

ADOLESCENT STUDENT BLOOD PRESSURE CHANGE
UPON TRANSITION FROM
SECONDARY TO TERTIARY EDUCATION

Robert Boyd, M.Env.Com.H., BHMS, Dip.P.E.

Lecturer
School of Human Movement Studies
Faculty of Health
Queensland University of Technology

Janet Chaseling, B.App.Sc.

Division of Environmental Science
Griffith University
Nathan, Qld.

A paper presented at
SCIENCE, HEALTH AND ENVIRONMENTAL EDUCATION RESEARCH
A symposium in the
AUSTRALIAN ASSOCIATION FOR RESEARCH IN EDUCATION
of
NEW ZEALAND ASSOCIATION FOR RESEARCH IN EDUCATION
CONFERENCE 1992
Educational Research: Discipline and Diversity
Deakin University - Geelong, Victoria
November 22-26 1992

INTRODUCTION

As for any valuable resource, a teacher's premature death or retirement for ill health reasons, and/or long periods off work because of illness, represent a poor return on the economic outlay provided by the community for his/her training. Yet, the possibility exists that one or a number of contributing factors to the cause of death or debilitating illness may be lifestyle behaviours that were initiated due to situations encountered during the training period in the training environment.

The majority of trainee teachers commence tertiary education at a time when they are attempting to master one of life's major transitions - adolescence. Also, first year tertiary education can be stressful. For the transitioning adolescent student, the unique stresses perceived from the tertiary academic environment in conjunction with those from family, financial, relationship and personal sources may have immediate impact on the mental and physical dimensions of his/her health. Further, during this time there exists the potential for the initiation of lifestyle behaviours, as coping strategies and/or as means of achieving mastery of developmental tasks, that will cause long term health status decrement.

An extensive study, carried out on two campuses of a Brisbane tertiary institution investigated the changes that occurred to a number of health status indicators in a volunteer group of transitioning adolescent tertiary students during the first term of their teacher training. This paper deals specifically with the blood pressure changes that occurred and generally with selected associated variables.

LIFESTYLE RISK FACTORS

Lifestyle is widely accepted as being one of the four factors which contribute to the health status of an individual, the other three being heredity, the environment and health care.

The idea that lifestyle influences health has been recognized for a long time. For example, Hetzel and McMichael (1987:11) relate in their publication, "The LS Factor":-
that (p.11):-

"Hygeia, the Greek goddess of health represented the view that 'health is the natural order of things and a positive attribute to which men are entitled if they govern their lives wisely'."

General recognition of the importance of lifestyle behaviours to health status went largely ignored until the 1950's. At this time in the western world the 'old' major causes of death such as diphtheria, rheumatic fever and tuberculosis were being replaced by chronic non-infectious diseases such as cancer, coronary heart disease and stroke (Better Health Commission [BHC], 1986). These non-infectious diseases have been termed the 'preventable' or 'lifestyle' diseases as they are largely due to behavioural factors (Farquhar, 1988). The widely accepted risk factors of these "lifestyle" diseases include raised blood pressure, raised blood lipid levels, cigarette smoking, overweight, stress and physical inactivity (National Heart Foundation [NHF], 1983; Farquhar, 1988; Better Health Commission [BHC], 1986; Hetzel and McMichael, 1987; Borushek and Borushek, 1981). Other less well accepted behavioural health risk factors include alcohol abuse, drink driving (Hetzel and McMichael, 1987; Health Targets and Implementation Committee [HTIC], 1988) and inadequate sleep (Egger, 1986).

THE TRANSITIONING ADOLESCENT TERTIARY STUDENT (TATS)

Clifton (1987) provides a general profile of the transitioning adolescent tertiary student (TATS) by claiming that he/she is typically:-

- . 18 years old and probably still living at home,
- . being at least partially supported financially by parents,
- . often doubtful of own competence to care for self,

- . uncertain of career goals and doubtful about the fact of even wanting a career,
- . uncertain about wanting another 3-4 years more study, and
- . anxious about leaving school friendship behind.

Transition, or the passage from one place, state or stage to another, is a part of life. Each transition carries with it the possibility of new options and opportunities but also the possibility of new sources of danger and distress (Adams and Spencer, 1988).

Adolescents on entering a tertiary institution will be at various stages of achievement of the necessary developmental tasks of adolescence, and as such, will still be in the process of mastering one of life's major transitions. At the same time, a TATs may either choose and/or be forced to undergo one or more additional associated transition situations. For example, transition from the family to independence, from the high school peer support group to a new peer support group, from total family financial support to total or partial financial self support in the part time work force. These transition situations are discussed briefly below.

Educational Transition

Transition into tertiary education from secondary education can be stressful. Power et al. (1987) relate that the results of a survey they carried out in South Australian tertiary institutions showed the three main problems of first year students to be (i) allocating time between study and other commitments; (ii) the ability to cope with the heavy workload, and (iii) the ability to achieve the required standard of work.

McMichael (1974) in referring to studies he carried out in an Australian University between 1969 and 1971, indicates that 38% of first year students reported some form of emotional disturbance within the first two terms of first year. He reported a correlation of this emotional disturbance with social stress, and in particular with the problems the

students had in adjusting to university life compared with secondary school life.

Eisenberg and Eisenberg (1979) concurred with the findings of McMichael when they reported that students found college work more difficult and extensive than they expected.

Other examples of educational transition stress for these students include pressure from new peer groups, enormous pressure to achieve despite diminishing job opportunities, and dealing successfully with rapid technological changes.

Support Groups Transition

While it is reported in the literature that family conflict is on the increase in Australia (Eckersley, 1989) and that there is an association between poor family relationships and a number of adolescent problems some of which are health related (Le Croy, 1988), it is also recognised that social support is critical to a student in a transitional state (O'Neil and Mingie, 1988). Poor support may make a student vulnerable to mental and physical problems during a period of transition (Compas et al, 1986). A student who is forced to leave the family home in order to attend a tertiary institution - and if this means moving to a distant city, to leave the peer support group as well - is further removed from such support. There is evidence to show that stable family situations and strong family support for the student at the time of tertiary education entry is important to the student's future health (Eisenberg and Eisenberg, 1979; Lopez et al, 1989; Kenny, 1990). However, up to 7.0% of Australian students have to leave their family residence in order to attend a tertiary institution (Young, 1987). This increases the student's vulnerability to stress, anxiety and perhaps depression (Rickarby, 1985).

Financial Situation Transition

Numerous authors such as Payne and Hahn (1989), Villanova and Bownas (1984), Bush et al. (1985), Greenberg et al. (1987) and O'Neil and Mingie (1988) have shown financial problems to be a substantial source of student stress and worry. Financial

problems have also been cited as reasons for students withdrawing from tertiary study (McShane, 1990).

