response options were the eight major Australian Standard Classification of Occupations categories plus two additional categories labelled 'domestic duties' and 'other, please specify'.

Socioeconomic position was assessed with the occupational group of each parent. Occupational groups were: Manager or administrator; Professional; Paraprofessional; Tradesperson; Clerk; Salesperson or personal service work; Plant or machine operator, or driver; Labourer; Domestic duties. Categories of 'Unemployed' and 'Other, please specify' were also offered.

When you were aged 10, what was the occupation category of your father (or male carer living in your household)?

When you were aged 10, what was the occupation category of your mother (or female carer living in your household)?

Family structure was indexed as parental cohabitation status at the referent age of 10 years. Participants were asked whether their parents lived together or separately. A third category of 'unsure, please specify' allowed written responses to be individually assessed and recoded where possible to one of these categories.

When you were aged 10 did your parents live together or separately? ('Together', 'Separately' and 'Unsure').

Respondents were invited to rate the quality of their primary caregiver's parenting style as 'generally positive and supportive', 'generally negative and unsupportive' or 'other, please specify'. The latter were reassigned where possible to either the positive or negative categories. These are presented in group A in the conceptual framework shown in Figure 4 and appear in Appendix B as the childhood circumstances items.

Parenting style refers to the elements of responsiveness (warmth or supportiveness) and demandingness (disciplinary approach) (Maccoby & Martin 1983) and styles such as indulgent, authoritarian and uninvolved are recognised. In this survey parenting style was dichotomised as being either positive or negative. Again, participants were able to specify their own circumstances and this information was used to assign participants where possible to one of the other categories. This question did not apply a referent age.

How would you describe the parenting style of the person chiefly responsible for rearing you? ('Generally positive and supportive', 'Generally negative and unsupportive' and 'Other, please specify').

Inclusion and exclusion criteria

The 1999 and 2002 NDTIS surveys sampled the entire Australian population to obtain a snapshot of the oral health of the nation and its use of dental services. Following the NDTIS surveys, self-complete questionnaires were sent to adult respondents. Analysis for this report restricted the sample to adults aged 25 years and over and omitted edentulous adults, i.e. those with complete tooth loss. Adults aged 18–24 years were omitted because of complications in interpreting equity among this group. Young adults are in transition between dependence on family and being financially independent. Some young adults may be financially supported by their parents and covered by their parents' private dental insurance scheme. Many are completing tertiary education and are not yet established in the workplace. Edentulous adults were omitted because people without teeth have different needs and less demand for dental services.

Data weighting

Two-stage sampling designs of this type lead to over-representation of persons from smaller households, since the probability of selection at the second stage is inversely proportional to the household size. Additionally, a person from a less populous stratum has a greater probability of being sampled than does a person from a larger stratum. Hence data were weighted using post-stratification by age and sex, to account for differing sampling probabilities due to the sampling design and to ensure that the sample from each stratum more accurately represented the population of that sampling stratum. Population estimates for males and females aged 18 years and over in each sampling stratum were based on the Australian Bureau of Statistics estimated resident populations.

Statistical analysis

Associations were tested for statistical significance using Pearson's Chi-square and Fisher's exact test where comparisons were based on categorical variables. The threshold for significance was taken as P-values of less than five per cent in the conventional manner. Tables and figures use the standard error as an indicator of variation in the estimate. As a general guide, non-overlapping standard errors in figures are suggestive of $P<0.05$ (but P could be $>=0.05$). Overlapping standard errors unequivocally signify $P>0.05$.

3 Participation

3.1 Demographic profile

The demographic (Table 2) and socioeconomic (Table 3) profiles are based on participation in the national dental telephone interview surveys rather than the questionnaires mailed to interviewees. Due to the weighting procedure, distributions by age, sex and geographic location reflect ABS estimates for each sampling stratum (Table 2). Participation of Indigenous Australians varied between the two surveys, with considerably less missing information reported for this characteristic in the 2002 survey. Apart from this difference, the proportions of persons interviewed in each key demographic group were similar in the 1999 and 2002 surveys.

Table 2: Demographic profile of dentate respondents aged 25+ years: 1999 and 2002

	1999	2002		1999	2002
	Per cent			Per cent	
Sex			**Indigenous status**		
Male	50.4	50.1	Aboriginal, Torres Strait Islander	0.9	1.5
Female	49.6	49.9	Non-ABSTI	74.0	98.3
			Missing	25.0	0.2
Age group					
25–34 years	26.3	24.8	**Country of birth**		
35–44 years	26.0	25.5	Australia	75.0	73.9
45–64 years	33.4	35.9	Other	25.0	26.1
65+ years	14.4	13.9			
			Main language at home		
Geographical location			English	87.1	90.1
Capital city	67.3	66.6	Other	12.9	9.8
Other	31.6	33.0	Missing	0.0	0.1
Missing	1.1	0.5			
			Housing tenure		
Employment status			Owned outright	–	48.1
In the workforce	64.4	64.5	Currently purchasing	–	30.9
Not in the workforce	14.8	18.8	Rented	–	17.8
Retired	15.8	16.3	Rent free/other/don't know	–	3.2
Missing	5.0	0.4	Missing	–	0.0

Source: National Dental Telephone Interview Surveys 1999 and 2002.

Reflecting Australia's urbanised population, two-thirds of the sample lived in a capital city. About two-thirds were in the workforce and of the remaining third, about half were retired and the other half described themselves as not being in the workforce. Estimates of country of birth status and main language were similar to national estimates. Housing tenure was not assessed in 1999. A substantial majority of adults (79%) either owned their dwelling outright or were currently purchasing it.

Differences between the 1999 and 2002 surveys probably do not reflect population trends, but rather are indicative of sampling variability.

3.2 Socioeconomic profile

Different household income categories were used for the 1999 and 2002 surveys (Table 3). Over this interval the percentage of adults with household income of up to $20,000 decreased by one percentage point, while the percentage eligible for a government concession increased by 5.8%. Just over a quarter (27.7%) of dentate adults aged 25 years or more were eligible for public dental care in 2002.

The sample was evenly distributed according to levels of educational attainment. Approximately one-third of respondents reported secondary, vocational or tertiary education as their highest level of attainment.

Table 3: Socioeconomic profile of dentate respondents aged 25+ years: 1999 and 2002

	1999	2002		1999	2002
	Per cent			Per cent	
Household income			**Educational attainment**		
Up to $20,000	18.9	–	Secondary or less	30.1	35.5
$20,000–<$50,000	36.7	–	Vocational or other	35.4	29.2
$50,000+	36.1	–	Tertiary	30.7	30.6
Missing	8.3	–	Missing	3.8	4.8
Household income			**Concession entitlement**		
Up to $20,000	–	17.9	Eligible for concession	21.9	27.7
$20,000–<40,000	–	21.1	Not eligible	78.0	72.2
$40,000–<80,000	–	33.8	Missing	0.2	0.1
$80,000+	–	18.0			
Missing	–	9.2			

Source: National Dental Telephone Interview Surveys 1999 and 2002.

Reimbursement mechanisms

The four reimbursement mechanisms are presented in rank order of disadvantage. The first mechanism refers to the 21.5% of people who hold a concession card and no insurance. These are the most disadvantaged. Presented next are those with neither card nor insurance, then those with both. Finally the fourth mechanism is insurance only. These people have the flexibility of choosing a private general dental practitioner and having part coverage for the services provided.

Just over a quarter of study participants (27.8%) were covered by a concession card. A further half (47.6%) held private dental insurance (Table 4). Only 6.3% held both. A sizable minority (30.9%) had neither forms of coverage and were obliged to meet the cost of dental care fully from out-of-pocket expenditure.

Table 4: Reimbursement mechanisms of sociodemographic groups

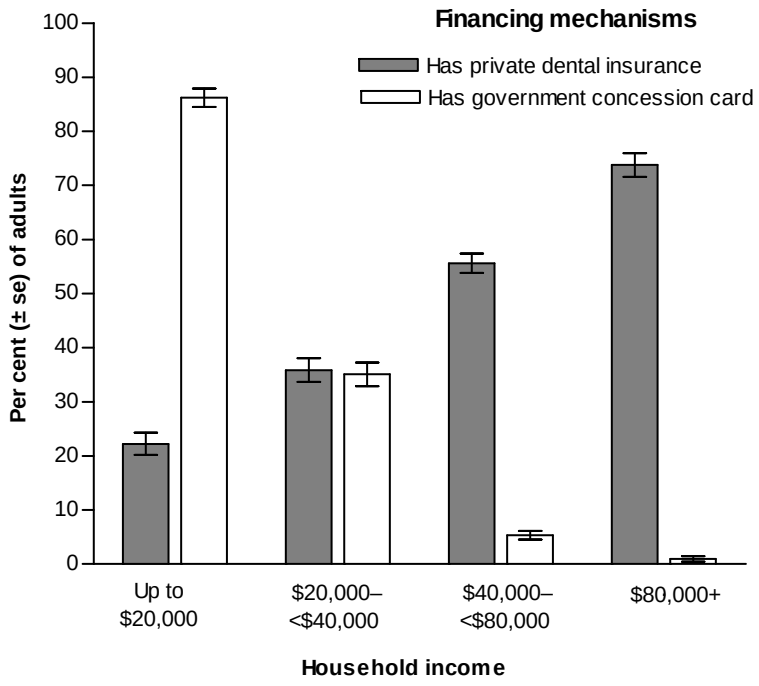
	Card only	Neither	Card + PDI	PDI only		Card only	Neither	Card + PDI	PDI only
	Row per cent					Row per cent			
Sex[(a)]					**Household income**[(a)]				
Male	18.7	34.0	5.0	42.3	Up to $20,000	70.3	7.6	15.9	6.2
Female	24.4	27.7	7.6	40.3	$20–<40,000	25.5	38.6	9.8	26.1
					$40–<80,000	3.2	41.1	2.1	53.5
Age group[(a)]					$80,000+	0.7	25.5	0.4	73.4
25–34 years	17.2	43.4	2.7	36.9					
35–44 years	15.3	34.4	3.5	46.8	**Education**[(a)]				
45–54 years	8.7	31.7	3.5	56.1	School	31.3	28.1	7.6	33.0
55–64 years	25.5	24.3	8.9	41.2	Vocational[(b)]	22.6	33.5	6.2	37.7
65+ years	59.7	5.2	21.2	13.9	Tertiary[(c)]	8.4	31.8	3.9	55.9
Total	**21.5**	**30.9**	**6.3**	**41.3**					

(a) P<0.05 (Chi-square test and Fisher's exact test).
(b) Trade certificate, apprenticeship, vocational, e.g. hairdressing; certificate or diploma course, e.g. TAFE 1–2-year course.
(c) CAE or Teacher's College or Nursing, University degree or diploma, University masters degree or PhD.
Source: National Dental Telephone Interview Survey 2002.

Due to the emphasis placed on ability to pay for dental care as a determinant of oral health, it is useful to describe the profiles of the population under the four possible reimbursement mechanisms. The most notable variations in reimbursement mechanisms were observed among age and socioeconomic groups (Table 4). Adults of retirement age were much more likely to hold a concession card than younger adults and were less likely to have neither card nor insurance. Among young adults, 43.4% had neither concession card nor insurance, meaning that they had to meet any dental costs out of pocket. Marked inequity across income groups presented as 70.3% of adults in the lowest income group holding a concession card and no insurance against 73.4% of adults in the highest income group holding insurance and no concession card.

Private dental insurance coverage was strongly associated with income (Figure 5). The proportion of insured adults in 2002 increased from 22% among those with household income of up to $20,000 to 74% of those with income of $80,000 or more.

An inverse income gradient in concession eligibility was observed that reflects the means testing against which eligibility is assessed. The proportion of cardholders ranged from 86% for those with income up to $20,000 to only 1% among adults with household income of $80,000 or more. More than 60% of adults in the $20,000–$40,000 household income bracket had neither insurance nor concession card. These adults had to meet the full cost of dental care from out-of-pocket expenditure.



Source: National Dental Telephone Interview Survey 2002.

Figure 5: Income relationship with dental insurance and government concession status

4 Social distribution of oral health

In this chapter tooth loss is defined two ways: as the percentage of people retaining less than 20 teeth, and as the mean number of teeth loss per sociodemographic group. Having demonstrated social inequality in tooth loss using both measures, future analyses are limited to one outcome; percentage of people with fewer than 20 teeth.

4.1 Tooth loss

The number of teeth that people retain and lose is indicative of their history of dental disease and its treatment by dental services throughout the life of the permanent teeth. Regular attendance allows disease to be diagnosed early and treated preventively. In this report of the dentate population aged 25 years and over, the term 'tooth loss' is used to indicate retention of fewer than 20 natural teeth.

Distribution according to demographic characteristics

Of dentate Australians aged 25 years and over, 12% had retained fewer than 20 natural teeth. The distribution was not associated with sex, but was strongly associated with age (Table 5). Prevalence among those younger than 55 years was less than one in ten, but increased dramatically to almost one in four adults aged 55–64 years. A further sharp rise among those aged 65 years and older underestimates the prevalence of tooth loss in this age group since adults with complete tooth loss (who dominate the older age group) were excluded from analysis.

Table 5: Prevalence of fewer than 20 teeth among demographic groups

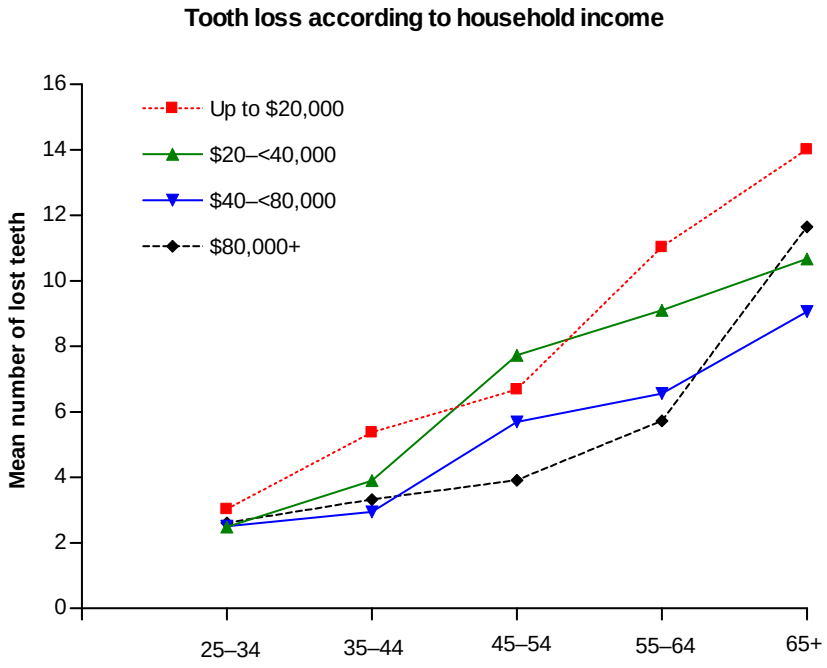
	Per cent	(se)		Per cent	(se)
Sex[ns]			**Age group**[(a)]		
Male	11.4	(1.0)	25–34 years	0.8	(0.4)
Female	12.6	(1.0)	35–44 years	2.4	(0.7)
			45–54 years	9.8	(1.4)
Total	**12.0**	**(0.7)**	55–64 years	24.0	(2.4)
			65+ years	43.5	(3.1)

(a) P<0.05 (Chi-square test and Fisher's exact test); ns p>0.05.
se refers to standard error.
Source: National Dental Telephone Interview Survey 2002.

Inequality in tooth loss across age groups is not necessarily a marker of inequity. In any comparison of social groups it may be a marker of the accumulative exposure to factors such as disease, dental treatment philosophies, treatment choices and fluorides, expressing both ageing and cohort effects.

Distribution according to income

Age stratification was used to adjust for the effect of age in examining the relationship between household income and average levels of tooth loss (Figure 6). At 25–34 years of age, tooth loss was minimal and varied by half a tooth between income groups.



	Up to $20,000	$20–<40,000	$40–<80,000	$80,000+
25–34	3.0	2.5	2.5	2.6
35–44	5.4	3.9	2.9	3.3
45–54	6.7	7.7	5.7	3.9
55–64	11.0	9.1	6.6	5.7
65+	14.0	10.7	9.1	11.7

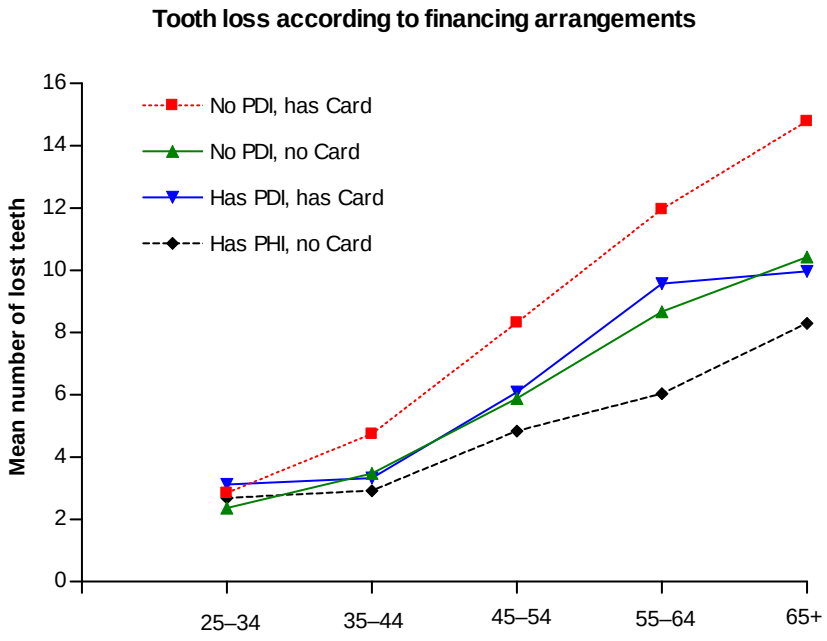
Source: National Dental Telephone Interview Survey 2002.

Figure 6: Age stratified association of household income with mean tooth loss

Inequalities in tooth loss peaked at 55–64 years, where adults on the lowest income had 11 missing teeth compared with 6 missing teeth among those in the highest income category—an absolute difference of 5 teeth. After retirement age adults with the lowest income reported 14 missing teeth on average. By contrast, adults aged 65+years with income of $80,000 or more had retained 20 natural teeth on average. After retirement age, tooth loss increased steeply among affluent adults. Some caution is required in interpreting these results since very few older adults had household incomes of $80,000 or more.

Distribution according to reimbursement mechanisms

The relationship of tooth loss according to reimbursement mechanisms (Figure 7) revealed three trends. Differences among adults aged 25–32 years varied by less than one tooth. By 35–44 years of age variations in tooth loss were apparent. Uninsured adults eligible for public dental care (cardholders) had lost 4.7 teeth on average while insured adults without a card had lost 2.9 teeth. By 55–64 years an absolute difference of 6 teeth was evident between uninsured adults with a concession card and insured adults without a card, representing a twofold difference in tooth loss. The former group had lost 12.0 teeth on average, while the latter had lost 6.0. After retirement age the differences increased further such that uninsured adults with a concession card had 14.8 missing teeth compared with 6.5 among insured adults with no card.



	No PDI, has Card	No PDI, no Card	Has PDI, has Card	Has PHI, no Card
25–34	2.8	2.4	3.1	2.7
35–44	4.7	3.5	3.3	2.9
45–54	8.3	5.9	6.1	4.8
55–64	12.0	8.7	9.6	6.0
65+	14.8	10.4	10.0	8.3

Source: National Dental Telephone Interview Survey 2002.

Figure 7: Age stratified association of financing arrangements with mean tooth loss

Adults who were eligible for a concession card had some protection against tooth loss if they also held dental insurance. These adults did not differ in terms of tooth loss at any age group from non-insured adults without a concession card. Their level of tooth loss was greater at older ages but did not exceed 10 teeth even in retirement. The financing arrangement that was associated with least tooth loss was private dental

insurance and no concession card. Adults in this group had between 6 and 7 more teeth than cardholders without private dental insurance from latter midlife onwards. Hence their level of tooth retention exceeded the critical threshold of 20 teeth.

A fivefold relative difference in tooth loss across income groups among adults aged 25–24 years (Table 6) was driven by high prevalence in the lowest income group. That income group aside, the absolute difference was less than 1 tooth. By 45–64 years the relative difference in tooth loss across income groups was eightfold. More than one in four adults with household income of up to $20,000 had fewer than 20 remaining teeth in this age group (27.6%) compared with only 3.3% of adults with household income of $80,000 or more. Comparison of the 35–44 and 45–64 years age groups revealed a threefold increased prevalence among the lowest income earners. For those on the highest income the relative increase was twofold. Income inequalities in tooth loss were most pronounced in this later middle-aged group. Prevalence increased further among adults aged 65 years and over. An approximate doubling in prevalence was observed for both the up to $20,000 income bracket and the $40,000–$80,000 income brackets. The estimate for the highest income group is unreliable as indicated by the very high standard error.

Table 6: Age stratified prevalence of fewer than 20 teeth among household income groups

	Per cent and standard error							
	25–34 years[(a)]		35–44 years[(a)]		45–64 years[(a)]		65+ years[(a)]	
Household income								
Up to $20,000	5.1	(2.9)	8.7	(4.2)	27.6	(4.1)	52.0	(4.1)
$20,000–<40,000	0.9	(0.9)	3.7	(1.8)	23.2	(3.4)	34.4	(6.1)
$40,000–<80,000	0.5	(0.4)	0.9	(0.6)	11.3	(2.0)	22.6	(7.5)
$80,000+	0.0	(0.0)	1.6	(1.1)	3.3	(1.4)	50.0	(25.0)
Total	**1.0**	**(0.5)**	**2.4**	**(0.7)**	**15.1**	**(1.4)**	**44.0**	**(3.2)**

(a) P<0.05 (Chi-square test).
Source: National Dental Telephone Interview Survey 2002.

Distribution according to education

Tertiary education was protective against tooth loss prevalence for adults up to retirement age (Table 7) especially evident at 45–64 years. More than one in five adults (22.8%) with education to secondary level had fewer than 20 teeth in later midlife compared with one in twenty (4.3%) with tertiary education. The comparative advantage of tertiary education was less apparent among older adults. Here one in two adults with secondary education had fewer than 20 teeth while one in four tertiary graduates had this extent of tooth loss. While prevalence approximately doubled between the 45–64 years and the 65 and over age groups for secondary educated adults, the comparative relative increase among tertiary educated adults was approximately six fold from 4.3% to 25.0%.

Table 7: Age stratified prevalence of fewer than 20 teeth among education groups

	Per cent and standard error							
	25–34 years[ns]		35–44 years[ns]		45–64 years[(a)]		65+ years[(a)]	
Educational attainment								
Secondary or less	1.2	(0.9)	3.7	(1.5)	22.8	(2.6)	49.3	(4.3)
Vocational or related	0.7	(0.7)	3.0	(1.3)	16.1	(2.6)	43.7	(5.9)
Tertiary	0.5	(0.5)	1.1	(0.8)	4.3	(1.3)	25.0	(6.0)
Total	**0.8**	**(0.4)**	**2.5**	**(0.4)**	**14.7**	**(1.3)**	**42.9**	**(3.1)**

(a) P<0.05 (Chi-square test); ns p>0.05.
Source: National Dental Telephone Interview Survey 2002.

4.2 Social impact of oral conditions

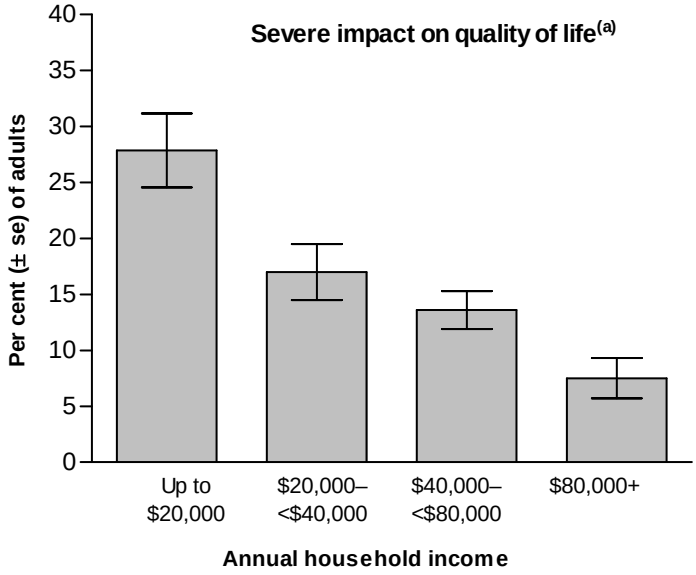
Higher scores on the OHIP-14 questionnaire indicate that oral conditions have imposed an adverse impact on quality of life. Only impact experienced fairly or very often is reported and is referred to as severe impact. Prevalence of severe impact was 16.4% overall. Variation in prevalence of severe impact was not significant on the basis of sex or age group (Table 8).

Table 8: Prevalence of severe impact of oral conditions on quality of life

	Per cent	(se)		Per cent	(se)
Sex[ns]			**Age group[ns]**		
Male	14.5	(1.6)	25–34 years	16.0	(2.5)
Female	18.1	(1.6)	35–44 years	15.4	(2.1)
			45–54 years	14.3	(2.3)
Total	**16.4**	**(1.1)**	55–64 years	20.8	(3.1)
			65+ years	16.9	(2.9)

(Chi-square test and Fisher's exact test); ns p>0.05.
Source: National Dental Telephone Interview Survey 2002.

Striking income variation revealed an almost fourfold difference in prevalence of severe impact (Figure 8) between those with income up to $20,000 (27.9%) and with those with income of $80,000 or more (7.5%).



(a) P<0.05 (Chi-square test).
Source: Questionnaire accompanying National Dental Telephone Interview Survey 2002.

Figure 8: Household income and prevalence of adverse impacts

The relationship between reimbursement mechanisms and the social impact of oral conditions appeared more as a threshold relationship with a twofold relative difference in prevalence between uninsured adults with a concession card and both those with neither insurance nor card and those with insurance and card (Table 9). Prevalence was lowest among insured adults without a card (11.5%). Unlike the strong associations found with income and reimbursement mechanisms, the social impact of oral conditions was not strongly associated with educational attainment. There appeared to be a protective effect of tertiary education, but differences did not reach statistical significance.

