AN INVESTIGATION OF THE RELATIONSHIP BETWEEN TRANSPORT AND HEALTH WHILST EXAMINING THE IMPORTANCE OF LOCAL PEOPLE AND ADOPTING A BOTTOM-UP APPROACH TO TRANSPORT PLANNING POLICIES AND PROCEDURES.

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Introduction

The relationship between socioeconomic status and both mental and physical health is widely recognised: poor socioeconomic conditions are tied to worse health. At the same time it is being increasingly recognised that place and space have an impact on human health. In other words, the community and environment in which an individual finds themselves plays an important role in determining their health. A new public health agenda has emerged over the past fifteen years that is based on a shift in focus from prescriptive treatment to preventative methods that promote good health (CABE, 2006). A vast range of potential solutions to Britain's health and inactivity crisis have been suggested by various professional bodies, with the link between transport and health appearing frequently within these solutions. It is widely recognised that health, transport planning and built environment professionals need to work together to meet the challenge of the cost of treating chronic diseases related to increasing levels of obesity, such as cardiovascular disease.

This paper aims to highlight the importance of using transport planning as a way of promoting health and in the process to reduce the incidence of chronic diseases such as cardiovascular disease. It argues that this can only be successful when local people and their opinions are involved in the process, as both health and transport decision-making processes are characteristics of the individual. To validate this suggestion, this paper builds on the growing evidence base that details the relationship between transport decision-making choices and health by investigating whether a link between transport and cardiovascular disease can be established. Existing literature concerning the relationship between cardiovascular disease, general health and transport is firstly reviewed, before the data collection and analysis undertaken to support this research paper are detailed. The economic impacts of transport planning projects that focus on the individual are considered, as well as potential economic benefits of associated health improvements. Finally, a set of conclusions and research recommendations are presented alongside potential avenues for future research.

Literature Review

Cardiovascular disease, defined as the collective term for all diseases that affect the circulatory system, is the leading cause of death and disability in the Global North and accounts for more than half of all deaths in the European region (World Health Organisation, 2012). It is the main cause of death in the United Kingdom and was responsible for 191,000 deaths in the UK in 2008. The disease is estimated to cost the UK government and the National Health Service a total of £3 billion annually (British Heart Foundation, 2012). Research into the causes of cardiovascular disease is well established; it can be traced back to the 1940s when Ancel Keys advanced the idea that cardiovascular disease (CVD) is not "an inevitable result of aging" but is instead related to social and environmental factors. A large body of evidence exists that shows a wide range of potential causes of and risk factors for cardiovascular disease, including smoking, high blood pressure, high cholesterol, obesity, family history, ethnicity and age. However, there is an inequitable geographic spread of CVD across the United Kingdom – suggesting that social factors also play a role in influencing CVD risk.

The Whitehall Study (and the follow up Whitehall II Study) is one of the most celebrated investigations into the causes of cardiovascular disease. The study found that car ownership is related to risk factors of CVD, whereby a reliance on the car was linked to a lower propensity towards active means of travel. As such, a link can be seen between CVD and transport.

People's transport decisions are influenced by the distance that they have to travel and their perception of the physical environment. Thus, land use decisions and good planning can encourage people to make sustainable travel choices by improving the quality of the built environment and connections between places. In areas with appropriate infrastructure, it is often possible for walking and cycling to be incorporated into daily routines to replace existing short car trips (for example, for travel to and from work, school and shopping activities). Compact, transit-supportive built environment and walkable neighbourhood patterns are frequently associated with increases in physical activity (Frank et al., 2004; Frank et al., 2012; King et al., 2003; Lopez, 2004).

Moderate physical activity through walking and cycling as part of a person's daily routine can and should play an important role in an integrated strategy to promote physical activity and to improve health. A number of studies have demonstrated the preventative effect that leisure-time activity can have on cardiovascular disease risk factors (for example Metsios et al., 2007; Myers, 2003; Warburton et al., 2006). The Chief Medical Officers of the UK recommend a minimum of 150 minutes moderate physical activity a week, equating to approximately 20 minutes a day. Walking and cycling as modes of travel can readily contribute in part or whole to reaching these recommendations. Both modes of travel are associated with numerous positive health outcomes in terms of reducing the risk for conditions such as cardiovascular disease.

