The Western Australian Cycling 100 Project.

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1. Summary

This paper deals with a central problem relating to bicycle promotion in Western Australia. Very few people currently ride to work in the Perth central buisness district. Australian Bureau of Statistics "journey to work" data from 1996 revealed that 801 people were riding to work compared to 85,000 people travelling by car. The major question then, is how can we motivate more people to use the bicycle mode to get to work and reduce our reliance on cars?

Using the physical incentive of a free bike together with intensive health monitoring was predicted to be a good way to motivate individual car drivers to switch to bike riding for a minimum of four trips per week over a one year period. The Cycling 100 Project has demonstrated that this incentive scheme is proven to work with a certain "target audience" of car commuters. Creating a successful cycle promotion project with clear and empirically derived health, job satisfaction and pollution-prevention benefits means we have the necessary evidence to ask for on-going and enlarged Government funds to promote cycling more widely.

2. Literature Review

Coronary heart disease (CHD) is Australia's biggest killer. In 1989-90, the cost of CHD to the community was four billion dollars. The Heart Foundation suggested that CHD costs the health system $0.5 billion per year and loss of economic productivity costs a further $0.7 billion (Hastings and Laing, 1996). The British Medical Association suggested that 60 million working days are lost in the UK through CHD due to a lack of physical exercise (London Cycling Campaign, 1997). Apart from hereditary causes, CHD is almost totally attributed to lifestyle factors such as low physical activity levels (Hastings and Laing, 1996; Berlin & Colditz, 1990). People who are sedentary are at greater risk of developing CHD (Peach, Bath and Farish, 1999; Roberts et al, 1995).

Howe demonstrated that half the population of New South Wales failed to meet the recommended requirement of physical activity for health promotion, with one in eight people being classed as "inactive" (1999). Inactivity is implicated in approximately one third of CHD deaths. Roberts et al demonstrated that 55 per cent of Australians engage in insignificant physical activity to make a difference to health (1995). Owen suggested that there would be a seven per cent reduction in deaths due to CHD if half the adult population participated in moderate exercise five times per week (1999).

High levels of obesity are also correlated with CHD (Binns, 1999). Australia has a high prevalence of overweight people. The 1995 National Nutrition Survey revealed that 45 per cent of men and 29 per cent of women are overweight and an additional 18 per cent of men and women were classified as obese (Public Health Association of Australia 1998). In Australia, estimated direct costs of obesity are $464 million, while indirect costs associated with worker absenteeism and premature death add a further $272 million (Public Health Association of Australia, 1998). The fundamental causes of obesity are sedentary lifestyles and over-consumption of high-fat, energy-dense foods.

CHD and obesity are largely preventable and physical activity is one of the main elements of prevention (Wannamathee, Shaper & Macfarlane, 1993). This is because regular moderate exercise improves the cardiovascular system's efficiency (Roberts et al 1995). Exercise also contributes to the reduction of excess weight (Hastings and Laing, 1996). For example, cycling uses a large number of calories both during and after riding. A 20 minute ride can raise metabolism by 29 per cent for up to one hour (Johnson, 1999). Exercise also reduces cholesterol in the blood and lowers blood pressure reducing the likelihood of strokes and heart attacks (Roberts et al. 1995). The relative risk of death for people who are hypertensive is 34 per cent higher than the general population (Roberts et al. 1995). High blood pressure causes nearly 11,000 deaths in people under the age of 70 each year in Australia. Physical

activity prevents the onset of high blood pressure and exercise helps to reduce blood pressure in people with hypertension. A study on sedentary people with high blood pressure who were encouraged to cycle three times per week showed that their blood pressure fell by 10mmHg systolic and 7mmHg diastolic and further research showed that cycling reduced blood pressure as effectively as some drugs (Johnson, 1999). Owen suggested that 40 per cent of people taking drugs to lower blood pressure wouldn't need treatment if they had 20-30 minutes of moderate exercise most days.

Cycling provides health promotion benefits for individual riders (Hillman, 1992). Hastings and Laing, (1996) demonstrated that office workers in sedentary jobs who cycled to work had half the expected number of heart attacks. Hillman showed that middle aged men who were involved in a physical activity promotion were 50 per cent less likely to have a heart attack than a control group and exercise was shown to greatly reduce the risk of stroke in middle age (1992). Aerobic activity is also associated with 40 per cent less risk of losing mobility for older people (Hastings and Laing, 1996)