Table 9: Reimbursement and education associations on social impact of oral conditions

	Per cent (se) with severe impact on quality of life				
	Per cent	**(se)**		**Per cent**	**(se)**
Reimbursement mechanisms[a]			**Educational attainment [ns]**		
No PDI, has Card	28.2	(2.9)	Secondary or less	17.9	(2.0)
No PDI, no Card	14.1	(2.0)	Vocational or other	18.2	(2.2)
Has PDI, has Card	16.9	(4.1)	Tertiary	12.9	(1.8)
Has PDI, no Card	11.5	(1.5)			
Total	**16.4**	**(1.1)**			

(a) P<0.05 (Chi-square test); ns p>0.05.
Source: National Dental Telephone Interview Survey 2002.

4.3 Self-rated oral health

Almost a quarter of the dentate population (23.2%) rated their oral health as average; poor or very poor (Table 10). Throughout this report this is referred to as low self-rated oral health. Consistent with observations for tooth loss and the social impact of oral conditions, prevalence of low self-rated oral health did not differ significantly in its distribution based on sex. Age-related differences were apparent but the relationship was not one of deteriorating oral health status with older age, as was the case for tooth loss. Prevalence peaked in the 55–64 years age group (28.3%) and declined in older age (21.6%).

Table 10: Prevalence of low self-rated oral health among demographic groups

	Per cent	(se)	Age group[(a)]	Per cent	(se)
Sex[ns]	23.2	(1.3)	25–34 years	18.5	(1.7)
Male	21.0	(1.2)	35–44 years	21.2	(1.8)
Female	22.1	(0.9)	45–54 years	23.7	(2.0)
			55–64 years	28.3	(2.6)
Total	**23.2**	**(1.3)**	65+ years	21.6	(2.5)

(a) P<0.05 (Chi-square test and Fisher's exact test); ns p>0.05.
Source: National Dental Telephone Interview Survey 2002.

Differences in prevalence of low self-rated oral health exceeded twofold between low income (35.0%) and high income (15.2%) groups (Table 11) and approached twofold across differing reimbursement mechanisms. Almost one in three uninsured adults with a concession card (31.9%) had low self-rated oral health compared with 16.4% of insured adults with no card. As was the case for tooth loss and the social impact of oral conditions, marked similarity in prevalence was evident by people with neither card nor insurance cover and people with both of these financing conditions.

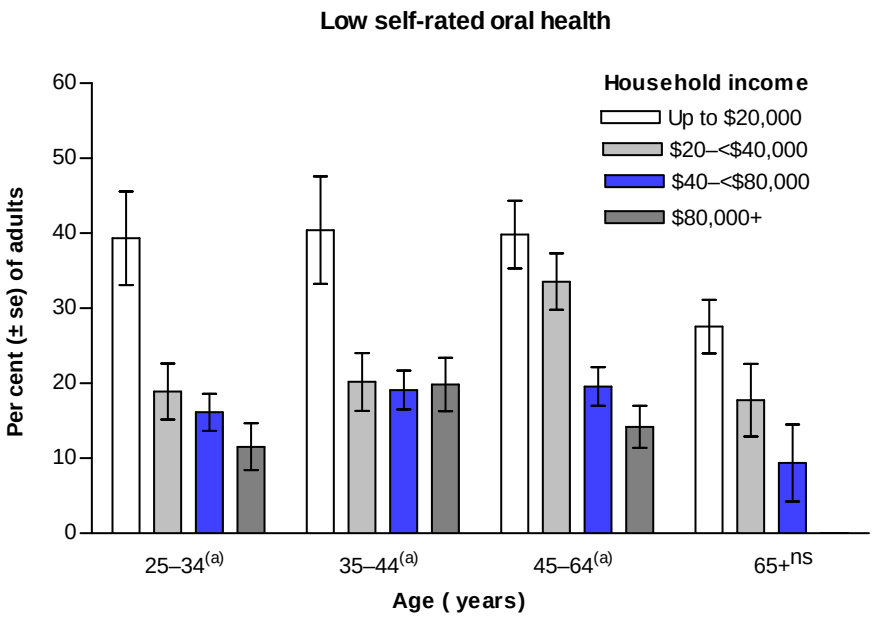
Table 11: Prevalence of low self-rated oral health among socioeconomic groups

	Per cent	(se)		Per cent	(se)
Household income			**Reimbursement mechanisms[(a)]**		
Up to $20,000	35.0	(2.4)	No PDI, has Card	31.9	(2.2)
$20,000–<40,000	24.3	(2.0)	No PDI, no Card	22.8	(1.6)
$40,000–<80,000	18.0	(1.4)	Has PDI, has Card	21.5	(3.5)
$80,000+	15.2	(1.8)	Has PDI, no Card	16.4	(1.2)
Educational attainment[(a)]					
Secondary or less	23.9	(1.6)			
Vocational or other	24.7	(1.8)			
Tertiary	17.7	(1.5)			
Total	**22.1**	**(0.9)**			

(a) P<0.05 (Chi-square test).
Source: National Dental Telephone Interview Survey 2002.

Income associations with self-rated oral health display a threshold pattern for adults aged less than 45 years and a linear pattern for older adults (Figure 9). In absolute terms prevalence fell about 20 percentage points in the shift from up to $20,000 household income to $20,000–$40,000 for adults aged 25–34 years (39.3% to 18.9%) and for adults aged 35–44 years (40.4% to 20.2%). In relative terms this represented a halving of the effect of low income. Results imply that low income either directly or

indirectly via unspecified mediating factors has a harmful effect on the subjective oral health status of younger adults.



(a) P<0.05 (Chi-square test); ns p>0.05.

Source: National Dental Telephone Interview Survey 2002.

Figure 9: Age stratified income associations with low self-rated oral health

Prevalence estimates for adults on income up to $20,000 did not alter across the 25–34, 45–44 and 45–64 years age groups. However, for adults aged 45–64 years, being positioned in the next highest income bracket was not associated with a gain in oral health status, as was observed among younger cohorts. Nevertheless, higher income was associated with marked reductions in prevalence in this age group, from a high of 39.8% for the lowest income households to 14.2% for adults in households with income of $80,000 or more.

As was the case with tooth loss, inequalities in self-rated oral health were most manifest in this period of midlife. From these cross-sectional data it is not possible to comment on whether this is an ageing or a cohort effect. An ageing effect would result from the accumulated effect of exposures over the life course, culminating in pronounced variation in midlife. A cohort effect on the other hand would result from something about this cohort of people born between 1938 and 1957 that produces strong variation in the experience of oral health status.

Among adults aged 65 years and over differences were non-significant.

5 Dental behaviour

5.1 Dental risk behaviour

Tooth brushing less than once daily was uncommon (7.5%) while not cleaning interdentally was reported by 38.1% (Table 12). One in five adults smoked. Males were over-represented in risk categories of infrequent brushing, no interdental cleaning and high consumption of NMES. A greater proportion of younger adults compared with older adults reported infrequent interdental cleaning, consumption of NMES and smoking.

Table 12: Prevalence of risk behaviours among demographic groups

	Per cent and standard error							
	Tooth brushing less than 7 times/week		No interdental cleaning over 1 week		Consumption of NMES upper quintile		Smoking daily or occasionally	
Sex								
Male	11.4	(1.4)[(a)]	42.2	(2.3)[(a)]	27.5	(2.0)[(a)]	22.0	(1.9)[ns]
Female	4.1	(0.8)	34.5	(2.0)	16.9	(1.6)	18.4	(1.6)
Age group								
25–34 years	11.4	(2.2)[ns]	51.9	(3.5)[(a)]	30.2	(3.2)[(a)]	25.7	(3.0)[(a)]
35–44 years	6.0	(1.4)	37.4	(2.9)	27.2	(2.6)	23.9	(2.5)
45–54 years	7.3	(1.7)	33.2	(3.1)	16.8	(2.4)	21.0	(2.7)
55–64 years	5.5	(1.8)	32.3	(3.7)	16.2	(2.8)	19.4	(3.1)
65+ years	6.8	(2.0)	34.6	(3.8)	14.8	(2.8)	5.0	(1.7)
Total	**7.4**	**(0.8)**	**38.1**	**(1.5)**	**21.8**	**(1.3)**	**20.1**	**(1.2)**

(a) P<0.05 (Chi-square test and Fisher's exact test); ns p>0.05.
Source: National Dental Telephone Interview Survey 2002 and accompanying self-complete questionnaire.

Infrequent tooth brushing had strong associations with socioeconomic position (Table 13). There was a threefold difference in prevalence of brushing less than daily between people with household income up to $20,000 (11.7%) and those with income of $80,000 or more (3.7%). Prevalence decreased at each successive income level, but a threshold effect was apparent such that adults with the lowest income were much more likely to report each risk behaviour.

Table 13: Prevalence of risk behaviours in socioeconomic and reimbursement groups

	Per cent and standard error							
	Tooth brushing less than 7 times/week		No interdental cleaning over one week		Consumption of NMES upper quintile		Smoking daily or occasionally	
Household income								
Up to $20,000	11.7	(2.2)[(a)]	39.0	(3.4)[ns]	20.5	(2.8)[ns]	21.5	(2.9)[(a)]
$20,000–<40,000	8.0	(1.8)	39.5	(3.3)	22.9	(2.8)	23.1	(2.8)
$40,000–<80,000	7.1	(1.3)	40.1	(2.5)	23.9	(2.2)	21.4	(2.1)
$80,000+	3.7	(1.4)	34.6	(3.5)	18.8	(2.8)	11.4	(2.3)
Reimbursement mechanisms								
No PDI, has Card	12.2	(2.2)[(a)]	38.1	(3.3)[ns]	22.2	(2.7)[ns]	24.0	(2.8)[(a)]
No PDI, no Card	6.2	(1.4)	42.5	(2.8)	23.7	(2.4)	22.3	(2.4)
Has PDI, has Card	3.7	(2.1)	38.3	(5.4)	23.2	(4.7)	11.0	(3.5)
Has PDI, no Card	6.3	(1.2)	34.7	(2.3)	19.9	(1.9)	18.1	(1.9)
Educational attainment								
Secondary or less	8.0	(1.4)[(a)]	40.3	(2.7)[ns]	23.2	(2.2)[ns]	22.3	(2.2)[(a)]
Vocational or other	10.4	(1.8)	36.4	(2.8)	25.0	(2.5)	21.4	(2.4)
Tertiary	3.7	(1.0)	35.5	(2.6)	17.8	(2.0)	14.9	(1.9)
Total	**7.2**	**(0.8)**	**37.4**	**(1.5)**	**21.8**	**(1.3)**	**19.5**	**(1.3)**

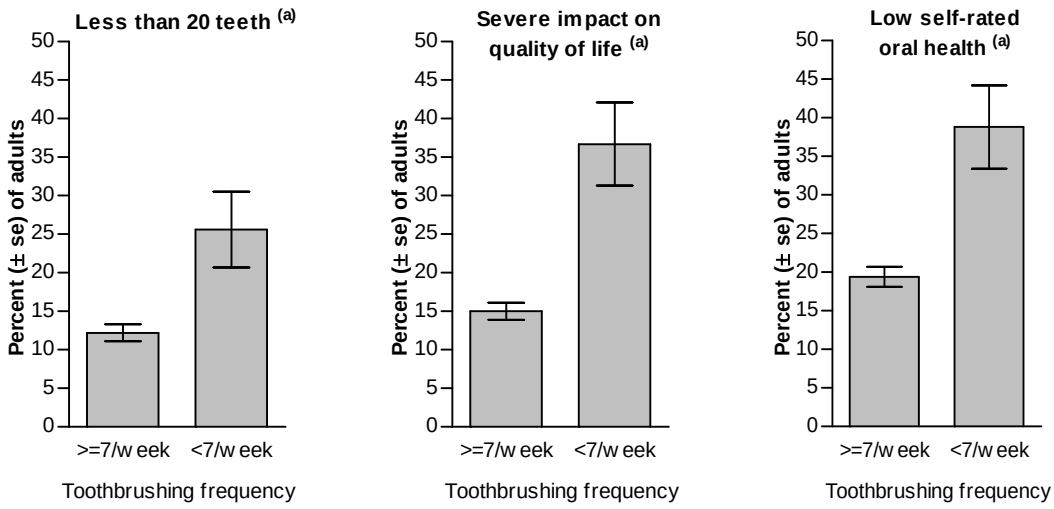
(a) P<0.05 (Chi-square test); ns p>0.05.
Source: National Dental Telephone Interview Survey 2002 and accompanying self-complete questionnaire.

The relationship of tooth brushing frequency to financial arrangements revealed a marked difference between concession cardholders. Compared with groups under other reimbursement mechanisms, those cardholders without insurance were most likely to brush infrequently (12.2%) while cardholders who held insurance were least likely to report infrequent brushing (3.7%). The latter may reflect an overall willingness to invest in oral health. The comparison of groups based on educational attainment revealed that a significantly smaller proportion of adults with tertiary education engaged in tooth brushing less than once a week. A similar distribution across socioeconomic groups was observed for smoking status. There was a difference in magnitude of approximately twofold between income groups and across reimbursement mechanisms. Again, insured adults eligible for a concession card had the lowest prevalence of this risk behaviour (11.0%) while their uninsured card-holding counterparts had the highest smoking prevalence (24.0%). Adults with secondary (22.3%) or vocational (21.4%) education exhibited similar outcomes while prevalence was lowest among tertiary educated adults (14.9%). Equally striking as the socioeconomic association with tooth brushing and smoking, was the absence of a relationship between socioeconomic position and both interdental cleaning and consumption of NMES items.

5.2 Risk behaviour and oral health

Tooth brushing and interdental cleaning

The same two dental risk behaviours associated with socioeconomic disadvantage—infrequent tooth brushing and smoking—were similarly associated with oral morbidity Infrequent tooth brushing was associated with twofold elevations in tooth loss, severe impact on quality of life and low self-rated oral health (Figure 10).



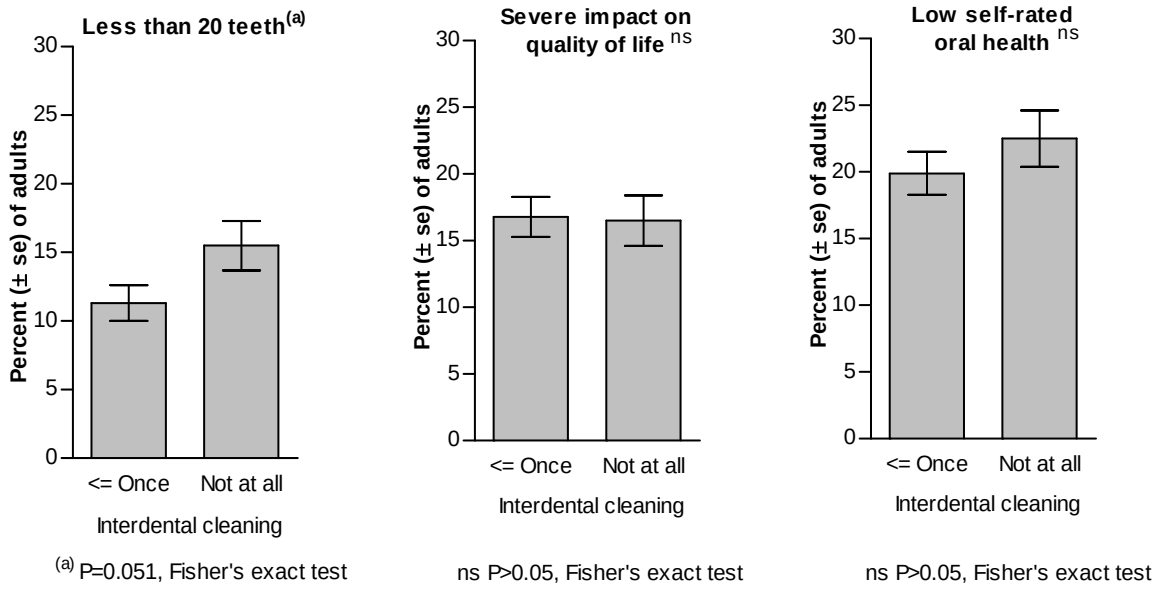
(a) P<0.05, Fisher's exact test.

Source: National Dental Telephone Interview Survey 2002 and accompanying self-complete questionnaire.

Figure 10: Relationship of tooth brushing frequency with oral health outcomes

Relationships between infrequent tooth brushing and prevalence of oral conditions were pronounced (Figure 10). Prevalence of retention of less than 20 teeth was 13.4 percentage points higher among people with infrequent brushing (25.6%) compared with people who brushed at least once daily (12.2%) An absolute effect of 22.8 percentage points was found in prevalence of severe impact on quality of life between infrequent brushing (36.7%) and brushing daily or more often (15.0%). The absolute effect on low self-rated oral health was 19.4 percentage points between those with infrequent brushing (38.8%) and other adults (19.4%).

Unlike tooth brushing, the practice of interdental cleaning was not significantly associated with significant variation in any of these three oral conditions, although a relationship with tooth loss was borderline (Figure 11).



(a) P=0.051, Fisher's exact test

ns P>0.05, Fisher's exact test

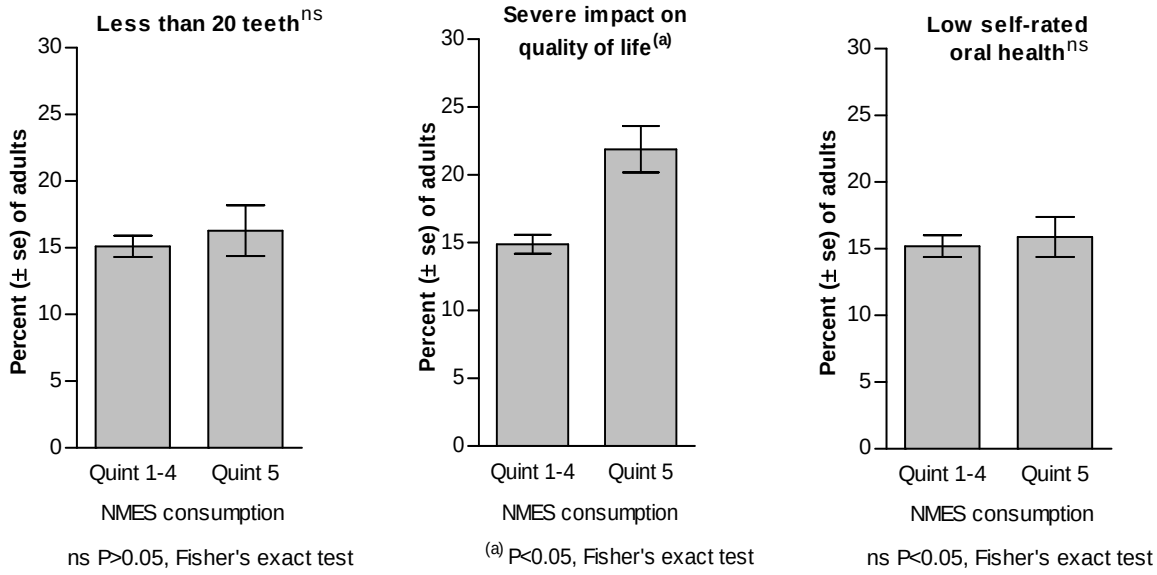
ns P>0.05, Fisher's exact test

Source: National Dental Telephone Interview Survey 2002 and accompanying self-complete questionnaire.

Figure 11: Relationship of interdental cleaning with oral health outcomes

Consumption of NMES, smoking and oral health

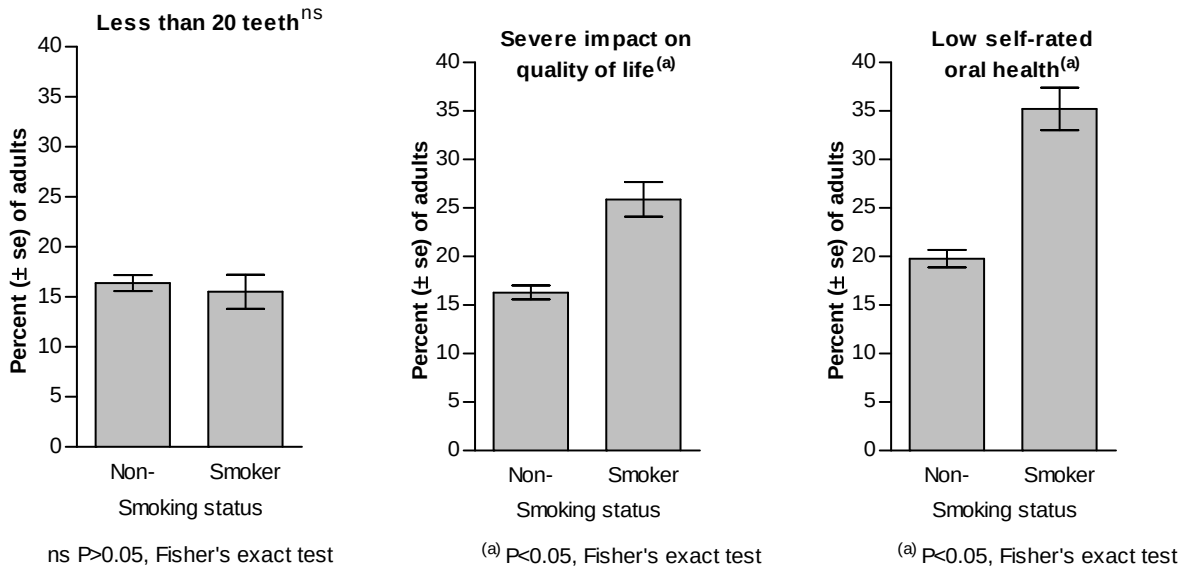
Consumption of NMES in the highest 20% of the distribution (quintile 5) was not associated with a significant difference in tooth loss or self-rated oral health when compared with lesser consumption of NMES (quintiles 1-4) (Figure 12). A difference was observed in the social impact of oral conditions. Prevalence of severed impacts on quality of life was higher among adults with higher consumption of NMES.



Source: National Dental Telephone Interview Survey 2002 and accompanying self-complete questionnaire.

Figure 12: Relationship of NMES consumption with oral health outcomes

The apparent lack of relationship between smoking on tooth loss may be influenced by age (Figure 13). High levels of tooth loss are mostly restricted to older age groups yet smoking is more prevalent among adults of younger age, where rates of tooth retention are greater. There was a fivefold difference in smoking prevalence between the 25–34 years age group (25.7%) and adults aged 65 years and over (5.0%) (Table 12). For adults who smoked daily or occasionally the condition of their teeth, mouth or dentures inflicted significantly greater impact on their quality of life (25.9%) than for non-smokers or former smokers (16.3%). A significantly larger proportion of smokers (35.2%) compared with non- or former smokers (19.8%) rated their oral health as average, poor or very poor.



Source: National Dental Telephone Interview Survey 2002 and accompanying self-complete questionnaire.

Figure 13: Relationship of tobacco smoking with oral health outcomes

5.3 Utilisation of dental services

The relationship between dental attendance and oral health status is complex since utilisation depends on the accessibility and affordability of care, need and demand for dental care. It is useful to distinguish between having access to needed dental services and gaining access. The former is mostly related to health policy and delivery systems— factors that are beyond the control of the individual. The latter, gaining access or utilisation, is influenced by additional factors beyond the scope of the health care system, such as people's preferences for health care consumption. The former is solely a function of supply while the latter is a function of the interaction of supply and demand. The NDTIS questions do not measure dental attendance in a way that can properly measure access.

Periodicity between dental visits and usual reason for a visit

One-quarter (25.1%) of adults attended for dental care twice a year or more often on average. A further 29.3% attended annually and 17.6% attended biennially. The remaining 28.0% attended less frequently on average than biennially. Since dental problems are frequently unaccompanied by pain or other symptoms, infrequent attendance increases the risk of undetected problem affecting teeth, supporting tissues or existing restorations. Adults were approximately equally distributed in terms of their usual reason for utilising dental care. While 51.5% usually attended for a check-up, 48.5% were motivated to attend by a dental problem.

Table 14: Visiting periodicity and usual reasons for visit among demographic groups

	Attends less often than biennially on average		Usually visits with a problem rather than for a check-up	
	Per cent	(se)	Per cent	(se)
Sex				
Male	35.0	(1.4)[(a)]	53.0	(1.5)[(a)]
Female	21.1	(1.2)	43.9	(1.5)
Age group				
25–34 years	35.5	(2.1)[(a)]	52.5	(2.1)[ns]
35–44 years	23.2	(1.8)	48.4	(2.1)
45–54 years	24.8	(2.0)	43.9	(2.2)
55–64 years	27.3	(2.5)	48.5	(2.7)
65+ years	29.7	(2.8)	48.6	(3.0)
Total	**28.0**	**(1.0)**	**48.5**	**(1.1)**

(a) P<0.05 (Chi-square test and Fisher's exact test); ns p>0.05.
Source: National Dental Telephone Interview Survey 2002.

Just as males were more likely than females to engage in risk behaviour for oral hygiene and sugar consumption (Table 12), they were also more likely to visit infrequently and be motivated to attend when a problem arose (Table 14). Adults in the youngest age bracket were over-represented in their infrequent attendance patterns, but age was unrelated with people's propensity to visit because of a problem (Table 14).

Socioeconomically disadvantaged groups are reputed to utilise more secondary and tertiary health care services and fewer primary preventive services compared with groups with greater resources. While similar patterns may be evident in the utilisation of dental services, this is more likely to reflect the consequences of institutional scarcity of resources rather than the freely chosen behaviour of low income groups.

Table 15: Visiting periodicity and usual reasons for visit among socioeconomic groups

	Attends less often than biennially on average		Usually visits with a problem rather than for a check-up	
	Per cent	(se)	Per cent	(se)
Household income				
Up to $20,000	35.8	(2.5)[(a)]	63.9	(2.4)[(a)]
$20,000–<40,000	31.6	(2.2)	54.7	(2.3)
$40,000–<80,000	25.0	(1.6)	46.0	(1.8)
$80,000+	20.5	(2.0)	30.8	(2.3)
Reimbursement mechanisms				
No PDI, has Card	42.1	(2.3)[(a)]	67.4	(2.1)[(a)]
No PDI, no Card	35.6	(1.9)	55.8	(1.9)
Has PDI, has Card	16.1	(3.1)	40.8	(4.1)
Has PDI, no Card	16.8	(1.2)	33.6	(1.6)
Educational attainment				
Secondary or less	32.8	(1.7)[(a)]	55.3	(1.8)[(a)]
Vocational or other	31.6	(1.8)	55.0	(2.0)
Tertiary	18.8	(1.5)	34.3	(1.8)
Total	**27.9**	**(1.0)**	**48.5**	**(1.1)**

(a) <0.05 (Chi-square test); ns p>0.05.
Source: National Dental Telephone Interview Survey 2002.