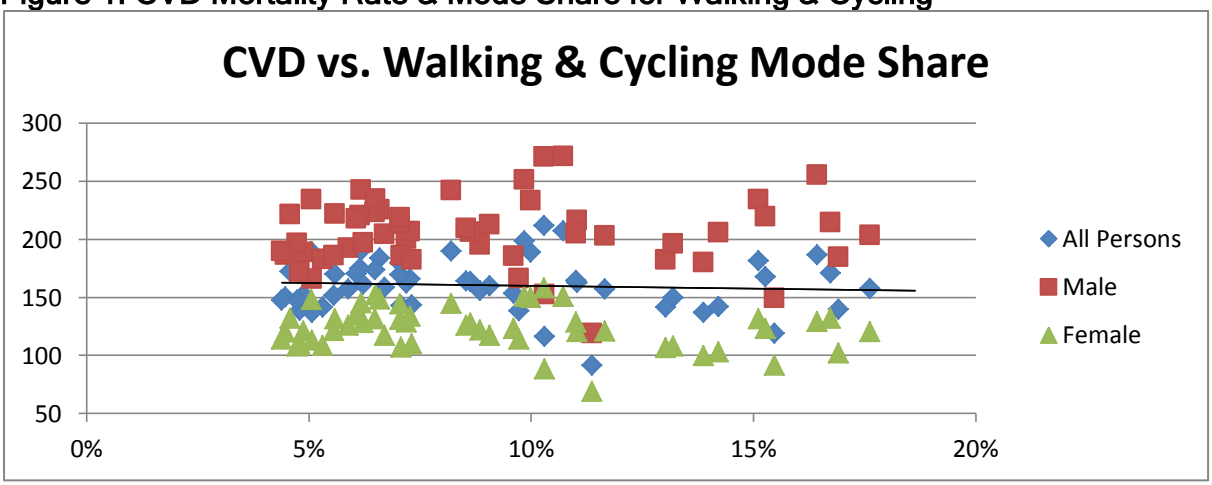
However, it is important to note that a large proportion of these studies have been undertaken in North America, Australia and Scandinavia, and therefore may produce different results to the United Kingdom given the differences that exist in transport services and infrastructure, travel patterns, racial and ethnic composition and cardiovascular disease risk profiles (Furie & Desai, 2012). Hence, there is a need for further research to be undertaken in the UK context to investigate the active transport-CVD relationship.

Data Analysis

As part of this research paper, the relationship between the mode share held by walking and cycling to travel to work and CVD mortality rates for men, women and all persons have been compared at a total of 54 locations distributed across England to investigate whether a link between walking, cycling and CVD can be established. This has been done using walking and cycling mode share from "Method of Travel to Work" data from the 2011 Census and CVD mortality rate data from local authority health profiles produced by the South East Public Health Observatory (SEPHO). The SEPHO CVD health profiles bring together a wide range of data on cardiovascular disease in upper tier local authorities within England with the aim of providing information to health care professionals, commissioners and other interested parties to aid planning and development (SEPHO, 2012). The two variables have been plotted against each other to investigate whether a correlation exists.

The relationship between walking and cycling to work and cardiovascular disease mortality rate (per 100,000 people) is detailed graphically below for all persons, men and women.