Although many teacher trainee students receive financial support from the Government, mostly through the Austudy scheme, it seems that many students have to supplement their allowances in some way. Some receive allowance supplementation from their own or parents' assets or are not expected to pay rent while still living at home, but many supplement their Austudy allowances by engaging in part-time work. In fact, according to McShane (1990) who quotes Department of Employment, Education and Training (DEET) figures, which he says are hard to confirm, up to two thirds of tertiary students work part-time.

Part-time work places stress on the transitioning adolescent tertiary student in that such employment may interfere with the amount of sleep, physical activity, recreation and relaxation the student is getting, and/or decrease the time the student spends on study and/or tertiary institution attendance. Health problems associated with part-time work include changing sleep patterns, stress and a decrease in physical activity involvement.

ADOLESCENT STUDENT HEALTH

The transitioning adolescent tertiary student (TATS) commences tertiary study at a chronological age of between 17 years to 18 years plus, but at a developmental stage anywhere between the beginning of the middle to the end of late adolescence. The TATS may or may not have already experienced and/or still be experiencing a problematic, turbulent adolescent transition with exposure to the associated social, emotional and physical health problems (Peterson, 1982; Bennett, 1984; World Health Organization [WHO], 1986; Pinch et al, 1986; Wolfish, 1987; Le Croy, 1988; Bradon, 1989;

Friedman, 1989; Offer et al, 1989; Zylke, 1989; Eckersley, 1989).

Upon entry to tertiary studies the TATS is involved in at least one (secondary to tertiary study) and perhaps three more life transitions such as family detachment, change of peer support and change of financial support, on top of the existing one - adolescent development. The TATS involvement in any one, and simultaneously in a number of life transitions, provides situations that are potentially depressing and stressful.

The two main mental health problems affecting adolescents are reported to be anxiety disorder and depression (Bennett, 1984). The prevalence of anxiety disorder in Australian university students has been reported as 19% in the past (Jones, 1972) while clinically diagnosed depression syndrome prevalence in one Australian university population was reported to be 0.05% (Buckle, 1972). Accidents, poisonings and violence are the greatest cause of adolescent ill health (Australian Bureau of Statistics [ABS] 1988). Motor vehicle accidents and suicide are the two major causes of both death and injury in adolescents (ABS, 1988). Research has reported significant relationships between depression scores and thoughts of self-harm and suicide in USA students (McDermott et al, 1989).

The self-health care danger for the TATS during this period of multiple transition is the possible initiation of lifestyle behaviours such as smoking, alcohol and drug use and unsafe sexual practices as coping measures and/or as attempts to achieve independence and self identity. Apart from the danger of death or injury from alcohol and/or drug intoxicated accidents and violence, most of these lifestyle behaviours are not significant immediate threats to a student's health. This is because most of the major causes of death and disease in Australia such as heart attack, stroke, cardiovascular disease, cancer, diabetes and high blood pressure, occur in middle to old age, not in

adolescence.

Consequently, most students show little health concern for them.

Although often considered one of the healthiest periods of life, adolescence has specific potential health problems associated with it. The adolescent who is a transitioning tertiary student potentially faces a greater risk to his/her health status because of specific factors associated with the academic environment.

BLOOD PRESSURE

Blood pressure (BP) is the force exerted against the walls of the body's large arteries by the blood stream. The organs of the body require a flow of blood through them in order to perform their tasks. The muscular pump action of the heart provides the driving force to make the blood flow. As such, BP is a measure of the force the heart has to exert in order to push blood around the circulatory system.

Physiology of Blood Pressure

Blood Pressure is highest in the arteries during the contraction (systole) or pumping phase of the heart and is termed the systolic blood pressure. During the relaxation or filling phase of the heart, that is, between contractions of the heart muscle (diastole), the pressure in the arteries is at its lowest and is termed the diastolic blood pressure. The value given to each of the pressures is the height (in millimeters) of a column of mercury which would exert an equivalent pressure. A person's blood pressure is then expressed as systolic pressure over diastolic pressure in millimeters of mercury, for example 125/75 mmHg.

The pressure of the blood in the arteries - BP - at any time is calculated as the product of the volume of blood leaving the heart in a set time (cardiac output [CO]) and the amount of resistance the heart has to overcome in pumping the blood around the body (peripheral resistance [PR]). That is, $BP = CO \times PR$ (Green, 1973). Elevation of

either or both of the systolic or diastolic pressures above set standards is termed high blood pressure. If this elevation is persistent over the long term the condition is known as hypertension. Hypertension may be classified as one of two types, essential (cause not clearly known) or secondary (triggered by some specific cause).

High Blood Pressure

The causes of high blood pressure are not yet totally understood. Physiologically, increases in blood pressure may occur due to an increase in either the cardiac output of the heart or the peripheral resistance of the body.

The amount of peripheral resistance is influenced by the diameter of the arterioles (small arteries) in the body tissues. If these arterioles are constricted for any reason (e.g. muscle tension), and/or their walls are inelastic (e.g. arteriosclerosis) and/or blocked for any reason (e.g. atherosclerosis), then peripheral resistance is increased. To overcome this increased peripheral resistance the heart has to work harder to produce an increased force to continue to push the blood around the circulatory system.

High blood pressure appears to be related to factors such as age, heredity, diet, obesity, smoking, inactivity and perhaps anxiety and unresolved stress. However, what is not understood very well is the way in which an individual's characteristics and lifestyle affect his/her blood pressure. Discussed below are the blood pressure factors considered of most importance to this study, namely, obesity, inactivity, and stress and anxiety.

Obesity and Blood Pressure

It has been well established that there is a greater prevalence of hypertension in obese people. The increased vascular bed and increased blood volume associated with obesity provide greater resistance which means a greater workload for the heart. A decrease in body weight of around 1 kg has been shown to lower systolic blood pressure

by up to 3 mmHg. There is some controversy regarding these research findings, however, as restriction of dietary sodium, which also has been shown to lower blood pressure, was not controlled for in the investigations (Egger, 1986). Hagberg (1990) in relating the results of a 1986 review of eleven weight-reduction studies, says that as a result of an average 9.8 kg weight loss 15 mmHg and 10 mmHg reductions in systolic and diastolic blood pressures respectively.

Inactivity and Blood Pressure

Recent reviews of the literature (Blair et al, 1985; Phelps, 1987; Powell et al, 1987) regarding the health benefits of physical activity, exercise and fitness report that physical activity is positively associated to weight control, improved work performance, increased amounts of deep sleep, and inversely associated to smoking habits, and CHD incidence.

As well, the reviews report increasing strong evidence to support habitual physical activity being positively associated to improved stress management, increased self-esteem, decreased depression, decreased anxiety levels, decreased risk of hypertension, preventive health behaviour, improved sleep habits and patterns, improved intellectual function, improved family and friend relationships in the young, and slowed atherosclerosis progression in the coronary arteries. The frequency, intensity and time necessary for exercise to produce increased cardiorespiratory fitness is well documented (American College of Sports Medicine, 1986) and it has been proven that exercise meeting the prescribed criteria reduces the risk of thrombosis, reduces blood pressure, alters total cholesterol to HDL cholesterol and LDL to HDL ratios to lower atherosclerotic profiles and improves psychological well-being (Wood and Stefanick, 1990).