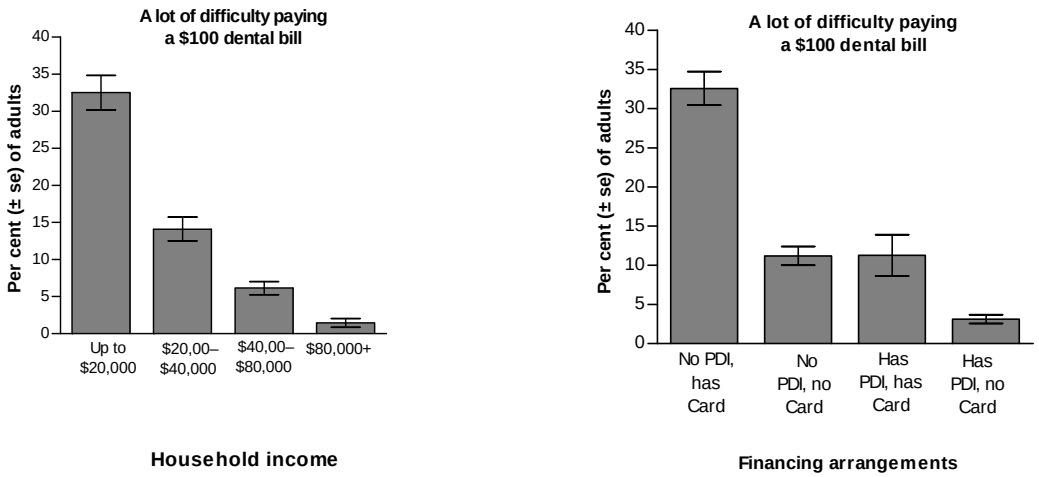
Looking firstly at usual periodicity for attendance, a linear relationship with income was apparent (Table 15). Propensity to attend infrequently decreased with increasing levels of household income to reveal a relative difference of approximately one-and-a-half-fold. The relationship with reimbursement mechanisms was threshold, with dental insurance being the pivotal factor. Infrequent attendance was elevated more than twofold among the uninsured compared with insured adults. The important detail here is that insured adults with and without a concession card did not differ in their attendance frequency, yet visiting periodicity among insured adults did not differ on the basis of eligibility for public dental care. This strengthens the argument that frequency of visiting is a function of ability to pay rather than a function of willingness to seek care. The relationship with education was also threshold, with a substantially smaller proportion of tertiary educated adults attending infrequently.

Income was inversely related to problem-oriented visiting, with a greater than twofold difference found across income categories (Table 15). Differences of a similar magnitude were found between uninsured concession cardholders and their insured counterparts without a card. Tertiary educated adults were less likely to attend with a problem than adults with either secondary or vocation-related education.

Influence of affordability on utilisation

In response to a question that asked about difficulty in paying a $100 dental bill, nearly half had no difficulty (48.5%). Of the others, 17.2% stated 'Hardly any', 21.3% stated 'A little' and 12.4% stated 'A lot'. The remaining 0.5% did not know.

A striking inverse income gradient in 'a lot of difficulty to pay' (Figure 14) was characterised by a 23-fold difference between the lowest income group (32.5%) and the highest (1.4%). Demonstrating that this difficulty was not attributed to eligibility for a concession card alone, there was no difference in the proportion reporting difficulty to pay between those with neither insurance nor concession card (11.2%) and those with both insurance and a card (11.3%).



P<0.001 (Chi-square test).

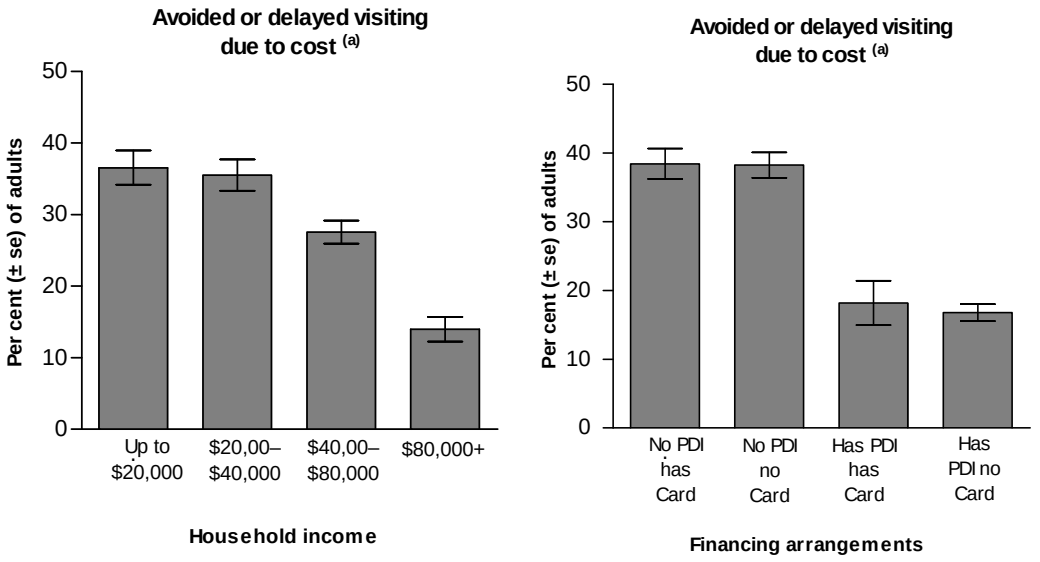
Source: National Dental Telephone Interview Survey 2002.

Figure 14: Household income, reimbursement mechanisms and difficulty in paying dental bills

The protective effect of insurance cover for concession cardholders was apparent in the relationship between financing conditions and perceived difficulty to pay a $100 dental bill (Figure 14). Among uninsured adults with a concession card, 32.6% reported that they would have a lot of difficulty with a bill of this amount. However, for cardholders who had purchased dental insurance a $100 dental bill would cause a lot of difficulty for 11.3%—a threefold relative difference in magnitude. Once again, there was a similarity of experience between those people with neither insurance nor card and those people who had both. Consistent with previous findings, adults who were not eligible for a concession and who had dental insurance were least troubled by the cost of dental care. Only 3.1% stated that they would have a lot of difficulty in paying a bill this size.

Avoidance of dental attendance due to cost

More than one in four adults (28.1%) had avoided or delayed a dental visit in the previous year because of the cost. Cost precluded attendance for a greater proportion of low income groups. Close to 36% of all adults with household income under $40,000 had avoided care because of cost. By contrast, 14% of adults with household income of $80,000 or more had avoided or delayed visiting (Figure 15). This is a striking example of the effect described by Hart (1971) as the inverse care law, where disadvantaged groups in greater need receive a smaller share of health care resources than healthier more affluent groups.



(a) P<00.1 (Chi-square test).

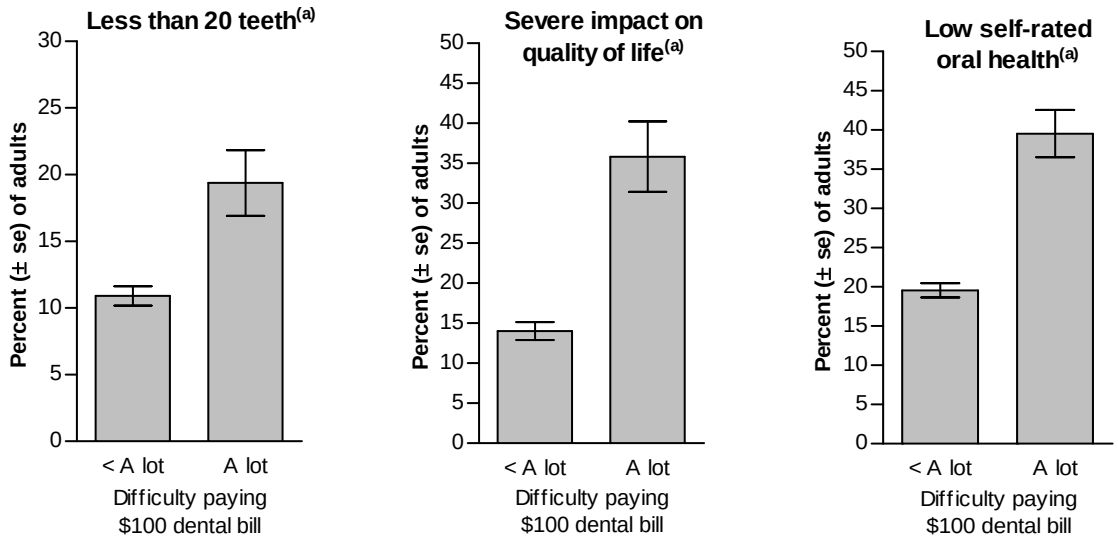
Source: National Dental Telephone Interview Survey 2002.

Figure 15: Household income, reimbursement mechanisms and avoidance of dental care

Dental insurance status was the decisive factor when cost-induced avoidance or delay was examined according to reimbursement mechanisms—38% of uninsured adults had been affected compared with about 17% of insured adults. Importantly, concession status did not affect probability of avoidance or delay. This finding suggests that poor adults who are eligible for public dental care do not intentionally neglect their oral health through episodic use of services, since those who have financing arrangements that assist them to utilise dental services do so.

Dental utilisation and oral health

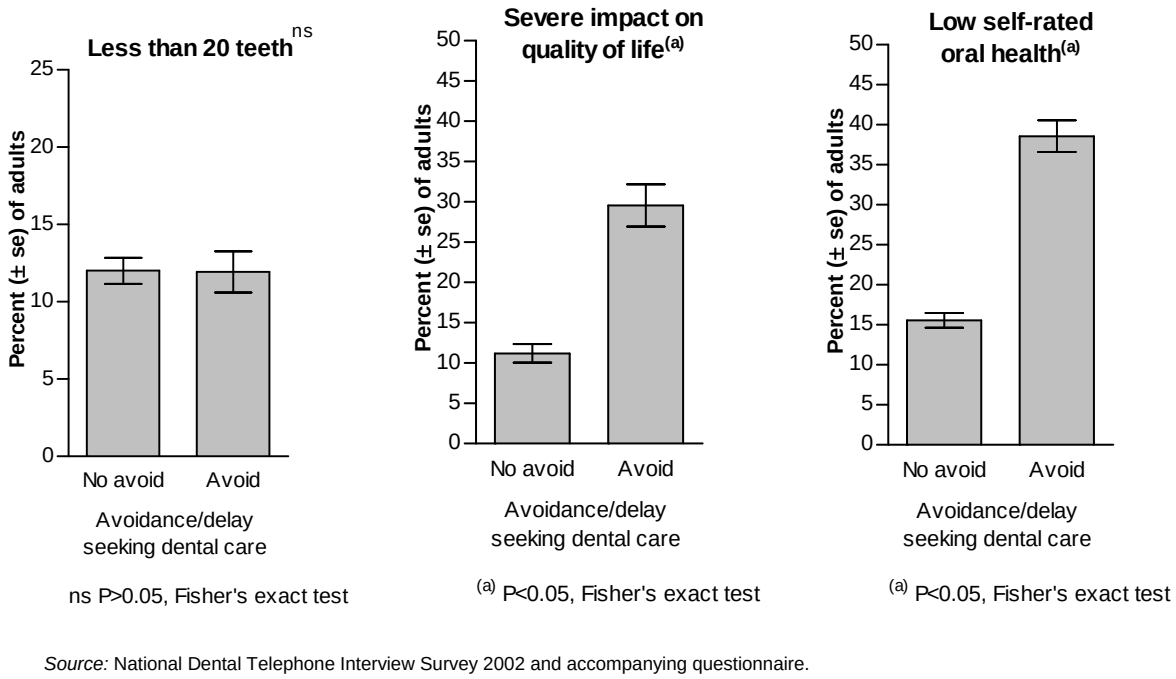
Adults who would face a lot of difficulty paying a $100 dental bill had poorer oral health status on all three outcomes (Figure 16). Prevalence of tooth loss among adults who would have a lot of difficulty with a $100 dental bill was 19.4% compared with 10.9% among those who would have less difficulty. For other outcomes the magnitude of relative differences was twofold. The absolute differences in severity of impact on quality of life and low self-rated oral health were substantial exceeding 20 percentage points between those who would and would not face a lot of difficulty with a $100 dental bill.



(a) P<0.05, Fisher's exact test.

Source: National Dental Telephone Interview Survey 2002 and accompanying questionnaire.

Figure 16: Relationship of difficulty with cost of dental care and oral health

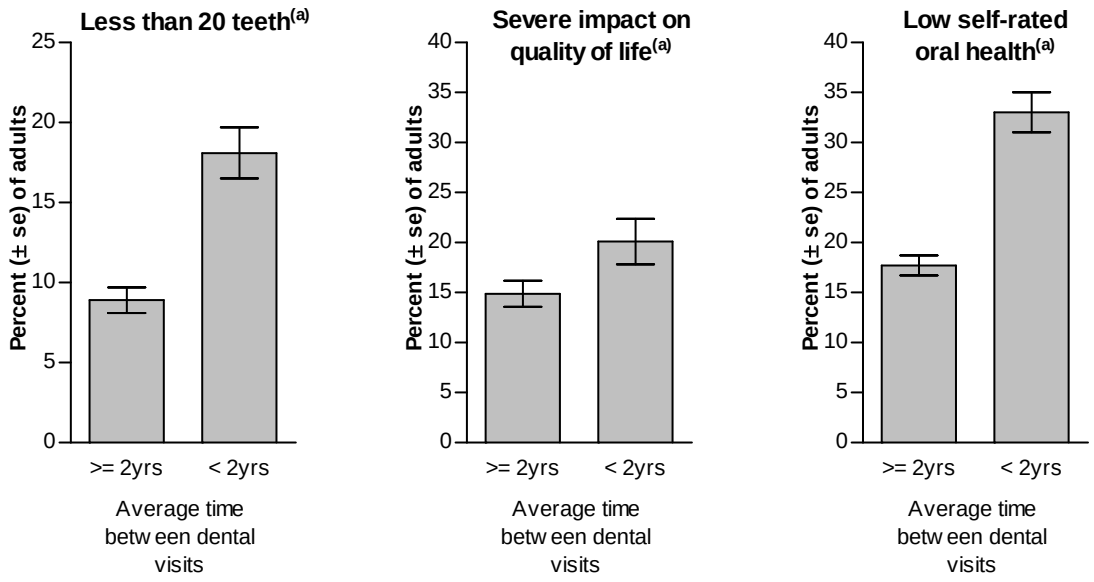


Source: National Dental Telephone Interview Survey 2002 and accompanying questionnaire.

Figure 17: Relationship of cost-related avoidance or delay of dental care and oral health

Cost-induced avoidance or delay in seeking dental care was associated with elevated dental morbidity (Figure 17). The notable exception was prevalence of tooth loss among those who had avoided or delayed seeking care (11.9%), which varied in absolute terms by 0.1% from those who had not avoided or delayed seeking care in the previous year (12.0%). There were pronounced differences in the impact of oral conditions on quality of life based on whether or not people had avoided or delayed dental care due to cost. Prevalence of severe impacts was 11.2% among those who had not avoided delayed dental care versus 29.6% among those who had. Even more pronounced, in absolute terms, was the difference in prevalence of low self-rated oral health among those who had avoided or delayed utilisation (38.6%) compared with those who had not (15.6%), representing a difference of 23 percentage points.

Attending dental services less often than once in 2 years was associated with greater oral morbidity (Figure 18). The smallest absolute effect size of 5.2% was observed for the experience of severe impact on quality of life where 14.9% of regular attendees experienced adverse impacts fairly often or very often compared with 20.1% of infrequent attendees. The largest absolute effect size of 15.3% was for self-rated oral health. While 17.7% of adults who attended dental services at least biennially had low self-rated oral health, prevalence was 33.0% among adults who attended less often.

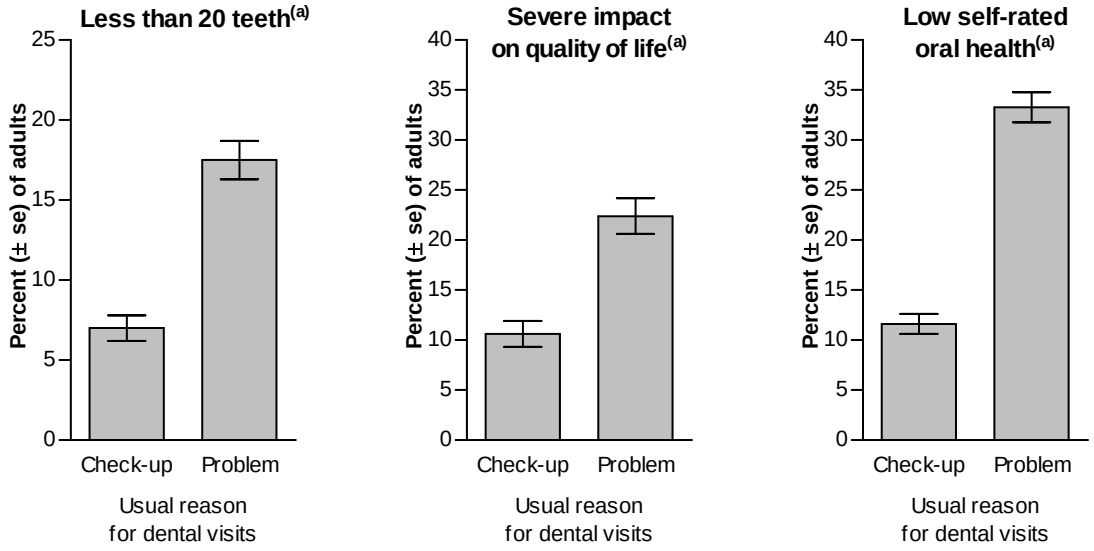


(a) P<0.05, Fisher's exact test.

Source: National Dental Telephone Interview Survey 2002 and accompanying questionnaire.

Figure 18: Relationship between average visiting periodicity and oral health

The effect of problem-oriented visiting on oral morbidity was striking (Figure 19). Relative differences in prevalence were greater than twofold for tooth loss and severe impact on quality of life and approached threefold for low self-rated oral health. In absolute terms the effect size of problem-oriented visiting on self-rated oral health was 21.7% with prevalence estimates of 11.6% for people who visited for a check-up and 33.3% among those who visited with a problem.



(a) P<0.05, Fisher's exact test.

Source: National Dental Telephone Interview Survey 2002 and accompanying questionnaire.

Figure 19: Relationship between usual reason for dental visit and oral health

6 Psychosocial factors

Psychosocial characteristics linked to both socioeconomic position and health status were demonstrated in the Kuopio Ischaemic Heart Disease Risk Factor study. This study found age adjusted rates of hopelessness elevated tenfold among males with primary schooling compared with males with post-secondary education (Lynch et al. 1997). Lower educated males had significantly lower levels of income, were more likely to experience financial insecurity, were three times more likely to not own their own home, and 20 times more likely to have been unemployed in the preceding 5 years. They experienced significantly higher rates of depression and cynical hostility. According to the psychosocial explanation for health inequalities, people ascribe meaning to the social and material conditions of their life. When comparing their conditions unfavourably with others this psychological burden may deflate self-esteem and induce a stress response. These responses influence patterns of behaviour with consequences for health. This was supported in findings from the Kuopio Ischaemic Heart Disease Risk Factor study, where males of low socioeconomic position were more likely than those of higher position to smoke and less likely to engage in 'conditioning' leisure time physical activity (Lynch et al. 1997).

6.1 Personal control

Personal control reflects the extent to which people consider that life circumstances, including health status, are subject to their own personal influence. When things go well, and when they go poorly, people with high personal control beliefs hold themselves accountable. A high level of personal control is generally considered an asset, yet while most associations between personal control and health are positive, mixed findings have been reported. When expectations for control are frustrated by a poor prognosis or other complication, the effect on health is harmful. Another example of control as a risk factor for health is the Type A personality pattern of high autonomy and high frustration, which is a recognised risk factor for coronary heart disease. In their review of psychosocial resources and the socioeconomic–health relationship, Taylor and Seeman (1999) cite animal and human studies where incongruity between expectations for control and actual opportunities for control were associated with the highest levels of physiological reactivity. In the main though, personal control is considered protective of health, and a range of health outcomes have been linked to control beliefs including lower mortality risk (Krause & Shaw 2000), lower incidence of coronary heart disease (Ganster et al. 2001), better self-rated health (Menec et al. 1999), less psychological morbidity (Price et al. 2002), faster recovery (Mahler & Kulik 1990) and, particularly among the elderly, better functional status (Miller & Iris 2002).

The Whitehall prospective cohort studies of British civil servants demonstrated a relationship between personal control and occupational gradients in health. The first cohort established in 1967 set out to investigate factors associated with cardiorespiratory diseases among 10,000 male civil servants in London. The finding at ten-year follow-up that workers in lower occupational grades had higher age-adjusted mortality rates from coronary heart disease was unexpected because it contradicted the belief that the highest job stress was found in senior positions (Marmot et. al. 1978). Also unexpected was the finding that established behavioural risk factors (smoking, physical inactivity, obesity), physiological indicators (plasma cholesterol, hypertension)

and psychological factors such as negative affectivity explained less than half of the gradient in coronary heart disease. In order to account for the relationship, a second cohort was established in 1985 comprising a further 10,000 civil servants (Whitehall II). The hypothesis that psychosocial factors such as levels of job demand, control and support explained variation in heart disease was supported. At follow-up workers with low job control were almost twice as likely to suffer subsequent coronary disease compared with workers with high job control.

Distribution of personal control

Mastery and Constraints scale scores were divided into approximate tertiles. In the following tables scores in the low tertile for personal control beliefs are characterised. These people felt least able to control their life circumstances.

Males (32.9%) and females (31.1%) did not differ in their perceptions of personal control (Table 16). Perceptions of low personal control were positively associated with age such that an increasing proportion of adults occupied each successive age category. The relative differential between youngest (19.8%) and oldest age groups (45.4%) exceeded twofold. This is likely to reflect an ageing effect where perceptions of control diminish with increasing age, suggesting that control is not a stable attribute throughout adult life.

Strong inverse associations were found between low personal control scores and socioeconomic resource (Table 16). Relative differentials exceeded twofold for household income and reimbursement mechanisms. Nearly half of all adults with low income up to $20,000 had low personal control beliefs compared with only one in five adults with income greater than $50,000. It is not clear from these cross-sectional results whether higher income fosters higher perceptions of personal control or whether perceptions of personal control influence the level of income that people secure. It may also be the case that perceptions of control are confounded by age. Being eligible for a concession was not necessarily linked to low beliefs about personal control and mastery. While one in two eligible adults without insurance held low personal control beliefs (51.5%), about one in three eligible adults with insurance (38.6%) held such beliefs.

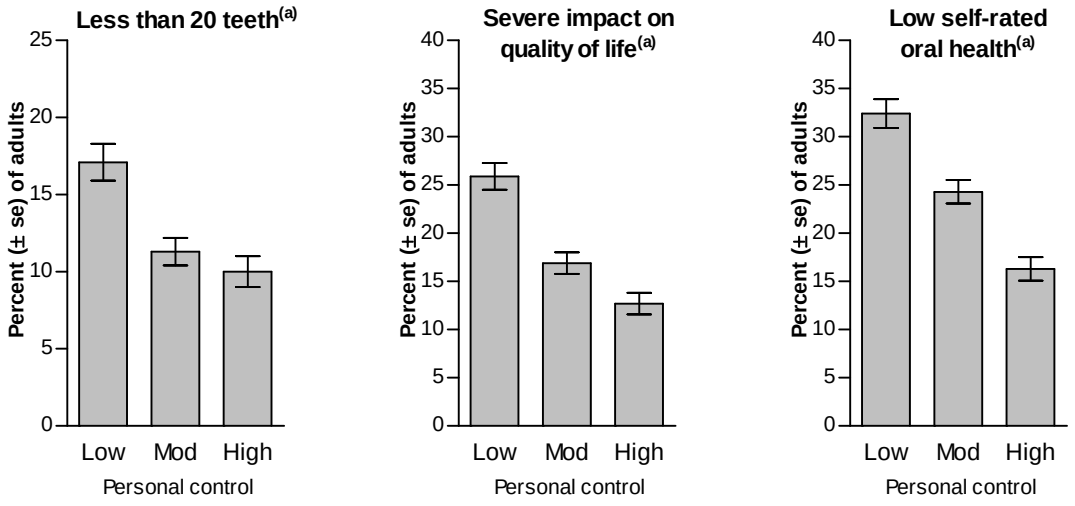
Table 16: Per cent (se) of people with low personal control scores

	Per cent	(se)		Per cent	(se)
Sex[ns]			**Household income**[(a)]		
Male	32.9	(1.2)	Up to $20,000	47.6	(2.1)
Female	31.1	(1.2)	$20–$50,000	35.0	(1.4)
			>$50,000	21.4	(1.2)
Age group[(a)]					
25–34 years	19.8	(1.4)	**Educational attainment**[(a)]		
35–44 years	32.4	(1.6)	Secondary or less	42.7	(1.7)
45–54 years	33.7	(1.9)	Vocational or other	30.4	(1.4)
55–64 years	36.3	(2.4)	Tertiary	24.4	(1.3)
65+ years	45.4	(2.3)			
			Reimbursement mechanisms[(a)]		
Total	**32.0**	**(0.8)**	No PDI, has Card	51.5	(2.5)
			No PDI, no Card	30.6	(1.2)
			Has PDI, has Card	38.6	(4.6)
			Has PDI, no Card	25.7	(1.3)

(a) P<0.05 (Chi-square test).
Source: National Dental Telephone Interview Survey 1999 and accompanying questionnaire.

Personal control and oral health

Stepwise gradients of increasing oral morbidity accompanied successive decrements in perceived personal control (Figure 20). For tooth loss and the social impact of oral conditions, the difference in prevalence was greater between the low and moderate tertiles than between the moderate and high tertiles. The shape of the gradient in self-rated oral health appeared as a linear relationship extending right across the control continuum.



(a) P<0.05, Chi-square test.
Source: National Dental Telephone Interview Survey 1999 and accompanying questionnaire.

Figure 20: Personal control and oral health

Prevalence of tooth loss decreased from 17.1% among adults with low control to 10.0% among adults with control scores in the high tertile range. A twofold relative difference in prevalence of severe impact on quality of life was found between adults with low control (25.9%) and high control (12.7%). A similar difference in magnitude between low (32.4%) and high (16.3%) control scores was observed for low self-rated oral health.

6.2 Psychological stress

Psychological stress is theorised to involve two cognitive appraisal processes. Primary appraisal involves an interpretation of whether the stimulus is threatening and secondary appraisal assesses the adequacy of available resources to deal with a threatening encounter (Lazarus 1966). According to stress and coping theory, distress arises when a stress stimulus is appraised to exceed an individual's coping resources. When resources are deemed adequate, the stressor is managed successfully and accompanying emotions are governed appropriately (Lazarus & Folkman 1984).