Figure 1: CVD Mortality Rate & Mode Share for Walking & Cycling



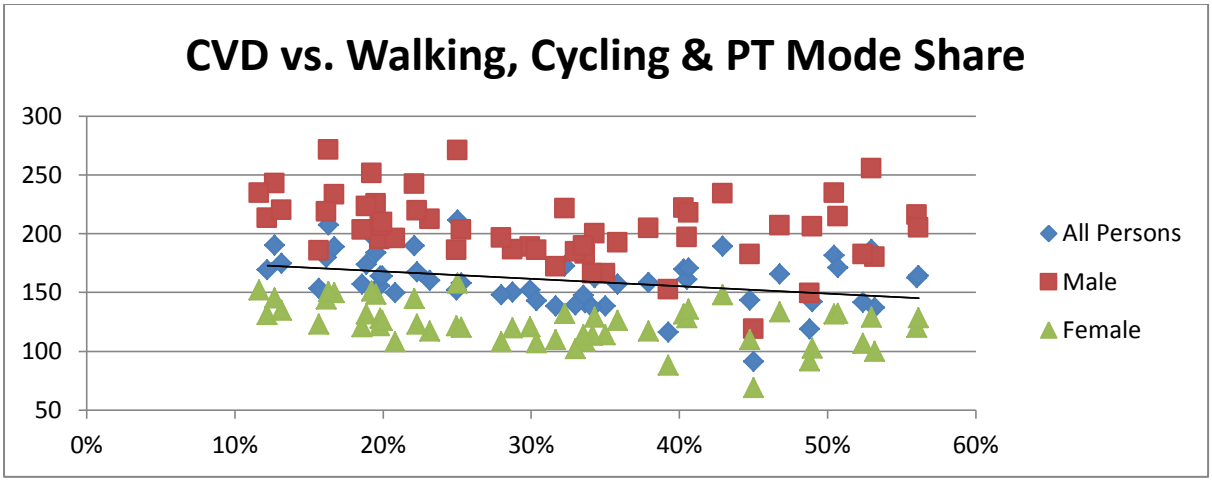
It can be seen that a correlation exists between the mode share held by walking and cycling for travel to work and CVD mortality rates; as the mode share held by walking and cycling increases, the CVD mortality rate (per 100,000 population) tends to decrease. This correlation is seen to be more pronounced for women than it is for men.

By transforming daily routines into an opportunity for physical activity, active transport can overcome many of the traditional barriers that prevent engagement in leisure-time or occupational physical activity (Furie & Desai, 2012). However, despite a wealth of evidence that demonstrates the health benefits of physical activity as already explored (particularly for sedentary populations), efforts to increase leisure-based physical activity have, on the whole, not achieved the desired results. As previously noted, a number of studies have demonstrated the preventative effect that leisure-based activity can have on cardiovascular disease risk factors. However, these studies focus solely on leisure-based physical activity with walking and cycling considered as primary modes of transportation. Should a focus on just walking and cycling as primary modes of transport be considered to be too linear? This paper has so far focused on walking and cycling as transport modes that promote health. However, a focus solely on these modes does not provide the complete picture: public transport provision, such as rail and bus services, can also play a role in encouraging physical activity, and therefore plays a role in both improving health and potentially reducing the risk of chronic diseases such as CVD.

There is a large body of evidence within the United States that links public transport users and physical activity. A study by LaChapelle and Frank (2009) found that users of public transport within the United States are almost three and a half times more likely to meet the US Surgeon General's physical activity recommendations of a minimum of 150 minutes of physical activity per week. Meanwhile, Basser and Dannenberg (2005) have found that public transport users in the USA spend on average 19 minutes a day walking to station and transit services, whilst 29% of public transport users walk for more than 30 minutes daily as part of their journey. It is clear therefore that government focus in improving health and reducing CVD risk through transport should not be solely on the promotion of walking and cycling as primary modes of transport, but should also incorporate the promotion of bus and train service use for travel.

To validate the hypothesis that the use of public transport can have a positive effect in reducing a population's risk of cardiovascular disease, the relationship between the mode share held by walking, cycling and public transport to travel to work and cardiovascular disease mortality rates for have been compared at the same 54 locations across England. The relationship between this mode share and cardiovascular disease mortality rate (per 100,000 people) is shown below for all persons, men and women.

Figure 2: CVD Mortality Rate & Mode Share for Walking, Cycling & PT



When the mode share held by walking and cycling is combined with that of public transport (bus, train, underground, tram and light rail services), a stronger correlation with CVD mortality rate for all ages can be seen, with the trendline decreasing from 135 deaths per 100,000 population at the lowest mode share to 110 deaths per 100,000 population at the highest mode share. The correlation is more defined for women than for men.

This analysis demonstrates that a relationship between active transport (walking, cycling and public transport) and CVD mortality rates exists in England: in general, locations with a higher mode share held by active transport modes for travel to work have a lower CVD mortality rate per 100,000 people. Therefore, an argument can be made that government focus should be steered towards the promotion of these modes, to result in a positive modal shift towards active travel, leading to reductions in CVD mortality rates alongside associated economic benefits. From this data, it can be assumed that a shift in the proportion of travel to work by private car to increased levels of travel by active modes (public transport, walking and cycling) is likely to result in CVD mortality rate reductions.