Cycling is an ideal exercise activity since it is non-weight bearing and provides aerobic exercise that minimises the risk of muscle and ligament injury (Hillman, 1992). The benefit of cycling to work is that it offers a regular, moderate exercise activity that is beneficial to overall health. Cycling provides the preventative maintenance for most of the vital functions of the body (Roberts et al. 1995). Numerous studies have also demonstrated that cycling provides health benefits via cancer prevention. Hastings and Laing (1996) noted that men who participated in regular exercise were 88 per cent less likely to develop prostate cancer. Besides the benefits related to CHD, cancer prevention, obesity and blood pressure, regular moderate exercise involving cycling has been demonstrated to play an important preventative function in relation to the following issues:

- Exercise reduces the risk of developing diabetes at middle age and physical activity reduces the need for drugs (Hastings and Laing, 1996; Roberts et al. 1995).
- Exercise is as effective as psychotherapy and anti-depressant drug therapy in treating mild to moderate depression (Harvey, 1998). Harvey also recorded reduced anxiety levels in those people who exercised regularly (1998). Johnson has also shown that people over 55 who bicycle have better recall than sedentary counterparts (1999).
- Hastings & Laing (1996) reported that cyclists increased their bone mineral density in the spine by 3.6 per cent and non-cyclists decreased their density by 2.4 per cent. This is particularly important for post-menopausal women (Hillman, 1992). Johnson showed that in sedentary men over 60 years of age, a 19 per cent increase in bone density was experienced after beginning a program of cycling for sixty minutes three times a week (1999).

The Traffic Advisory Unit (1997) suggested that there are numerous other benefits to employers who encourage cycling amongst their staff. Shayler et al. (1993) showed that absenteeism was reduced by between 14 and 80 per cent as a result of improved fitness in the workplace. Improvement also led to increased productivity. Organisations that implemented cycling strategies received a $1.33 – $6.50 return for each $1 they'd spent in cycle promotion (Shayler et al. 1993). Besides these advantages, cycling has one other major benefit.

Personal transport using cars is the most polluting behaviour in urban society and cycling can help to reduce this pollution source (Rowell & Fergusson, 1991). People in Perth experience two major forms of air pollution: 1) summer photochemical smog containing ozone gas and 2) winter haze containing harmful particulates (Western Power (WP) & Department of Environmental Protection (DEP), 1996). Smog has many negative health and environmental effects. Perth exceeds World Health Organisation ozone safety levels about 15 times per year and it is estimated that Perth's haze problems cause seventy premature deaths each year. (DEP/CSIRO, 1996).

In spite of the potential benefits of cycling to individuals, organisations, and society generally, Western Australia has a very low level of commuter cycling and a very high car ownership level with 679 cars per 1000 people. The 1991 and 1996 Australian Census's revealed that 85,000 cars were driven in to the Perth cental business district (CBD) for work purposes each day. Almost 65,000 of these cars transported the driver only with no passengers. At the same time, only 792 people rode bicycles in 1991 and this figure had increased to just 801 cycle commuters by 1996. Car use is the main form of transport in Perth and 76 per cent of trips in the metropolitan region are made by car (WP and DEP, 1996; Campbell & Adam, 1995). One third of all car journeys are estimated to be three kilometres or less and at least 25 per cent of all car trips could be converted to cycling (Department of Transport, 1995; Austroads, 1999).

A reduction in the use of cars for work trips by commuters would help to reduce air quality problems in Perth.

Although the potential for cycling is great, it is also the case that many car commuters perceive difficulties associated with cycle riding. A lack of “safe” cycle routes, lack of end of trip facilities such as showers, bike racks and lockers and negative perceptions about wind, rain or hilly terrain are all “real” issues in the minds of some people. Other problems related to working patterns (e.g., nightshift), the need for a car during working hours, the requirement to pick up or drop off children or other people and the long distance of some commuter trips are also problematic for cycle promotion activities.

The rationale for the Cycling 100 Project starts with the recognition that, while these perceptions are objective problems for many car commuters, other drivers could switch to the bicycle without encountering such problems. These people live close enough to work for cycling to be a feasible alternative to the car for at least four trips each week. They already work in organisations with end of trip facilities. They have good access to the Perth Bicycle Network (PBN). They work regular and standard work patterns, infrequently require a car during the daytime, don’t need to carry heavy loads, and they don’t need to drop off or pick up other people on the way to work. In spite of these positive conditions, however, thousands of people in this category still drive to work each day. This group of potential cyclists forms the target audience for the Cycling 100 Project.

They are the easiest group to convert to cycling because their objective conditions are already favourably inclined towards cycling. Unlike other social marketing or health promotion activities that assume the need to promote a change in attitudes, values or beliefs as a precursor to positive behavioural change, the Cycling 100 Project starts with the assumption that behavioural change is what really matters. Using the motivational incentive of a loan bicycle together with health tests and on going monitoring of performance, the Cycling 100 Project offers the potential to encourage thousands of people to start cycling.