The literature differentiates between the effects of acute and chronic stress. The latter results from the strain of living in sustained disadvantage. Individuals in such circumstances are exposed to a host of ongoing stressors such as economic insecurity, and have limited control over daily circumstances, the nature of their work and work environment, and the availability of resources. There is increasing evidence that ongoing or repeated stress, as opposed to short-term stress, has a generalised adverse effect on health. Whether stress is harmful depends upon the individual's appraisal of the stressor relative to their capacity to adapt. Stress that challenges and motivates has a positive effect on health but distress results when coping resources are perceived to be inadequate. Not all coping strategies have favourable health effects. Maladaptive coping through overeating, excessive alcohol consumption, cigarette smoking and other drug use independently heightens the risk to health. Personality traits also moderate the influence of stress. Optimism and hardiness are thought to confer stress resistance, while negative affectivity, particularly anger, hostility and depression, increase susceptibility to the harmful effects of stress on health.

Recent advances have been made in understanding biological mechanisms linking psychosocial stress and relative social status to disease. Much of this is experimental research conducted with non-human primates to investigate the health effects of social hierarchies. Animal studies are important not only because non-human primates have similar hierarchies of dominance as humans, but also because these animals share physiological risk factors that are distributed along similar social gradients. Wilkinson (1999) cited animal studies conducted by Shively and colleagues and by Sapolsky & Mott. They noted that compared with dominant animals, socially subordinate animals have worse ratios of high density to low density lipids, central adiposity and glucose intolerance, increased atherosclerosis, raised basal cortisol levels and attenuated cortisol responses to experimental stressors. Because experimental conditions controlled for factors such as diet and environment and because manipulating social status could reverse the effects, such studies have strengthened the case for causality.

McEwen (1998) investigated the neurobiological stress response in humans and discussed this in terms of allostatic load. Allostasis is the process that maintains all systems in equilibrium by integrating regulatory parts of the nervous and endocrine systems and other metabolic control functions. Perceived stress evokes physiological responses that activate a cascade of stress hormones that affect the cardiovascular and

immune systems in an attempt to adapt to challenge. Although a normal protective response, prolonged activation or chronic overactivity exacts a demand on the body, leading to what is termed allostatic load. Allostatic load is a cumulative biological burden that accelerates pathophysiology and predisposes individuals to chronic disease. There is evidence of a socioeconomic gradient in allostatic load (McEwen 2000).

Distribution of psychological stress

Sex differences in perception of psychological stress revealed higher stress levels among females compared with males (Table 17). Prevalence of high psychological stress tended to decrease across successive age groups and was substantially lower among adults aged 65 years and older (19.6%). This represented a relative halving in effect observed in the youngest age group (32.1%).

Table 17: Per cent (se) of people with high psychological stress scores

	Per cent	(se)		Per cent	(se)
Sex[(a)]			**Household income**[(a)]		
Male	26.3	(1.1)	Up to $20,000	33.0	(2.0)
Female	31.5	(1.2)	$20–$50,000	31.7	(1.4)
			>$50,000	24.5	(1.2)
Total	**28.9**	**(0.8)**			
			Educational attainment[(a)]		
Age group[(a)]			Secondary or less	32.8	(1.6)
25–34 years	32.1	(1.7)	Vocational or other	28.6	(1.3)
35–44 years	30.5	(1.6)	Tertiary	25.8	(1.4)
45–54 years	32.6	(1.9)			
55–64 years	23.6	(2.2)	**Reimbursement mechanisms**[(a)]		
65+ years	19.6	(1.9)	No PDI, has Card	38.9	(2.5)
			No PDI, no Card	29.9	(1.2)
			Has PDI, has Card	22.6	(3.9)
			Has PDI, has Card	24.6	(1.3)

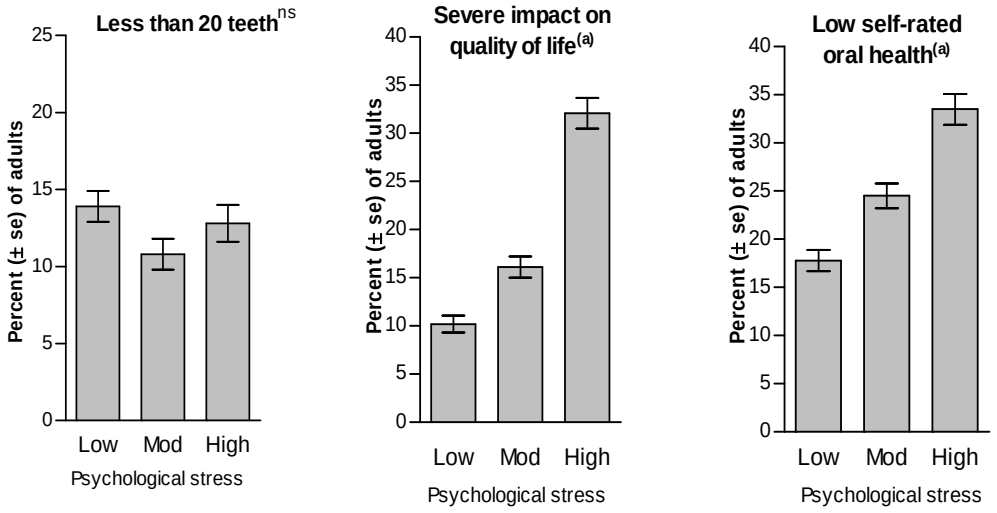
(a) P<0.05 (Chi-square test and Fisher's exact test).
Source: National Dental Telephone Interview Survey 1999 and accompanying questionnaire.

Levels of psychological stress were inversely related to income and educational attainment (Table 17), suggesting that socioeconomic resources provided a means of coping with stress. Alternatively, stress exposures may be less common among groups with material advantage. A smaller proportion of insured adults had high stress scores and uninsured adults who were eligible for a concession (38.9%) were most likely to report stress scores in the highest tertile range.

Psychological stress and oral health

Levels of psychological stress were not significantly associated with tooth loss (Figure 21). There are several possible reasons to explain the absence of a crude association. For instance, age might modify the effect of psychological stress on tooth loss. As evident from Table 17, prevalence of high stress was elevated almost twofold among younger adults compared with older adults and yet tooth loss was greater among older adults.

There was a threefold difference in prevalence of severe impact on quality of life between adults with low (10.2%) and high (32.1%) levels of perceived stress. A similar, but flatter stress gradient in self-rated oral health was observed, with a twofold relative difference between adults with low (17.8%) and high stress levels of stress (33.5%).



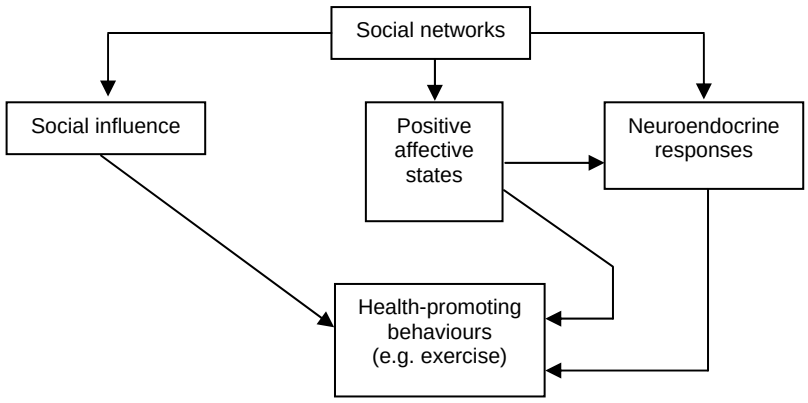
Source: National Dental Telephone Interview Survey 1999 and accompanying questionnaire.

Figure 21: Psychological stress and oral health

6.3 Social support

It is generally agreed that social support comprises four dimensions—emotional, appraisal, instrumental and informational attributes. Emotional support is empathy, love, caring and trust. Appraisal support includes feedback on personal performance. Instrumental support refers to tangible aid such as the sharing of tasks or actions such as loaning money. Informational support includes the teaching of skills, advice and provision of information for problem solving.

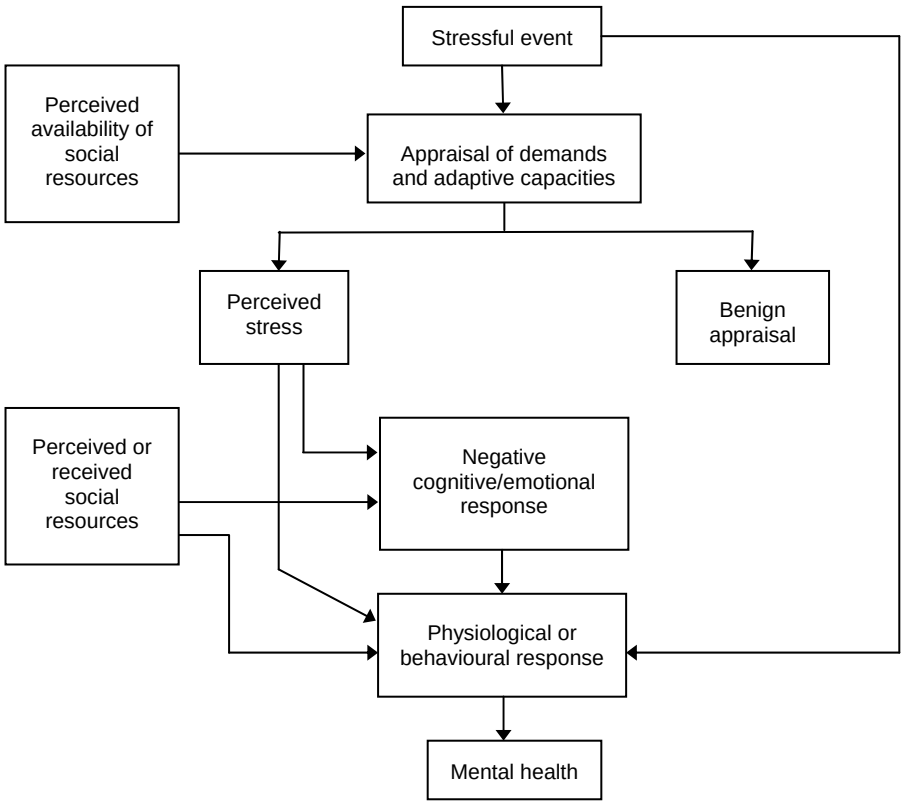
Two models theoretically explain mechanisms by which social relationships influence health. In the main-effects model (Figure 22) social support promotes health regardless of whether or not the individual is experiencing psychological stress. It does this through one of two pathways. One pathway is via the effect of psychological states. Positive influences enhance self-efficacy and coping beliefs, or promote a sense of purpose and self-worth. These attributes may assist individuals in their efforts to quit smoking, lose weight, manage illness or seek health care. In a second pathway social support guides the adoption of health-promoting behaviours such as engagement in physical activities and healthy dietary patterns.



Source: Taken from Kawachi & Berkman 2001; 78:458–67 (adapted from Cohen et al. 2000).

Figure 22: Main-effects model linking social ties to mental health

The second theoretical model depicts a direct pathway via neuroendocrine responses (Figure 23). Social support is thought to buffer the harmful health effects of deprivation and the psychological stress it evokes. Persons perceiving that social resources are available are less likely to appraise demands as being distressing and more likely to perceive that their capacity to cope with demands is greater. In this situation the cognitive and emotional response to stress is less likely to have a negative impact. In summary, stressors may activate social support, or social support may buffer stressors.



Source: Taken from Kawach & Berkman 2001 (adapted from Cohen et al. 2000).

Figure 23: Stress-buffering model linking social ties to mental health

Distribution of social support

There was a high level of consensus among study participants that different dimensions of social support were readily available to them—86.2% agreed or strongly agreed that there was someone who paid attention to their feelings and problems; 81.2% agreed or strongly agreed that there was someone who would express appreciation of their work; 80.4% agreed or strongly agreed that they could get help from with certain activities if needed; and 88.2% agreed or strongly agreed that they could get advice on how to handle things if needed. This report presents findings for people for whom forms of support were not readily available or were inadequate.

Table 18: Per cent (se) of people with unavailable social support

	Per cent and standard error							
	Emotional		Appraisal		Instrumental		Informational	
Sex								
Male	16.2	(0.9)[a]	20.4	(1.0)[a]	11.3	(0.8)[ns]	13.7	(0.9)[a]
Female	11.4	(0.8)	17.2	(1.0)	9.8	(0.8)	10.0	(0.8)
Age group								
25–34 years	9.7	(1.1)[a]	19.2	(1.4)[ns]	9.0	(1.0)[ns]	9.3	(1.1)[ns]
35–44 years	16.5	(1.3)	19.0	(1.4)	10.6	(1.1)	13.9	(1.2)
45–54 years	15.8	(1.5)	20.3	(1.6)	12.6	(1.3)	12.5	(1.3)
55–64 years	15.0	(1.8)	18.2	(2.0)	11.7	(1.6)	13.0	(1.7)
65+ years	11.9	(1.5)	15.8	(1.7)	9.3	(1.4)	10.6	(1.4)
Household income								
Up to $20,000	17.4	(1.6)[a]	23.2	(1.8)[a]	13.6	(1.5)[a]	16.3	(1.6)[a]
$20–$50,000	13.7	(1.0)	20.1	(1.2)	12.4	(1.0)	12.2	(1.0)
>$50,000	12.1	(0.9)	16.0	(1.0)	7.5	(0.8)	10.2	(0.9)
Educational attainment								
Secondary or less	13.7	(1.2)[a]	20.7	(1.4)[a]	14.7	(1.2)	15.2	(1.2)
Vocational or other	17.4	(1.1)	21.6	(1.2)	11.2	(0.9)	12.3	(1.0)
Tertiary	9.6	(0.9)	13.8	(1.1)	6.4	(0.8)	8.3	(0.9)
Reimbursement mechanisms								
No PDI, has card	16.1	(1.8)[a]	22.7	(2.1)[a]	14.9	(1.8)[a]	15.6	(1.8)
No PDI, no card	16.0	(1.0)	21.0	(1.1)	10.7	(0.8)	12.7	(0.9)
Has PDI, has card	11.3	(3.0)	14.0	(3.3)	11.3	(3.0)	10.5	(2.9)
Has PDI, no card	10.4	(0.9)	14.6	(1.1)	9.0	(0.9)	9.6	(0.9)
Total	**13.8**	**(0.6)**	**18.8**	**(0.7)**	**10.6**	**(0.6)**	**11.8**	**(0.6)**

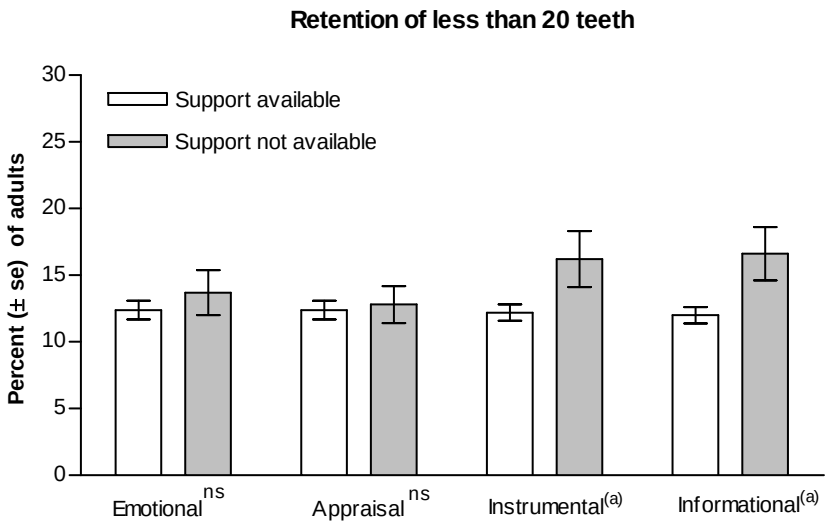
(a) P<0.05 (Chi-square test and Fisher's exact test); ns p>0.05.
Source: National Dental Telephone Interview Survey 1999 and accompanying questionnaire.

Compared with females, males reported significantly lower availability of emotional, appraisal and informational dimensions of social support (Table 18). Age-related differences in the availability of support were only significant for emotional support; although a pattern of inaccessibility in midlife (45–54 years) seemed a consistent pattern.

All four dimensions of social support were less available to groups with lower levels of socioeconomic resource (Table 18). Socioeconomic gradients tended to be flatter for emotional and appraisal support and steeper for instrumental and informational support. Emotional support provides love, caring, sympathy and understanding and appraisal support offers help in decision making and giving appropriate feedback. While emotional and appraisal support reinforce the recipient's sense of well-being, instrumental and informational support offer concrete practical aid. The skills and resources necessary in providing instrumental and informational support may be more readily available to adults who themselves have stocks of these resources. This is consistent with the theoretical view of social support as a transaction between individuals that involves both offering of support as well as its receipt (Kahn & Antonucci 1980). Steepest socioeconomic gradients were found for instrumental support, particularly according to educational attainment. Only 6.4% of tertiary graduates were unable to access instrumental help compared with 14.7% of persons with secondary education. The income gradient in instrumental support approached twofold, ranging from 13.6% among those on lowest income to 7.5% of those with income greater than $50,000.

Social support and oral health

The availability of emotional and appraisal dimensions of social support were not significantly associated with tooth loss (Figure 24). Having emotional needs met or obtaining personal feedback from other people did not seem to translate into better levels of tooth retention. Speculatively, this may be because these forms of support do not result in actions that people actually need in order to retain teeth.



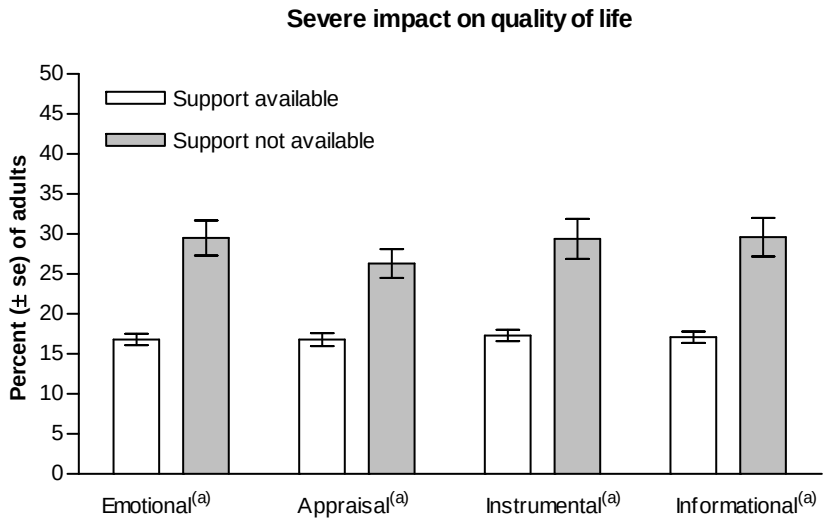
(a) P<0.05 (Chi-Square test; ns p>0.05).

Source: National Dental Telephone Interview Survey 1999 and accompanying questionnaire.

Figure 24: Associations of social support with tooth loss

By contrast, instrumental and informational support was positively related to tooth retention. Prevalence of tooth loss was higher by four percentage points on average among adults who could not readily access instrumental support (12.2%) compared with those who could (16.2%). Prevalence of tooth loss was also significantly greater among adults without ready access to and informational (16.6%) support compared to those adults with informational support (12.0%). Informational support refers to the provision of advice, guidance and information, while instrumental support is to do with practical help. There may be something about sharing points of view, health literacy, or practical assistance that allows people to find solutions for dental problems that do not involve loss of teeth.

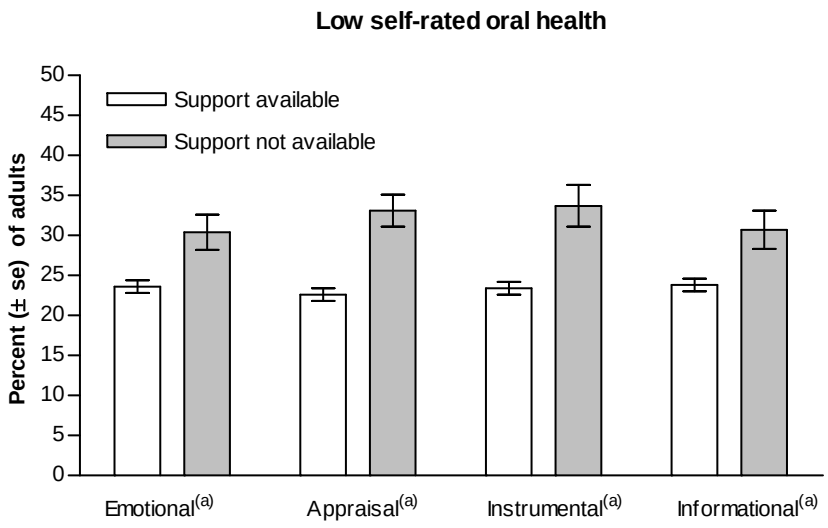
All four dimensions of social support were significantly associated with the social impact of oral conditions on quality of life (Figure 25). Prevalence of severe impact was 16.8% among adults with accessible emotional support and 29.5% among adults without this resource. Similar associations were observed for appraisal support, where prevalence of severe impact was 16.8% among those who could gain access to appraisal support and 26.3% among those who could not. Instrumental support was associated with an absolute difference in prevalence of severe impact on quality of life of 12.1 percentage points, ranging from 17.3% for those who could access this support to 29.4% among those who could not. A similar difference in magnitude was found for informational support. Prevalence of severe impacts varied by 12.5 percentage points from 17.1% among those who could access informational support to 29.6% among those who could not.



(a) P<0.05 (Chi-square test).

Source: National Dental Telephone Interview Survey 1999 and accompanying questionnaire.

Figure 25: Associations of social support with severe impact on quality of life



(a) P<0.05 (Chi-square test).

Source: National Dental Telephone Interview Survey 1999 and accompanying questionnaire.

Figure 26: Associations of social support with low self-rated oral health

All four forms of social support were negatively associated with self-rated oral health (Figure 26) with greatest differences observed for appraisal and instrumental support.

In absolute terms prevalence of low ratings were 23.6% among those with ready access to emotional support and 30.4% among those with less ready access. Prevalence of low self-rated health was elevated by 10.5 percentage points among those who could not access appraisal support (33.1%) compared with those who could (22.6%). Similarly, there was a 10.4 difference in net percentage points on average on the basis of instrumental support. Prevalence of low self-rated oral health varied from 23.4% for adults with instrumental support to 33.7% for adults who could not readily access this support. Prevalence varied from 23.8% to 30.7% on the basis of availability to informational support.

7 Workplace environment

Three variations in reporting results are introduced in this chapter. First, analysis was limited to adults who were active in the labour force. Second, because this created a younger sample, the threshold for tooth loss was raised to retention of fewer than 24 teeth, rather than 20 teeth as applied elsewhere in this report. Third, most results are presented separately for males and females since the literature suggests that health is more sensitive to the effects of work-related characteristics among males than females.

7.1 Australian labour force

Australian labour market statistics indicate that the labour force comprised 9,379,000 persons at the time of data collection in 1999, with an overall participation rate of 63.1% and a female participation rate of 53.8%. The unemployment rate of 7.4% had been in decline since 1995. Of the total employed, 26.1% were in part-time work and, of these, males comprised 12.6% and females comprised 43.6% (ABS 2006a).

In this report, almost two-thirds of the overall sample (63.7%) was active in the labour force, with 48.7% engaged in full-time work and 15.0% in part-time work. Retirees comprised 16.4% and a further 14.1% were not employed. Employment status data were missing for 5.8%.

Defining occupational groups

Details about job title and main tasks supplied by those active in the labour force were used to assign an occupational category based on the Australian Standard Classification of Occupations structure (ASCO, first edition, ABS 1990). The classification criteria were based on skill level and skill specialisation so that occupations grouped together shared similar levels of education, knowledge, responsibility and experience. This finely detailed structure was summarised according to the eight ASCO Major Groups and then reclassified to form three broad groupings as applied by Turrell and colleagues (2006). Under these groupings ‘Upper white collar’ comprised managers, administrators, professionals and paraprofessionals; ‘Other white collar’ comprised clerks, salespeople and personal service workers; and ‘Blue collar’ comprised tradespeople, plant and machine operators and drivers, and labourers and related workers.

Distribution of occupational groups

Sex differences were evident between occupational groups. Males were predominant among the upper white collar group. Males were also more likely than females to be in blue collar occupations as tradespersons, plant or machine operators or drivers, or labourers, while females dominated among clerks, salespeople and personal service work (other white collar occupations).

Table 19: Per cent (se) of people employed in various occupational groupings

	Row per cent and standard error					
	Upper white collar		Other white collar		Blue collar	
Sex[(a)]						
Male	53.9	(1.7)	16.5	(1.3)	29.6	(1.6)
Female	42.3	(1.7)	42.4	(1.7)	15.3	(1.3)
Age group[ns]						
25–34 years	50.3	(2.3)	29.5	(2.1)	20.2	(1.8)
35–44 years	45.1	(2.0)	32.0	(1.9)	22.9	(1.7)
45–54 years	47.4	(2.4)	28.1	(2.2)	24.5	(2.1)
55–64 years	53.5	(3.6)	22.5	(3.1)	24.1	(3.1)
Household income[(a)]						
Up to $20,000	33.3	(5.0)	38.9	(5.1)	27.8	(4.7)
$20–$50,000	34.7	(1.9)	38.1	(1.9)	27.2	(1.8)
>$50,000	59.3	(1.6)	21.9	(1.4)	18.8	(1.3)
Educational attainment[(a)]						
Secondary or less	28.1	(2.3)	44.8	(2.5)	27.1	(2.2)
Vocational or other	31.9	(2.0)	35.9	(2.0)	32.2	(2.0)
Tertiary	70.7	(1.7)	16.2	(1.4)	13.2	(1.2)
Reimbursement mechanisms[(a)]						
No PDI, has Card	28.6	(5.4)	28.6	(5.4)	42.9	(5.9)
No PDI, no Card	45.0	(1.7)	32.6	(1.6)	22.4	(1.4)
Has PDI, has Card	52.4	(10.9)	19.0	(8.6)	28.6	(9.9)
Has PDI, no Card	54.4	(1.9)	25.1	(1.7)	20.5	(1.5)
Total	**48.2**	**(1.2)**	**29.2**	**(1.1)**	**22.6**	**(1.0)**

(a) P<0.05 (Chi-square test and Fisher's exact test); ns P>0.05.
Source: Questionnaire linked to 1999 NDTIS, adults in the workforce, 25–64 years.

Although differences in the distribution of occupational grouping across age groups did not reach the threshold for statistical significance, there was a tendency for a greater proportion of workers aged 55–64 years to be in upper white collar occupations and for a lower proportion of this age group to be other white or blue collar employees (Table 19).