As such, an argument can be build that advocates the use of transport planning to reduce incidence of chronic diseases such as cardiovascular disease through the promotion of walking, cycling and public transport for travel to work. As previously stated the success of such promotion depends on the extent to which local people are involved in the process. It is important that local people are aware of the potential health benefits associated with a change in travel patterns towards active travel. Rather than implementing a set of large scale top-down measures with no consultation or consideration of local contexts, it is important for the government to ask local people what measures would encourage them to alter their method of travel to work: both health and transport decision-making processes are characteristics of the individual. Therefore, prescriptive methods for influencing such personal choices will not be the most effective mechanism.

Thus far, this paper has attempted to demonstrate that an increase in walking, cycling and public transport usage for travel to work correlates with a decrease in

cardiovascular disease mortality rates. At the same time, it has argued that the individual is at the heart of both these factors – health profiles and transport choices are both characteristics of individual decision making. However, it is important to question whether the general public recognises this link, despite the wealth of literature that links transport and health. In order to answer this question an online survey has been undertaken, with a total of 80 respondents out of 120 survey requests. The survey ran between for a total of four weeks during October and November 2014 and was undertaken to provide an understanding of general walking, cycling and public transport usage patterns, and of respondents' understanding of the link between transport choices and CVD risk factors. In order to provide consistency with the rest of this paper's research, only transport choices for travel to work have been considered.

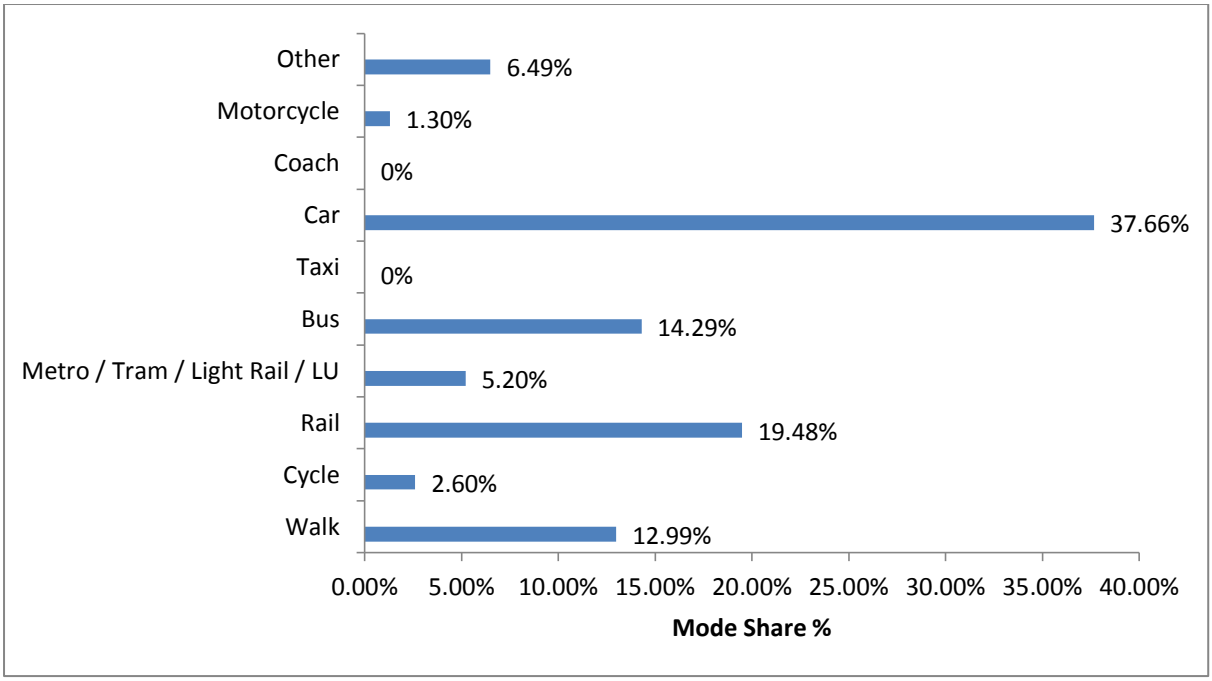
A near-equitable gender split was recorded, with 53% of respondents male and 47% female. Respondents' postcodes were recorded to ensure an equitable geographical spread of responses across the country and to avoid geographical concentration within one area. Responses were received from locations including London, Birmingham and other locations in the Midlands, Brighton, Cambridge, Essex, Gateshead, Lancashire, Plymouth and Sheffield.