Hagberg (1990) presents a review of 25 studies in which the relationship between blood pressure reduction and endurance exercise was explored. In this review,

Hagberg cites

the Tecumesh study which was reported by Montoye et al. in 1972, in which significantly lower blood pressures were found in the leanest men with the highest levels of daily

energy expenditure, even after eliminating the effect of body fatness.

Hagberg concludes

in his review that the literature supports the notion that both systolic and diastolic blood

pressure in essential hypertension can be reduced by endurance exercise.

This is

supported by Paffenbarger and Hyde (1988) and Powell (1988) after their own relevant

literature reviews.

The reduction of blood pressure by aerobic exercise may be associated with the lower

resting heart rate which occurs with increasing aerobic fitness levels as a consequence of

the stronger heart muscle ejecting more blood per contraction (Egger, 1986). Another

mechanism by which aerobic exercise may reduce blood pressure is through the effect

that exercise has in raising High Density Lipoprotein (HDL) cholesterol levels in the

blood (Wood and Stefanick, 1990). HDL levels are reported to have an inverse

relationship with diastolic blood pressure (Egger, 1986).

Stress and Blood Pressure

In the 1930's, Dr. Hans Selye used the term 'General Adaptation Syndrome' (GAS) to

refer to the three phase response in animals to a variety of stressors. He later referred to

the non-specific reaction of the human body to any external demand as Stress (Singer, 1980).

The first, or alarm phase of the GAS, often called the 'fight or flight' response, prepares

the human body for survival from perceived threats. Among the many changes which

occur as part of the body's survival preparation are a number which increase blood

pressure, e.g. increased muscular tension and cardiac function. One of the numerous

immediate physical responses of a person feeling stressed is an increase in blood pressure

(Miller et al, 1985).

In early times, all the bodily changes produced by the 'fight or flight' response were immediately dissipated as our ancestors either 'fought or fled' the perceived threat. Modern society, however, does not allow a great number of opportunities for an immediate 'fight or flight' response action to be initiated by a stressed person. This type of action is generally not socially acceptable. An added complication is that modern threats are not always the easily discernable, immediate life threatening types that require a physically active response. The common human reaction to these modern non-specific perceived stressors is often a sense of persistent, prolonged anxiety. Hypertension is one of a number of major diseases with some origin in unresolved anxiety from non-specific stress (Miller et al, 1985; Hetzel & McMichael, 1987; WHO, 1986; Payne & Hahn, 1989). Stress reduction techniques, either relaxation or physical activity, can lead to a fall in blood pressure (Miller et al, 1985). Losses of up to 10 mmHg systolic have been reported in some studies. What is not understood is the exact mechanism of how this fall is accomplished (Egger, 1986).

EFFECTS OF HIGH BLOOD PRESSURE ON HEALTH

High blood pressure has long been recognised as a risk factor in cardiovascular disease. In general, the higher an individual's blood pressure, the greater the risk of cardiovascular diseases such as congestive heart failure, coronary heart disease (CHD), and stroke. High blood pressure may also cause invalidism due to direct effects on various tissues of the body. A brief summary only of some of the ill-effects as described by Borushek and Borushek (1981), Hetzel and McMichael (1987) and Payne and Hahn (1989) is included here.

Persistently high blood pressure imposes additional, unnecessary workload

on the heart.

This workload over time causes the heart to become weaker and enlarged.

The heart

muscle tires easily and the veins entering the heart become congested.

This manifests

itself as swollen, puffy legs and shortness of breath. Hagberg (1990)

states that men who

have blood pressures greater than 160/95 mmHg have a fourfold increase in their risk for

congestive heart failure, while a blood pressure between 140/90 mmHg and 160/95

mmHg increases the risk by two times.

High blood pressure accelerates atherosclerosis - the build up of plaque in the arteries -

and arteriosclerosis - hardening of the arteries. This increases the risk of heart attack by

a factor of three if blood pressure is greater than 160/95 mmHg and by two if it is

between 140/90 mmHg and 160/95 mmHg (Hagberg, 1990). Angina pains may result

due to the reduced blood flow caused by the subsequent narrowing and hardening of the coronary arteries.

A stroke may occur because of an interruption of blood supply to part of the brain as a

result of either the blood at high pressure rupturing an atherosclerosis weakened blood

vessel - cerebral haemorrhage - or a blockage in an artery due to atherosclerosis -

cerebral thrombosis. Hypertension may also cause damage to arteries in other parts of

the body which leads to problems such as kidney failure, eye damage and intermittent

claudication (lameness on walking).

ADOLESCENT BLOOD PRESSURE

Until relatively recently, hypertension was thought of mainly as a disease of middle to old

age, and not identified as a major health risk of the adolescent years.

Because of this, the

research carried out and the quantity of data available by comparison to adult data is

poor, especially Australian based data. It would seem that the fact that it has not been

proven that diagnosed adolescent high blood pressure continues into adulthood, has had a negative influence on research activity in this area.

As in an adult, the variation in blood pressures in the adolescent depends on a large number of factors both environmental and genetic. The report prepared by The Second Task Force on Blood Pressure Control in Children [TSTFBPCIC] (1987) reinforces that some of these factors, with relation to the adolescent, are still unknown. However, due to the increasing evidence that primary or essential hypertension is being diagnosed more and more in adolescents (Harris, 1987) there is increasing general acceptance of a number of relationships regarding adolescent blood pressure.

The report of the TSTFBPCIC (1987) does list some trends relating to the adolescent age group which they claim are fairly well established. These are as follows:-

- . Blood pressure increases with age during pre-adult years. This occurs in all populations but the rate and level of increase may be population specific;
- . Larger children - taller and/or heavier - in general, have higher blood pressure than smaller children of the same age; and,
- . Obese children in general have higher blood pressures than lean children of the same age.

Not all studies agree that the above trends hold true for all ages and both genders. For example, in a sample of 335 male and 271 female twelfth grade students in the USA city of Illinois during 1981-1985, Adeyanju et al, (1987) found significant relationships ($p =$

0.001) between Body Mass Index - a measure of body size - and the systolic and diastolic body pressures of females but not males ($p = 0.17$, systolic; $p = 0.04$, diastolic).

Normal blood pressure is defined in the TSTFBPCIC (1987) report as 'values below the 90th percentile for age and sex'. Values of the 90th percentile systolic

and diastolic blood pressures and the associated height and weight figures for 16, 17 and 18 year olds as listed by TSTFBPCIC (1987) in the report, are included in Table 1.

Table 1: Normal systolic and diastolic blood pressure values and related height and weight data for 16 - 18 year olds.

Source:- The Second Task Force on Blood Pressure Control in Children - A Report (1987).