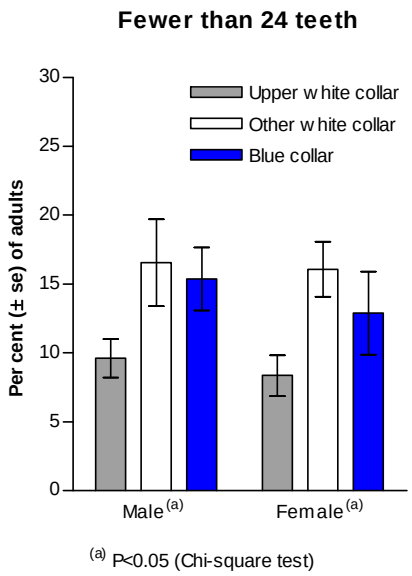
Upper white collar workers accounted for almost half the sample (48.2%), while other white collar workers comprised 29.2% and blue collar workers contributed the remaining 22.6%.

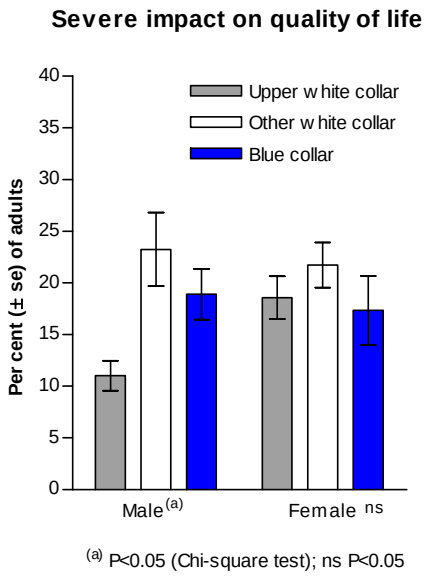
Low household income of up to $20,000 was distributed comparatively evenly among upper white collar (33.3%), other white collar (38.9%) and blue collar (27.8%) occupations (Table 19). By contrast, high household income was predominantly found among upper white collar workers (59.3%) with only 18.8% of workers in blue collar occupations commanding this level of household income.

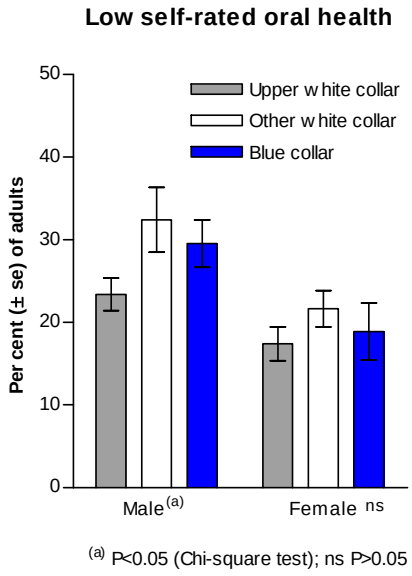
Similarly, secondary education was equally distributed between upper white collar (28.1%) and blue collar (27.1%) occupations, with nearly half of these participants (44.8%) holding other white collar positions. As with household income, gradients were much steeper among the most advantaged. Tertiary graduates occupied 48.1% of upper white collar occupations, and only 13.2% of tertiary graduates worked in blue collar occupations.

Occupational groups and oral health

Retention of fewer than 24 teeth was less prevalent among upper white collar occupations for males (9.6%) and females (8.4%) than among blue collar workers for males (15.3%) and females (12.9%) (Figure 27). The apparent protective effect of managerial or professional status was also evident in the social impact of oral conditions and self-rated oral health status, but the effect was only detected among males. Among females occupational status had no measurable influence on these oral health outcomes.







Source: Questionnaire linked to 1999 NDTIS, adults in the workforce, 25–64 years.

Figure 27: Occupational groups and oral health status, males and females

7.2 Hours worked in Australia

According to the Australian Bureau of Statistics, the average hours worked by persons employed full-time in 1999 was 41.1 hours and one-quarter of full-time workers (24.9%) worked 50 hours or longer per week. In 2002 Australia ranked in sixth highest place from among 26 OECD nations for annual number of hours worked per worker. At 1,824 hours per worker, Australians exceeded the OECD average of 1,762 hours. Australian workers put in longer hours than their counterparts in the United States (1,815), Japan (1,798) and the United Kingdom (1,707), but substantially fewer hours than the Scandinavian countries, Belgium, France, Germany and the Netherlands (OECD 2006).

Distribution of working hours

Males and females reported different working hours (Table 20). A quarter of females (25.6%) worked up to 20 hours a week compared with only 3.5% of males (Table 20). A similar proportion of females (27.5%) worked longer than 40 hours but nearly 60% of males exceeded a 40-hour working week. Higher proportions of upper white collar workers exceeded 40 hours per week compared with other occupational groups. This was particularly the case among males, where some 70.9% worked more than 40 hours compared with about 44.5% of females.

Table 20: Per cent (se) of males and females in part-time, full-time and extended working hours

	Males[(a)]						Females[(a)]					
	Row per cent and standard error											
	Up to 20 hours		21–40 hours		>40 hours		Up to 20 hours		21–40 hours		>40 hours	
Occupational group												
Upper white collar	3.5	(0.9)	25.6	(2.0)	70.9	(2.1)	18.1	(2.1)	37.4	(2.6)	44.5	(2.7)
Other white collar	3.5	(1.5)	60.8	(4.1)	35.7	(4.0)	35.4	(2.6)	50.7	(2.7)	13.9	(1.9)
Blue collar	3.6	(1.2)	50.2	(3.1)	46.2	(3.1)	19.2	(3.5)	63.2	(4.3)	17.6	(3.4)
Total	**3.5**	**(0.6)**	**38.7**	**(1.7)**	**57.8**	**(1.7)**	**25.6**	**(1.5)**	**46.9**	**(1.7)**	**27.5**	**(1.6)**

(a) P<0.05 (Chi-square test).
Source: Questionnaire linked to 1999 NDTIS, adults in the workforce, 25–64 years.

The most noteworthy finding concerning differences in the number of hours worked among sociodemographic groups related to household income (Table 21). Less than one in ten adults (8.9%) in the highest income group worked up to 20 hours compared with more than four in ten adults (42.6%) in the lowest income group. By contrast, a greater proportion of adults in households with high income worked more than 40 hours (52.1%) than adults with low household income (15.7%).

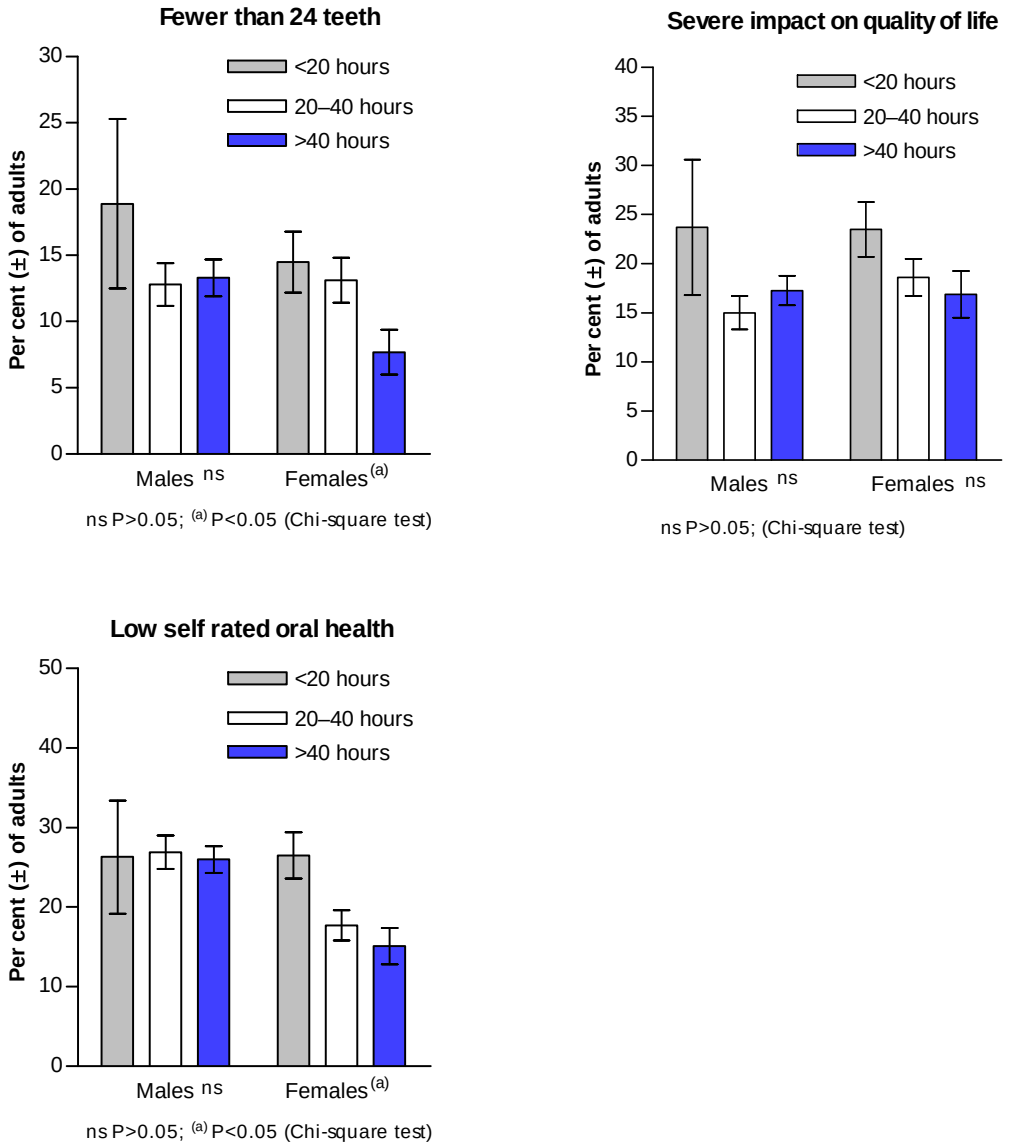
Table 21: Per cent (se) of socioeconomic groups in part-time, full-time and extended working hours

	Row per cent and standard error					
	Up to 20 hours		20–40 hours		More than 40 hours	
Household income[(a)]						
Up to $20,000	42.6	(4.8)	41.7	(4.7)	15.7	(3.5)
$20–$50,000	15.6	(1.3)	48.5	(1.8)	35.9	(1.7)
>$50,000	8.9	(0.9)	39.0	(1.5)	52.1	(1.5)
Educational attainment[(a)]						
Secondary or less	16.5	(1.7)	49.0	(2.3)	34.5	(2.2)
Vocational or other	14.1	(1.3)	43.5	(1.8)	42.4	(1.8)
Tertiary	11.2	(1.1)	38.7	(1.7)	50.1	(1.8)
Reimbursement mechanisms[(a)]						
No PDI, has Card	45.8	(5.5)	39.8	(5.4)	14.5	(3.9)
No PDI, no Card	13.6	(1.0)	42.9	(1.5)	43.5	(1.5)
Has PDI, has Card	15.8	(8.4)	36.8	(11.1)	47.4	(11.5)
Has PDI, no Card	9.7	(1.1)	42.6	(1.8)	47.7	(1.8)
Total	**13.4**	**(0.8)**	**42.6**	**(1.1)**	**44.0**	**(1.1)**

(a) P<0.05 (Chi-square test and Fisher's exact test).
Source: Questionnaire linked to 1999 NDTIS, adults in the workforce, 25–64 years.

Hours of work and oral health

Length of working week was not significantly associated with oral health status for males (Figure 28), whereas for female workers, longer working hours were associated with better oral health. Prevalence of high tooth loss among females working more than 40 hours was 7.7% compared with 14.5% among females working less than 20 hours. Prevalence of low self-rated oral health was 15.1% among females working more than 40 hours compared with 26.5% among those working less than 20 hours.

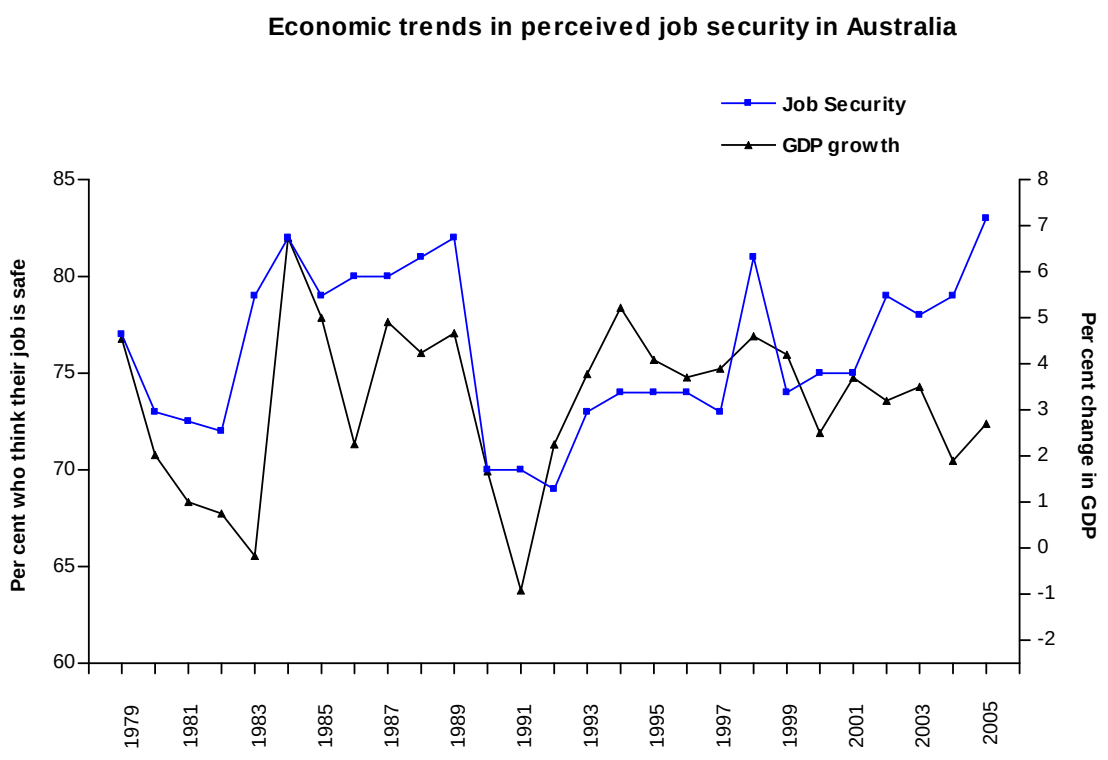


Source: Questionnaire linked to 1999 NDTIS, adults in the workforce, 25–64 years.

Figure 28: Length of working week and oral health status, males and females

7.3 Economic trends in perceived job security

Since 1975 Roy Morgan Research has assessed subjective job security among Australian workers annually with the question, 'Do you think your present job is safe, or do you think there's a chance you may become unemployed?' In November 2005, 85% of those interviewed thought their job was safe, the highest recorded figure since data collection began (Figure 29). The perception of job security held by Australians closely resembles the nation's economic prosperity as measured by gross domestic product. There were two sharp downturns in economic prosperity over this period: in 1982–83 and 1991. In 1982–83 recession rates of unemployment and inflation exceeded 10%, manufacturing jobs were in decline, and industrial disputation resulted in loss of 692 working days per 1,000 workers in 1981, compared with 187 lost days per 1,000 workers for the 12 months to June 2006 (ABS 2006b).



Sources: Roy Morgan Research. Finding No. 3942 – December 2005; Australian National Accounts: National Income, Expenditure and Product National Accounts, ABS Cat. no. 5206.0 (quarterly statistics).

Figure 29: Economic trends in perceived job security in Australia, 1979–2005

Distribution of perceived job security

Perceptions of job security were obtained from a single item that asked, 'Do you expect that your job will be secure for the next five years?' Less than half (43.3%) replied 'yes'. Of the remainder, 38.4% said 'probably', 9.9 said 'unlikely' and 8.4 said 'no'. In coding responses for analysis, any level of uncertainty was taken as an element of risk to secure employment, i.e. all those that did not state 'yes' (56.7%). This is consistent with coding protocol in the Whitehall prospective cohort study of British civil servants that dichotomised responses into insecure or very insecure versus secure or very secure (Ferrie et al. 2002). In that study the threat of job security was associated with minor psychiatric morbidity and physiological indicators, with different effects occurring for male and female workers.

Table 22: Per cent (se) of people perceiving a risk to job security

	Per cent	(se)		Per cent	(se)
Sex[ns]			**Household income**[(a)]		
Male	56.2	(1.5)	Up to $20,000	75.9	(4.1)
Female	57.3	(1.7)	$20–$50,000	59.3	(1.8)
			>$50,000	53.3	(1.5)
Age group[(a)]					
25–34 years	48.5	(2.0)	**Educational attainment**[ns]		
35–44 years	57.2	(1.9)	Secondary or less	57.5	(2.3)
45–54 years	62.5	(2.2)	Vocational or other	54.5	(1.8)
55–64 years	65.6	(3.2)	Tertiary	58.0	(1.7)
Reimbursement mechanisms[(a)]					
No PDI, has card	80.2	(4.4)			
No PDI, no card	55.7	(1.5)			
Has PDI, has card	50.0	(11.2)			
Has PDI, no card	55.5	(1.8)			
Total	**56.7**	**(1.1)**			

(a) P<0.05 (Chi-square test and Fisher's exact test); ns p>0.05.
Source: Questionnaire linked to 1999 NDTIS, adults in the workforce, 25–64 years.

Males (56.2%) and females (57.3%) did not differ in perceptions of job security (Table 22). The threat was positively associated with age such that 48.5% of 25–34-year-olds perceived some insecurity compared with 65.6% of workers aged 55–64 years. It is not clear whether higher levels of perceived threat convey older worker's concerns about finding new work in the event of redundancy.

Workers in upper white collar jobs were least likely to perceive any risk to their job security (53.8%) while other white collars workers held the greatest sense of risk (63.0%) (Table 23).

Table 23: Per cent (se) of occupational groups perceiving a risk to job security

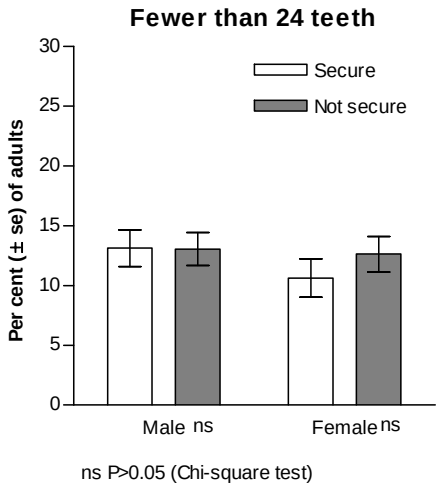
	Per cent	(se)		Per cent	(se)
Occupational group[(a)]			**Usual hours worked[(a)]**		
Upper white collar	53.8	(1.8)	Up to 20 hours	58.5	(3.0)
Other white collar	63.0	(2.2)	20–40 hours	63.4	(1.6)
Blue collar	56.4	(2.6)	More than 40 hours	49.5	(1.7)
Risk of skill obsolescence[(a)]					
Obsolescence unlikely	51.7	(1.2)			
Probable or certain risk	78.2	(2.1)			
Total	**56.8**	**(1.1)**			

(a) P<0.05 (Chi-square test and Fisher's exact test).
Source: Questionnaire linked to 1999 NDTIS, adults in the workforce, 25–64 years.

People who believed that their work skills may become obsolete were considerably more likely to also believe that their job security was at risk. In absolute terms the percentage who believed that their job was insecure was elevated by 26.5 percentage points among those at risk of skill obsolescence (78.2%) compared with workers who were not concerned about skill obsolescence (51.7%). Part-time workers who worked between 20 and 40 hours a week were more likely than those on shorter or longer hours to believe that their job security was threatened. Two categories with comparatively high levels of job insecurity—other white collar employees and workers on 20–40 hours—were comprised predominantly of female workers (see Tables 19 and 20).

Job security and oral health

Perceptions of job security were not associated with tooth loss for either males or females (Figure 30). A twofold elevation in the experience of severe impact on quality of life was reported among males with insecure job prospects (21.8%) compared with males who felt secure in their employment (10.1%). For females the effect was borderline. Job security was also associated with self-rated health among males but not females. Prevalence of low self-rated oral health among males in insecure employment was 29.1% compared with 22.8% among men in secure employment.



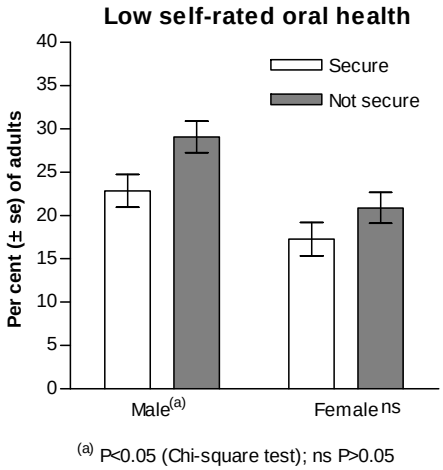


Figure 30: Perceived job security and oral health

7.4 Skill obsolescence

With technology advancing at a rapid pace, workers are required to adjust their knowledge and skills to remain productive in their work. Skills that were in demand in one decade can become obsolete within the next decade in industries under pressure to remain efficient and competitive in the global economy. Workers with high levels of skill specialisation in the professions may receive better organisational support for professional development than workers with lower level skills. Variation among population groups in the risk of skill obsolescence is likely to affect health.

Participants in the labour force were asked, 'Do you expect that your present job skills will be obsolete within ten years?', to which 42.9% responded 'no', 37.6% stated 'unlikely', 13.7% stated 'probably' and 5.8% indicated 'yes'. Response categories were dichotomised to form a risk group comprising responses of 'probably' and 'yes'.

Distribution of perceived risk of skill obsolescence

Older workers perceived greater risk of skill obsolescence. Perception that skill obsolescence was probable or certain was perceived by 36.1% of workers with household income up to $20,000 and by 18.2% of workers with income greater than $50,000.

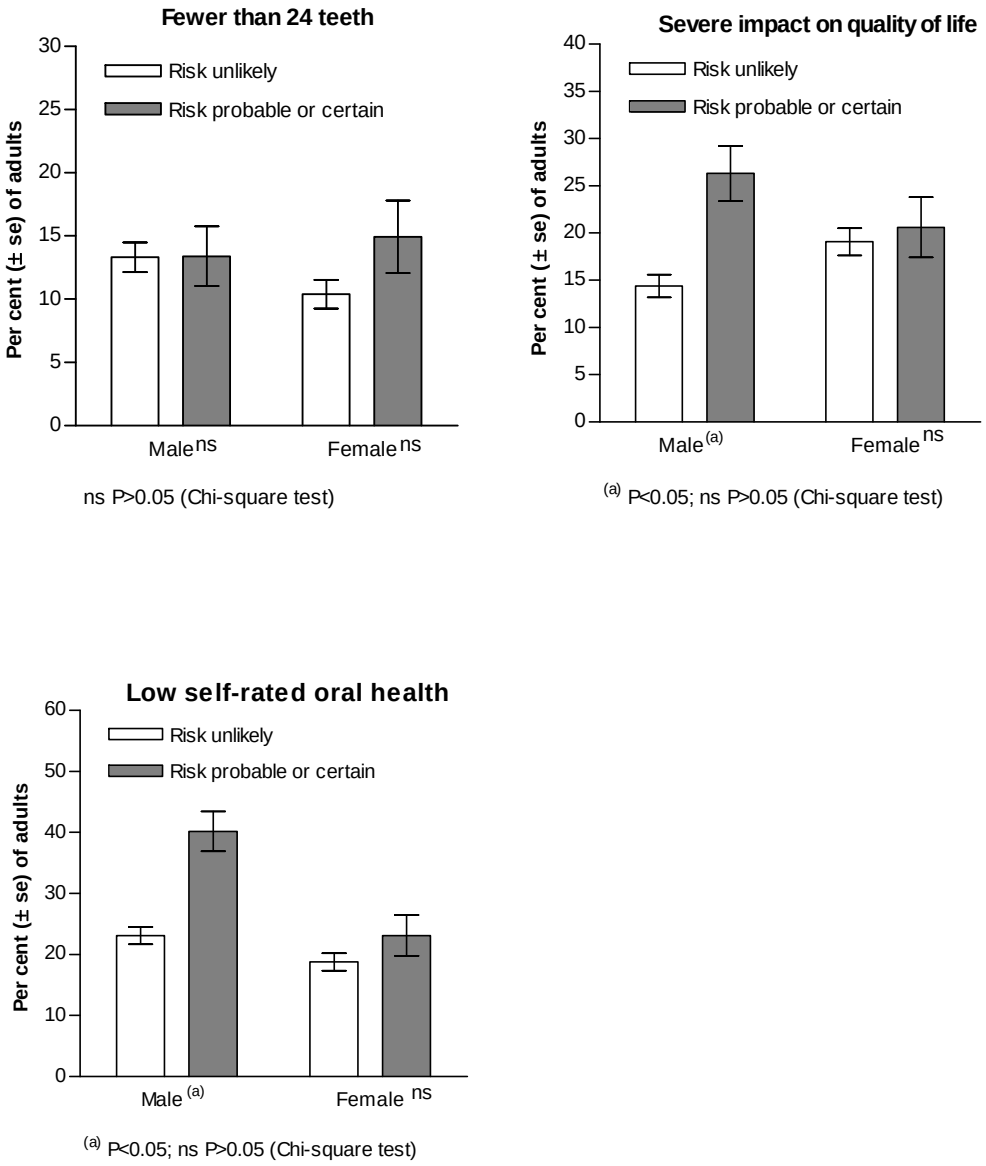
Table 24: Per cent (se) of people perceiving that skill obsolescence is probable or certain

	Per cent	(se)		Per cent	(se)
Sex[ns]			**Household income[(a)]**		
Male	20.7	(1.2)	Up to $20,000	36.1	(4.6)
Female	17.9	(1.3)	$20–$50,000	17.2	(1.4)
	19.4	(0.9)	>$50,000	18.2	(1.2)
Age group[(a)]					
25–34 years	16.4	(1.5)			
35–44 years	16.9	(1.4)	**Educational attainment[ns]**		
45–54 years	23.0	(1.9)	Secondary or less	23.0	(2.0)
55–64 years	27.7	(3.0)	Vocational or other	18.3	(1.4)
	19.4	(0.9)	Tertiary	18.2	(1.4)
Reimbursement mechanisms[ns]					
No PDI, has Card	22.9	(4.6)			
No PDI, no Card	19.4	(1.2)			
Has PDI, has Card	33.3	(10.3)			
Has PDI, no Card	18.6	(1.4)			
Total	**19.4**	**(0.9)**			

(a) P<0.05 (Chi-square test and Fisher's exact test); ns p>0.05.
Source: Questionnaire linked to 1999 NDTIS, adults in the workforce, 25–64 years.