Travel patterns for respondents were varied, with the private car the most frequently cited method of transport to and from work (38%). 13% of respondents walk to and from work, whilst 3% cycle. 39% of respondents travel via public transport, with the following split:

- Rail 19.5%
- Bus 14.3%
- Metro / Tram / Light Rail 1.3%
- London Underground 3.9%

One respondent works from home. The mode split by percentage for travel to and from work for all respondents is provided in Figure 4.

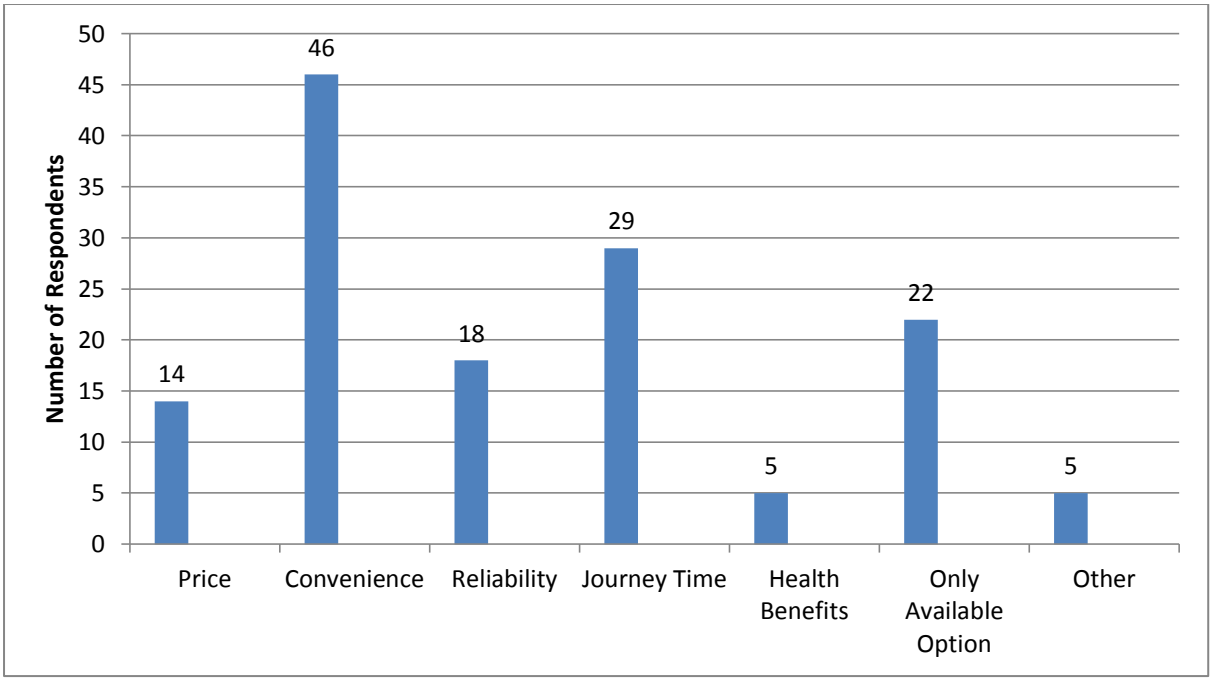
Figure 4: Mode Share, Travel to Work: All Respondents



Data was also gathered on the factors affecting the transport decisions detailed in Figure 5, and to investigate whether health benefits are considered to be important when making transport choices. Convenience and journey time were the two most common reasons for existing travel patterns, cited by 46 and 29 respondents respectively. Reliability was given by 18 respondents as a reason for their current travel patterns, whilst 22 respondents stated that their current mode of transport is the only option available to them.

Most importantly for this research, however, is the fact that only five respondents (7%) stated that their travel patterns are based on the health benefits provided. As such, it can be assumed that the relationship between health and transport is not widely recognised or understood by the general public. It should be noted that it is possible that even if people are aware of the health benefits of travel by certain modes, they may not feel equipped or enabled to make these travel choices. Figure 4 below provides a full breakdown of reasons for mode of transport used for travel to work.

Figure 4: Why Travel by this Mode(s)?



Respondents were presented with the following factors and asked to rate their importance in influencing transport decisions for travel to work on a scale of 1-10 (where 1 represents not at all important and 10 represents very important):

- Price;
- Convenience;
- Reliability;
- Journey Time; and
- Health Benefits.

The rating of importance given to each of these factors by respondents is detailed in Figure 5 with full results provided in Table 1.