On this basis, the Cycling 100 Project had two integrated, practical objectives. The project targeted the associated problems of increasing air pollution and decreasing exercise opportunity. The outcome was to demonstrate the possibility for encouraging car commuters to replace four of their regular car trips with periods of moderate physical exercise involving bicycle riding. The project used the incentive of a “free” bike to encourage drivers to replace four car trips per week for a twelve-month period. It was also necessary to evaluate if people who replace car trips with cycling obtain significant personal health and lifestyle improvements. The objective was to demonstrate the potential efficacy of this approach to cycle promotion. In demonstrating the potential of bicycle promotion activities such as the Cycling 100 Project, it was hoped that further funding and commitment from Government would be achieved to enlarge the project over coming years.

3. Methodology

3.1. Procedure and participants

The study promoted four periods of regular moderate exercise per week for one-year using the physical incentive of a loan bike. Participants in the study were drawn from 11 CBD-based organisations who were willing to sponsor their own staff at the rate of $400 per rider. The project recruited 100 riders (36 females, 64 males) with an average age of 39 years. For inclusion in the study, participants had to meet several criteria, including the following:

- They were regular car drivers for their work trips;
- They lived within 10-15 kilometres of their workplace;
- Willing to replace four car trips to work each week for one year;
- Able to pass a series of fitness evaluations;
- Not considering moving employment within the next 12 month period; and
- Willing to complete all necessary pre-screening activities.

The research process involved contacting potential sponsors and seeking a commitment to pay for riders. Once sponsorship was forthcoming, an initial meeting with interested staff members was organised. Staff were invited to nominate themselves and enter the recruitment stage. Recruitment involved the completion of a medical with a general practitioner, keeping a travel diary over a two-week period, completing a screening questionnaire and undergoing a fitness appraisal. The final activity was a kilometre target calculation for each individual

based on their home to work trip distance and calculated over a one month period. When participants completed all these activities, they were provided with the cycling equipment. Riders were then required to meet the monthly target over a one-year timeframe. Kilometres were monitored using a cycle computer attached to each bike. Routine checks were also made to ensure that the bikes were being ridden to work on a regular basis.

3.2. Measurement of effects:

Study data was collected in two ways. Firstly, a test battery was used prior to the intervention and again at the conclusion of the study. Secondly, evaluation of cycle performance was conducted on a monthly basis. The test battery involved comparison of data regarding the following health and travel variables:

- Physical work capacity (PWC 170 test). This test provides a high-level indicator of aerobic fitness and can be used to compare individual participants against Australian adult fitness norms.;
- Plasma cholesterol tests of LDL, HDL, VDL, triglycerides, etc;
- Coronary risk ratio;
- Job satisfaction using the 15 item Warr, Cook and Wall Job Satisfaction Survey. This instrument is widely cited in the job satisfaction literature and covers a range of issues related to intrinsic and extrinsic job satisfaction themes; and
- Monthly evaluation of kilometre target data. This information was collected from a computer attached to each bicycle.

3.3. Equipment:

Each rider was provided with an Indi-Maverick mountain bike equipped with road-going tyres, front and rear lights, lock, cateye cycle computer and bicycle helmet.

4. Results

The cyclists replaced over 121,000 kilometres of car commuting with cycling (see table one) equating to a reduction of 37 tonnes of “greenhouse” gases (C02 equivalent).

Month	Target KMs	Actual KMs
January	8,237	10,730
February	7,853	10,393
March	7,693	11,328
April	7,489	10,937
May	7,121	9,576
June	6,961	7,840
July	7,665	8,267
August	6,542	8,162
September	6,757	7,309
October	8,635	10,533
November	11,081	15,727
December	11,403	11,970

Table 1. Target kilometres and actual totals recorded.