Skill obsolescence and oral health

The perceived risk of skill obsolescence was not associated with tooth loss for either males or females, but sex differences were found for the other two oral health indicators. Prevalence of severe impact on quality of life among males at risk of skill obsolescence was 26.3% compared to 14.4% while among other males where the risk of skill obsolescence was unlikely. Differences were non-significant among females. Similarly, prevalence of low self-rated oral health among males at risk of skill obsolescence was 40.2% compared with 23.1% among males without risk. Again, differences in self-rated oral health among females were not significantly associated with risk of skill obsolescence.



Source: Questionnaire linked to 1999 NDTIS, adults in the workforce, 25–64 years.

Figure 31: Skill obsolescence and oral health

7.5 Work and family balance

In 1999 when data were collected for this study, Australia, New Zealand and the United States were the only three OECD countries not to provide a universal system of paid maternity or paternity leave for workers. Such a scheme was introduced in New Zealand in July 2002. The absence of this support places parents, especially women, under additional pressure in combining the responsibilities of work and family life.

In its submission to the Commonwealth Parliamentary Inquiry into 'Balancing Work and Family', in 2005, the South Australian government (Commonwealth Inquiry 2005) drew attention to the economic and social implications of not supporting families. It declared, 'Failure to address work family balance issues will have significant social costs for individuals and societies as a whole, such as stress-induced health conditions and family and relationship breakdown. Similarly, the past reliance—typically on women—as providers of informal care for partners, children, grandchildren, parents and other family members, is unlikely to continue as women increasingly remain in paid employment.'(p.2).

Gender roles in work and home responsibility are rapidly evolving. In the 5 years to 1997, for example, fathers increased the amount of time spent in childcare activities in a week by an average of almost 47 minutes, according to estimates of the Australian Bureau of Statistics (2006). Changes to traditional gender roles such as the division of time spent on activities in the home and elsewhere can induce strain.

Distribution of work and home strain

Study participants were classified as experiencing work and home strain if they expressed agreement or strong agreement with one or more of the eight questionnaire items. Based on this definition, prevalence was 42% among adults of working age.

Prevalence of work and home strain among males (47.0%) exceeded that of females (36.7%) by 10.3 percentage points (Table 25). This may be unexpected given the lower prevalence of psychological stress among males. On the other hand, working in excess of 40 hours a week was twice more common among males than females (Table 20), so it is possible that females achieve a better balance between these dual domains. Work and home strain may be a function of child raising demands or it may reflect the demand of financial and social obligations within partnerships. Prevalence of work and home strain was substantially lower in the last decade of adults' working lives (27.7%), suggesting resolution of the strain in coincidence with reduction of financial pressures.

Table 25: Per cent (se) of people experiencing work and home strain

	Per cent	(se)		Per cent	(se)
Sex[(a)]			**Household income**[(a)]		
Male	47.0	(1.4)	Up to $20,000	16.0	(2.1)
Female	36.7	(1.3)	$20–$50,000	41.5	(1.6)
			>$50,000	51.8	(1.4)
Age group[(a)]					
25–34 years	44.7	(1.8)	**Educational attainment**[(a)]		
35–44 years	45.7	(1.7)	Secondary or less	32.3	(1.8)
45–54 years	41.9	(2.0)	Vocational or other	40.2	(1.6)
55–64 years	27.7	(2.2)	Tertiary	50.4	(1.6)
Reimbursement mechanisms[(a)]					
No PDI, has card	20.4	(2.5)			
No PDI, no card	45.1	(1.4)			
Has PDI, has card	13.0	(4.6)			
Has PDI, no card	44.4	(1.6)			
Total	**41.9**	**(1.0)**			

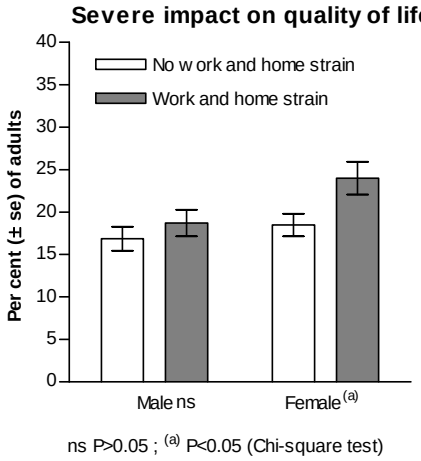
(a) P<0.05 (Chi-square test and Fisher's exact test); ns p>0.05.
Source: Questionnaire linked to 1999 NDTIS, adults in the workforce, 25–64 years.

Work and home strain was positively associated with socioeconomic resource such that prevalence among those whose income was up to $20,000 (16.0%) was 35.8 percentage points lower than those in households with >$50,000 income (51.8%), representing an effect size greater than threefold. This relationship was consistent across educational attainment, where prevalence among tertiary educated adults (50.4%) was substantially higher than those with secondary education (32.3%). In addition, it was higher among adults who were not eligible for a government concession card than those who were. These positive associations with socioeconomic resource leave open the possibility that work and home strain may exemplify eustress (positive stress) rather than distress.

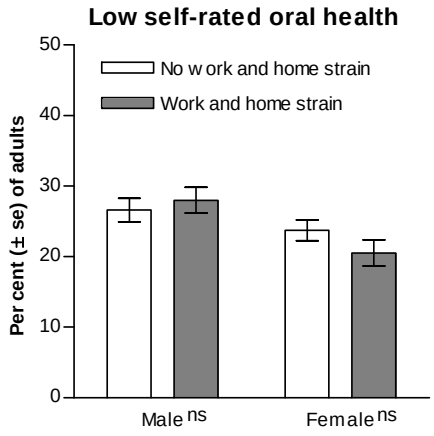
Work and home strain and oral health

The experience of work and home strain was not associated with oral morbidity in males (Figure 32). The relationship was different for females where work and home strain was associated with lower levels of tooth loss (9.5%) than for those without this strain (17.5%). Yet work and home strain accompanied a greater severity of impact on oral health related quality of life (24.0%) than that experienced by females without strain (18.5%).

ns P>0.05 ; (a) P<0.05 (Chi-square test)



ns P>0.05 ; (a) P<0.05 (Chi-square test)



ns P>0.05 (Chi-square test)

Source: Questionnaire linked to 1999 NDTIS, adults in the workforce, 25–64 years.

Figure 32: Work and home strain relationship with oral health

8 Childhood environment

8.1 Early life

Material and social conditions early in life leave an indelible imprint on the individual. Family environment is critical to the acquisition of social competence, health habits, and cognitive and emotional development. Disruption in the family between infancy and puberty is linked to growth deficits (Wadsworth et al. 2002) and increased risk of adulthood depression (Gilman et al. 2003). In a meta analysis of literature on family environment, child development and health, Repetti and colleagues (2002) found that families characterised by conflict, hostility and aggression and parent–child relationships that were cold, unsupportive and neglectful increased the risk of behavioural problems in childhood, mental and physical disorders in adolescence and chronic health conditions in adulthood.

In support of these findings, Nicolau and colleagues (2005) showed that adolescents who recalled high levels of paternal punishment from childhood had higher levels of dental caries experience at 13 years of age. Short status was also associated with more dental caries, adding to the weight of evidence of height as a marker of conditions early in life. Consistent with a life course approach to health status, Nicolau and colleagues examined a wide range of retrospectively reported details about childhood shown elsewhere to predict health status. Familial variables included socioeconomic indicators, family structure (nuclear, single-parent, reconstituted family), parental support (trust, love, attention, understanding) and discipline (strictness, punishment). Information was also collected on anthropometric measures (height and weight), and psychosocial and behavioural factors. Family structure was significantly associated with gingival bleeding (Nicolau et al, 2003a) and paternal discipline, family structure and support were associated with traumatic dental injury (Nicolau et al. 2003b). Height and socioeconomic factors were associated with dental caries (Nicolau et al. 2003c).

Prospective cohort studies in this area are very limited. One exception is the Dunedin Multidisciplinary Health and Development Study where researchers found that low parental socioeconomic position was significantly associated with greater dental caries and periodontal disease experience at 26 years of age (Poulton et al. 2002). They found no evidence that upward socioeconomic mobility between childhood and adulthood brought with it an oral health benefit. This underscores the importance of socioeconomic conditions early in life to oral health. Although the Dunedin study has examined family adversity, the relationship between these factors and adult oral health status has yet to be reported.

There are several ways by which material and social conditions in childhood might have implications for adult oral health. The neo-material explanation is the direct effect of economic resource on the affordability and accessibility of goods and services that affect oral health, including timely access to dental care. A second pathway is via behavioural practices. Disadvantage may lead to episodic use of dental services, smoking, inadequate diet and poor oral self-care. A third pathway might be via psychosocial development. Psychosocial attributes are increasingly recognised for their role in mediating the relationship between socioeconomic position and health status (Taylor & Seeman 1999).

8.2 Measurement of childhood conditions

In this chapter the childhood conditions are examined for their relationships with socioeconomic position, psychosocial profile and oral health status in adulthood.

Middle childhood, the development stage extending from 6 to 12 years, was selected as the referent period as individuals are believed to be able to accurately recall key events from that period of life. Adults were asked to recall different familial characteristics in childhood at the age of 10 years.

8.3 Childhood socioeconomic position

The distribution of parental occupation groups for study participants when they were aged 10 years is presented in Table 26. One-quarter of fathers (25.4%) had held managerial, professional or paraprofessional positions. One-fifth (21.7%) had worked as tradespersons and a further 12.2% as labourers or in related work. For one-quarter of respondents, paternal occupation was either unclassifiable (13.4%) or information was not provided (15.9%). Less than 1% was unemployed.

Table 26: Description of parental occupation groups

	Father	Mother
	Per cent	
Occupational group of parent		
Manager or administrator	14.1	2.4
Professional	11.3	4.8
Paraprofessional	4.1	2.1
Tradesperson	21.7	1.5
Clerk	6.1	4.8
Salesperson or personal service worker	5.5	4.4
Plant or machine operator or driver	7.9	2.0
Laborer or related work	12.2	2.6
Domestic duties	0.6	68.5
Unclassified (other)	13.4	3.3
Unemployed	0.7	1.7
Missing	15.9	1.9
Total	**100.0**	**100.0**

Source: National Dental Telephone Interview Survey 1999 and accompanying questionnaire.

Maternal occupation was dominated by domestic duties reported by two-thirds of study participants (68.5%). Similar proportions were reported for each of professional (4.8%), clerk (4.8%) and salesperson or personal service worker (4.4%). Of note, data were missing for only 1.9%. A comparison of paternal and maternal occupational groups indicates that 29.5% of fathers were in managerial or professional jobs compared with 9.3% of mothers. Many adults in this study were children at a time when there was a stricter division of labour in Australian households. The male breadwinner and female homemaker model prevailed and males were paid higher wager than females for the same work.

From a cross-tabulation of parental occupational groups, two-thirds of study participants (66.1%) had neither father nor mother in upper white collar occupations. One-quarter (24.1%) reported paternal upper white collar occupation and maternal

occupation in other white or blue collar work, and 5.8% had both parents employed in upper white collar occupations. The remaining 3.7% was composed of study participants whose mother had been in upper white collar work and whose father had been in other white collar or blue collar work (results not tabulated).

Child socioeconomic position and adult occupation

Of those study participants whose father had been a manager, administrator professional or paraprofessional, 62% were in one of these occupational groups themselves as adults (Table 27), and downward social mobility occurred for 38%. Upward social mobility was more common, with 45.3% of study participants (whose father had been in other white collar or blue collar work themselves) being in upper white collar occupations in adulthood.

Table 27: Occupational groups of parents and participant's own occupational group

	Participant's own occupational group					
	Upper white collar		Other white collar		Blue-collar	
	Row per cent and standard error					
Father's occupational group[(a)]						
Upper white collar	62.0	(1.9)	20.6	(1.5)	17.4	(1.4)
Other	45.3	(1.4)	28.2	(1.3)	26.5	(1.2)
Mother's occupational group[(a)]						
Upper white collar	68.8	(3.0)	13.3	(2.2)	17.9	(2.5)
Other	48.4	(1.2)	27.3	(1.1)	24.3	(1.0)
Total	**50.9**	**(1.1)**	**25.6**	**(1.0)**	**23.5**	**(1.0)**

(a) P<0.05 (Fisher's exact test).

Source: National Dental Telephone Interview Survey 1999 and accompanying questionnaire.

Maternal occupational group was related to own occupational group in a similar fashion to the relationship between paternal and own occupational group (Table 27). While less than 10% of study participants reported that their mother had held upper white collar employment when they were 10 years old (Table 26), more than two-thirds of these held upper white collar employment themselves.

Child socioeconomic position and adult household income

Of those study participants whose father had been employed in an upper white collar occupation when they were aged 10, more than half (52.6%) had household income in the highest income category at the time of the survey. By contrast, 38.0% of study participants whose fathers had held other white collar or blue collar occupations had household income in the highest category. A very similar relationship was observed between maternal occupational group and participant's household income in adulthood.

Table 28: Occupational group of parents and participant's household income

	Annual household income in adulthood					
	Up to $20,000		$20,000–$50,000		>$50,000	
	Row per cent and standard error					
Father's occupational group[(a)]						
Upper white collar	12.5	(1.1)	34.9	(1.6)	52.6	(1.7)
Other	22.4	(0.9)	39.5	(1.1)	38.0	(1.1)
Mother's occupational group[(a)]						
Upper white collar	13.0	(2.0)	31.5	(2.8)	55.6	(3.0)
Other	20.1	(0.8)	39.1	(1.0)	40.8	(1.0)
Total	**19.4**	**(0.7)**	**38.4**	**(0.9)**	**42.2**	**(0.9)**

(a) P<0.05 (Fisher's exact test).
Source: National Dental Telephone Interview Survey 1999 and accompanying questionnaire.

Child socioeconomic position and adult educational attainment

Of those study participants whose father had held an upper white collar occupation, nearly half (47.3%) were tertiary educated and less than one in five (19.2%) had secondary education only (Table 29). A very similar relationship was observed between maternal occupational group and participant's educational attainment in adulthood.

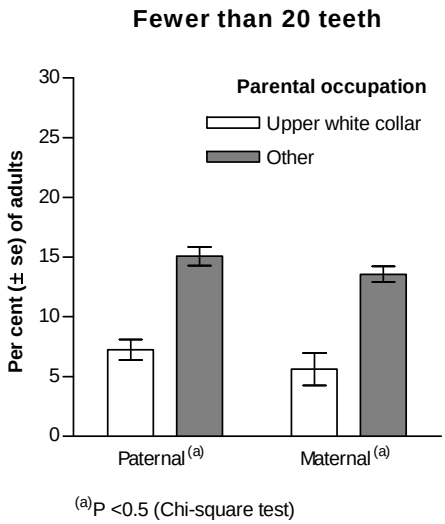
Table 29: Occupational group of parents and participant's educational attainment

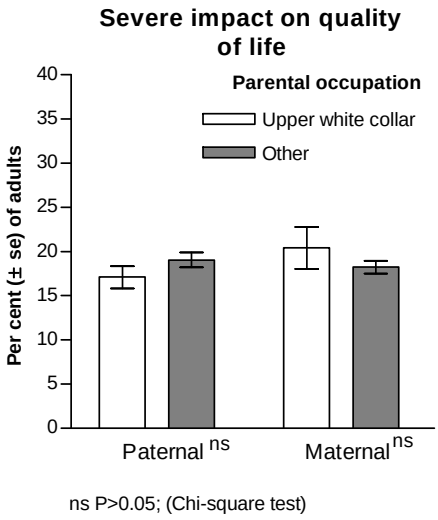
	Educational attainment					
	Secondary or less		Vocational or other		Tertiary	
	Row per cent and standard error					
Father's occupational group[(a)]						
Upper white collar	19.2	(1.3)	33.4	(1.6)	47.3	(1.7)
Other	33.3	(1.0)	38.7	(1.1)	28.0	(1.0)
Mother's occupational group[(a)]	15.5	(2.1)	37.6	(2.8)	46.9	(2.9)
Upper white collar	30.7	(0.9)	37.1	(0.9)	32.3	(0.9)
Other	29.2	(0.8)	37.1	(0.9)	33.7	(0.9)
Total	**15.5**	**(2.1)**	**37.6**	**(2.8)**	**46.9**	**(2.9)**

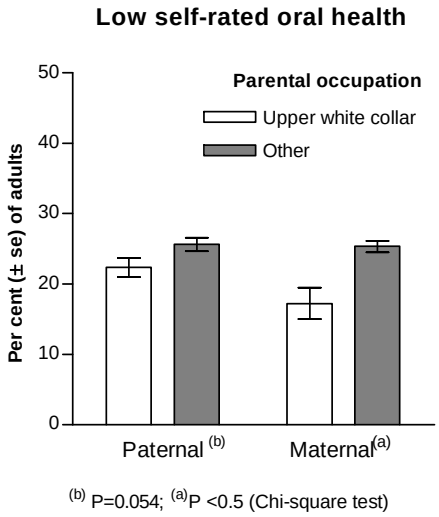
(a) P<0.05 (Fisher's exact test); ns p>0.05.
Source: National Dental Telephone Interview Survey 1999 and accompanying questionnaire.

Childhood socioeconomic position and adult oral health

Prevalence of tooth loss in adulthood was significantly associated with childhood socioeconomic position indexed by parental occupational group (Figure 33). There was a twofold difference in prevalence of retaining less than 20 teeth between those adults whose father had been in upper white collar work (7.2%) compared with other white collar or blue collar work (15.1%). The relative effect was marginally greater for maternal occupation. Prevalence of tooth loss was 5.6% among adults whose mother had been in upper white collar work and 13.6% for those whose mother had not. Prevalence of low self-rated oral health was lower among those whose mothers had been in upper white collar work (17.2%) compared with those whose mother had not (25.3%). A weak effect of borderline significance was found for paternal occupation with an absolute difference in prevalence of 3 percentage points.







Source: National Dental Telephone Interview Survey 1999 and accompanying questionnaire.

Figure 33: Parental occupation status and oral health status in adulthood

8.4 Distribution of parental cohabitation status

The great majority of participants (89.9%) had lived with both parents at the age of 10 years. A small minority reported they did not cohabit (7.1%) and the remainder were either unsure (0.5%) or did not provide an answer (2.6%). A similar large proportion reported that the rearing style of their primary caregiver in childhood had been positive and supportive (86.3%).

Parental cohabitation status did not differ on the basis of sex (Table 30). Age differences were apparent, with those adults aged 55–64 years being more likely to have lived with one parent only. There was a twofold difference in the proportion of participants whose parents did not cohabit across household income categories, ranging from 5.4% of those with highest income to 10.8% of those with lowest income. A similar twofold difference was found between uninsured cardholders (12.2%) and insured people without a card (6.0%). The socioeconomic relationship was further substantiated with a significant educational gradient in adulthood associated with parental cohabitation status, ranging from 5.9% among tertiary graduates to 9.1% among those with secondary education only.

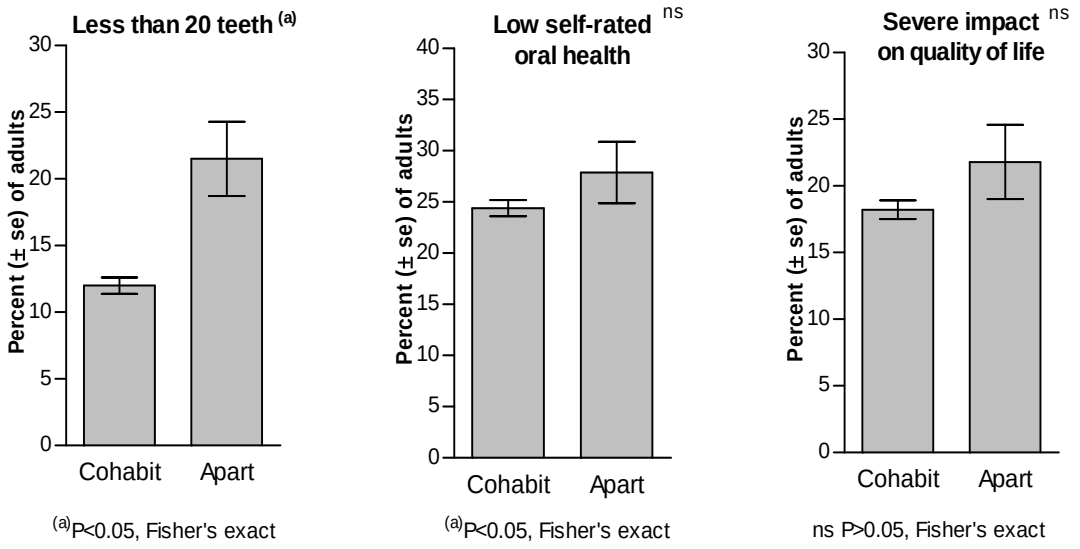
Table 30: Per cent (se) of people whose parents did not cohabit

	Per cent	(se)		Per cent	(se)
Sex[ns]			**Household income[(a)]**		
Male	6.7	(0.6)	Up to $20,000	10.8	(1.3)
Female	7.8	(0.7)	$20,000 – $50,000	7.8	(0.8)
			>$50,000	5.4	(0.6)
Age group[(a)]					
25–34 years	8.5	(1.0)	**Educational attainment[(a)]**		
35–44 years	5.9	(0.8)	Secondary or less	9.1	(1.0)
45–54 years	5.8	(0.9)	Vocational or other	7.0	(0.8)
55–64 years	10.9	(1.6)	Tertiary	5.9	(0.7)
65+ years	6.6	(1.2)			
Reimbursement mechanisms[(a)]					
No PDI, has Card	12.2	(1.7)			
No PDI, no Card	6.8	(0.7)			
Has PDI, has Card	9.8	(2.8)			
Has PDI, no Card	6.0	(0.7)			
Total	**7.3**	**(0.5)**			

(a) P<0.05 (Chi-square test and Fisher's exact test); ns p>0.05.
Source: National Dental Telephone Interview Survey 1999 and accompanying questionnaire.

Parental cohabitation and oral health

Differences in prevalence of tooth loss approached twofold among adults whose parents had lived apart when the respondents were children (21.5%) as among adults whose parents had cohabited (12.0%). Although differences did not reach the statistical threshold for significance, a higher proportion of adults who had lived with one parent in childhood now rated their oral health poorly (27.9%) compared with those who had lived with two (24.4%). Differences in severity of oral impact on quality of life were also non-significant.



Source: National Dental Telephone Interview Survey 1999 and accompanying questionnaire.

Figure 34: Parental cohabitation and oral health in adulthood

Distribution of parental rearing style

Study participants gave favourable ratings about the parenting style of their primary caregiver, with 86.3% describing it as positive and supportive. Only 9.2% described it as negative and unsupportive, 1.6% gave responses that could not be classified as either positive or negative and 2.9% did not answer this question.

Perceptions of rearing style were not patterned socially on the basis of sex or socioeconomic indicators. There was an effect for age, however, that showed that adults aged between 35 and 54 years were twice as likely as younger and older adults to rate their caregiver's rearing style as negative and unsupportive.

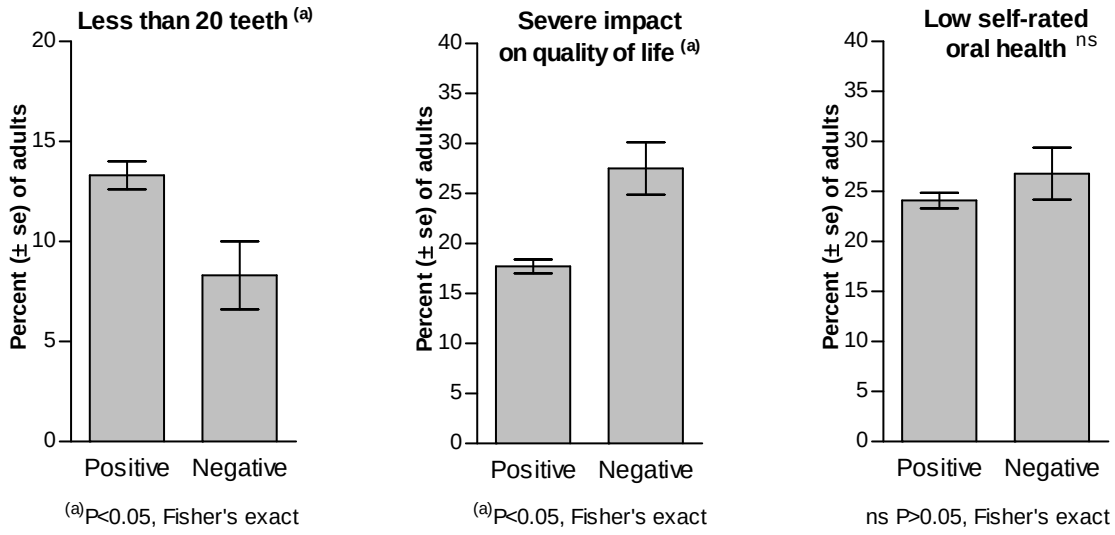
Table 31: Per cent (se) of people whose caregiver's style was negative and unsupportive

	Per cent	(se)		Per cent	(se)
Sex[(a)]			**Household income[ns]**		
Male	8.2	(0.7)	Up to $20,000	9.4	(1.3)
Female	11.1	(0.8)	$20,000–$50,000	9.3	(0.9)
			>$50,000	10.8	(0.9)
Age group[(a)]					
25–34 years	6.9	(0.9)	**Educational attainment[ns]**		
35–44 years	13.0	(1.2)	Secondary or less	9.5	(1.0)
45–54 years	13.1	(1.4)	Vocational or other	9.7	(0.9)
55–64 years	9.0	(1.5)	Tertiary	9.9	(0.9)
65+ years	4.4	(1.0)			
Reimbursement mechanisms[ns]					
No PDI, has Card	11.1	(1.6)			
No PDI, no Card	10.2	(0.8)			
Has PDI, has Card	8.0	(2.6)			
Has PDI, no Card	8.9	(0.9)			
Total	**9.6**	**(0.5)**			

(a) P<0.05 (Chi-square test and Fisher's exact test); ns p>0.05.
Source: National Dental Telephone Interview Survey 1999 and accompanying questionnaire.