Figure 5: Importance of Travel Factors

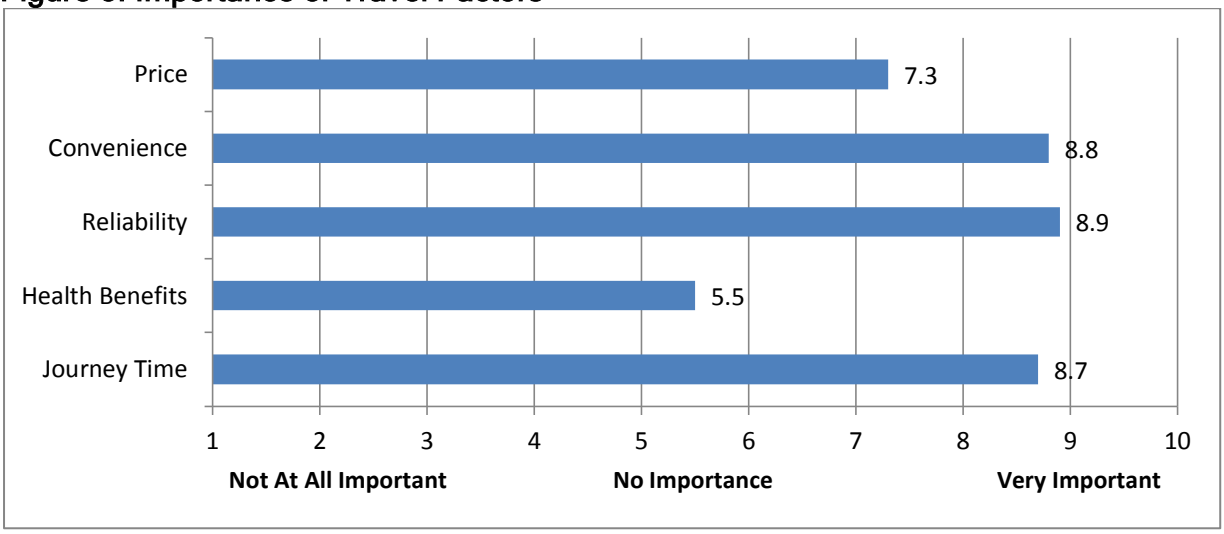


Table 1: Importance of Travel Factors

	Importance (Least to Most)											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**Ave**	**Total**
Price	4	1	2	0	7	6	12	16	3	19	7.3	70
Convenience	0	1	0	2	2	1	4	13	8	38	8.8	69
Reliability	0	1	2	0	1	0	3	14	8	36	8.9	65
Journey Time	0	1	0	2	3	0	5	15	10	32	8.7	68
Health Benefits	9	3	5	4	13	6	12	9	1	6	5.5	68

Respondents commented that reliability is the most important factor in terms of influencing transport decisions for travel to work, with a weighting of 8.9 on a scale of 1-10. Convenience and journey time are of equal following importance, with a weighting of 8.8 and 8.7 respectively.

Health benefits were rated to be the least influential factor, with an overall weighting of 5.5. Six respondents (8%) see health benefits as very important (with a rating of 10), whilst nine respondents (12%) do not see any importance in health benefits (with a rating of 1). It can be assumed therefore that health benefits are not considered to be an important deciding factor when making transport choices for travel to work.

To gauge current level of understanding of the relationship between cardiovascular disease and transport in terms of travel to work, respondents were asked to rate on a scale of 1-10 how related they believe CVD risk and mode of travel to work to be, as detailed in Table 2. A rating of 1 represents a belief that no relationship exists, whilst a rating of 10 represents belief in a strong relationship between the two.

Table 2: CVD – Travel to Work Relationship Rating

Relatedness (Not At All Related to Very Related)												
	1	2	3	4	5	6	7	8	9	10	Ave	Total
Relevance	6	2	5	2	16	12	12	10	0	4	5.6	69

Of the 69 respondents that answered this question, the mean weighting given to the relationship between CVD and travel to work is 5.6. This highlights that whilst people are aware of the relationship between cardiovascular disease and transport in terms of travel to work and the potential health benefits of active transport, this awareness is applicable only to a certain extent. This demonstrates a need for policy to reflect the advocacy of active travel as a conduit for health promotion. The fact that as the mode share held by public transport, walking and cycling increases, CVD mortality rates decrease, as does an individual's risk of CVD should be actively publicised.

