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## The relationship between transportation mode choice and well-being: An ecological perspective

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**The Relationship Between Transportation Mode Choice  
and Well-Being:  
An Ecological Perspective**

**Carolyn King Bpsych**

**Edith Cowan University**

**A Thesis in Partial Fulfillment of the Requirements for the**

**Award of**

**Master of Psychology**

**At the Faculty of Health and Human Sciences, Edith Cowan University**

## Abstract

The present study is based on an ecological analysis of transport and well-being as devised by Stokols and Novaco (1981). This study seeks to examine the link between transport mode and well-being. One hundred and eight Participants (N= 108) filled out a questionnaire that contained the psychological well-being scales of self-efficacy, general health and perceived stress; and the organizational scales of job satisfaction and absenteeism. The participants were divided into groups of 18 according to which transport mode they used. The transport mode groups were drive alone, train, bus, car pool, walk or cycle. It was hypothesized that there would be a significant difference in well-being between transport modes, that alternative modes of transport would score better than the drive alone category and that transport mode had an effect on psychological and organizational well-being. Findings supported that there was a difference in well-being between transport modes with the cycle and drive alone categories being significantly different to the bus, car pool and walk categories. Only the alternative mode of cycle performed better on the well-being scales than the drive alone category which did not support our second hypothesis. Transport mode did have an effect across both the psychological and organizational categories. Research and practical implications are discussed and directions for future research are highlighted.

## Declaration

"I certify that this thesis does not incorporate without acknowledgement any material previously submitted for a degree or diploma in any institution of higher education; and that to the best of my knowledge and belief it does not contain any material previously published or written by another person except where due reference is made in the text."

## **Acknowledgements**

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## CHAPTER 1

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### Transportation Issues

#### 1.1 Introduction

The car has allowed us to live further from where we work, shop and play, at the same time making itself a necessity for many people (Vlek, 1986). Since the early 1960s, the proportion of personal car ownership has steadily increased in the West, while the mobility of people without cars such as the elderly, young, people with disabilities and the poor has steadily declined as they have found transport options other than the car less available (Everett, 1981; Zielinski, 1997). The fastest growth in vehicle ownership has been in households with two or three cars. In Melbourne the proportion of households with three or more cars is predicted to show an increase from 800 000 in 1975 to 1.2 million by 2005 (VATS, 1995 cited in Parker, 1995, p.58). This trend continues in Australia even though there has been a decline in the average household size from 3.47 persons in 1966 to 2.81 persons in 1991 (VATS, 1995 cited in Parker, 1995, p.58).

The automobile plays an increasingly dominant part

in our day to day lives. The environmental, economic and social impacts of the motor vehicle are enormous at an individual, community and global level (Zielinski, 1997, Parker, 1995, Prendergast 1990, Agenda 21, 1997). It is argued that next to war, driving is the most energy-depleting, expensive, and highly subsidised human activity in the world, and it is also the fastest growing (Zielinski, 1997). The environmental and economic costs of the motor vehicle have been recognised and well documented, the problem that we are now facing is to reverse our dependency on the automobile. Historically transportation research has been the domain of engineers and planners who have been primarily concerned with the design and construction of transport systems and infrastructure (Hartgen, 1981). Transport related problems have been dealt with by capital-intensive technical solutions such as the construction of more freeways and the development of more fuel efficient cars (Levin & Louviere, 1981). However in the 1970s policy makers began to realise that the technical solutions were not effectively solving our transportation problems. For example despite doubling fuel efficiency between 1973 and 1988, transportation oil consumption has increased nearly 20% (Newman, 1997). Policy makers also began to think that there might be less expensive alternatives that may help to resolve our transportation problems (Everett, 1981). For example money spent on developing more fuel-efficient cars or more roads could be spent on improving and expanding the public transport system.

## Transportation Management

The above alternatives fall under the heading of Transportation Management which entails efforts to use our current transportation such as public transport, bicycle, pedestrian and automobile options more efficiently (Everett, 1981). Innovative suggestions have come from both community and government groups. For example, the environmental group Auto Relief demonstrated that public funds can go much further when spent on sustainable transportation rather than the automobile (Zielinski, 1997). They found that a reported \$157 million that was to be spent on four new highways in the city of Eugene, Oregon, could alternatively be used to purchase the following:

- Free bus transportation to the year 2000, including a \$1 million per year increase in the administration budget
- A 10-fold increase in funding for ride-share programs
- A free bicycle for every resident over the age of 11, complete with lock, helmet and rain gear; 10 000 bike racks around the city
- 10 000 free carrying racks for cars
- 10 000 free bike trailers
- 48 kilometres of bike paths
- total elimination of the projected municipal deficit to the year 2000

- a \$100 rebate to every citizen
- a \$7.1 million surplus

(Zielinski, 1997, p.11)

Zielinski does not include the environmental and health benefits that Eugene would also receive including reduced pollution, reduction in vehicle accidents, and less valuable land being buried under roads. These benefits have much more than just an economic value.

It has been demonstrated that travel management makes economic sense but a crucial aspect of travel management is the development of strategies to change travel behaviour (Everett, 1981; Zielinski, 1997). The behavioural sciences have redefined our automobile dependence as a social dilemma, because of its individual attractiveness and collective problems (Vlek, 1996). The automobile is convenient and accessible to the individual, as it provides transport directly from home, at any time with no planning required. At the same time it has environmental and quality of life repercussions for society (Vlek, 1996). For example, it is still convenient for many to walk outside their home and get in a car to go to work, even though the air pollution caused by car drivers is a negative consequence for all members of society, including those who do not drive.

The current focus of travel management has focussed on this social dilemma. Marketing campaigns that inform commuters of the economic and environmental costs of the car and campaigns that

promote the convenience and economic savings of public transport have been implemented (Gifford, 1997). These campaigns aim to increase the number of people who use alternative modes by using the media to promote the benefits of alternative transport and reduce the popularity of the sole-occupancy vehicle by promoting the negative environmental consequences (Gifford, 1997).

The convenience of the car to the individual is immediately apparent while the costs to society of one car trip are not as tangible to the individual. Individual's can rationalize that their one car is not doing much damage to the environment, because it is not, it is the huge number of cars on the road that is causing the damage (Zielinski, 1997). This leads to the conclusion that the collective problems of automobile dependency can only be solved by changing the thinking and subsequent behaviour of the individual car users (Prendergast, 1990). This means that we need to focus on methods to change commuters behaviour even though their current behaviour has significant benefits for the individual such as convenience and time saving. Levin & Louviere (1981), suggest that to do this we need more information on transportation-related impacts, attitudes, choices and behaviours, information that can be used to change commuter choices.



## **1.2 Theoretical Perspective: Changing Commuter Choices**

Simply encouraging people to abandon car commuting has no history of success (Zielinski, 1997). Commuters have significant motivators that lie behind our continued preference for the motor vehicle (Levin & Louviere, 1981). For example, it has been shown that commuters who are aware of the problems of traffic jams, parking constraints and expenses, air pollution and the high costs of the car still prefer driving alone to work (Kidder, 1976).

Any attempt to change commuter travel choices must look closely at the commuter decision process and the motivators that play a major part in the commuter's decision. Four major groups of motivators have been identified that are part of the commuter decision process, they are; economic self-interest, time saving, personal well-being and environmental concern (GVRD Communications, 1995).

### **Behavioural Travel Modeling**

Behavioural travel modeling is an area of research which has traditionally been involved in assessing current travel patterns, predicting changes in those patterns and developing more efficient transportation systems. In recent years behavioural travel modeling has begun to move more towards trying to explain human travel behaviour and the commuter decision process (Levin & Louviere, 1981).

The leading source of theory in the area of behavioural travel

modeling blends consumer theory from economics and decision theory from psychology (Levin & Louviere, 1981). This combination has resulted in a model of commuters choice process that describes how the commuter's motivators may be either objective facts or subjective impressions and that they both influence transit mode choices (Levin & Louviere). Examples of objective facts that may be part of the commuters' decision process include; the price of a train ticket, the cost of petrol or the distance to the local bus stop. Subjective impressions include such things as the commuter's attitudes to the public transport system. Subjective impressions do not have to be correct to play a major role in the decision process. Levin and Louviere (1981) found that commuters who chose to drive to work underestimate considerably the overall cost of this choice (Gifford, 1987).

Support has been established for the theory of Levin and Louviere (1974) with both objective facts and subjective impressions having been found to play a role in the travel consumer decision process (Stokols & Novaco, 1981). Norman and Louviere (1974) found that people were less likely to state that they would take the bus if either bus fare, distance to bus stop or service frequency were at an unfavorable level. Dobson and Tischer (1978 cited in Levin and Louviere, 1981), assessed perceptions of comfort, convenience and safety for each transport mode. Perceptual groups derived from these data were readily distinguishable from each other and perceptions were highly correlated with transit mode choice patterns. Tischer and Phillips (1979) found that commuters who

perceived that public transport is easy to use, reliable, safe, and uncrowded tended to use public transport more often (cited in Gifford, 1987). Gifford and Foerster (1977) found that people who had bad memories of public transport and perceived that it is only the poor who use public transport tend to use it less.

Levin and Louviere's theory of behavioral choice modeling describes the importance of both facts and impressions to the commuter decision process, resulting in the proposal of two general approaches to get commuters to change their travel mode choice from the motor vehicle to an alternative mode. The first approach is to provide more objective information about the true costs of the car and the benefits of using alternative modes of transport. The second approach is to examine commuter preferences with a view to designing and altering transport systems to better fit these preferences. The basis of these approaches is to examine the transport systems from the individual users point of view.