Parental rearing style and oral health

A negative and unsupportive style of parenting in childhood was associated with lower prevalence of less than 20 teeth. The direction of this relationship was the opposite of the a priori assumption. Prevalence of less than 20 teeth was 5 percentage points higher among adults whose rearing had been in a positive style (13.3%) compared with adults whose rearing had been negative (8.3%). An absolute difference of 9.8 percentage points was observed in prevalence of severe impact on quality of life between those with negative rearing (27.5%) and positive rearing (17.7%). Differences in self-rated oral health did not reach statistical significance. Since differences in rearing style were not related to socioeconomic circumstance, and any causal effect must operate via other mechanisms.



Source: National Dental Telephone Interview Survey 1999 and accompanying questionnaire.

Figure 35: Parental rearing style and oral health in adulthood

9 Drawing themes together

This report goes beyond describing social inequality in the distribution of population oral health by suggesting how this inequality is socially determined. It does so by drawing on social science theory and scientific evidence to illustrate key associations. There is an inherent tendency in these explanatory studies to explore a diverse and scattered set of factors. New risk factors are emerging constantly, each with modest effects. The quality of evidence for these factors varies and the causal relationships among them are poorly established. Conceptually it is not clear what some of these factors are markers of or even whether they represent 'new' factors or merely new terms. This study limits exploration to a parsimonious set of social factors classified as childhood, behavioural, contextual and psychosocial determinants of health that are supported by a sound empirical foundation and form a plausible sequence along a causal chain.

Even within this restricted field, a large number of tables and figures are presented throughout this report in a set of bivariate associations – most of them unadjusted for other explanatory factors such as age. It should be noted that the process of categorising continuous measures is often arbitrary and crude. For simplicity, associations are discussed in terms of risk factors, such as low social position, poor oral hygiene, infrequent and non-preventive use of dental services, low levels of personal control, inaccessible social support, high psychosocial stress and job insecurity; however, it is useful to recognise that the inverse configuration of each of these factors is protective of oral health.

Without some integrating conceptual framework this maze of information is difficult to assemble into a simple and coherent story, but (Table 32) helps to make this link. This table highlights the relationship between childhood circumstances and current psychosocial profile. If psychosocial factors are indeed mediators in the causal chain between social position and health inequalities, it is useful to demonstrate links between socioeconomic position and other conditions in childhood (well before manifestations of oral disease in adulthood), and subsequent psychosocial profile and oral health status in adulthood.

In a matrix of 24 cells, (Table 32) shows associations between four childhood conditions and adult psychosocial profile indexed by personal control, four dimensions of social support and psychological stress. Significant associations in the anticipated direction were found for 16 of these. Emotional support was significantly associated with all four conditions of childhood.

In summary, father's occupation was associated with levels of personal control and psychosocial stress and the availability of emotional support. It was not associated with other forms of social support. Mother's occupation was associated with personal control and the availability of emotional, appraisal and instrumental social support. Parental cohabitation status was associated with emotional, instrumental and informational forms of social support and psychological stress. Finally, a negative and unsupportive style of parenting was associated with low levels of personal control; inadequate access to emotional, appraisal, instrumental and informational forms of social support; and high levels of psychosocial stress. Indeed, a perception of negative rearing was significantly associated with poorer outcomes on each psychosocial characteristic except personal control, where differences were not statistically significant.

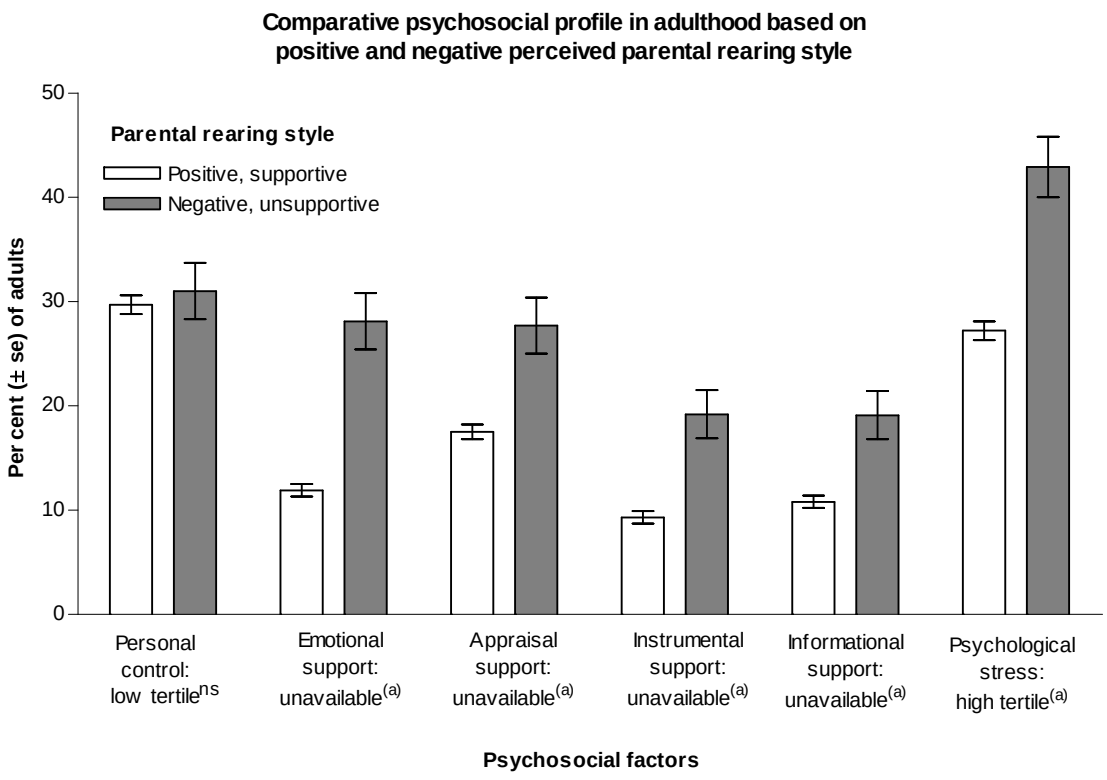
Table 32: Associations between childhood circumstances and adulthood psychosocial profile

	Personal control: low tertile		Emotional support: unavailable		Appraisal support: unavailable		Instrumental support: unavailable		Informational support: unavailable		Psychological stress: high tertile	
Paternal occupational group												
Upper white collar	33.1	(1.6) [a]	10.9	(1.0) [a]	16.7	(1.2) [ns]	10.1	(1.0) [ns]	11.4	(1.1) [ns]	24.4	(1.4) [a]
Other	28.2	(1.0)	15.1	(0.8)	19.3	(0.9)	10.6	(0.7)	11.7	(0.7)	30.4	(1.0)
Maternal occupational group												
Upper white collar	44.1	(2.9) [a]	9.3	(1.7) [a]	13.5	(2.0) [a]	4.8	(1.3) [a]	11.8	(1.9) [ns]	28.5	(2.7) [ns]
Other	28.0	(0.9)	14.1	(0.7)	19.3	(0.8)	11.2	(0.6)	11.8	(0.6)	28.9	(0.9)
Parental cohabitation status												
Together	30.0	(0.9) [ns]	13.3	(0.6) [a]	18.7	(0.7) [ns]	10.0	(0.6) [a]	11.2	(0.6) [a]	28.2	(0.9) [a]
Not together	24.5	(2.9)	18.3	(2.6)	17.5	(2.6)	17.5	(2.6)	20.1	(2.7)	33.6	(3.2)
Parental rearing style												
Positive and supportive	29.7	(0.9) [ns]	11.9	(0.6) [a]	17.5	(0.7) [a]	9.3	(0.6) [a]	10.8	(0.6) [a]	27.2	(0.9) [a]
Negative and unsupportive	31.0	(2.7)	28.1	(2.7)	27.7	(2.7)	19.2	(2.3)	19.1	(2.3)	42.9	(2.9)
Total	**29.9**	**(0.8)**	**13.5**	**(0.6)**	**18.5**	**(0.7)**	**10.2**	**(0.6)**	**11.6**	**(0.6)**	**28.7**	**(0.8)**

(a) P<0.05 (Chi-square test and Fisher's exact test); ns P>0.05

Source: National Dental Telephone Interview Survey 1999 and accompanying questionnaire

For illustrative purposes the associations of parental rearing style and psychosocial characteristics presented in (Table 32) are depicted graphically in (Figure 36).



(a) P<0.05, (Chi-square test); ns P>0.05.

Source: National Dental Telephone Interview Survey 1999 and accompanying questionnaire.

Figure 36: Parental rearing style and adulthood psychosocial profile

Relative differences in the accessibility of both emotional and instrumental support were greater than twofold between adults who had been reared in a positive way and those whose rearing had been negative and unsupportive. An absolute difference of 15.7 percentage points was found in the accessibility of emotional support and psychological stress in the high tertile range of scores.

Given the strength and consistency of these associations with parental rearing style, it is interesting that there is an apparent lack of association with personal control beliefs. Theoretically, supportive parenting should foster confidence, with positive effects on mastery and control. However it should be noted that since less than 10% of study participants described their parents rearing as negative, this factor in the population has a relatively small effect.

Further links are made by illustrating associations between childhood circumstances and behavioural factors in adulthood (Table 33). Only very tentative links are drawn here because the risk behaviours of infrequent tooth brushing, absence of interdental cleaning, consumption of NMES and being a current smoker were evaluated in the 2002 survey and not in the 1999 survey. Furthermore, childhood circumstances were evaluated in 1999 and not in 2002. Nevertheless, periodicity between dental visits and usual reason for a visit were evaluated in both 1999 and 2002. Both of those behavioural factors measured in adulthood were found to be strongly associated with oral morbidity (Figure 18) and here (Table 33) they show strong associations with childhood circumstances. Adults whose father was not employed in an upper white collar occupational group were significantly more likely to utilise dental services less frequently. The effect of childhood circumstances was most pronounced on the basis of parental cohabitation status, where 27.2% of adults whose parents lived together attended less often than biennially on average compared with 41.0% of adults whose parents did not live together. Adults raised in an unsupportive style were more likely to be utilise dental services infrequently (36.1%) compared with those raised supportively (27.4%).

Table 33: Associations between childhood circumstances and adulthood behavioural profile

	Attends less often than biennially on average		Usually visits with a problem rather than for a check-up	
	Per cent	(se)	Per cent	(se)
Father's occupational group				
Upper white collar	25.1	(1.5) [(a)]	42.1	(1.6) [(a)]
Other	29.9	(1.0)	49.6	(1.1)
Mother's occupational group				
Upper white collar	26.6	(2.6) [ns]	37.2	(2.9) [(a)]
Other	28.7	(0.9)	48.6	(1.0)
Parental cohabitation status				
Together	27.2	(0.9) [(a)]	46.6	(0.9) [(a)]
Separately	41.0	(3.4)	58.9	(3.3)
Parental rearing style				
Positive and supportive	27.4	(0.9) [(a)]	46.3	(1.0) [(a)]
Negative and unsupportive	36.1	(2.9)	54.2	(2.9)
Total	**28.3**	**(0.8)**	**47.1**	**(0.9)**

(a) P<0.05 (Chi-square test and Fisher's exact test); ns p>0.05.
Source: National Dental Telephone Interview Survey 1999 and accompanying questionnaire.

Adults were significantly more likely to seek dental care when they had a problem than for a check-up if their father or mother had been in an occupational group other than upper white collar. Prevalence of problem-oriented visiting was elevated by 12.3 percentage points among those whose parents did not live together (58.9%) compared with those who parents cohabited (46.6%). Finally, adults whose parenting had been positive and supportive were less likely to use dental services for a problem (46.3%) than those whose parenting had been negative and unsupportive (54.2%).

This report draws quite heavily on adults' retrospective recall of childhood circumstances. A potential limitation is recall bias. For the 8% of adults aged 70 years or older, retrospective reporting about circumstances at the age of 10 years necessitated

recall from 60 or more years earlier. The validity of retrospectively reported information has been explored. Krieger and colleagues (1998) found that childhood socioeconomic position and paternal education were accurately recalled in adulthood and that recall was not affected by adulthood socioeconomic position, ethnicity or age. In testing a temporal referencing system to assist the retrospective collection of personal details, Berney and Blane (1997) found that recall bias on information recorded 50 years previously was minimised if the material was not detailed. For example, occupational and residential information was accurately recalled but childhood illness was less accurately recalled. There is no doubt that prospective study designs are preferable for collecting life course information, but the cost of collecting information, the loss to follow-up of study participants and the sheer paucity of information in areas of current interest means that information provided from cross-sectional surveys has great value.

10 Discussion and conclusion

An unequal distribution of oral health status in the Australian population is the product of a constellation of adverse social circumstances beginning with unfavourable conditions during childhood and compounded by an inequitable distribution of public services such as dental care. Scarce material and social resources, inadequate constraints against risk behaviour, fewer opportunities to influence or participate in society, a lack of control over working conditions, and cognitive and emotional responses to these circumstances are additional layers of disadvantage that cluster within individuals and probably accumulate over time.

The picture that emerged from this study was one of compounding forms of disadvantage. Groups who were most disadvantaged in terms of social and material resources were the same groups most vulnerable to psychosocial risk factors. Hence, disadvantage was not arbitrarily distributed throughout the population but instead was concentrated among specific vulnerable groups. The burden of low economic resource was intensified by the additional burdens of social and psychological deficits, and these coincided with structural barriers to dental care services.

Stark inequality was found in the distribution of oral health in the adult Australian population. Oral morbidity was disproportionately experienced by groups with poorer access to material resources and marked differences were apparent by midlife. By 55–64 years of age, adults on lowest household income had 11 missing teeth while their same aged counterparts in the highest income category had 6 missing teeth—an absolute difference of 5 teeth. Relative differences in the social impact of oral conditions across income groups approached fourfold. The consequences of problems with teeth, mouth or dentures and the impact on quality of life reached a level described as 'severe' for 27.9% of low income adults. Similar severity was experience by 7.5% of adults with household income in the highest category. There was little evidence to support a notion that financially disadvantaged adults accept lower levels of health status as satisfactory. When asked how they rated their oral health, 35.0% of participants with low income rated their oral health as being average, poor or very poor compared with 15.2% of adults in the highest income group.

Yet the distribution of oral health was not threshold in shape. Threshold refers to a point beyond which a determinant of health has very little additional effect. Rather oral health tended to follow a continuous graded distribution along the socioeconomic hierarchy. This was particularly clear in the distribution of the social impact of oral conditions along the income distribution. Prevalence of severe impacts increased by around 10 percentage points between the lowest income category and the next highest, then increased by a further 10 percentage points across the next two highest income categories. What this gradient tells us is that the impact of material and social determinants of health is not confined to the most disadvantaged segments of the population, but affects all population groups. The relevance of this to public policy is that packages of support, such as public dental care, should not be confined to people who are most needy in society. Rather, programs should be seamlessly woven into the social fabric of society, benefiting all groups to a greater or lesser extent across the entire scale of living standards to minimise opportunities for inequity before they are expressed in multiple forms of disadvantage including poor health. Policy should

address the unequal social structure of society rather than focus on the poor, who are the greatest victims of the unequal structure.

The conceptual framework depicted dental behaviour as a proximal influence on oral health that was in turn determined by factors further upstream. The underlying determinants of health behaviour are factors such as the psychosocial consequences of inequality in the social, economic, living and working environments. The explanatory links in the conceptual framework were supported by the research findings and represent a step forward in understanding the determinants and pathways that link social circumstances to adult oral health in the Australian population. Understanding how disadvantage in its various forms becomes manifest in unequal health outcomes through a psycho-physiological pathway, and/or indirectly by lowering the individual's capacity to resist health damaging behaviour, is a topic that needs further investigation.

Greater clarity is needed about the role and responsibility of the health care system in general and the dental care system in particular. To what extent should the health care system either promote the social and living environments of the population or confine itself to the provision of curative medicine? As Blaxter (1983) asked, does health care have a role in the 'defence' against the consequences of poverty? To answer this question we need to know what the good is that we want health care to provide for society. Should health care play a role in treating inequality or be limited to the health effects of inequality?

One challenge for clinicians, researchers and policy makers alike is to understand the mechanisms that produce income differentials in oral health. One mechanism that can be demonstrated simply is the effect of reimbursement mechanisms for dental care. Ironically, differences in the delivery systems and reimbursement mechanisms for dental care not only penalise those who are least able to pay, but also generously subsidises those most able to pay and in least need through the federal government's subsidy of health insurance (Harford & Spencer 2004). Although adults using public-funded dental care contribute by cost sharing, their co-payment is not subsidised by private dental insurance for those with cover. Yet through their taxation they contribute to the federal government rebate to purchases of private dental insurance. Adults with lowest income have the poorest oral health and the greatest need for dental care, yet are least likely to hold private dental insurance. Less than one in four adults with low household income had private dental insurance cover compared with three in four adults with high income. These low income adults were compensated with eligibility to public sector dental care but this did not translate into equal utilisation. This is certainly an area that can be addressed through health policy.

Public sector dental care, a safety net for disadvantaged adults, fails to supply opportunities for access to dental care at levels concomitant with the private sector. There is evidence that inequity favouring the insured in the supply of dental services in the Australian adult population is not accounted for by difference in need or cost. Inequities in access remain even after statistically placing everyone on an equal footing in terms of need and cost burden (Sanders 2006). A negative relationship exists between the need for dental care and its supply, aggravated by fixed non-subsidised cost sharing for public dental care and its rationing imposed by the waiting list.

A second challenge is to identify the appropriate entry points for intervention. A logical point is to target risk behaviours in individuals. Evidence that risk behaviours produce

dental disease is compelling. Smoking and periodontitis is a case in point. From a public health point of view this knowledge is of limited value when viewed alone. To separate the behaviour from its social context is to ignore the role of social forces in determining health behaviour. We need to look behind the smoking behaviour to identify the social determinants of smoking and understand how these factors exert a powerful influence on social patterns in smoking. Why is prevalence of smoking greater among disadvantaged groups? Only then can we address the root causes and disrupt the interlocking facets of structurally determined effects of disadvantage. While changing individual behaviour is the goal, the means to achieve it is best addressed at the environmental level—such as restricting smoking in public places.

The idea that risk behaviour may account for the socioeconomic gradient in health status seems plausible. Compared with more affluent adults, those of lower social position lack sufficient material or educational resources to respond promptly to health promotion initiatives. Smoking may relieve the immediate stress of deprivation or may substitute for reward among people working in occupations with low levels of skill, prestige and pay. Similarly, disadvantaged groups may be less likely to invest in future oral health through diligence in oral hygiene and preventive use of dental services because their coping resources may be directed towards more urgent survival needs. Hence, the incentive to forego risk behaviours in exchange for some future health gain may be less appealing for adults in disadvantaged circumstances. Yet despite finding positive associations between risk behaviour and oral morbidity, Sanders and colleagues (2006) did not find that dental attendance and dental self care significantly attenuated the socioeconomic gradient in oral morbidity. While interventions that target risk behaviours only may improve oral health at the population level, they are less likely to reduce the magnitude of inequalities in health status.

A study of the psychosocial consequences of exposure to social environments yields useful information on causal pathways to host susceptibility. It helps to explain how social and material resources, or a lack of them, 'get under the skin'. On the one hand this answers biological questions at the individual level. On the other hand the study of psychosocial factors directs the focus appropriately on the effects of society and social groups. Inequalities in health reflect the policies that determine the organisation of society, our workplaces and even aspects of our family lives. One of the most noxious exposures is argued to be the effect of living in an unequal society. This has been well illustrated in New York City, where impoverished groups in Harlem live virtually side-by-side with the wealthy and influential. Here mortality among African-American males was shown to be 50% higher than that of the U.S. on average, where inequality was less pronounced. In fact survival analysis indicated that these males were less likely to live to 65 years of age than men in Bangladesh, where poverty was more extreme but inequality was less (McCord & Freeman 1990).

Efforts to reduce oral health inequalities are best managed by directing interventions at all levels, from upstream factors in public policy areas, through to working and living environments and also behaviours among individuals. Turrell and colleagues (2006) argued that while changes made at the societal level are likely to be the most effective in reducing inequalities in health, they are limited from being difficult to instigate and the most politically challenging. However, given that social inequalities in health are symptomatic of the inequalities embedded in major economic and social institutions; serious consideration should be given to tackling the root causes of inequalities created by policies.

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Appendixes

Appendix A: Interview Schedule 2002 NDTIS

This appendix provides the questions and response categories used in the 2002 National Dental Telephone Interview Survey. Unless otherwise specified responses were '*Yes*', '*No*' and '*Don't know*'. Response categories used are indicated by italicised text. This appendix does not include: the skip sequences used, in-built range and error checking, the numerical coding of responses, additional onscreen notes for interviewers, and lead-in statements to questions or question blocks.

1. Do you have any of your own natural teeth?
2. Have you been without natural teeth for more than one year?
3. How many years would that be?

    Literal response

4. Currently do you think that you need to have:

    Any filling(s)?
    Any extraction(s)?
    Scaling and cleaning of your teeth?
    Denture(s) made or repaired?
    A dental check-up?
    Gum treatment?
    Dental crown or bridge?
    Any other treatment?

5. How soon do you think you need a dental visit?

    In less than 1 week
    From 1 week to less than 1 month
    From 1 month to less than 3 months
    From 3 months to less than 6 months
    Six months or more
    Don't know

6. How long ago did you see a dental professional about your teeth, dentures or gums?

    Less than 12 months
    1 to less than 2 years
    2 to less than 5 years
    5 to less than 10 years
    10 years or more
    Never attended
    Don't know

7. How long ago was that in months?

    Less than 3 months
    3 to less than 6 months
    6 to less than 12 months
    Don't know

8. How many dental visits did you make in the last 2 weeks?

    Literal response

9. How many dental visits did you make in the last 12 months?

    Literal response

10. Did you last see the dental professional because you had a dental problem?

11. Was that dental visit for a check-up?

12. Was that dental visit necessary for the relief of pain?

13. How many dental visits in the last 12 months were for a check-up?

Literal response

14. How many times did you have a scale and clean during the last 12 months?

Literal response

15. How many fillings did you have during the last 12 months?

Literal response

16. How many teeth were extracted during the last 12 months?

Literal response

17. What were the problems with that tooth or teeth?

Wisdom teeth
Decayed
Cracked or fractured
The filling had broken down
Abscessed or infected
Loose
Orthodontic extractions
Don't know

(All offered reasons are recorded)

18. Were any of the following the reasons for having the tooth / teeth extracted?

The cost of keeping the tooth or teeth?
The extensive time required for treatment?
Failure of previous treatment?
Feeling that the tooth would be extracted sooner or later?
Wanted to stop the pain?
No alternative treatment offered?
Any other reason? → What was that reason? *(Literal response)*

19. In the last 12 months, did you have:

Any dental X-rays?
Crowns or bridges?
Endodontic (root canal) treatment?
Denture work / New dentures prepared or fitted?
Any other treatment?

20. What was that treatment?

Professional fluoride application
Other oral surgery (besides tooth extraction)
Gum treatment (periodontal treatment)
Adjustment, reline or rebase of denture(s)
Orthodontics
Cosmetic dentistry (bleaching / laser whitening)
Other treatment
(All offered reasons are recorded)

21. Have you had the extracted tooth / teeth replaced by a denture, bridge or implant?

    Yes—denture
    Yes—bridge
    Yes—implant
    No—not replaced
    Don't know

22. Was your last dental visit made at a:

    Private dental practice (including specialist)
    Government dental clinic (including dental hospital)
    School dental service
    Dental technician
    Clinic operated by health insurance fund
    Armed Services / Defence Force clinic
    Other site
    Don’t know

23. Do you currently have a Pensioners Concession Card, a Health Care Card or a Department of Veterans Affairs Card; or do you receive a pension or allowance from the Government?

24. Which Health Card(s) are you covered by?

    Pensioner Concession Card
    Health Care Card
    Commonwealth Seniors Health Card
    Department of Veterans Affairs treatment gold card
    Department of Veterans Affairs treatment white card
    Other card
    Don’t know
    (All offered reasons are recorded)

25. Did the Government or an insurance fund pay any part of the expenses for your last dental visit?

    Paid all own expenses
    Insurance paid some - patient paid some
    Insurance paid all - patient paid none
    Government paid some - patient (or insurance) paid some
    Government paid all - patient paid none
    Other payment arrangement
    Don’t know

26. Can you tell me what type of pension, allowance or benefit you are receiving?

    Aged pension
    Sole parent
    Invalid pension
    War / Defence Widow's pension
    Carer pension
    Other pension
    Don’t know
    (All offered reasons are recorded)

27. Can you tell me what type of [pension], allowance or benefit you are receiving?

    Youth Allowance (Unemployed)
    Newstart Allowance
    Sickness Allowance
    Widow Allowance
    Parenting Payment (Partnered)
    Other pension / allowance
    Don't know
    (All offered reasons are recorded)

28. How long have you had your [card type]?

    Less than 6 months
    6 to less than 12 months
    1 to less than 2 years
    2 to less than 5 years
    5 to less than 10 years
    10 years or more
    Don't know

29. Were you covered by your government concession card at the time of that [last] visit? [To a private dental practice]

    Not eligible at time
    Eligible at time
    Don't know

30. Did you last go to a private practice because you prefer to see a private dentist?

31. Was it because:

    The treatment wasn't available at the public clinic?
    You had to wait too long at the public clinic?
    You didn't know you were eligible for public care?
    There was no public clinic to attend?
    It was difficult to get to the public clinic?

32. Why do you prefer to see a private dentist?

    The quality of care
    Don't have to wait
    Treatment not available at the public clinic
    No public clinic to attend
    Continuity of care
    Other
    Don't know / refusal
    (All offered reasons are recorded)

33. Were all of your visits made at a *{last site}* during the last 12 months?

34. Are you currently on a waiting list for public dental care?

35. How long have you been on a waiting list for public dental care?

    Literal response in months

36. For your last dental visit, were you on a waiting list before you were given an appointment [at the government dental clinic]?

37. How long did you have to wait before being given an appointment?

    Literal response in months and weeks

38. For your last dental visit, how long did you have to wait between the time you made an appointment and the time of visiting the dental professional?