Respondents were informed of the fact that this research has identified a relationship between CVD and transport choices for travel to work, and were asked whether a clear explanation and publication of this relationship, its implications and the potential benefits of changes to individual travel patterns by the government would influence their own travel choices for journeys to work. 11% of respondents said that this information would influence their travel patterns, 30% said it would probably influence their travel patterns, whilst 34% said it would not influence their travel patterns. Although the percentage of respondents who answered yes to this question may seem low at 11%, it is important to note that a potential modal shift of 11% in favour of walking, cycling and public transport for travel to work represents a far greater shift than that usually targeted through large-scale, top-down urban realm improvement projects.

Economic Impacts

As argued throughout this paper, it is important that local people are made aware of the potential health benefits associated with a change in travel patterns for travel to work.

To provide a cost-benefit analysis of an approach that focuses on the needs and individual aspects of local people, consideration is given to a personalised travel planning (PTP) project undertaken by JMP Consultants Ltd in Dundee between 2009 and 2011. Part of the Dundee Active Travel Programme, it was the first large scale PTP initiative to focus specifically on promoting active travel and active lifestyles. Recognising the intrinsic relationship between transport decision-making choices and health, the initiative employed social marketing techniques adapted from the health and transport sectors to attempt to influence travel choices to target 13,500 residential households.

The initiative has been successful in meetings its objective to increase physical activity and active travel. Over 40% of participants reported increased physical activity as a result of advice and information they received, with an average reported

increase of 20 minutes per person per day. Such an increase is in line with the UK Chief Medical Officers' recommendations of a minimum of 150 minutes of exercise a week. Such a personalised approach is associated with significant costs, with £67 spent per household engaged, or £120 per person reporting a sustained increase in physical activity (JMP, 2011).

Conclusion

Academic research recognises that shaping and using the built environment for the promotion of health and an active lifestyle is a powerful tool that should be included as a means of changing lifestyles and behaviour: regular physical activity can improve health through reduction in the risk of cardiovascular disease. However, recent government focus to promote health and active lifestyle choices has been centred on a top-down approach with large-scale (and often expensive) programmes, projects and policies.

This paper has advocated transport planning that promotes and encourages commuting to work by walking, cycling and public transport as a way of promoting long-term health benefits, particularly the reduction of cardiovascular disease mortality rates and associated risk factors. Travel to work has been focused on as the commute comprises the highest proportion of the majority of the population's travelling time. As a result it is most likely to be ingrained; it has the largest scope for positive change and therefore positive economic impact if a shift in policy is successful It is important to note that health is a characteristic of the individual, and as such this paper argues that the potential for success of such promotion increases significantly when local people and their opinions are involved in the process.

The short-term costs associated with a number of these recommendations are recognised. However, as previously outlined, cardiovascular disease is estimated to cost the UK government and the National Health Service a total of £3 billion annually . It is believed that the long-term economic benefits of increased active travel and reduced CVD mortality rates will greatly outweigh the initial capital outlay.

It is important that such measures are implemented alongside the continued use of recommended design standards for public realm improvements aimed to promote active travel, such as Manual for Streets (2010) and the recently-published Welsh Active Travel Act (2015), which provides a legislative obligation for local authorities to plan developments with a strong focus on enabling walking, cycling and public transport use for utility transport. There should also be promotion of the application of such measures through the use of tools that quantify the health benefits of walking, cycling and using public transport to travel to work, such as the World Health Organisation's Health Economic Assessment Tool.

It is important to note that although walking, cycling and public transport usage away from travel to work are important, this does not fall within the scope of this study. Similarly, it should be noted that although this paper has focused on cardiovascular

disease, an increase in physical activity is likely to have numerous other 'co-benefits', including a reduction in risk of other diseases, carbon dioxide emissions, air and noise pollution, traffic congestion and improved cognition (US Department of Health, 2010). There is potential for further research to be undertaken on the relationship between transport and other diseases, following a similar methodology to that employed for this study.

Finally, it is important to note that although this paper has focused on cardiovascular disease, an increase in physical activity is likely to have numerous other 'co-benefits', including a reduction in risk of other diseases, carbon dioxide emissions, air and noise pollution, traffic congestion and improved cognition (US Department of Health, 2010). There is scope for future research to consider such co-benefits in greater detail.

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