Government agencies that wish to motivate commuters to use alternative modes of transport have in the past promoted the economic and environmental consequences of the transport modes at the societal level (Stokols & Novaco, 1981). Knowledge of and concern for the environment has significantly increased with individuals recognizing that single occupancy vehicles are the cause of major environmental problems (Nelson, 1996). However this information is changing attitudes and knowledge not behaviour (Goodwin, Hallett, Kenny & Stokes, 1991). The community is acknowledging the highly significant environmental

costs of the car but at an individual level people are not changing their behaviour to match this concern (Cosgrove, 1996). Further it is argued by Goodwin et al (1981) that increasing awareness of our environmental problems is of no importance unless it causes a subsequent change in behaviour. Increasing an individual's awareness of the negative environmental impact of the car is not influential enough to convince him or her to give up the enormous individual advantages of car use (Arthey & Clarke, 1995). There is a need to combine this information with the greater awareness of the costs to the individual.

### Commuter Well-being

According to Stokols and Novaco (1981) the focus on environmental consequences neglects the potentially important motivators of personal well-being associated with emotional, behavioural and health consequences of our transport conditions. They have devised an ecological analysis of transportation and well-being that emphasizes the reciprocal nature between the transport environment and the commuter. Stokols and Novaco summarize the implications of an ecological approach to transport as follows (1981, p.98):

From an ecological perspective, then, the relationship between transportation and well-being is construed not in terms of the isolated causal connections between dependent and independent variables but in terms of mutually causal relationships among situationally relevant

factors. An important challenge posed by our contextual approach is to identify and delineate those situations, occurring at personal and/or aggregate levels of analysis, that are of greatest theoretical and policy relevance to transportation and well-being.

There is a high degree of community awareness about the negative impact of the car on the environment but there is very little awareness of the negative effect of the car on the individual (Stokols & Novaco, 1981). For example, we know that the car has a negative effect on the environment but what about the effect that it has on the body and mind of the commuter who is driving that car? According to Levin and Louviere's (1981) behavioral choice modeling approach, these physical and psychological effects could be an instrumental part of the commuter decision process. For example, campaigns that have focussed on environmental costs could have more influence on individuals if they also informed commuters of any negative costs to their well-being as a consequence of driving to work.

The negative costs of the vehicle are not limited to environmental and economic costs and commuters' need to be provided with more objective information on the true costs and benefits of transport options. The link between transport and personal well-being needs to be researched and promoted. The identification and promotion of this link could play an important part in providing objective facts and in changing subjective impressions that are playing an influential role in the commuter

decision process. Research in this area has been sparse but preliminary findings do indicate that the negative physical consequences of commuting on the commuter are substantial (Stokols & Novaco, 1981; Zielinski, 1997).

### Physical Consequences for the Commuter

In looking at the impact of transport conditions on the commuter, "transport" has meant private automobile travel (Stokols & Novaco, 1981; Zielinski, 1997). Most of the research in this area has looked at the short-term physical consequences of real and simulated automobile travel on the commuter, neglecting the long-term effects (Stokols & Novaco, 1981). A variety of adverse physiological reactions to traffic conditions have been found when examining the effects of road design and traffic volume on the drivers' tension responses. In a study by Michaels (1962) drivers were tested on four different road designs of differing levels of complexity during off-peak and peak-hour traffic. Tension reactions were measured through continuous recording of the Galvanic Skin Response (GSR). Elevated levels of GSR (indicating an increase in tension) were found on the more complicated routes and in increased traffic volume. Commuters who travel in cars in peak hour traffic, with complicated routes arrive at work with a higher degree of tension.

Levin and Louviere (1981) found that increased heart rate, blood pressure and electrocardiogram irregularities have been correlated positively with traffic volume in numerous studies (p. 89). Traffic situations of high complexity (e.g. passing other vehicles, intersections and sudden

braking) have been found to be associated with increased heart rate and blood pressure (Littler, Honour & Sleigh, 1973, Simonson, Baker, Burns, Keiper, Schmitt & Stackhouse, 1968). This indicates that there are significant health impacts associated with commuting by single-occupancy vehicle. Mackie, O'Hanlon, and Mc Cauley (1974) found that prolonged exposure to heat and humidity adversely affected drivers' physiology, mood and performance. Research has firmly established that exposure to different travel demands causes short-term stress reactions.

The above experimental studies have focused primarily on the physical-environmental demands of the transport environment and the consequent physiological responses. However, this approach neglects the complex interaction of physical, psychological and social factors that determine commuters' reactions (Stokols & Novako, 1981). Research needs to extend its focus from the short-term reactions of commuters to stress, to the cumulative behavioural and health consequences of chronic exposure to travel conditions.

A longitudinal, field-experimental study on 100 urban workers found that commuters who drive longer distances have higher blood pressure and that the more interchanges they negotiated on their way to work the more days they are ill enough to be hospitalized (Stokols & Novaco, 1981). Their results indicate that there is a long-term impact of transport on the commuter. It was concluded that more information is needed on the cumulative behavioural and health consequences of

chronic exposure to travel conditions as well as the differing effects of the different transport modes (Stokols & Novaco).

### **1.3 Transportation Modes**

The above research has looked at the transportation setting of the car. Transportation settings are part of the environment and the conditions of the transportation environment vary depending on the mode of transport that is chosen by the user (Gifford, 1987). A person who rides a bike to work experiences a very different environment than somebody who takes the train to work each day (Gifford, 1987). Transportation modes vary according to such variables as crowding, air quality, privacy, physicality, sense of control and status to name just a few. Little empirical research has looked at the impact of alternative modes of transport on the commuter or the characteristics of commuters who choose different transport options (Koslowsky & Krausz, 1994). The four modes of transport that shall be examined below are the main forms of alternative transport available to people in Perth, Western Australia.

#### **Public Transport**

Public transport traditionally incorporates such modes as trains, buses, ferries and trams. Public campaigns have frequently aimed at converting private vehicle owners to public transport use to reduce



environmental problems and overall costs to the community (Zielinski, 1997).

Public transport has community benefits as it has been found that it increases land values along its routes, and commercial development around stations (Zielinski, 1994). Public transport can encourage more development and nodes of life in the suburbs, which would again reduce the travel distance of many trips. Freeways in comparison to railway lines disperse development and reduce access, making many facilities only reachable by car (Zielinski, 1994). Public transport is also more economical to build as new urban highways cost up to \$100 million per mile while railway lines cost approximately \$15 million (Zielinski, 1994,p.5).

Two major studies have looked at the effect of public transport on the commuter. The first study indicated that the negative effects of commuting were greater for those workers arriving in private automobiles than for users of public transportation (Taylor & Pocock, 1972). A London survey incorporating over 2000 employees found that car users had significantly higher rates of unscheduled absences than those that used public transport (Taylor and Pocock, 1972). Unscheduled absences are usually a result of ill health for the individual and result in an economic cost to the organisation.

Singer, Lundberg and Frankenhauser (1978) conducted a field experiment on 30 Swedish male train commuters. The participants were assigned to two groups according to where they boarded the train. One

programs such as encouraging people to look to friends and relatives for possible candidates to car pool with. By encouraging people to car pool environmental problems associated with the car can be limited by simply reducing the numbers of cars on the road thus reducing pollution, congestion and the economic costs of the car. On the other hand, reducing the number of cars on the road may reduce the negative consequences of the car but we will not reduce dependency on it (Zielinski, 1997).

### Walking and Cycling

For people who live near their workplaces, commuting to work by cycling or walking can be an alternative to using a car. Cycling and walking are likely to improve your health and eliminate the costs of petrol, car maintenance, car accidents, parking and car insurance (Parker, 1995).

Cycling and walking differ from other transport modes in that they involve a degree of sustained aerobic exercise. People who exercise regularly are rewarded with substantial health benefits, such as less likelihood of having high blood pressure, high stress, less obesity and heart problems (Allen, 1995). The health benefits of walking and cycling may result in further economic benefits by reducing the medical costs associated with unhealthy people that are met by taxes (Parker, 1995).

Walking requires limited infrastructure and equipment and can be done by anybody with mobility and some degree of fitness. A British study

of ten cities found that there were economic benefits to traffic calming and pedestrianisation schemes (Newman, Kenworthy & Robinson, 1989). The study found that they were associated with higher rents, higher land values and that environmental improvement and a healthy economy were causally related (Newman, Kenworthy & Robinson, 1989). Contrary to popular belief no relationship was found between retail turnover and the provision of parking (Newman, Kenworthy & Robinson, 1989). The current trend of setting aside large parking areas in preference to other public facilities such as public transport or more retail stores should be examined.

The bicycle, like walking is an ideal alternative to the car over short distances because it produces no pollution, uses no energy, has health benefits to the user, is silent, takes little space, is cheap and equitable. Bicycles use space so efficiently that 10-12 can be parked in the space taken by one car. A study by Shayler, Ferguson & Rowell (1993), found that car commuters are subject to high levels of stress, air pollution and do not get the exercise benefits that cyclists do. At an organizational level it was found that employees who commute by car are less fit than cyclists, more likely to be ill, have higher absenteeism rates, are less punctual and are less productive when at work (Shayler, et al., 1993).

In 1992 the personal health costs of an automobile dependent lifestyle were examined by the British Medical Association. They also estimated the health benefits of regular cycling. Regular cycling can reduce the likelihood of suffering a coronary heart disease, stroke and

other chronic diseases (BMA, 1992). The BMA found that the life years gained from the health effects of bicycle use were greater than the life years lost as a result of road accident or injury.