MALE	FEMALE	Age	BP	Ht (cm)	Wt (kg)	BP	Ht (cm)	Wt (kg)
16	16	16	117/70	152	45	117/70	152	45
17	17	17	127/80	160	55	127/80	160	55
18	18	18	134/83	168	65	134/83	168	65

Definition of blood pressures higher than normal blood pressure are defined by TSTFBPCIC (1987:7) in the following general way:-

"High Normal BP*. Average systolic and/or average diastolic BP between the 90th and 95th percentiles for age and sex.

High BP (hypertension). Average systolic and/or diastolic BPs equal to or greater than 95th percentile for age and sex with measurements obtained on at least three occasions.

(* = If the BP reading is high normal for age but can be accounted for by excess height for age or by excess lean body mass for age, such children are considered to have normal BP)."

Figures given by TSTFBPCIC (1987:7) for hypertension in adolescents 16-18 yrs old

are:-

"Significant Hypertension (mmHg) (95th-99th percentile)

Systolic BP equal to or greater than 142

Diastolic BP equal to or greater than 92

Severe Hypertension (mmHg) (equal or above 99th percentile)

Systolic BP equal to or greater than 150

Diastolic BP equal to or greater than 98"

ADOLESCENT STUDENT BLOOD PRESSURE

It is extremely difficult to make definitive statements about Australian adolescent tertiary students' blood pressure, due to a lack of reliable information. It is possible that neither their mean blood pressures nor the prevalence of high blood pressures are greatly different to persons of similar age in the wider community, similar to the situation of USA tertiary students. It may be though, that Australian tertiary students are measurably different to USA tertiary students with regard to their blood pressure profile. Lack of information does not allow comparisons to be made.

Although not proven, adult hypertension may have its beginning in adolescence. In fact, the Second Task Force on Blood Pressure Control in Children (TSTFBPCIC, 1987) warn that there is increasing evidence to support the concept that adult hypertension has its roots in childhood. Certainly, the lifestyle habits associated with the causes of adult hypertension - obesity, inactivity, smoking, and inappropriate diet - are at a stage during late adolescence whereby a change to less healthy behaviours may initiate possible adult

habit imprinting and increased health risk. As well, the Australian adolescent tertiary student may be at risk of developing short term high blood pressure problems due to specific stress and anxiety associated with the academic environment.

Student Stress

Studies support the concept that tertiary students experience substantial stress during their tertiary studies (Pinch et al, 1986; Greenberg et al, 1987; Forney et al, 1990). In some studies up to 90% of students report some degree of stress from some sources, but this may not necessarily be at a very high intensity of stress level. Many studies found that students attribute a large proportion of the stress they experience to academic sources, particularly examinations, assignments and academic workload (Bush et al, 1985; Payne & Hahn, 1989). However, not all authors agree that academic stress is the most significant cause of stress in a student's life as there are a number of other factors and situations that students also cite as being significant sources of stress, for example, financial factors, personal factors, living conditions, career choices, and family and peer relationships (Payne & Hahn, 1989). These may be classified as being separate sources of student stress than from those from the academic arena, or as some authors point out, they are just part of the many sources of stress that any adolescent student confronts.

No matter which way it is viewed, the combination of all potential stress sources, academic or otherwise are still related to the adolescent student's ability to cope with the tertiary transition as well as his/her own on-going adolescent development. A number of authors allude to the transition from high school to tertiary education as being a particularly stressful time (Pinch et al, 1986; Payne and Hahn, 1989). One study found that students experience greater stress immediately upon entry to tertiary study than either at the end of term one or at the end of their secondary education (Compas et al, 1986).

In some studies more than 80% of students have been found to experience feelings of depression, anxiety and fear while up to 38% of first year tertiary students with high stress levels have been shown to suffer decreased mental health, nearly 20% to a moderate level or worse (McMichael and Hetzel, 1975). The evidence supporting the relationship between the types of physical illness normally associated with increased physical stress, and tertiary student academic stress, is not as consistent with at least one study reporting finding no such relationship (Lesko and Summerfield, 1987). This particular study names the amount of, not the stress from, examinations and assignments during a tertiary period as being the factor that was related to increased student physical

illness. The authors of this study do, however, note a significant positive relationship ($p < 0.05$) between mean assignment stress and mean student diastolic blood pressure during a ten week term. Also, diastolic blood pressure during examination week was found to be significantly correlated to overall stress ($p < 0.001$) and examination stress levels ($p < 0.01$).

A number of studies support the concept that female students report experiencing higher levels of stress than males even though both males and females generally nominate similar sources of stress with regard to both academic and personal factors. A number of authors cite substance abuse, irresponsible behaviour, institution withdrawal, poor academic record and suicide as possible coping behaviours and/or outcomes for tertiary students who report high stress levels (Greenberg et al, 1987; Forney et al, 1990). One Australian study did confirm significant ($p < 0.0005$) correlations between high stress scores and university study withdrawal, and high stress scores and poor examination results (McMichael & Hetzel, 1975).

The small number of studies available to be reviewed in relation to the

comparison of student and non-student stress, all point to a higher percentage of students reporting stress than that of non-students reporting stress from 'work' and 'financial' sources (Hetzel & McMichael, 1987; O'Neill & Mingie, 1988; National Institute of Occupational Health and Safety [NIOHS], 1987).

Student Sleep Problems

Decreased vigor, increased fatigue, irritability, aggression, confusion and poor concentration are well documented effects of 24-48 hours of total sleep deprivation, while detriment to psychomotor function and gross motor function occur respectively after one night and three nights of partial sleep deprivation (Mendelson et al, 1977).

Research suggests that the frequencies of student sleep disturbances (less than 50% 'occasionally'), are in general lower than those reported by samples of older community members (Andrews & Davis, 1988; Lack, 1986; Farnill & Robertson, 1990). This is as

expected given the observed increases in sleep disturbances with increasing age.

However, when compared to a group of workers of similar age (NIOHS, 1987), student frequencies of general sleep difficulties are substantially higher.

Insomnia is the most common sleep problem affecting students and the proportion of students classifying themselves as sufferers of insomnia (3.8% - 13.0%) is similar to the proportion of the community who classify themselves as such (Giesecke, 1987). Causes of student short term insomnia include academic deadlines, anticipation of major life changes, substance abuse, noisy/uncomfortable sleeping conditions and inability to recover from all night study and/or work (Giesecke, 1987).

One chronic insomnia sleep problem which may be of a greater specific problem in students than in the community, is the delayed sleep phase syndrome (DSPS). Adolescent

development factors predispose the adolescent to this sleep problem, while the addition of factors in the academic environment specifically, may make the young student more prone to this sleep problem (Lack, 1986). University students with sleep problems such as DSPS have been shown to have significantly higher levels of depression, stress and anxiety than students not experiencing sleep problems (Lack, 1986).

One in twelve students have sought medical help for sleep problems and one in eight have taken medication, prescribed or non-prescribed, on a regular basis to cure sleep problems (Andrews & Davis, 1988). Other substances used occasionally by small percentages of students to solve sleep problems include alcohol and non-drug substances (Lack, 1986).