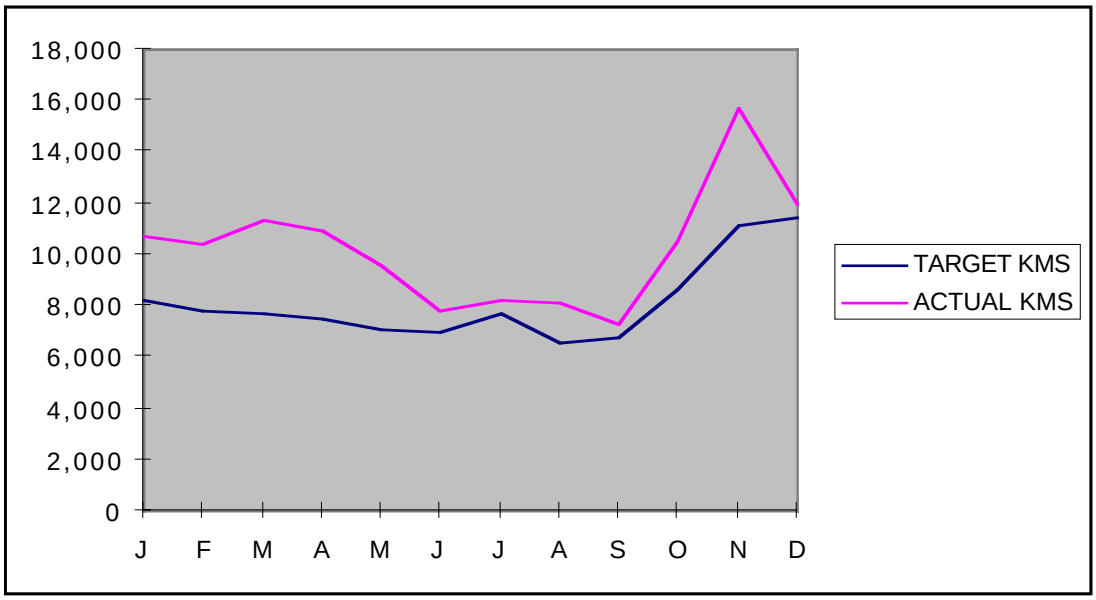

Figure 1. Despite seasonal variation, the cyclists always stay above target.

Using SPSS (version 8), each of the various health-test results were submitted to a dependent t test (see table 2 for descriptive statistics). Results are shown below:

- Physical Work Capacity: t (41) = -2.10, p = 0.042. This indicates that aerobic fitness was significantly improved after the year long cycling intervention. Those people in the low fitness category dropped from eight to five people and those in the high fitness category jumped from 24 to 32 people;
- Coronary Risk Ratio: t (35) = 3.53, p = 0.01. This indicates that the risk of heart attack and stroke was reduced significantly between the first and second health test periods;
- Total Cholesterol: t (34) = 2.58, p = 0.014. This indicates that plasma cholesterol was reduced in the participants and the following results indicate that HDL (good) cholesterol was significantly increased while LDL (bad) cholesterol was significantly decreased;
- LDL Lipoproteins: t (34) = 4.49, p = 0. 00;
- HDL Cholesterol: t (34) = -2.09, p = 0.04; and
- VLD Lipoproteins: t (34) = -2.16, p = 0.01.

Test	No	Pre-test mean	Post-test mean
Physical work capacity	42	3.61 (SD: 1.22)	4.00 (SD: 1.12)
Total cholesterol	36	5.50 (SD: 0.96)	5.24 (SD: 0.83
HDL cholesterol	36	1.65 (SD: 0.34)	1.74 (SD: 0.39)
LDL cholesterol	36	3.38 (SD: 0.92)	3.00 (SD: 0.73)
Coronary risk ratio	36	3.45 (SD: 0.97)	3.15 (SD: 0.83)

Table 2. Descriptive statistics

Using SPSS (version 8), a dependent t test was also conducted on pre- and post test results taken from the 15-item Job Satisfaction Survey. The pre-test mean score was 5.0 and the post-test mean was 5.4. Participants demonstrated improved satisfaction on ten of the 15 items (with two remaining the same and three showing a small decline).

5. Discussion

The incentive of a “free” bike encouraged 100 car drivers to replace a minimum of four car trips per week over a twelve-month period. This clearly demonstrated the possibility for encouraging commuters to replace their regular car trips with periods of moderate physical exercise involving bicycle riding. Evaluation of the fitness levels of the new riders indicates that taking up cycling leads to significant health improvements. The study demonstrated the efficacy and success of this approach to health promotion. It is worth noting, however, that although corporate sponsorship to fund this project was secured, the process was extremely difficult to achieve. Over 70 organisations approached the DEP for information but only 11

offered funding. A limitation of the corporate sponsorship approach is actually finding sponsors with an interest in committing dollars to health promotion activities. A further problem of the low level of available resources, was the lack of an adequate control group of non-cyclists. A control group would have allowed for unequivocal attribution of the positive health impacts of the study to the cycling intervention. The next phase of the project involves recruitment of 300 new riders alongside a comparison control of non-riders.

The Cycling 100 Project demonstrated that car drivers can be encouraged to forego their polluting form of commuting and change to the bicycle. It was also demonstrated that new riders can gain significant improvements in fitness as a result. In conclusion, large numbers of the 85,000 car drivers travelling into Perth each day could be converted to cycling using the incentive of a free bike together with ongoing monitoring of personal health and monthly kilometre targets.

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