In summary, although there is some research looking at alternative modes of transport it is generally sparse, particularly in the area of health and psychological impact on the commuter. This area is critical to establish any possible link between transport and well-being.

#### **1.4 Transport and Well-being**

The research summarised above, has indicated that there are very real consequences associated with transport mode choice. Stokols and Novaco (1981), define the term well-being as "referring to multiple dimensions of mental and physical health, including personal productivity, sense of purpose, the quality of relationships with others, and levels of physiological and emotional disorder" (p.96). Stokols and Novaco argued that the main priority for future research needs to be the development of an ecological conceptualization of transport and well-being. They state that such an analysis would (a) emphasize the multiple dimensions of transport conditions and their impact on commuters; (b) examine the cumulative as well as the short-term consequences of transport conditions on health and behaviour; (c) assess the ways in which people cope with prolonged exposure to travel demands (p. 95). The ecological conceptualization of transportation and well-being put forward by Stokols and Novaco (1981), involves studying the link between the transport

environment and well-being at different levels of analysis. This means that research needs to encompass the effect of transport conditions on individuals, organizations and communities.

Stokols and Novaco (1981) also argued that it is crucial not to only look at how people are affected by travel demands but also to consider how people actively cope with, and attempt to modify, these conditions. Their analysis reflects a transactional rather than a linear conceptualization of transport conditions and the resulting behaviour and well-being of individuals. Stokols and Novaco acknowledged that their transactional view of well-being is grounded in earlier formulations of system theory. A key assumption of this theory is that "the survival and effectiveness of individuals and groups depend on their capacity to cope with environmental constraints and to accomplish their goals and activities in spite of those constraints" (Stokols & Novaco, p.97). They further claim that the well-being of individuals and groups is dependent on the degree of fit between human goals and activities and the environmental context in which they are pursued (Stokols & Novaco, p.97). Well-being itself is a construct and only indicators or outcomes of well-being can be measured. Some possible indicators of well-being are stress, self-efficacy, general health, absenteeism and job satisfaction.

### Stress

Existing literature supports a significant link between conditions of transport and stress reactions among commuters (Stokols & Novaco,

1981). These studies of stress reactions have been of a short-term and physiological nature, neglecting the complex interplay of social, psychological and physical factors that determine our reactions to the transport environment (Stokols & Novaco). Transportation stressors conceptualized as conditions of the transportation environment that constitute a threat to physical or psychological well-being include a broader range of conditions than have been incorporated into most previous research (Novaco, Stokols & Milanese, 1990). These include the diversity of travel environments, length of commute, air pollution, interpersonal conflict, vehicle malfunctions and travel impedance. These conditions are products of individual, organisational and community decision-making (Novaco et al).

A national study published by Blue Cross showed that five out of six employees at all levels of employment indicated that stress is a major factor in their occupations resulting in "dissatisfaction, low self-esteem, angina, persistent coughs, neurotic behaviour" and various other conditions (Pelletier, 1982, p.39). It has begun to be recognized that to address such stress problems it is important for organizations not to look simply at band-aid approaches such as burnout programs, stress leave and meditation breaks but rather to look at ways to prevent the occurrence of stress (Pelletier, 1982). Pelletier asserts that the daily difficulties of everyday life have been shown to carry over into the workplace, including the stress associated with commuting to work. People also often misattribute their feelings of stress to a particular

source when in fact it is caused by another (Pelletier, 1982; Cohen, Kamarck & Mermelstein, 1983). This means that people may be assuming that they are stressed because of work when in fact it is from another source such as family problems or that morning's traffic jam. Research into the levels of stress experienced by users of different modes of transport may be crucial in identifying a significant source of stress. Only when the sources of stress are identified can they be rectified in an appropriate manner.

### Self-efficacy

Thoughts, emotions and actions are so intertwined that you can not understand or influence one without the other which makes an individual's level of self-efficacy an important factor in all of these areas (Mental Health Net, 1995). To modify transport choices or understand stress reactions you must look at the cognitions that underlie them. Self-efficacy makes a difference to how people feel, think and behave, which makes it an important variable in the decision-making process. A person of high self-efficacy is more likely to believe that they can take action to solve a problem, are more likely to do so and feel committed to the decision (Schwarzer, Babler, Kwiatek & Schroeder, 1997). For example, a commuter with high self-efficacy may feel that they are unfit, to solve this problem they may decide to cycle to work and may continue to cycle because there is a high level of commitment to this decision.

Low levels of self-efficacy are associated with depression, stress,

anxiety and helplessness while high levels are associated with better health, higher achievement and more social integration (Schwarzer et al, p.70 1997). People with high self-efficacy choose to perform more challenging tasks, recover more quickly from setbacks, and invest more effort and persistence to tasks (Schwarzer et al). Research has established that self-efficacy versus helplessness is a major determinant in the balance between health and illness and even life and death (Locke, 1982 cited in Pelletier, 1982). Whether transportation modes attract people with different levels of self-efficacy or influence the self-efficacy of users has not been researched.

### General Health

During the last decade research has established that a relationship exists between stressors in the environment and the health of individuals (Pelletier, 1982). Research has found links between the mind, the brain and nervous system and the body's ability to defend against degeneration, infections and tumors (Pelletier, 1982). These studies clearly indicate that stress in terms of minor stressors, major life events, disruptions in social support systems and difficulties at work can dramatically affect the body's system of defenses making it more susceptible to health problems (Pelletier, 1982). Research by Stokols and Novaco (1981) has established that many conditions of the driving environment cause short-term stress reactions in commuters such an increase in heart rate, higher blood pressure and electrocardiogram irregularities and that increased stress has a negative impact on an



individual's health. The impact of the automobile on the health of the community is more difficult to assess.

One study by Cohen, Glass, & Singer (1973), found that exposure to chronic traffic noise contributes to learning deficits. The study looked at primary school children that lived in a 32-floor apartment block overlooking a busy expressway. The noise levels gradually decreased from the base of the building to the top floor. They found a positive correlation between apartment floor and auditory discrimination and auditory discrimination and scores on reading tests. The length of time the child had lived in the apartment block was also found to positively influence the correlation between noise and auditory discrimination.

Regular exercise such as from walking or cycling has been shown to lower blood pressure, strengthen the heart, lower cholesterol, lower blood glucose levels and reduce obesity (Allen, 1995). The effect of exercise on stress is difficult to measure but there is some evidence that regular exercise reduces stress (Allen, 1995). The hormone adrenaline is released during times of stress, increasing the heart rate, blood pressure and blood glucose. Exercise reduces the amount of adrenaline released during stress and also reduces muscular tension (Allen, 1995). A comparison of the health costs and benefits of different modes of transport has not been examined but research into health, stress and exercise all indicate that it should be a valid area of inquiry.

### Absenteeism and Job Satisfaction

Absenteeism and job satisfaction are commonly used measures of individual well-being and organizational effectiveness (Koslowsky & Krausz, 1993). The dimension of job satisfaction appears to be important in determining both the quality and quantity of life for employees at all levels. In a classic study, Kornhauser (1965), found that of a sample of 407 auto workers, 40% had overt symptoms of mental health problems, and that the only variable found to distinguish psychologically healthy workers was job satisfaction (cited in Pelletier, 1982). Employees who are satisfied with their work are healthier which benefits their employer as well as themselves.

Palmore, found surprising evidence that job satisfaction followed by overall happiness predicted an individual's longevity better than any standard physical indicators, risk factors such as smoking, and even genetic inheritance (cited in Pelletier, 1982). This indicates that factors that influence job satisfaction are of crucial importance to employees and the organisations that they work in.

Existing research has illustrated that stressors within and outside the workplace are significant predictors of variations in attendance behaviour (VandenHeuval & Wooden, 1995). Similarly research has found a correlation between commuting time and absenteeism for both public transport users (Taylor & Pocock, 1972) and drivers (Stokols & Novaco, 1981).

### 1.5 The Present Study

The current research will examine the link between transport mode and well-being. This study will compare workers, who commute into the central business district using one of the five transport modes of sole-occupancy vehicle, car pooling, bus, train, walking and cycling on psychological/physiological and organisational measures. Although researchers have reported significant associations between the commuting experience, psychological/physiological measures and organizational outcomes, there has not been a comparison done on these different levels between the different transport modes (Koslowsky & Krausz, 1993).

Psychological/physiological measures that shall be examined in the present study are self-efficacy, perceived stress and general health. The question of whether transport-related stress is an important contributing factor in the deterioration of physical and mental health has not yet been researched. In addition, transport-related stress can not be studied in isolation from the other parts of our lives, the quality of life at home and at work will influence and be influenced by transport-related stress (Gifford, 1987). It is for the above reasons that it is perceived stress, which is the individuals subjective evaluation of their own general level of stress, that is to be examined.

The organizational outcomes to be measured are job satisfaction and absenteeism. These measures have been chosen as indicators of the well-being of commuters. The examination of overall well-being

reflects a theme of the ecological approach, which is an emphasis on the reciprocal influence of environments and their occupants (Stokols & Novaco, 1981). The chosen indicators of well-being reflect both active modes of cognition and behaviour (self-efficacy and perceived-stress) and reactive modes at an individual level (general health), and organizational level (absenteeism, job satisfaction).