Most Australian students sleep between 7-8 hours per night (Lack, 1986; Farnill and Robertson, 1990; Andrews and Davis, 1988). Studies also suggest that most students claim that they get less sleep than they feel they need. There is some evidence which suggests that female students get less sleep, yet report the need for more sleep, than male students (Lack, 1986; Farnill and Robertson, 1990). More tertiary students than not claim their sleep time was reduced upon entry to a tertiary institution (Farnill and Robertson, 1990). A significant relationship between sleep difficulties and decreased student academic performance has been shown in some studies (Lack, 1986).

Adolescent Inactivity

Adolescence is the period of life during which the majority of Australians are physically active, but even so, less than half of adolescents are active enough to gain some health benefits (Department of the Arts, Sport, the Environment, Tourism and Territories (DASETT, 1988). However, after adolescence progressively fewer people engage in any physical activity as well as progressively fewer people engage in activity frequently enough at an intensity enough to attain the associated health benefits (DASETT, 1988).

This fact, coupled with recent Australian survey results showing a progressive increase in the percentage of 24-64 year old people who have body compositions classified by the BMI method as a health risk (Castles, 1991), emphasises the importance of activity in an adolescent's lifestyle for his or her future health. Any event in an adolescent's life which directly or indirectly decreases his/her involvement in physical activity or is seen as a barrier to his/her initiation of any, or increased levels, of physical activity, should be seen as a major concern by health workers.

METHOD

As part of a more extensive study, the height, weight, percentage fat (sum of four sites - Champion, 1990), flexibility (sit and reach), blood pressure, cholesterol levels and maximal oxygen consumption (estimated by a sub-maximal bicycle ergometer test - Astrand and Rodahl, 1970) of 10 male and 54 female Diploma of Teaching (Primary) and 13 male and 8 female Diploma of Teaching (Secondary) Physical Education students were assessed during the period February 8-16, 1990. In conjunction with these assessments a series of questionnaires to ascertain socio-economic and demographic details, health attitudes, health knowledge and values, health care utilization, 'life event concerns' ratings (Howat et al, 1990) as well as information on lifestyle behaviours such as smoking, alcohol consumption, drink driving, physical activity, sleep, and nutrition were administered. Participant daily diaries encompassing many aspects of the questionnaires were kept. Reassessment of the physical health status indicators occurred between April 30 and May 11, 1990. Repeat questionnaires similar to the initial ones, but requesting additional information on level of satisfaction and perceptions of various aspects of personal and academic life, were administered during this reassessment period.

RESULTS

For the purposes of this paper, only changes in student blood pressure over the 12 week term will be presented here.

Male mean height was $178.8 + 4.9$ cm ($n=23$) and female mean height was $165.8 + 5.8$ cm ($n=62$).

Over the 12 week term there was a highly significant ($p < 0.001$) increase in female mean systolic blood pressure from $117.5 + 10.3$ mmHg ($n=60$) to $130.0 + 16.5$ mmHg ($n=52$). This is in contrast to a non-significant ($p > 0.05$) increase in male mean systolic blood pressure from $123.9 + 12.68$ mmHg ($n=23$) to $124.5 + 13.6$ mmHg ($n=18$). Overall, the increase from $119.3 + 11.3$ mmHg ($n=83$) to $128.6 + 15.9$ mmHg ($n=70$) in student mean systolic blood pressure was highly significant ($p < 0.001$).

Changes in mean diastolic blood pressures found over the 12 week term were female students, a significant ($p < 0.02$) increase from $66.5 + 9.8$ mmHg to $72.4 + 9.8$ mmHg; male students, a non-significant increase from $68.9 + 10.2$ mmHg to $71.6 + 7.1$ mmHg; and for all students a significant ($p < 0.01$) increase from $67.2 + 9.9$ mmHg to $72.2 + 9.1$ mmHg.

DISCUSSION

The literature search showed that initially, male participants were different to similar age subjects only in that they were marginally heavier, more cardiovascular fit with lower

smoking and drinking prevalence and consumption rates. Female participants were found to be different to similar age subjects reported in the literature in that they had marginally higher percentage fat and systolic blood pressure but marginally lower

cholesterol levels,
while fewer drank but did so at higher consumption rates. All other
variables measured
initially were approximately similar to values reported in the literature.

Some of the changes which occurred to the male participants during the
study period
altered the comparison to the literature profile. Comparisons at
reassessment showed that
male students less sleep than equivalent age subjects in the literature and
participants who
drank did so at a rate in excess of the literature. As well there was a
change in the
proportion of males who had 'at risk' diastolic blood pressures to be now
similar to the
literature and a change in the proportion of males who had 'at risk' BMI's
to be now
marginally lower than the literature. All other male comparisons to the
literature did not
alter during the term of the study.

The profile of female literature comparisons also changed during the study.
All remained
as they were except that at reassessment the cardiovascular fitness level
of students was
equal to the literature, systolic and diastolic blood pressure values were
now higher than
the literature, the amount smoked per week was equal to the literature and
sleep time per
week was slightly lower than the literature.

The initial mean systolic blood pressures for females was significantly ($p < 0.05$) lower
than that of the males (117.5 v 123.9 mmHg). This was in agreement with
the literature.

When systolic blood pressures measured in the present study were classified
in
accordance with the recommendations of TSTFBPCIC (1987) into categories of
high
normal (> 127 mmHg for females and > 134 mmHg for males), hypertense (equal
to or
greater than 142 mmHg or females and males) or significant hypertense
(equal to or
greater than 150 mmHg for females and males), in accordance with the
recommendations
of The Second Task Force on Blood Pressure Control in Children [TSTFBPCIC]
(1987),
initially 5% of females were classified as 'at risk' systolic
hypertensives. This percentage

is higher than those reported in the literature including the percentage reported in USA

University students (Hahn, Brooks & Hite, 1990). Initially 9% of males were classified as 'at risk' hypertensives, this being approximately mid-range of percentages reported in the literature and above the percentage reported in USA University students (Hahn, Brooks & Hite, 1990).

In agreement with the literature, the current study initial female mean diastolic blood pressure was lower than the male mean value (66.5 v 68.9 mmHg) but not significantly so ($p > 0.05$).

When diastolic blood pressures were classified into categories of normal or hypertense in accordance with the recommendations of TSTFBPCIC, initially 1.6% of females were classified as 'at risk' diastolic hypertensives. This percentage is equal to the highest percentage cited from the literature (NIOHS, 1987). Based on the TSTFBPCIC classification, 0.0% of males from the present study were classified initially as diastolic hypertense. This is lower than percentages cited from the literature.

The reassessment mean systolic blood pressures for females and males did not differ significantly ($p > 0.05$) - 130.0 v 124.5 mmHg respectively.