    Literal response in weeks and days

39. Is there a public dental service in your local area?

40. There are 16 teeth, including wisdom teeth, in the upper jaw.

    Could you tell me EITHER:

    the number of MISSING teeth in your upper jaw, OR
    the number of REMAINING teeth in your upper jaw?
    Literal response

41. There are also 16 teeth, including wisdom teeth, in the lower jaw.

    Could you tell me EITHER:

    the number of MISSING teeth in your lower jaw, OR
    the number of REMAINING teeth in your lower jaw?
    Literal response

42. Do you have a denture or false teeth for your upper jaw?

43. Do you have a denture or false teeth for your lower jaw?

44. Which is your usual reason for visiting a dental professional, for check-ups or when you have a dental problem?

    Check-ups
    Dental problem
    Don't know

45. Would your dental visits usually be (necessary) for the relief of pain?

46. How often on average would you seek care from a dental professional?

    Two or more times a year
    Once a year
    Once in 2 years
    Less often than that
    Don't know

47. Average number of years between visits?

    Literal response

48. When do you expect to make your next dental visit?

    Less than 6 months
    6 to less than 12 months
    1 to less than 2 years
    2 to less than 5 years
    5 to less than 10 years
    10 years or more
    Pain / problem
    Don't know

49. During the last 12 months how often have you had toothache? Was it:

    Very often
    Often
    Sometimes
    Hardly ever
    Never during the last 12 months
    Don't know

50. How often have you felt uncomfortable about the appearance of your teeth, mouth or dentures during the last 12 months?

    Very often
    Often
    Sometimes
    Hardly ever
    Never during the last 12 months
    Don't know

51. How often have you had to avoid eating some foods because of problems with your teeth, mouth or dentures during the last 12 months?

    Very often
    Often
    Sometimes
    Hardly ever
    Never during the last 12 months
    Don't know

52. How often have you felt that life in general was less satisfying because of problems with your teeth, mouth or dentures during the last 12 months?

    Very often
    Often
    Sometimes
    Hardly ever
    Never during the last 12 months
    Don't know

53. During the last 12 months did your NATURAL teeth or gums cause you any pain or discomfort?

54. During the last 12 months has the pain or discomfort of dental problems caused you to limit any of your usual activities?

55. How many days during the last 12 months have you had to limit your usual activities because of the pain or discomfort of dental problems?

    Literal response

56. How often have you had trouble sleeping because of problems with your teeth, mouth or dentures during the last 12 months?

    Very often
    Often
    Sometimes
    Hardly ever
    Never during the last 12 months
    Don't know

57. During the last 12 months have you had:

    A broken or chipped NATURAL tooth?
    Gums that hurt or bleed?
    Sores on the tongue or the inside of the mouth?
    A bad taste in the mouth or bad breath?

58. During the last 12 months have you avoided or delayed visiting a dental professional because of the cost?

59. Has the cost prevented you from having any dental treatment that was recommended during the last 12 months?

60. What was that treatment?

Filling(s)
Replace amalgams
Extraction(s)
Crown or bridge
Endodontic (root canal) treatment
Gum treatment (periodontal treatment)
New dentures
Orthodontics
Cosmetic dentistry (bleaching / laser whitening)
Other treatment
(All offered reasons are recorded)

61. Did you take up an alternative lower-cost option for the treatment that was recommended?

62. During the last 12 months has the waiting list at government dental services prevented you from having any dental treatment which you wanted?

63. In the last 12 months how much of a financial burden have dental visits been for you?

Would you say:

None
Hardly any
A little
A large burden
Don't know

64. At most times of the year how much difficulty would you have paying a $100 dental bill? Would you say:

None
Hardly any
A little
A lot of difficulty
Don't know

65. Do you have private insurance cover for dental expenses?

66. At any time in the last 5 years, did you have private insurance cover for dental expenses?

67. Can you tell me the main reasons for dropping your dental insurance cover?

The cost / too expensive
Benefits too small
Rebate too small
Couldn't afford it any longer
Not using it
Circumstances changed / no longer need
Previously covered by parents' insurance
Any other reason? → What was that reason? (Literal response)
(All offered reasons are recorded)

68. How long ago was that dental insurance cover taken up?

10 or more years ago
5 to 10 years ago
1998
1999 to 2001
Since 2001
Don't know

69. Is the insurance cover single or family cover?

    Single
    Family
    Don’t know

70. Do you have an appointment set for a check-up in the next 18 months?

71. Do you expect to receive an appointment or reminder notice for a visit within the next 18 months?

72. Is there a dentist you usually go to for dental care?

73. How long have you gone to that dentist for dental care?

    12 months or less
    1 to less than 2 years
    2 to less than 5 years
    5 to less than 10 years
    10 years or more
    Don’t know

74. How would you rate your own GENERAL health? Would you say that it is:

    Excellent
    Very good
    Good
    Average
    Poor
    Very poor
    Don’t know

75. And how would you rate your DENTAL health? Would you say that it is:

    Excellent
    Very good
    Good
    Average
    Poor
    Very poor
    Don’t know

76. Are you afraid of going to the dentist? Would you say:

    Not at all
    A little
    Yes, quite
    Yes, very
    Don't know

77. You are:

    Male
    Female
    Refusal

78. Could you tell me your age please?

    Literal response

79. Are you of Aboriginal or Torres Strait Islander origin?

    Yes, Aboriginal
    Yes, Torres Strait Islander
    Yes, Torres Strait Islander & Aboriginal
    No
    Don't know / Refusal

80. In which country were you born?

Australia
England
New Zealand
Italy
Vietnam
Scotland
Greece
Germany
Philippines
Netherlands
Don't know / Refusal
OR Literal response

81. Were either of your parents born overseas?

Yes, mother only
Yes, father only
Yes, both
No, both Australian-born
Don't know / Refusal

82. Do you speak a language other than English at home?

83. What language do you mainly speak at home?

English
Italian
Greek
Chinese (Cantonese)
Chinese (Mandarin)
Arabic / Lebanese
Vietnamese
German
Tagalog (Filipino)
Don't know / Refusal
OR Literal response

84. What was your first language? {First language learned / spoken as child}

English
Italian
Greek
Chinese (Cantonese)
Chinese (Mandarin)
Arabic / Lebanese
Vietnamese
German
Tagalog (Filipino)
Don't know / Refusal
OR Literal response

85. Do you attend school or any other educational institution either full-time or part-time?

Full-time
Part-time
Not at school / TAFE / Uni
Don't know

86. What kind of educational institution do you attend?

Secondary school
TAFE
University or other higher education institution
Other
Don't know

87. What is the highest Year level of schooling you have completed?

Primary school [Year 7 or less]
Year 8
Year 9
Year 10
Year 11
Year 12
Don't know / Refusal

88. Have you completed a trade certificate or any other educational qualification since leaving school?

89. What is the highest qualification / level of education you have completed since leaving school?

University degree or diploma
University masters degree or PhD
CAE or Teacher's College or Nursing
Trade Certificate / apprenticeship / vocational, e.g. TAFE, hairdressing
Certificate or diploma course, e.g. TAFE 1–2 year course
Other
Don't know / Refusal

90. How would you describe your current employment status?

Full-time
Part-time
Not employed
Don't know / Refusal
Are you currently:
Retired
Home duties
Unemployed and looking for work
Student
Not employed, and not looking for work
Don't know / Refusal

91. What is your usual / current occupation?

Literal response

What are your tasks?

Literal response

92. Could you please indicate the category of your total household income?

Per year	Per fortnight	Per week
Up to $12,000	Up to $460	Up to $230
From 12 to $20,000	$461 to $770	$231 to $385
From 20 to $30,000	$771 to $1154	$386 to $577
From 30 to $40,000	$1155 to $1538	$578 to $769
From 40 to $50,000	$1539 to $1923	$770 to $961
From 50 to $60,000	$1924 to $2307	$962 to $1153
From 60 to $70,000	$2308 to $2692	$1154 to $1346
From 70 to $80,000	$2693 to $3077	$1347 to $1538
More than $80,000	More than $3077	More than $1538
Don't know		
Refusal		

93. How many people aged 5 years or more live in the household?

Literal response

94. Can you please tell me the postcode where you live [or suburb]?

Literal response

95. Is this dwelling:?

Rented accommodation
Currently being purchased
Owned outright
Rent-free accommodation
Other
Don't know / Refusal

Appendix B: Questionnaire linked to 1999 NDTIS

This appendix provides the questions and response categories used in the self-complete questionnaire mailed to adult interviewees in the 1999 National Dental Telephone Interview Survey. Response categories used are indicated by italicised text. This appendix does not include instructions to respondents, the skip sequences used, diagrams, or complex formatting.

Dental Satisfaction Survey

Response options: strongly disagree, disagree, neither disagree nor agree, agree, strongly agree

1. The distance to the dental clinic made it difficult to attend my last visit.
2. Travel to the dental clinic I visited was convenient for me.
3. I found it difficult to arrange with the dental clinic a date and time for my dental visit.
4. I was able to make the dental visit as promptly as I felt was necessary.
5. The dental clinic waiting room was attractive.
6. I was not kept waiting long when I was at the dental clinic.
7. The dental surgery had everything needed to provide my dental care.
8. The dental surgery was modern.
9. The dental clinic staff were friendly to me.
10. The dental professional I saw was impersonal or indifferent towards me.
11. I saw the dental professional I wanted to see.
12. I saw the same dental professional each time I visited.
13. The dental professional I saw explained well what treatment was needed.
14. The dental professional explained whether there were any patient costs and how much before beginning.
15. The dental professional I saw could have been more thorough in examining me.
16. The dental professional I saw answered my questions.
17. I would like to have had more explanation of my dental treatment options.
18. The dental professional I visited avoided expensive treatment options.
19. I was satisfied with the dental care I received.
20. I received more dental care than I was convinced I needed.
21. There were other dental problems I had that were not treated.
22. The dental care I received was more painful than I had expected.
23. The dental professional explained what was being done during the treatment.
24. The dental care I received fixed my dental problems.
25. The dental care I received did not improve my dental health.
26. It took longer than I expected before my dental problems showed improvement.
27. My dental care cost me more than I could reasonably afford.
28. I am confident that I received good dental care at my last visit.
29. There are things about the dental care I received that could have been better.
30. My dental professional gave me good advice about how to look after my teeth and gums.
31. I feel protected financially against possible dental expenses.

(Modified) Dental Neglect Scale

Response options: strongly disagree, disagree, neither disagree nor agree, agree, strongly agree

1. It is good practice to have regular dental checks-ups.
2. I avoid seeking dental care even when I think I have a dental problem.
3. I generally make dental appointments for check-ups even when I believe there is no problem.
4. I brush my teeth at least once every day.
5. I succeed in any effort I make to have good dental health.
6. I carefully follow any instructions my dental professional gives me about home-care.
7. When I have a dental problem, it is not a high priority.
8. If I had toothache, I would deal with it myself for at least a week.
9. I floss my teeth every day.
10. I control snacking between meals.

Self-reported number of natural teeth that are present, missing, filled and decayed

Response options: literal

1. How many natural teeth do you have in each jaw? (minimum 0 and maximum 16 teeth)
2. How many teeth are missing for each of the following reasons?
   Never erupted, i.e. never came through into the mouth
   Extracted because of crowding, e.g. premolars and impacted wisdom teeth
   Extracted because of decay, pain or other dental disease
   Lost through injury
3. How many teeth with one or more fillings can you count in each jaw? (minimum 0 and maximum 16 teeth) 'Fillings' includes crowns, silver fillings and white fillings.
4. How many teeth with untreated (unfilled) decay do you think you have in each jaw?

Oral Health Impact Profile (short form)

Response options: very often, fairly often, occasionally, hardly ever, never

HOW OFTEN during the last year …

1. … have you had trouble pronouncing any words because of problems with your teeth, mouth or dentures?
2. … have you felt that your sense of taste has worsened because of problems with your teeth, mouth or dentures?
3. … have you had painful aching in your mouth?
4. … have you found it uncomfortable to eat any foods because of problems with your teeth, mouth or dentures?
5. … have you been self-conscious because of problems with your teeth, mouth or dentures?
6. … have you felt tense because of problems with your teeth, mouth or dentures?

7. . … has your diet been unsatisfactory because of problems with your teeth, mouth or dentures?
8. … have you had to interrupt meals because of problems with your teeth, mouth or dentures?
9. … have you found it difficult to relax because of problems with your teeth, mouth or dentures?
10. … have you been a bit embarrassed because of problems with your teeth, mouth or dentures?
11. … have you been a bit irritable with other people because of problems with your teeth, mouth or dentures?
12. … have you had difficulty doing your usual jobs because of problems with your teeth, mouth or dentures?
13. … have you felt that life in general was less satisfying because of problems with your teeth, mouth or dentures?
14. … have you been totally unable to function because of problems with your teeth, mouth or dentures?

Mastery and Constraints Scale

Response options: strongly disagree, disagree, neither disagree nor agree, agree, strongly agree

1. I can do just about anything I really set my mind to.
2. Other people determine most of what I can and cannot do.
3. When I really want to do something I usually find a way to succeed at it.
4. Whether or not I am able to get what I want is in my own hands.
5. There is little I can do to change many of the important things in my life.
6. I often feel helpless in dealing with the problems of life.
7. There are many things that interfere with what I want to do.
8. I have little control over the things that happen to me.
9. There is really no way I can solve all the problems I have.
10. I sometimes feel I am being pushed around in my life.
11. What happens to me in the future mostly depends on me.
12. What happens in my life is often beyond my control.

Perceived Health Competence Scale

Response options: strongly disagree, disagree, neither disagree nor agree, agree, strongly agree

1. I take responsibility in caring for my health.
2. No matter how hard I try my health doesn't turn out the way I would like.
3. It is difficult for me to find effective solutions to the health problems that come my way.
4. I succeed in the projects I undertake to improve my health.
5. I'm generally able to achieve my goals with respect to my health.

6. I find my efforts to change things I don't like about my health don't work.
7. Generally, my plans for my health don't work out well.
8. I am able to do things for my health as well as most other people.

Social support items

Response options: strongly disagree, disagree, neither disagree nor agree, agree, strongly agree

There are PEOPLE IN MY LIFE who …

1. … pay attention to my feelings and problems.
2. … express appreciation of my work.
3. … I can get help from with certain activities if needed.
4. … I can get advice from on how to handle things if needed.

Social ties, affiliations and networks

Response options: Indication of any active membership

1. Sporting club
2. Social group
3. Religious group
4. Community service club
5. Hobby club
6. Support group
7. Parent group
8. Charitable organisation
9. Professional association
10. Fund-raising group
11. Cultural association
12. Other (please specify)

Perceived Stress Scale

Response options: not at all, rarely, sometime, fairly often, very often

HOW OFTEN during the PAST YEAR have you felt? …

1. … upset because of something that happened unexpectedly?
2. … unable to control the important things in your life?
3. … either nervous or stressed?
4. … that you dealt successfully with irritating life hassles?
5. … that you effectively coped with important changes in your life?
6. … confident about your ability to handle your personal problems?
7. … things were going your way?

8. … unable to cope with all the things that you had to do?
9. … able to control irritations in your life?
10. … you were on top of things?
11. … angered because of things that happened outside of your control?
12. … yourself thinking about things that you have to accomplish?
13. … able to control the way you spend your time?
14. … difficulties were piling up so high that you could not overcome them?

Satisfaction with Life Scale

Response options: strongly disagree, disagree, neither disagree nor agree, agree, strongly agree

1. In most ways my life is close to my ideal.
2. The conditions of my life are excellent.
3. I am satisfied with my life.
4. So far I have acquired the important things I want in life.
5. If I could live my life over, I would change almost nothing.

Childhood circumstances

Name the town/suburb, state and postcode for the area in which you lived at the age of 10 years.

Literal response

When you were aged 10 did your parents live together or separately?

Together
Separately
Unsure

How would you describe the parenting style of the person chiefly responsible for rearing you?

Generally positive and supportive
Generally negative and unsupportive
Other (please specify)……

When you were aged 10 years, what was the occupation category of your father (or male carer living in your household)?

Manager or administrator
Professional
Paraprofessional
Clerk
Tradesperson
Salesperson or personal service worker
Plant or machine operator, or driver
Labourer
Domestic duties
Unemployed
Other (please specify)

When you were aged 10 years, what was the occupation category of your mother (or female carer living in your household)?

Manager or administrator
Professional
Paraprofessional
Clerk
Tradesperson
Salesperson or personal service worker
Plant or machine operator, or driver
Labourer
Domestic duties
Unemployed
Other (please specify)

Conditions of work and workplace environment

Please state your usual occupation. Write description, e.g. 'accounts clerk'.

Please write a brief description of your usual type of work. Examples are 'in charge of invoicing', 'supervisor in large firm', 'self-employed'.

How many hours per week do you spend on work related to your paid employment?

Less than 10 hours
Between 10 and 20 hours
Between 20 and 30 hours
Between 30 and 40 hours
More than 40 hours

Do you expect that your job will be secure for the next 5 years? (Indicate one)

Yes
Probably
Unlikely
No

Do you expect that your present job skills will be obsolete within 10 years? (Indicate one)

Yes
Probably
Unlikely
No

Job autonomy, decision latitude

Response options: rarely or not at all, sometimes, often

1. Are you able to influence the planning of your work?
2. Are you able to influence the pace at which you are required to work?
3. Are you able to influence how your time is used in your work?
4. Are you able to plan when you take work breaks?
5. Are you able to plan when you take your holidays?
6. Are you able to work flexible working hours?
7. Are you free to receive a phone call during working hours?
8. Are you free to receive a private visitor at work?
9. Does your work have varied skill levels?
10. Does your work have varied work procedures?
11. Are there possibilities for on-going education as part of your work?

Job strain and job social support

Response options: Yes, no

1. Does your job require you to work at a hard, fast pace?
2. Is your job psychologically demanding?
3. Are you able to talk to co-workers during your work?
4. Are you able to leave your job to talk with co-workers?
5. Are you able to interact with co-workers as part of your work?
6. Do you meet with co-workers outside of the work place?
7. Have you met with a co-worker within the last 6 months outside of the work place?

Work and home interference

Response options: strongly disagree, disagree, neither disagree nor agree, agree, strongly agree

1. After work I am too tired for leisure activities, family time or household chores.
2. I have so much work to do that it takes away from my personal interests.
3. My family / friends dislike how often I am preoccupied with work while I am at home.
4. Work takes up time that I'd like to spend with family or friends.
5. I'm often too tired at work because of the things I have to do at home.
6. My personal demands are so great that they interfere with my work.
7. My superiors and peers dislike how often I am preoccupied with my personal life while at work.
8. My personal life takes up time that I'd like to spend at work.

Appendix C: Questionnaire linked to 2002 NDTIS

Oral Health Impact Profile (short form)

Response options: very often, fairly often, occasionally, hardly ever, never

HOW OFTEN during the last year …

1. … have you had trouble pronouncing any words because of problems with your teeth, mouth or dentures?
2. … have you felt that your sense of taste has worsened because of problems with your teeth, mouth or dentures?
3. … have you had painful aching in your mouth?
4. … have you found it uncomfortable to eat any foods because of problems with your teeth, mouth or dentures?
5. … have you been self-conscious because of problems with your teeth, mouth or dentures?
6. … have you felt tense because of problems with your teeth, mouth or dentures?
7. . … has your diet been unsatisfactory because of problems with your teeth, mouth or dentures?
8. … have you had to interrupt meals because of problems with your teeth, mouth or dentures?
9. … have you found it difficult to relax because of problems with your teeth, mouth or dentures?
10. … have you been a bit embarrassed because of problems with your teeth, mouth or dentures?
11. … have you been a bit irritable with other people because of problems with your teeth, mouth or dentures?
12. … have you had difficulty doing your usual jobs because of problems with your teeth, mouth or dentures?
13. … have you felt that life in general was less satisfying because of problems with your teeth, mouth or dentures?
14. … have you been totally unable to function because of problems with your teeth, mouth or dentures?

Dental behaviour

1. In the last week, how many times did you brush your teeth?
   Literal response
2. In the last week, how many times did you use an electric toothbrush?
   Literal response
3. In the last week, how many times did you use a mouth rinse or mouth wash?
   Literal response
4. In the last week, how many times did you chew-sugar free gum for at least 10 minutes continuously?
   Literal response
5. In the last week, how many times did you clean between your teeth (using dental floss, tape, or interdental brush / pick / stick)?
   Literal response

6. In the last week, how long did you usually spend on each occasion brushing your teeth?
   Less than 1 minute
   About 1 minute
   About 1½ minutes
   About 2 minutes
   About 2½ minutes
   About 3 minutes
   More than 3 minutes

7. How would you describe the pressure applied in brushing your teeth and gums in the last week?
   Very gentle
   Gentle
   Firm
   Firm to vigorous
   Vigorous
   Very vigorous

8. In the last week, how closely did you follow any recent advice from a dental professional?
   No advice offered recently
   Did not follow advice
   Not very closely
   Fairly closely
   Very closely

9. How many, if any, of the following problem(s) did you manage yourself in the last week using a product obtained without prescription (e.g. any ointment, tablet, herbal remedy, gel, or drops).
   None
   Cold sore
   Toothache
   Stained teeth
   Oral thrush
   Denture soreness
   Mouth ulcer
   Other (please specify)

10. Please circle ONE or MORE item(s) you used in the past week to clean between your teeth.
   No item used
   Dental floss
   Dental tape
   Interdental brush
   Interdental pick or stick
   Other item……..

11. In the last YEAR, did you wear a mouthguard for playing contact sport?
   Did not play contact sport
   Always wore one
   Sometimes wore one
   No, but I have one
   No, I do not have one

Standard serves consumed daily and number consumed in the last hour before bed

Literal responses to all questions

1. Fruit and natural unsweetened fruit juice
   1 medium piece or 2 small pieces or 1 medium glass
   Sweetened fruit drinks/juices
   1 medium glass
2. Sweetened (non-diet) soft drinks, mineral waters, cordials and sport drinks
   1 medium glass
3. Artificially sweetened (diet/low kilojoule) soft drinks, mineral waters and cordials
   1 medium glass
4. Plain milk
   1 medium glass
5. Flavoured milk (Milo, chocolate milk, Nesquik etc.)
   1 medium glass
6. Sweetened dairy products
   1 cup yoghurt or 2 scoops ice-cream or ½ cup custard
7. Breakfast cereal – please specify main type: 1. _____ 2. _____
   1 cup
8. Biscuits, cakes, puddings
   2 biscuits or 1 slice cake or 1 cup-cake
9. Table sugar (in tea, coffee, Milo, on cereal etc.)
   1 teaspoon
10. Chocolate- and sugar-based confectionery
    1 bar chocolate or 4–5 lollies
11. Syrups, jams and sweet spreads (honey, jam, Nutella, maple syrup etc.)
    1 tablespoon
12. Muesli bars and health bars
    1 bar

Importance of health messages

Response options: Not important at all, not very important, neutral, quite important, extremely important

HOW IMPORTANT IS IT TO YOU …

1. to eat 5 serves of fruit or vegetable every day?
2. to not exceed the recommended daily alcohol limit? (4 standard drinks for men and 2 standard drinks for women.)
3. to undertake a total of at least 30 minutes of moderate physical activity every day?
4. to brush your teeth using fluoridated toothpaste at least once every day?
5. to drink the equivalent of 6 to 8 glasses of plain water every day?
6. to protect your skin from sun exposure every day?
7. to live and work in places every day that are tobacco smoke-free?

1. How tall are you without shoes?
2. How much do you weigh without clothes and shoes?

3. Which of the following best describes your smoking status?
   I smoke daily
   I smoke occasionally
   I don't smoke now but I used to
   I've tried it a few times but never smoked regularly
   I've never smoked

4. How often do you usually drink alcohol?
   I don't drink alcohol
   Less than once a week
   On 1 or 2 days a week
   On 3 or 4 days a week
   On 5 or 6 days a week
   Every day

5. On a day when you drink alcohol, how many standard drinks do you usually have?
6. How many hours of sleep do you usually get daily?
7. Do you feel rested and refreshed 1 hour after waking?
   Always
   Mostly
   Sometimes
   Rarely
   Never

Leisure time physical activity

1. In the last week, how many times have you walked continuously for at least 10 minutes, for recreation, exercise or to get to or from places?
   Literal response
2. What do you estimate was the total time that you spent walking in this way in the last week?
   Literal response
3. In the last week how many times did you do any vigorous gardening or heavy work around the yard which made you breathe harder or puff and pant?
   Literal response
4. What do you estimate was the total time that you spent doing vigorous gardening or heavy work around the yard in the last week?
   Literal response
5. In the last week how many times did you do any vigorous physical activity which made you breathe harder or puff and pant? (e.g. jogging, cycling, aerobics, competitive tennis etc.)
   Literal response
6. What do you estimate was the total time that you spent doing this vigorous physical activity in the last week?
   Literal response
7. The next question excludes household chores or gardening or yard work.
   Literal response

8. In the last week how many times did you do any other more moderate physical activity that you haven't already mentioned? (e.g. gentle swimming, social tennis, golf etc.)
   Literal response
9. What do you estimate was the total time that you spent doing moderate physical activity in the last week?
   Literal response

Costing time lost to dental problems

1. Other than reasons for dental visits, have you been away from work because of problems with your teeth, mouth or dentures during the last 12 months?
   No – did not work in last 12 months
   No – did not have any time off work for dental problems (but may have made a dental visit)
   Yes – had time off work for dental problems (other than for dental visits)

2. Other than reasons for dental visits, approximately how much time have you had to limit your usual activities because of problems with your teeth, mouth or dentures during the last 12 months?
   Literal response

3. Did you make a dental visit in the last 12 months?
   Yes, no

4. Approximately how much time did you spend travelling to or from a dental clinic during the last 12 months?
   Literal response

5. Approximately how much time did you spend at a dental clinic during the last 12 months?
   Literal response

6. What was the approximate total cost of your dental treatment in the last 12 months?
   Literal response

7. What was the approximate out-of-pocket cost that you (or a family member or friend) had to pay for your dental treatment in the last 12 months?
   Literal response

8. Did any of the following pay or subsidise any or all of your treatment costs?
   Not applicable, all treatment costs paid out-of-pocket
   Health insurance fund
   Government
   Other (specify) _____

9. What was the total cost you had to pay for travel to get to and from the dental clinic?
   Literal response

10. Did you have to pay any other costs specifically to enable you to visit the dental professional during the last 12 months? For example, paid for child care that was arranged specifically because of a visit to a dental professional.
    No other costs
    Had to pay for _____ $_____
    Had to pay for _____ $_____
    Had to pay for _____ $_____

11. Did you work during the previous 12 months?
    Yes, no

12. Which one option that best describes your dental visits during the last 12 months?
    I specifically took paid leave to attend my dental visits
    I had to take unpaid leave to attend my dental visits
    I made up time taken during working hours in my own time
    I made dental visits during working hours but did not take leave
    I made dental visits outside of my usual work hours

13. Approximately how much time did you take as leave specifically to attend dental visits during the last 12 months?
    __ __ days
    OR __ __ hours as unpaid leave__ __ days
    OR __ __ hours as recreation leave__ __ days
    OR __ __ hours as sick leave__ __ days
    OR __ __ hours as other paid leave

14. Approximately how much pay do you estimate that you lost in order to attend dental visits during the last 12 months?
    Literal response

List of tables

List of figures