## 1.6 Research Questions

Research into the well-being of transport users is as of yet, at a preliminary stage. The relationships between the indicators of well-being are likely to be a complex one that is just beginning to be understood (Pelletier, 1982). Hence the research questions to be addressed are partly exploratory. The questions that the current research is designed to examine are:

- 1. Are there differences in the well-being of users of different modes of transport?*
- 2. Do commuters who use alternative modes of transport have higher levels of well-being than commuters' who travel by sole-occupancy vehicles?*
- 3. Does transport-related stress correlate with the health of individuals and the levels of absenteeism and job satisfaction in their work?*

These questions are aimed at examining transport at two levels of analysis, namely the individual and the organizational. The emphasis on well-being and not specific physiological reactions emphasizes the reciprocal nature between the transport environment and the commuter. Grouping commuters by the transport mode that they use, reflects the importance of analyzing transportation from a contextual perspective.

Previous research and theory has contributed to the following hypotheses:

Hypothesis 1. *There is a significant difference in the well-being of users of each transport mode.*

Well-being scores will be calculated by averaging the combined scores on all measures. It is predicted that the measures chosen shall discriminate between users of each transport mode.

Hypothesis 2. *Users of alternative modes of transport will have higher well-being scores than users of traditional modes.*

It is predicted that users of alternative modes of transport will score more positively on these measures than sole-occupancy vehicle drivers. It is also predicted that amongst alternative transport users, cyclists and walkers will perform the best (because these modes involve regular aerobic exercise); followed by public transport users (who do not have to deal with traffic stressors); and lastly car poolers whose transportation environment is most like that of the sole-occupancy vehicle driver.

*Hypothesis 3. Transport mode has significant effects on both the individual and organisational level with those using alternative modes having higher job satisfaction and lower rates of absenteeism.*

It is predicted that physiological/psychological measures will be related to organisational measures. The transport modes with low well-being scores on the stress and health measures will also have negative job satisfaction and absenteeism scores. It is predicted that alternative modes of transport have higher scores on job satisfaction and lower absenteeism scores than the sole-occupancy vehicle.

The social, environmental and economic costs of the car have made transport-related research both relevant and imperative to social scientists. Research such as this will help give us a clearer picture of lifestyle factors that promote high performance and personal happiness for individuals, organisations and communities.

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## CHAPTER 2

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### Method

#### 2.1 Sample

Participants were recruited from a larger project being run through the Environmental Protection Agency (EPA) in Perth, Western Australia. The convenience sample consisted of 210 employees which incorporated 35 employees from the six different transport modes. Participants were sent questionnaires through the internal mail system of their organisation and were given a response time of three weeks to return the questionnaire.

The data analysed in the present study is based on a subsample of 108 employees with 18 from each transport mode. All 18 walkers who returned questionnaires were used and a random selection from the remaining modes was taken to get equal cell sizes. The gender and age characteristics for each transport mode are shown below in table 2.1.

Table 2.1

## Age and Gender Characteristics of Each Transport Mode Group

Transport Mode	Age Groups		Gender	
	18-40	41-60	Male	Female
Drive Alone	9	9	13	5
Train	12	6	9	9
Car pooling	10	8	8	10
Walk	13	5	11	7
Cycle	11	7	14	4
Bus	10	8	8	10

**2.2 Instrument**

A questionnaire that included 110 items was prepared to measure the variables of workaholism, job satisfaction, general health, absenteeism, self-efficacy, and perceived stress (see Appendix A). The questionnaire was devised so that each scale was presented in the same



font and style. The first scale on the paper was designed to measure workaholism but it was not included in the analysis because of difficulties with scoring and reliability. The measures were not identified by their title on the paper. Demographic questions were placed at the end of the questionnaire.

Participants were asked to respond to the question 'what mode of transport have you used most regularly for your commute to work in the last month?' This question was further qualified with the statement 'please tick the one mode that accounts for the greater part of your journey'. Participants were given the six categories of cycle, bus, walk, train, drive alone and car pool, plus the additional 'other' category with an indication to specify. Any participant that misread the instructions and indicated more than one mode or who fell into the 'other' category was left out of the analysis. Three participants indicated that they were in the 'other' category and three participants had chosen more than one category. Participants were asked to indicate their age in years by ticking an age category.

Participants were not informed that a comparison between users of alternative modes of transport was being conducted being led to believe that information was being gathered on the well-being of Perth workers. To aid in this purpose remaining unknown the question which asked the participant what mode of transport they used was placed on the last page of the questionnaire.

In order to ensure that adequate measures of the variables

were obtained, the variables were measured with multiple-item scales with the exception of the absenteeism data. Existing scales were utilised that had the qualities of validity, reliability and utility.

### Self-efficacy

The General Self-efficacy scale is a ten-item scale developed by Jerusalem and Schwarzer (1981) and is scale number 3 on the well-being questionnaire. The scale measures your broad and stable sense of personal competence and your ability to deal with stressful situation (e.g., I can always manage to solve difficult problems if I try hard enough). There are ten items and responses to each item are made on a four-point scale ranging from '*Not at all true*' to '*Exactly true*'. This scale has been used in numerous research projects where it typically yielded internal consistencies between  $\alpha = .75$  and  $.90$  (Schwarzer et al. 1997). The general self-efficacy scale is also valid in terms of convergent and discriminant validity, it correlates positively with self-esteem and optimism and negatively with anxiety, depression and physical symptoms (Schwarzer et al. 1997). Participants were instructed to 'please circle the numbered response you judge to be the most accurate description of you for each of the following statements'.

### General Health Questionnaire

The general health questionnaire (GHQ) focuses on the psychological components of ill health and was developed by Goldberg

(1972). It is scale number 2 on the well-being questionnaire (see Appendix A). Each item consists of a question asking whether the respondent has recently experienced a symptom on a scale ranging from '*less than usual*' to '*more than usual*'. The following instructions preceded the scale items:

'The questions in this scale ask you about your feelings and thoughts during the last month. In each case, you will be asked to indicate how often you felt or thought a certain way. Although some of the questions are similar, there are differences between them and you should treat each one as a separate question. The best approach is to answer each question fairly quickly. That is don't try to count the number of times you felt a particular way, but rather indicate the alternative that seems like a reasonable estimate'.

The shortened version of the questionnaire, which contains 30 items, was used along with the GHQ scoring method, which condenses the four-way response scale into a bimodal scale. The bimodal scoring method eliminates errors due to 'end-users' and 'middle users' by giving them the same score. Numerous studies have illustrated that the GHQ has high reliability and validity (Goldberg, 1978).

### Job Satisfaction

Brayfield and Rothe's Index of Job Satisfaction is an 18 item scale with a five-way response scale ranging from '*Strongly agree*' to '*Strongly*

*disagree*'. This index is a general measure of overall job satisfaction and is applicable to a wide variety of jobs (Sample items are; there are some conditions concerning my job that can be improved, most days I am enthusiastic about my work). It is scale 4 on the questionnaire and the following instructions preceded the scale items:

'Some jobs are more interesting than others. We want to know how people feel about different jobs. You are to circle the phrase below each statement that has best described how you feel about your present job. There are no right or wrong answers. We should like your honest opinion on each one of the statements'.

A general measure of satisfaction was chosen in preference to one that looked at specific aspects of one's job to avoid confounding between job satisfaction and work stress. The index has a reliability coefficient of .87 and research has found it to have high validity (Miller, 1970).

### Absenteeism

Participants were asked to estimate how many days they had been absent in the last six months in question 7 on the questionnaire.

Absenteeism was defined for participants as 'days away from the workplace, which are not anticipated or scheduled by the employer'. Self-report methods of absenteeism are not known to be very reliable however it is not the level of absence per se which is of interest but rather factors

predicting that absence, there are no reasons to suspect a systematic under-reporting of absence (VandenHeuvel & Wooden, 1995).

### Perceived Stress Scale (PSS)

The PSS is a 14-item scale designed to measure the degree to which individuals appraise situations in their life as stressful (e.g. in the last month, how often have you felt that you were on top of things?). The scale was number 6 on the questionnaire and the following instructions precede the scale items:

'The questions in this scale ask you about your feelings and thoughts during the last month. In each case, you will be asked to indicate how often you felt or thought a certain way. Although some questions are similar, there are differences between them and you should treat each as a separate question. The best approach is to answer each question fairly quickly. That is don't try to count the number of times you felt a particular way, but rather indicate the alternative that seems like a reasonable estimate'.

Coefficient alpha reliability is reported at .86 and is correlated in the expected manner with a number of self-report and behavioural criteria (Cohen, Kamark & Mermelstein, 1983).

### **2.3 Procedure**

A written letter of consent was obtained from all participating organisations and the questionnaires were sent directly to each subject at their workplace. Each participant was sent a cover letter, a questionnaire which contained the above measures and demographic questions and a stamped self-addressed envelope to return the questionnaire. The cover letter stated that the study was being done for the Environmental Protection Authority by a researcher at Edith Cowan University. In addition all participants were informed of the confidentiality of their individual responses but that the pooled data would be used by the EPA to assess the well-being of workers in the city. No incentive was given to fill out the questionnaire and a contact number was given to participants if they required further information or wished to discuss their response to the questionnaire. Participants were informed that by filling out the questionnaire that they were consenting to these conditions.

### **2.4 Ethical Considerations**

The present study obtained ethical clearance from the Edith Cowan University Ethics Committee provided that:

1. A written letter of consent was obtained from the companies who employed the participants.
2. The participants were informed that the study was anonymous and confidential in that no names were recorded.

3. Participants were informed that both the EPA and a Edith Cowan  
Researcher would have access to the data and that participation was  
purely voluntary.