Comparison of the reassessment systolic blood pressure values to the literature suggests that at the end of their first term of tertiary education, females in the present study had higher systolic blood pressure than those of equivalent age and that male students of the current study had systolic blood pressure that was typical of those of equivalent age. More than eleven percent of females (11.7%) and males (11.2%) were classified as 'at risk' systolic hypertensives at reassessment. The female percentage is higher than the percentages of female hypertension cited from the literature, whereas the male percentage is approximately mid range of cited hypertensive percentages.

There was no significant difference ($p > 0.05$) between the mean diastolic

blood pressures of males or females at reassessment.

At reassessment, male students of the present study had diastolic blood pressures similar

to those of equivalent age reported in the literature and female students had diastolic blood pressures above the average pressures of equivalent age females in the literature.

Six percent (6%) of females and 5.6% of males were classified as 'at risk' diastolic hypertensives at reassessment. The female percentage is higher than percentages reported in the literature. The male percentage is higher than the prevalence of hypertension found in male USA university students (Hahn, Brooks & Hite, 1990) and Sydney government employees (NIOHS, 1987).

Due to the trend of increasing blood pressure values with increasing age, any situation that increases an adolescent's systolic blood pressure above normal for a lengthy period of time constitutes an increased long term health risk. However, to an adolescent who is an existing diagnosed hypertensive, even a short term significant increase in systolic blood pressure constitutes an immediate health risk. The systolic blood pressure results reported here indicate that for female students in this study, there was possibly a long term increased health risk which would only be verified by follow up assessments. However, even if the significant increase in female systolic blood pressure was a short term increase due to stress caused by impending end of term examinations and the workload associated with the completion of final assignments, the 4.9% of females initially classified as 'significantly hypertense' were potentially at a greater short term health risk. No such increased health risk occurred for the male students as a group.

In general, the direction of changes in diastolic blood pressure are similar to the direction of changes in systolic blood pressure. The diastolic blood pressure of

females and all students increased significantly ($p < 0.01$). Similar to the concern expressed above with regard to increased adolescent systolic blood pressure any increase in an adolescent's diastolic blood pressure constitutes an increased long term health risk. Over the term of the current study, a potential long term increased health risk due to significantly increased diastolic blood pressure occurred for the student group. However, the possibility of increased diastolic blood pressures only for a relatively short period of time due to end of term assignment and examination workload, as reported by Lesko and Summerfield (1989), cannot be ignored. Potential individual risk would only be verified by follow up

personal assessments. The one female student who was classified as 'significant diastolic hypertense' at initial assessment being the student with the greatest potential risk.

Results of relevant variables, measured in the larger study, associated with blood pressure changes are discussed briefly below.

Sleep

The amount that all students of the current study slept at the end of the term was significantly less than at the beginning of term (3.49 hours, $p < 0.01$).

Questionnaire responses showed that 46% of the participants perceived that their amount of sleep had decreased over the term. Also, greater than 62% of participants indicated that they were not satisfied with the amount of sleep that they were getting at reassessment. Participants who had indicated that they were not satisfied with the amount of sleep they were getting, were asked to nominate up to three reasons in order of descending importance as to why they were not satisfied. Over 70% of all those students nominated 'study' as their primary reason for amount of sleep dissatisfaction. 'Worry' was the second most nominated choice (18%) of the primary reasons for student dissatisfaction with amount of sleep. Note should be made that the seven

students making up this 18% were all females. 'Worry' was also the most nominated second (50%) and third (37.5%) choices of students for reason of dissatisfaction with amount of sleep.

Physical Activity

The change in weekly physical activity involvement from the beginning to the end of the 12 week term was ascertained by the difference in the mean rating of responses by participants to the same question contained in the initial and the re-assessment physical assessment sheets. This question requested participants to select one of three categories (0-3, 4-5 or daily) to show the frequency with which they engaged in physical activity that produced an elevated heart rate for 20-30 minutes per session. Overall, the students participating in the study reported a significant decrease in their physical activity involvement at the end of the term to that at the start of term (0.28, $p < 0.01$).

Questionnaire responses showed that 32% of the students perceived that the amount of physical activity that they were involved in in May of 1990 was less than it was in January of 1990.

Although during the 12 week term there was no significant ($p > 0.05$) changes to the male mean oxygen consumption values from 47.0 ± 11.0 ml/kg/min ($n=19$) to 46.5 ± 8.7 ml/kg/min ($n=18$) nor the female values from 37.9 ± 5.8 ($n=54$) to 39.9 ± 8.24 ($n=46$) indicating no significant changes in cardio-vascular fitness, given the relationship between decreased physical activity and risk of hypertension, in conjunction with the trend of decreasing physical activity involvement over the life cycle, the significant decrease in student physical activity involvement is of concern.

Weight and Percentage Fat Body Composition

Over the period of the study, male student mean weight changed from 72.6 ± 8.1 kg ($n=23$) to 72.4 ± 7.8 kg ($n=18$) and female student mean weight changed from

58.9 +
7.4 kg (n=62) to 59.1 + 7.5 kg (n=53). Neither change was statistically significant.
No significant ($p > 0.05$) differences were found between initial assessment and reassessment of male and female percentage fat body composition (14.8 + 5.5%, n=23 v's 14.9 + 4.1 %, n=17; and 26.7 + 5.2, n=60 v's 26.5 + 4.9%, n=52 respectively).
Changes to weight and body fat composition would appear not to have had any significant effect on student blood pressure changes over the term of the study.

Stress

Responses to questionnaires indicated that one third of the participants were less than satisfied with their levels of stress during the term and 50% of participants perceived that their levels of stress had increased over the term of the study. A greater percentage of female than male students (57% v 27%) reported a perceived change for the worse with regard to their stress levels over the term of the study. Another health related variable that many students indicated had become worse during the study was 'leisure and relaxation'.

When asked to nominate the level of satisfaction of their stress levels at reassessment, 33% of participants (37% of female and 20% of male) indicated that they were less than satisfied.

Given that unresolved perceived stress may cause hypertension and that first year tertiary students have been shown to suffer from anxiety and perceived stress due to their concern about many factors relating to their transition period, the relationship between participants 'level of concern for life events' score and blood pressure was investigated.

A significant positive relationship (0.275 , $p < 0.05$) was found between the reassessment 'concern for life events' score of all students and their reassessment diastolic blood

pressure. The changes in diastolic blood pressure of females and males both demonstrated significant positive relationships to the changes in their 'concern for life events' scores (0.535 and 0.327, $p < 0.05$). Highly significant positive relationships between the change of 'concern for life events' score and changes in the diastolic blood pressures of all students was found (0.410, $p < 0.001$).

The fact that the only significant relationships between scores of reported 'concern for life events' and blood pressure is between diastolic and not systolic blood pressure is perhaps related to the long term physiological changes that occur because of unresolved anxiety and stress.