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## CHAPTER 3

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### Results

#### 3.1 Scoring

Returned questionnaires were scored and coded by hand by the researcher. Each scale was scored as per its author's instructions. The scores for each scale were then converted to percentage scores. The best score by any participant was used to give relative percentages to the remaining scores. For some scales such as the self-efficacy scale, the best score was the highest score and for others such as perceived stress it was the lowest. For example, if the highest score on the self-efficacy scale was 40 then that score was converted to 100%, a score of 20 would then be converted to 50%. If the lowest score on the perceived stress scale was 6 then that would be converted to 100% and a score of 12 would be converted to 50%. Converting the scores so that they are being measured on the same scale was necessary for the chosen data analysis method. Data was analysed using SPSS version 7.5.

#### 3.2 Profile Analysis

Profile analysis is an application of multivariate analysis of variance (MANOVA) in which several dependent variables are measured



all on the same scale. Instead of asking a single question of whether the groups differ on at least one variable, profile analysis will give us the answers to the following two questions about group differences. They are as follows:

**Parallelism of profiles:** Are the population means for each transport mode parallel to each other? This is equivalent to testing the interaction of the well-being measures and transport mode in a factorial design. Parallelism would imply that the difference between the means of the well-being measures is the same for each transport mode.

**Equality of Profiles:** Assuming parallelism, are the profiles of each transport mode equal? This is equivalent to testing the main effect of transport mode in a factorial design. Testing the equality of profiles tells us whether there is a difference in the scores of each transport mode.

### **3.3 Descriptive Data**

The scores on each scale were averaged for each transportation mode to give a combined mean which represents a general well-being score (see figure 1). The transportation mode that performed the best was the cycle mode ( $M=72.967$ ,  $SD= 8.925$ ), followed by drive alone

( $M=70.856$ ,  $SD=7.319$ ), train ( $M=67.022$ ,  $SD=7.758$ ), walk ( $M=63.311$ ,  $SD=6.675$ ), bus ( $M=62.644$ ,  $SD=7.758$ ), and car pool ( $M=62.556$ ,  $SD=11.521$ ).

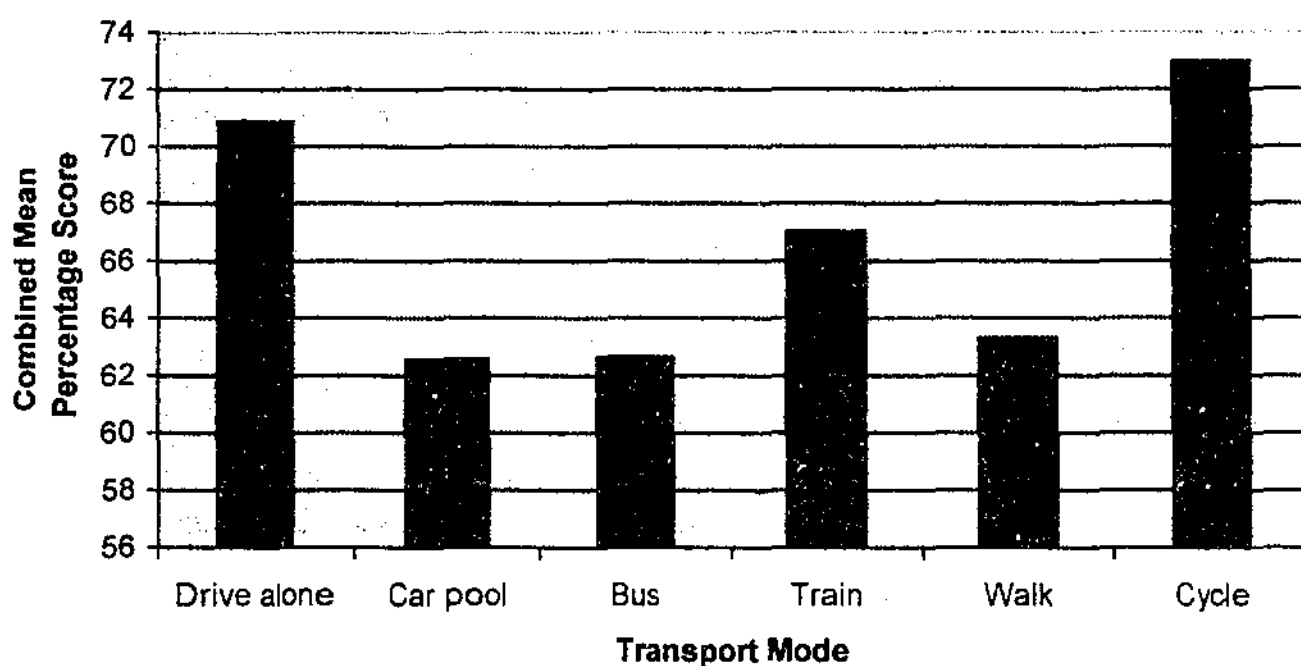


Figure 3.1. Combined Means of General well-being scales for each transportation mode.

The means and standard deviations from each mode of transport for each well-being scale were calculated. Each transport mode was given a rank score for their performance on each scale (see Table 3.1).

The rankings show that either the cycle or drive alone modes of transport were the top ranked mode for each scale. The lower rankings were shared among the transportation modes of walk, car pool and bus.

Table 3.1

Descriptive statistics for each transport mode on psychological and organisational scales.

Transport mode		Psychological			Organisational	
		Self-efficacy	Stress	Health	Absenteeism	Job Sat.
Drive Alone	Mean	89.72	31.50	84.39	87.56	61.11
	SD	9.01	21.50	14.75	13.84	11.31
	Rank	1	1	2	2	2
Car Pool	Mean	78.94	22.94	83.28	77.61	50.00
	SD	7.39	11.20	18.35	23.35	11.01
	Rank	4	5	6	5	6
Bus	Mean	74.00	19.28	83.89	81.56	54.50
	SD	12.83	7.11	17.61	13.31	9.61
	Rank	5	6	5	3	4
Train	Mean	82.44	26.67	89.33	80.17	56.50
	SD	7.85	12.05	12.17	12.21	14.31
	Rank	3	2	3	4	3
Walk	Mean	73.89	24.72	84.44	81.56	51.94
	SD	10.01	11.89	10.89	16.02	14.31
	Rank	6	4	4	3	5
Cycle	Mean	86.11	25.83	92.28	92.78	62.78
	SD	9.80	8.16	14.07	10.82	12.00
	Rank	2	3	1	1	1

### **3.4 Data analysis Overview**

SPSS MANOVA using Wilk's criterion was used for the analysis. A profile analysis was performed on all scales: absenteeism, self-efficacy, general health, job satisfaction and perceived stress. The grouping variable was mode of transport, which was categorized into the six groups of drive alone, car pool, bus, train, walk and cycle.

#### **3.4.1 Test of Parallelism**

Each segment of the profile was tested for parallelism (see figure 2). The tests of parallelism are not significant at  $\alpha = .05$  (see Table 3.2). Parallelism of the mean profiles of each transport mode can be assumed. This means that each transport mode had the same pattern of highs and lows on the well-being scales.

Table 3.2.

Test of Parallelism

Contrast	F	Significance
Drive alone/car pool	.948	.449
Drive alone/bus	2.458	.066
Drive alone/train	1.429	.248
Drive alone/walk	2.046	.112
Drive alone/cycle	1.850	.055
Car pool/bus	2.601	.144
Car pool/train	.214	.929
Car pool/walk	.869	.483
Car pool/cycle	1.913	.133
Bus/train	1.053	.396
Bus/walk	.594	.670
Bus/cycle	.818	.523
Train/walk	.869	.493
Train/cycle	1.889	.137
Walk/cycle	1.828	.149

 $\alpha = .05$ **3.4.2 Testing for Equality of Profiles**

Table 3 shows that the equality of transportation mode profiles can not be assumed across all modes of transport. This suggests that some transportation mode groups differed in their overall level of well-being.

Descriptive statistics (see Figure 1) show that it is the transport modes cycle and drive alone which had the highest means on the combined well-being scores that are significantly different from the three bottom

performers of walk, bus and carpool. This means that participants from the cycle and drive alone modes did have significantly higher well-being scores to those from the modes of walk, bus and car pool. The participants in the train group did have significantly lower well-being scores than the cyclists but not the drive alone category. The participants from the train mode also did not have significantly higher scores than the three lowest ranked modes of car pool, walk and bus.

Table 3.3.