CONCLUSIONS

In relation to the effect on the general health status of the student group with respect to changes in the various health indicators, the following comments may be made from the large study. There was no significant change during the study in health status with regard to weight, flexibility, cardiovascular fitness, BMI, percentage fat body composition and cholesterol levels. There was potential decrement to the health status of the student group in terms of a significant increase ($p < 0.001$) in systolic blood pressure, a significant

increase ($p < 0.01$) in diastolic blood pressure, a significant decrease ($p < 0.01$) in sleep time per week, and a significant decrease ($p < 0.05$) in physical activity frequency.

The health status of female students as compared to that of male students potentially decreased more so because of a highly significant increase ($p < 0.001$) in systolic blood pressure, a significant decrease ($p < 0.01$) in sleep time, a significant decrease ($p < 0.05$) in physical activity frequency, and for those who drank, a significant increase ($p < 0.01$) in alcohol consumption. These changes were in contrast to no

significant health indicator changes being recorded for the male student participants.

Other concerns about the health status of students at the completion of the study were the shortfall in estimated weekly income over an estimated weekly expenditure, the number of students who cited 'study' and 'worry' as the main reasons for a lack of sleep, the number of students who perceived that their levels of other health related variables such as nutrition, leisure and relaxation, and social life has become worse during their first term at a tertiary institution.

Although the larger study did not indicate that immediate life threatening changes to numerous health status indicators for transitioning adolescent tertiary students had occurred during term one at a tertiary institution, this specific health status factor study has shown that in a group of transitioning adolescent tertiary students there were significant unhealthy differences blood pressure values upon entry and at the end of their first term of study. It has also suggested that the elevated levels of blood pressure may be due to unresolved anxiety and stress perceived by the students as being related to their academic environment.

This highlights the need for a great deal more Australian research in the area of tertiary student health. In the terms of the need to know the 'big' picture, this study is but a small, insignificant drop in the bucket. However maybe it will motivate researchers to show more of an interest in the area. Long term studies are needed to ascertain whether lifestyle behaviours initiated or changed during tertiary attendance are due primarily to the academic environment and whether these behaviours persist into adulthood.

There is a need to establish and/or improve student health services in many Australian universities (especially on some campuses of the 'new' universities) and a need for the establishment of standardized health screening procedures in all student

health services.

There is also a need to encourage health service personnels to become involved in research leading to the publication of an increased volume of Australian student health data.

Perhaps this will, in time, not only allow educators of adolescent students to become more aware of the full impact that the education process has on student wellness, but also enable health professionals to conduct cost-benefit analyses of the tertiary education process.

REFERENCES

Adams, J.D. and Spencer, S.A. (1988). "People in Transition." Training and Development Journal, (Oct) 61-63.

Adeyanju, M., Cresswell, W.H., Stone, D. and Macrina, D. (1987). "A Three-Year Study of Obesity and Its Relationship to High Blood Pressure in Adolescents." Journal of School Health, 57 (3) 109-113.

American College of Sports Medicine (1986). Guidelines for Exercise Testing and Prescription (3rd Edition). Lea and Febiger, Phil.

Andrews, H.B. and Davis, N. (1988). "Sleeping Disorders Among West Australian Tertiary Students." Community Health Studies, 12 (2) 208-211.

Astrand, P.O. and Rodahl, K. (1970). Textbook of Work Physiology. McGraw-Hill, New York.

Australian Bureau of Statistics (1988). Causes of Death in Australia - 1987. A.G.P.S., Canberra.

Bennett, D.L. (1984). Adolescent Health in Australia: An Overview of Needs and Approaches to Care. Australian Medical Association, Glebe, New South Wales.

Better Health Commission (1986). Looking Forward to Better Health (Vol's 1, 2, 3),

A.G.P.S., Canberra.

Blair, S.N., Jacobs, D.R. and Powell, K.E. (1985). "Relationships Between Exercise or Physical Activity and Other Health Behaviours". Public Health Reports, 100(2) 172-180.

Borushek, A. and Borushek, J. (1981). The Complete Australian Heart Disease Prevention Manual. Family Health Publications, W.A.

Braden, W. (1989). "History and Definition of Adolescence" in Adolescent Health (eds.)

Brown, E. and Hendee, W. American Journal of Disease of Children, 143(4) 466-470.

Buckle, R.G. (1972). "University Students: Psychological Problems and Their Management". The Medical Journal of Australia, 1(455-459).

Bush, H.S., Thompson, M. and Van Tubergen, N. (1985). "Personal Assessment of Stress Factors for College Students." Journal of School Health, 55 (9) 370-375.

Castles, I. (1991). 1989-90 National Health Survey, Summary of Results, Australia, ABS No.4364.0, A.G.P.S., Australia.

Champion, N. (1990). "Fitness Testing" in The Fitness Leaders Handbook (3rd ed.) (Comp. by) Egger, G. and Champion, N., Kangaroo Press, Sydney, (120-137).

Clifton, L. (1987). "Difficulties Experienced in Transition to University." The Australian Counselling Psychologist, 3, 74-81.

Compas, B.E., Wagner, B.M., Slavin, L.A. and Vannatta, K. (1986). "A Prospective Study of Life Events, Social Support, and Psychological Symptomatology During the Transition from High School to College." American Journal of Community Psychology, 14(3) 241-257.

Department of the Arts, Sport, the Environment, Tourism and Territories (1988). Physical Activity Levels of Australians, A.G.P.S., Canberra.

Eckersley, R. (1989). "Casualties of Change: Social and Economic Issues

Affecting

Youth". The Bulletin of the National Clearing House for Youth Studies, 7(4) & 8(1) 3-8.

Egger, G. (1986). Common Sense Health. Allen and Unwin, Sydney, Australia.

Eisenberg, A. and Eisenberg, H. (1979). Alive and Well: Decisions in Health. McGraw-Hill Book Co., N.Y.

Farnill, D. and Robertson, M.F. (1990). "Sleep Disturbance, Tertiary-Transition Stress, and Psychological Symptoms Among Young first-Year Australian College Students." Australian Psychologist, 25(2) 178-188.

Farquhar, J.W. (1988). "Lifestyle Research: An Overview" in Lifestyle Report, (eds.) Russell, D.G. and Buisson, D.H. Human Performance Associates, Dunedin.

Forney, M.A., Forney, P.D., Sheets, K., Sijorius, M., Rixey, S., McGinty, D., Smith, S. and Yates, M.L. (1990). "The Relationship Between Stress and Substance Use Among First-Year Medical Students: An Exploratory Investigation." Journal of Alcohol and Drug Education, 35(3) 54-65.

Friedman, H.L. (1989). "The Health of Adolescents: Beliefs and Behaviour." Social Science and Medicine, 29 (3) 390-315.

Giesecke, M.E. (1987). "The Symptom of Insomnia in University Students." Journal of American College Health, 38 (5) 215-221.

Green, J.H. (1973). Basic Clinical Physiology (2nd edn.). Oxford University Press, London.

Greenberg, J.S., Ramsey, S.A. and Hale, J.F. (1987). "A Portable Self-Instructional Stress Management Program for College Students." Journal of School Health, 57 (2) 53-55.