Significance of the equality of transportation mode profiles

Contrast	F	Significance
Drive alone/car pool	6.655	.014*
Drive alone/bus	10.667	.002*
Drive alone/train	2.925	.096
Drive alone/walk	10.439	.003*
Drive alone/cycle	.239	.628
Car pool/bus	.001	.978
Car pool/train	2.118	.155
Car pool/walk	.058	.811
Car pool/cycle	9.345	.004*
Bus/train	3.555	.068
Bus/walk	.076	.784
Bus/cycle	15.982	.000*
Train/walk	3.045	.090
Train/cycle	5.896	.021*
Walk/cycle	16.400	.000*

$\alpha = .05$

\*denotes significance

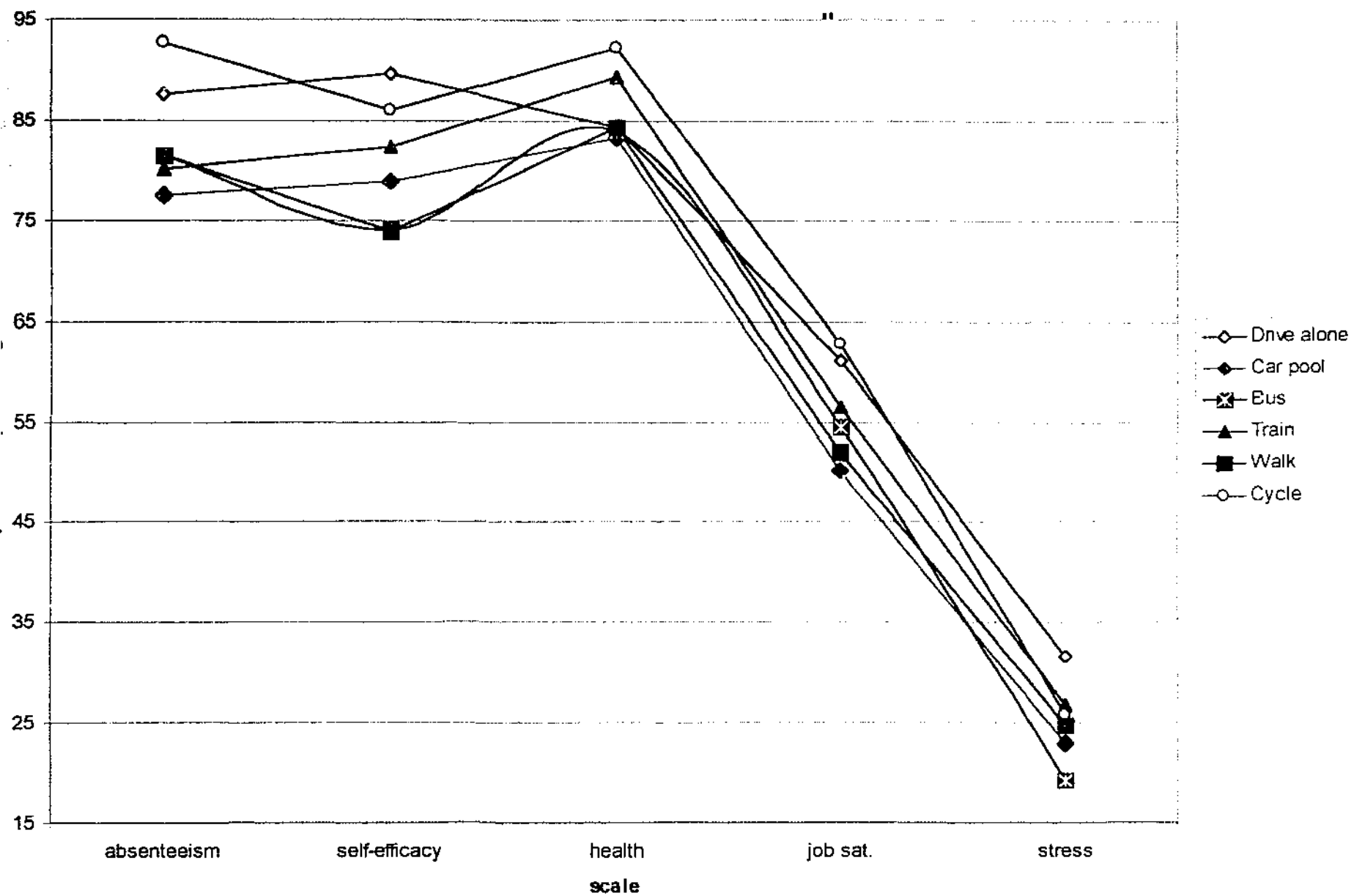


Figure 3.2 Sample Mean Percentage Score for Each Transport Mode Across Each Scale 52

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## CHAPTER 4

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### Discussion

#### 4.1 The Link Between Transportation Mode and Well-being

This study found support for a link between transportation mode and general well-being. The transportation environments examined are those of drive alone, car pool, bus, cycle, train and walk. Well-being measured using the indicators of perceived stress, self-efficacy, general health, absenteeism and job satisfaction has been related to the mode of transportation that the participants in the study used. It must be acknowledged that it can not be assumed that transport mode directly affects psychological well-being. The nature of the variable of transport mode means that randomization of participants to experimental conditions was not possible. This means that there may be the possibility of confounding variables, meaning that transport mode may not be the only variable that differentiates the transport mode categories. Possible confounding variables are discussed in section 4.5, Methodological Issues.

Each of the three hypotheses of the study shall be reviewed in turn followed by the methodological issues, research and practical implications of the study.



## 4.2 Hypothesis 1

The first hypothesis, that there is a significant difference in the well-being of users of each transport mode was partially supported. An analysis of the equality of profiles found that the categories of drive alone and cycle were significantly different from the modes of walk, bus and car pool. The transportation modes of cycle and drive alone were not significantly different from each other and the transportation modes of walk, bus and car pool were also not significantly different from each other. The transportation mode of train did not have a profile that was significantly different from any other transport mode.

The above results are surprising given that the transportation modes whose physical conditions are similar are in some cases significantly different from each other in their well-being profiles. The conditions of driving alone and car pooling are very similar in that they both involve the indoor and outdoor environment of the car and yet they had significantly different profiles. Cycling and walking are also similar in that they involve being outdoors and aerobic exercise and yet they were also significantly different from each other. It is also surprising to note the modes that were not significantly different from each other such as the train mode that was not significantly different to any other mode while the other public transport mode of bus was significantly different to drive alone and cycle.

These results suggest that the relationship between transportation mode and well-being is a very complicated one. These results clearly show that transport mode is a significant correlate of well-being but the conditions of each transport mode that cause it to have positive or negative relationships to well-being are yet to be identified.

### **4.3 Hypothesis 2**

The second hypothesis, that users of alternative modes of transport will have higher general well-being scores was not supported. The means of each well-being scale were combined to give a general well-being score (see figure 1). The highest scoring group was cyclists followed closely by the drive alone category. The train category in the mid range the lowest scoring groups being walk, bus and then car pool in that order. Cyclists as predicted had the higher overall scores but the other alternative modes all scored lower than the drive alone mode, which was expected to be the lowest performer.

These results differ from previous research which found that the negative effects of commuting were greater for those workers arriving in private automobiles than for users of public transportation (Taylor & Pocock, 1972). Car commuters have also been found to have higher absenteeism rates than users of public transport (Taylor & Pocock, 1972). This research did support the findings of Shayler et al. 1993 who found that car commuters had higher rates of absenteeism than cyclists. It must be noted that the above studies are British and that the environmental conditions and public transport system do differ in

Australia.

The surprising findings for the drive alone category may indicate that there are very real benefits to driving to work for the individual besides the highly publicised ones of time and convenience. It may be speculated that the car gives the commuter a sense of dominance over the environment, a sense of freedom and status, a personal space of their own to take from the home to the work environment. These individual benefits need to be identified if campaigns are going to combat them and successfully encourage individuals to use alternative modes of transport.

The results of this study may not indicate the effects of transportation modes on the commuter as much as the type of people who are attracted to each mode of transport. The modes of cycling and drive alone may attract people with high levels of well-being while walking, car pooling and buses attract people of lower well-being. A combination of these speculations may also be the case. These results do fulfil one expectation of this study in that the link between transportation mode and well-being is not simple.

#### **4.4 Hypothesis 3**

Hypothesis three, that transport mode has significant effects at both the individual and organisational level was supported. This research used scales which assessed psychological well-being; perceived stress, general health and self-efficacy, as well as scales that looked at

organizational well-being (job satisfaction and absenteeism). A parallelism test showed that the 6 different transport categories have the same pattern of highs and lows on all well-being scales. This means that the transportation modes had parallel profiles across both the organizational and psychological well-being scales. An examination of the rankings for each scale (see figure 2) show that the modes who scored the lowest on the psychological measures of self-efficacy, perceived stress and general health also scored the lowest on the organizational measures of absenteeism and job satisfaction. From the significant difference between these modes and the parallelism of profiles it can be concluded that transportation mode choice has both individual and organizational repercussions.

This finding was supported by previous literature which had found that transportation mode did effect both organizational and individual measures. Taylor and Pocock (1972), found that the organizational measure of absenteeism rates were effected by transportation mode, although as mentioned previously they did find that public transport had lower rates than car users which is contrary to our findings. Research by Shayler et al (1993) found transportation mode had a significant effect on the individual measure of stress with car drivers having higher stress levels than cyclists. These studies support the hypothesis that transportation mode has an effect on organizational and individual measures, although the present study is the first to incorporate more than

two modes of transport and organizational and individual measures in the same study.

#### **4.5 Methodological Issues**

The results of this study must be considered preliminary in view of several methodological limitations caused by limited time, resources and expertise. Firstly the study only examined a small sample of transport users who may or may not be representative of all commuters in Perth. Time restrictions meant that the sample size was limited to 108 participants with only 18 from each mode of transport. The small sample size also made it impossible to match participants from each mode of transport on variables such as age, profession, sex and length of commute. The variable of gender, has not been adequately addressed in transportation research. Transportation modes that had the lowest well-being scores in the present study had slightly more female members, gender may be a confounding variable. A matched sample would have given more information on whether the above are important variables in commuter well-being and would also have increased the generalisability of the current study.

One potentially confounding factor that has not been controlled for in this study is that of company position. The participants in the study were from five companies located in the central business district of Perth. These participants may have held positions in the companies ranging from menial positions to senior management positions. It may have been

the case that some transport modes consisted of participants who held higher company positions. Car drivers may have had company cars or parking spots which means they probably have been more successful in their careers and have a higher socio-economic status. It has been found that individuals who have higher incomes use public transport less (Hartgen, 1974). People who have had more success and recognition in their lives would be expected to have higher well-being particularly in reference to indicators such as self-efficacy and job satisfaction. It may also be the case that the participants current mode is not their mode of choice which may affect feelings of well-being. For example, a walker may prefer to cycle but they can't afford the equipment or a car pooler may prefer to drive alone but cannot afford the cost of parking. Hence whether current mode of transport used was the most preferred option and not the only option should have been assessed. It must also be kept in mind that the transportation environments that each participant experienced were specific to one city and that even living in the same city they may have differed depending on the suburb that the participant lived in.

The present study was set in Perth, Western Australia and the characteristics of the transport modes present in that city may differ substantially from other cities or countries. Some of the characteristics that may differ are those of cost, crowding, cleanliness, frequency of services and safety. It should also be noted that this study was conducted at the end of winter. Winter weather conditions may have made

transportation conditions more unpleasant for particular transportation modes such as walking. Weather conditions from other cities or countries may also have a substantial effect on well-being.

#### **4.6 Practical and Research Implications**

This research suggests that there is a complex link between transport mode and general well-being. Differences were found in the well-being scores of the six different transportation modes examined in this study. The relationship of the transportation modes to the well-being scales was not predicted and can not be readily explained by any current theories or previous research.

These results imply that psychological factors are important variables in transportation research and should be incorporated into future research. Previous research that has pooled together commuters from different modes of transport should be interpreted with caution. The present research indicates that even commuters who use similar transport modes such as drive alone and car pool or the different public transport modes should be placed in separate transport mode categories.

The finding of a significant difference in the well-being profiles of users of differing modes of transport suggests that marketing campaigns aimed at getting people to change from their current mode of transport need to focus on the characteristics of that particular group. For example the drive alone category had a very high self-efficacy score which may mean that a campaign that highlights the challenges and difficulties of

rush-hour traffic may not be effective.

The promotion of alternative modes of transport may be more effective when all the consequences of transport choice for the commuter are known. Are there particular personal characteristics that attract people to the car? Do some transportation environments foster powerlessness and helplessness? The characteristics of current and potential users of transportation systems are instrumental in the design and marketing of transport systems and alternatives.

The surprisingly high well-being scores of the drive alone category in this study may suggest that the car on an individual level may have a positive effect on general well-being. Researching the benefits of driving alone to work may seem self-defeating from the perspective of the anti-car campaigner but this information could be an important tool in the fight to reduce our dependence on the car. Furthering our understanding of why the car is so popular may play an important part in designing other transport options to be more in line with the preferences of the commuter.

This research suggests that mode of transport may have psychological and organizational repercussions. Information on the effect that transport mode choice has on the commuter, organizations and society could be important in persuading people to change their travel behaviour. Campaigns aimed at promoting alternative modes of transport have in the past limited their focus to economic, environmental and convenience factors (Stokols & Novaco, 1981). Given that individuals, organizations and the community may be experiencing health costs



associated with transport choice, organizations and government agencies may be induced to play a part in providing facilities and resources needed to promote alternative modes of transport.

The identification of the negative impacts of transport conditions needs to be seen as a first step in preventing the exposure of commuters to visible and invisible hazards. Research such as the present one way in which the focus of communities, individuals and organizations can be shifted from the diagnosis and treatment of disease to the prevention of disease and the promotion of lifestyle choices that promote optimal health and performance.

#### **4.7 Future Research Directions**

The results of this research suggest several potentially important areas of future research. The generalizability of the current results needs to be assessed and established. This could be done by having a much larger sample. It is suggested that future research participants be matched on variables such as gender, age, income and access to certain transport facilities.

Future research could look at changes in well-being for commuters who change from one mode of transport to another. Research such as this would increase our understanding of the link between transport mode and well-being by identifying whether well-being increased or decreased when a commuter changed from one mode to another.

Future research could look at other indicators of well-being such as productivity, anxiety and depression. The present study looked at well-being at two levels of analysis, which were psychological and organizational. Future research could begin to look at larger levels of analysis such as community well-being.

#### **4.7 Conclusions**

The results of this study indicate that the link between mode of transport and general well-being is both real and complex. The findings of the study must be considered tentative in nature as research of this kind is just at the beginning stages. As the body of research in the area of transportation modes grows then more sophisticated studies may be designed. Future research in the behavioural sciences may hold the key to solving our transport-related problems. The substantial economic, social and environmental costs of the car make a change in our transportation habits both necessary and urgent.

From the ecological perspective, the relationship between transportation and well-being is not construed in terms of independent distinct variables but in terms of mutually causal relationships between clusters of situationally relevant factors (Stokols & Novaco, 1981, p.98). The challenge posed by this approach is to identify the factors that are of the greatest theoretical and practical relevance to the study of transportation and well-being. This research has established that transportation mode is one of those factors.

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# General Well-Being Questionnaire

*This questionnaire comprises of different scales and questions that assess your general well-being. Information gathered by this questionnaire will be used by the Department of Environmental Protection to assess the well-being of workers in the city. By filling out this questionnaire you are consenting to these conditions. All information will be kept confidential and you do not need to identify yourself on the questionnaire. The best approach is to answer all questions as quickly as possible. Indicate the alternative that is the most accurate response for you. It is important that you try to answer ALL questions. Thankyou for your cooperation.*

1. Using the scale shown below, circle a number for each statement

A.

	Strongly Disagree	Somewhat Disagree	Somewhat Agree	Strongly Agree
-I depend on my lists and notes.	1.....	2.....	3.....	4.....
-I cannot work within a normal eight hour day.	1.....	2.....	3.....	4.....
-I make lists of things to do on a regular basis.	1.....	2.....	3.....	4.....
-I rely on my daily diary.	1.....	2.....	3.....	4.....
-I regularly check whether I have achieved my goals.	1.....	2.....	3.....	4.....
-I use lists and notes to organise my time.	1.....	2.....	3.....	4.....
-I could not work without my lists and notes.	1.....	2.....	3.....	4.....
- Keep notes in my line of vision so that I do not forget to complete tasks.	1.....	2.....	3.....	4.....

B.

	Strongly Disagree	Somewhat Disagree	Somewhat Agree	Strongly Agree
-It is easy for me to concentrate on the task at hand.	1.....	2.....	3.....	4.....
-It is only at the last minute of a deadline that I can get a good concentration .	1.....	2.....	3.....	4.....
-I feel resentment about having to complete tasks.	1.....	2.....	3.....	4.....
-It is rare that I need to push myself at the last minute of a deadline.	1.....	2.....	3.....	4.....
-I can only work under pressure.	1.....	2.....	3.....	4.....
-I use schedules to push myself to finish projects.	1.....	2.....	3.....	4.....
-I leave some things half undone.	1.....	2.....	3.....	4.....
-I use last minute deadlines to push myself to perform.	1.....	2.....	3.....	4.....

C

	Strongly Disagree	Somewhat Disagree	Somewhat Agree	Strongly Agree
-When I'm working, I am so focused on the work in front of me that I lose track of time.	1.....	2.....	3.....	4.....
-I see an endless array of tasks waiting to be completed	1.....	2.....	3.....	4.....
-I often feel the need to get just a few more tasks done	1.....	2.....	3.....	4.....
-I feel in control of the intensity with which I work.	1.....	2.....	3.....	4.....
-I feel I am able to control the amount of work I do.	1.....	2.....	3.....	4.....
-I often find myself with an overpowering need to finish up a few 'things'.	1.....	2.....	3.....	4.....
-I have difficulty following a project through from beginning to end.	1.....	2.....	3.....	4.....
-Often I see only the present task before me followed by a parade of other tasks.	1.....	2.....	3.....	4.....

D

	Strongly Disagree	Somewhat Disagree	Somewhat Agree	Strongly Agree
-When I think about myself and other people, I feel a strong sense of separation and standing alone.	1.....	2.....	3.....	4.....
-It is important for me to be 'right'.	1.....	2.....	3.....	4.....
-I prefer work which provides the opportunity to control others.	1.....	2.....	3.....	4.....
-I think I am quite a special person.	1.....	2.....	3.....	4.....
-In most things, I feel I am superior to other people.	1.....	2.....	3.....	4.....
-I like finding faults with experts.	1.....	2.....	3.....	4.....
-I feel others just cannot keep up with me.	1.....	2.....	3.....	4.....
-I think I know the best way to go about doing things.	1.....	2.....	3.....	4.....
-I exaggerate my achievements and rarely mention my failures.	1.....	2.....	3.....	4.....