Hagberg, J.M. (1990). "Exercise, Fitness and Hypertension" in Exercise, Fitness and Health: A Concensus of Current Knowledge (eds) Bouchard, C., Shephard, R.J., Stephens, T., Sutton, J.R. and McPherson, B.D. Human Kinetics Books, Champaign, Illinois, (455-466).

Hahn, W., Brooks, J. and Hite, R. (1990). "Results of Blood Pressure Screening in White College Students." *Journal of College Health*, 38 (5) 235-237.

Harris, J. (1987). "High Blood Pressure in Children and Adolescents." *Health Education*, 18 (3) 31-33.

Health Targets and Implementation (Health for All) Committee (1988). *Health for All Australians*, A.G.P.S., Canberra.

Hetzel, B. and McMichael, T. (1987). *The LS Factor*. Penguin Books, Australia.

Howat, P., Frizzell, S., Robinson, S., Jackson, G., Sauer, K., Lo, S. and Rose, J. et al. (1990). "Health Risk Behaviours of Young Adults." Curtin University Centre for Health Promotion Research, Division of Health Sciences, Curtin University of Technology, Perth, W.A., Paper Presented at International Conference on Health, Physical Education, Recreation and Dance, Auckland, January 1990.

Jones, I.H. (1972). "Australian Students with Psychiatric Illness". *The Medical Journal of Australia*, 1 (459-464).

Kenny, M.E. (1990). "College Seniors' Perceptions of Parental Attachments: The Value and Stability of Family Ties". *Journal of College Student Development*, 31(1) 39-46.

Lack, L.C. (1986). "Delayed Sleep and Sleep Loss in University Students." *Journal of American College Health*, 35(3) 105-110.

Le Croy, C. (1988). "Parent-Adolescent Intimacy: Impact on Adolescent Functioning." *Adolescence*, Vol.XXIII (89) 137-147.

Lesko, W.A. and Summerfield, L. (1989). "Academic Stress and Health Changes in Female College Students." *Health Education*, 20(1) 18-21.

Lopez, F.G., Campbell, V.L. and Watkins, C.E. (Jr.) (1989). "Effect of Marital Conflict and Family Coalition Patterns on College Student Adjustment." *Journal of College Student Development*, 30(1) 46-52.

- McDermott, R.J., Hawkins, W.E., Littlefield, E.A. and Murray, S. (1989). "Health Behavior Correlates of Depression Among University Students." *Journal of American College Health*, 38(3) 115-119.
- McMichael, A.J. (1974). "The Relationship Between Social Stress, Adolescence and Mental Health Among University Students." *Australian and New Zealand Journal of Psychiatry*, 8,251-260.
- McMichael, A.J. and Hetzel, B.S. (1975). "Mental Health Problems Among University Students, and Their Relationship to Academic Failure and Withdrawal." *Medical Journal of Australia*, 1,499-504.
- McShane, I. (1990). "Student Income Support in Higher Education." *Youth Studies*, 9(1) 30-38.
- Mendelson, W.B., Gillin, J.C. and Wyatt, R.J. (1977). *Human Sleep and Its Disorders*. Plenum Press, N.Y.
- Miller, L.H., Ross, R. and Cohen, S.I. (1985). *Stress*. Bay Books, Sydney.
- National Heart Foundation (1983). *Risk Factor Prevalence Study, Report No. 2*, Canberra.
- National Institute of Occupational Health and Safety (NIOHS) (1987). *Blood Pressure Study. Handbook of Tables*, A.G.P.S., Canberra.
- Offer, D., Ostrov, E. and Howard, K.I. (1989). "Adolescence: What is Normal?" *American Journal of Diseases in Children*, 143(6) 731-736.
- O'Neil, M.K. and Mingie, P. (1988). "Life Stress and Depression in University Students: Clinical Illustrations of Recent Research." *Journal of American College Health*, 36(4) 235-240.
- Paffenbarger, R.S. (Jr.) and Hyde, R.T. (1988). "Exercise Adherence, Coronary Heart Disease and Longevity", in *Exercise Adherence: Its Impact on Public Health*. (ed) Dishman, R.K., Human Kinetics Books, Champaign, Illinois (41-73).
- Payne, W.A. and Hahn, D.B. (1989). *Understanding Your Health* (2nd

Edition). Times
Mirror/Mosby College Publishing, St. Louis.

Petersen, A.C. (1982). "Developmental Issues in Adolescent Health" in
Promoting
Adolescent Health (eds.) Coates, T.J., Petersen, A.C. and Perry, C.
Academic Press, N.Y. (61-71).

Phelps, J.R. (1987). "Physical Activity and Health Maintenance - Exactly
What is
Known?" The Western Journal of Medicine, 146(2) 200-206.

Pinch, W.J., Heck, M. and Vinal, D. (1986). "Health Needs and Concerns of
Male
Adolescents." Adolescence, 21(84) 961-969.

Powell, K.E. (1988). "Habitual Exercise and Public Health: An
Epidemiological View"
in Exercise Adherence: Its Impact on Public Health, (ed) Dishman, R.K.,
Human Kinetics, Champaign, Illinois (15-39).

Powell, K.E., Thompson, P.D., Caspersen, C.J. and Kendrick, J.S. (1987).
"Physical
Activity and the Incidence of Coronary Heart Disease." Annual Review
Public Health, 8, 253-287.

Power, C.N., Robertson, F. and Baker, M. (1987). Success in Higher
Education.
Commonwealth Tertiary Education Commission, A.G.P.S., Canberra.

Rickarby, G. (1985). "Stress and Vulnerability in Adolescence" in Problems
of
Adolescents at Work and at Play. (ed) Bennett, D.L. The Australian
Association for Adolescent Health.

Singer, J.E. (1980). "Traditions of Stress Research: Integrative
Comments" in Stress
and Anxiety (Vol.7). (ed.) Sarason, I.G. and Spielberger, C.D.
Hemisphere Publishing Corp., Washington (3-11).

The Second Task Force on Blood Pressure Control in Children - A Report
(1987).
Pediatrics, 79(1) 1-25.

Villanova, P. and Bownas, D.A. (1984). Dimensions of College Student
Stress. Paper
presented at South Eastern Psychological Association Conference.

Wolfish, M.G. (1987). "Normal Adolescent Development" in Child and

Adolescent

Health for Practitioners, (ed) Buchanan, N., Williams and Wilkins, Sydney (427-439).

World Health Organization (1986). (Report of a W.H.O. Study Group on Young People and Health for All). Young People's Health - A Challenge for Society. World Health Organization, Technical Report Series, No.731, World Health Organization, Geneva.

Young, C. (1987). Young People Leaving Home in Australia. Australian Family Formation Project Monograph No.9. Dept. D.P.S.S.S. (ANU) and AIFS (MELB), Canberra.

Zylke, J.W. (1989). "Characterizing Healthy Adolescent Development: Distinguishing it from Possible Disturbances." Journal of the American Medical Association, 262(7) 880-881.