**2. We should like to know if you had any medical complaints and how your health has been in general, over the past few weeks. Please answer ALL the questions that follow by simply circling the answer which you think most nearly applies to you. Remember that we want to know about present and recent complaints, not those that you had in the past.**

**Have you recently**

-been feeling perfectly well and in good health?	Better than usual	Same as usual	Worse than usual	Much worse than usual
-been feeling in need of a good tonic?	Not at all	No more than usual	Rather more than usual	Much more than usual
-been feeling run down and out of sorts?	Not at all	No more than usual	Rather more than usual	Much more than usual
-felt that you are ill?	Not at all	No more than usual	Rather more than usual	Much more than usual
-been getting any pains in your head?	Not at all	No more than usual	Rather more than usual	Much more than usual
-been getting a feeling of tightness or pressure in your head?	Not at all	No more than usual	Rather more than usual	Much more than usual
-been having hot or cold spells?	Not at all	No more than usual	Rather more than usual	Much more than usual

**Have you recently**

-lost much sleep over worry?	Not at all	No more than usual	Rather more than usual	Much more than usual
-Had difficulty in staying asleep once you are off?	Not at all	No more than usual	Rather more than usual	Much more than usual
-felt constantly under strain?	Not at all	No more than usual	Rather more than usual	Much more than usual
-been getting edgy and bad tempered	Not at all	No more than usual	Rather more than usual	Much more than usual
-been getting scared or panicky for no good reason?	Not at all	No more than usual	Rather more than usual	Much more than usual
-found everything getting on top of you?	Not at all	No more than usual	Rather more than usual	Much more than usual
-been feeling nervous and strung-up all the time?	Not at all	No more than usual	Rather more than usual	Much more than usual
-been managing to keep yourself busy and occupied?	More so than all	Same as usual	Rather less than usual	Much less than usual

**Have you recently**

-been taking longer over the things you do?	<b>Quicker at all</b>	<b>Same than usual</b>	<b>Longer than usual</b>	<b>Much longer than usual</b>
-felt on the whole you were doing things well?	<b>Better than usual</b>	<b>About the same</b>	<b>Less well than usual</b>	<b>Much less well</b>
-been satisfied with the way you've carried out your task?	<b>More satisfied</b>	<b>About same as usual</b>	<b>Less satisfied than usual</b>	<b>Much less than usual</b>
-felt that you were playing a useful part in things?	<b>More so than usual</b>	<b>Same as usual</b>	<b>Less useful than usual</b>	<b>Much less useful</b>
-felt capable of making decisions about things?	<b>More so than usual</b>	<b>Same as usual</b>	<b>Less so than usual</b>	<b>Much less useful</b>
-been able to enjoy your normal day-to-day activities?	<b>More so than usual</b>	<b>Same as usual</b>	<b>Less so than usual</b>	<b>Much less than usual</b>
-been thinking of yourself as a worthless person?	<b>Not at all</b>	<b>No more than usual</b>	<b>Rather more than usual</b>	<b>Much more than usual</b>
-felt that life is entirely hopeless?	<b>Not at all</b>	<b>No more than usual</b>	<b>Rather more than usual</b>	<b>Much more than usual</b>
-felt that life isn't worth living?	<b>Not at all</b>	<b>No more than usual</b>	<b>Rather more than usual</b>	<b>Much more than usual</b>

**Have you recently**

-thought of the possibility that you might make away with yourself?	<b>Definitely not</b>	<b>I don't think so</b>	<b>Has crossed my mind</b>	<b>Definitely have</b>
-found at times you couldn't do anything because your nerves were too bad.	<b>Not at all</b>	<b>No more than usual</b>	<b>Rather more than usual</b>	<b>Much more than usual</b>
-found yourself wishing you were dead and away from it all?	<b>Not at all</b>	<b>No more than usual</b>	<b>Rather more than usual</b>	<b>Much more than usual</b>
-found that the idea of taking your own life kept coming into your mind?	<b>Definitely not</b>	<b>I don't think so</b>	<b>Has crossed my mind</b>	<b>Definitely has</b>

3. Please circle the numbered response you judge to be the most accurate description of you for each of the following statements.

	Not at all True	Barely True	Moderately True	Exactly True
-I can always manage to solve difficult problems if I try hard enough	1 .....	2 .....	3 .....	4 .....
-If someone opposes me, I can find means and ways to get what I want.	1 .....	2 .....	3 .....	4 .....
-It is easy for me to stick to my aims and accomplish my goals	1 .....	2 .....	3 .....	4 .....
-I am confident that I could deal efficiently with anything that comes up.	1 .....	2 .....	3 .....	4 .....

	Not at all True	Barely True	Moderately True	Exactly True
-Thanks to my resourcefulness, I know how to handle unforeseen situations.	1 .....	2 .....	3 .....	4 .....
-I can solve most problems if I invest the necessary effort.	1 .....	2 .....	3 .....	4 .....
-I can remain calm when facing difficulties because I can rely on my coping abilities.	1 .....	2 .....	3 .....	4 .....
-When I am confronted with a problem, I can usually find several solutions.	1 .....	2 .....	3 .....	4 .....
-If I am in a bind, I can usually think of something to do.	1 .....	2 .....	3 .....	4 .....
-No matter what comes my way, I'm usually able to handle it.	1 .....	2 .....	3 .....	4 .....

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4. Some jobs are more interesting than others. We want to know how people feel about different jobs. You are to circle the phrase below each statement that has best described how you feel about your present job. There are no right or wrong answers. We should like your honest opinion on each one of the statements.

a) There are some conditions concerning my job that could be improved.

Strongly agree, agree, undecided, disagree, strongly disagree.

b) My job is like a hobby to me.

Strongly agree, agree, undecided, disagree, strongly disagree.

c) My job is usually interesting enough to keep me from getting bored.

Strongly agree, agree, undecided, disagree, strongly disagree.

d) It seems that my friends are more interested in their jobs.

Strongly agree, agree, undecided, disagree, strongly disagree.

- e) I consider my job rather unpleasant.  
Strongly agree, agree, undecided, disagree, strongly disagree.
- f) I enjoy my work more than my leisure time.  
Strongly agree, agree, undecided, disagree, strongly disagree.
- g) I am often bored with my job.  
Strongly agree, agree, undecided, disagree, strongly disagree.
- h) I feel fairly well satisfied with my job.  
Strongly agree, agree, undecided, disagree, strongly disagree.
- i) Most of the time I have to force myself to go to work.  
Strongly agree, agree, undecided, disagree, strongly disagree.
- j) I am satisfied with my job for the time being.  
Strongly agree, agree, undecided, disagree, strongly disagree.
- k) I feel that my job is no more interesting than others I could get.  
Strongly agree, agree, undecided, disagree, strongly disagree.
- l) I definitely dislike my work.  
Strongly agree, agree, undecided, disagree, strongly disagree.
- m) I feel that I am happier in my work than most other people.  
Strongly agree, agree, undecided, disagree, strongly disagree.
- n) Most days I am enthusiastic about my work.  
Strongly agree, agree, undecided, disagree, strongly disagree.
- o) Each day of work seems like it will never end.  
Strongly agree, agree, undecided, disagree, strongly disagree.
- p) I like my job better than the average worker does.  
Strongly agree, agree, undecided, disagree, strongly disagree.
- q) My job is pretty uninteresting.  
Strongly agree, agree, undecided, disagree, strongly disagree.
- r) I find real enjoyment in my work.  
Strongly agree, agree, undecided, disagree, strongly disagree.
- s) I am disappointed that I ever took this job.  
Strongly agree, agree, undecided, disagree, strongly disagree.

**6. The questions in this scale ask you about your feelings and thoughts during the last month. In each case, you will be asked to indicate how often you felt or thought a certain way. Although some of the questions are similar, there are differences between them and you should treat each one as a separate question. The best approach is to answer each question fairly quickly. That is don't try to count the number of times you felt a particular way, but rather indicate the alternative that seems like a reasonable estimate.**

- a) In the last month, how often have you been upset because of something that happened unexpectedly?**  
 Never      Almost never      Sometimes      Fairly often      Very often
- b) In the last month, how often have you felt that you were unable to control the important things in your life?**  
 Never      Almost never      Sometimes      Fairly often      Very often
- c) In the last month, how often have you felt nervous and 'stressed'?**  
 Never      Almost never      Sometimes      Fairly often      Very often
- d) In the last month, how often have you dealt successfully with irritating life hassles?**  
 Never      Almost never      Sometimes      Fairly often      Very often
- e) In the last month, how often have you felt that you were effectively coping with important changes that were occurring in your life?**  
 Never      Almost never      Sometimes      Fairly often      Very often
- f) In the last month, how often have you felt confident about your ability to handle your personal problems?**  
 Never      Almost never      Sometimes      Fairly often      Very often
- g) In the last month, how often have you felt that things were going your way?**  
 Never      Almost never      Sometimes      Fairly often      Very often
- h) In the last month, how often have you found that you could not cope with all the things that you had to do?**  
 Never      Almost never      Sometimes      Fairly often      Very often
- i) In the last month, how often have you been able to control irritations in your life?**  
 Never      Almost never      Sometimes      Fairly often      Very often
- j) In the last month, how often have you felt that you were on top of things?**  
 Never      Almost never      Sometimes      Fairly often      Very often
- k) In the last month, how often have you been angered because of things that happened that were outside of your control?**  
 Never      Almost never      Sometimes      Fairly often      Very often
- l) In the last month, how often have you been able to control the way you spend your time?**  
 Never      Almost never      Sometimes      Fairly often      Very often
- m) In the last month, how often have you felt the difficulties were piling up so high that you could not overcome them?**  
 Never      Almost never      Sometimes      Fairly often      Very often

7. How many days would you estimate that you have been absent in the last six months? \_\_\_\_\_  
*(this does not include working at home; absent days are defined as days away from the workplace which are not anticipated or scheduled by the employer).*

8. What mode of transport have you used most regularly for your commute to work in the last month?  
*(Please tick the ONE mode that accounts for the greater part of your journey)*

- ☐ CYCLE
- ☐ BUS
- ☐ WALK
- ☐ TRAIN
- ☐ DRIVE ALONE
- ☐ CAR POOL
- ☐ OTHER (please specify) \_\_\_\_\_

9. Age in years: *Tick one box only*

<input type="checkbox"/> Under 18	<input type="checkbox"/> 61-65
<input type="checkbox"/> 18-40	<input type="checkbox"/> Over 65
<input type="checkbox"/> 41-60	

10. Gender: *Tick one box only*

☐ Male ☐ Female

11. Postcode of residence: \_ \_ \_ \_ \_

**Thankyou for your participation in this survey**  
**For More Information about this Survey Please Contact Carolyn King**  
**PH: 447 6697**