

Next Stop a Longer Life

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Abstract

Aim

A request was made to the Department of Public Health in early 2019 for some interesting statistics (funtistics) for a planned health promotion campaign encouraging public transport users to increase their physical activity levels by alighting one stop earlier and walking to their destination. For a novel presentation of the benefits of increasing physical activity it was decided to calculate the potential increase in life-expectancy that a given amount of physical activity would correspond to (at a population level).

Method

Estimated increase in weekly walking time was calculated for the Dublin Bus commuter walking the last stop of their journey. The reduced risk of mortality was estimated for this increase in physical activity and applied to Irish life tables to calculate change in life expectancy.

Results

Alighting from a bus one stop earlier in Dublin would lead to an average of 4.42 minutes additional walking (44.21 minutes additional walking per week for a commuter). In the Dublin Bus commuter population, this leads to an estimated 50 day increase in life expectancy (male population).

Conclusion

At the lower end of the dose response curve for physical activity, health benefits include: reduced risk of cardiovascular disease, reduced risk of diabetes, psychosocial benefit, reduced risk of musculoskeletal problems. For the prevention of weight gain and some cancers, activity at the upper end of the range (1000 MET.min/week, approximately 300 minutes of walking/week) is thought to be required ⁷.

Introduction

A request was made to the Department of Public Health in early 2019 for some interesting statistics (funtistics) for a planned health promotion campaign encouraging public transport users to increase their physical activity levels by alighting one stop earlier and walking to their destination. The initial promotional campaign was to be piloted in Dublin (DART, Bus and Luas) with health promotion messages using on-board advertising space.

For a novel presentation of the benefits of increasing physical activity it was decided to calculate the potential increase in life-expectancy that a given amount of physical activity would correspond to (at a population level).

Methods

Estimation of amount of walking associated with walking 1 extra bus stop

Each Dublin Bus stop has a corresponding number and using a random number generator ¹ a sample of 30 Dublin Bus stops were selected and the distance between the randomly selected bus stop and the next bus stop along the same route in the most southward direction was calculated.

Average walking speed and the associated level of physical exertion in METs was found by literature review to be approximately 1.4m/s or 4MET ^{2,3}.

Time spent walking one bus stop was calculated by dividing the mean distance between Dublin Bus stops by the average walking speed. Weekly walking time was calculated on the assumption that a commuter using Dublin Bus travels to work in the morning and home from work in the evening five days per week (10 trips).

Increase in weekly physical activity level was converted to MET.minutes/week and plotted on a dose-response curve calculated using studies which contained 280,000 individuals and 2.6 million person-years. The aggregated mean age for participants was 56.6 years (range 20–93 years)³.

Using a similar methodology to Shaw, Mitchell, & Dorling, 2000⁴, the death rates from recent interim life tables for men and women in Ireland⁵ were adjusted to account for the relative risk reduction in all-cause mortality associated with 44 additional minutes of walking per week.

Given the well demonstrated dose-response relationship between physical activity and all-cause mortality postponement³, the reduced risk of all-cause mortality can be estimated for a 44 minute/week increase in physical activity.

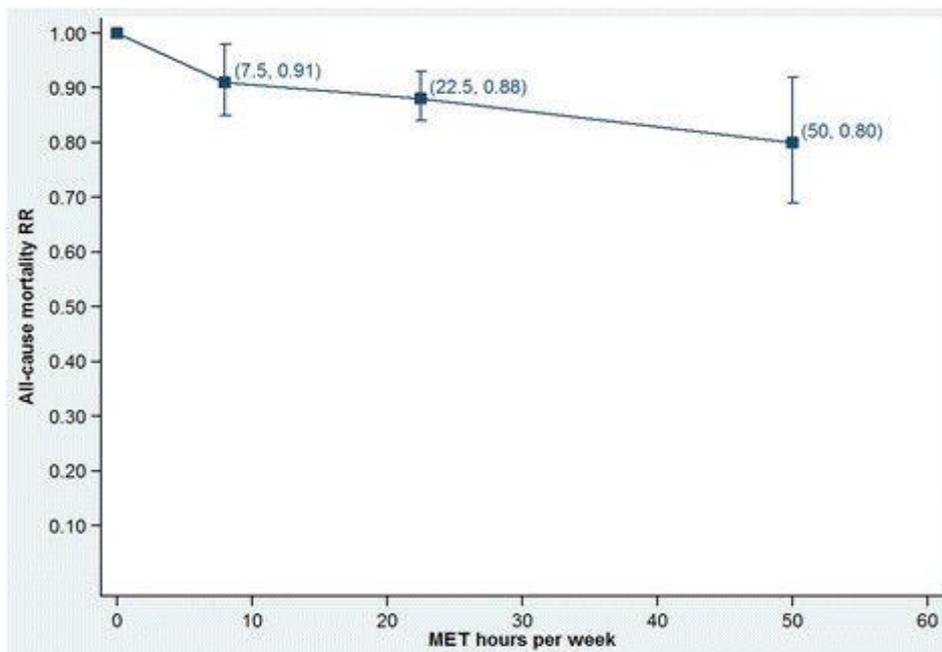
Results

Estimation of amount of walking associated with walking 1 extra bus stop

The average distance between bus stops in Dublin (Dublin Bus) is 371.33 metres (95%CI 311.29, 431.37). At an average walking speed of 1.4metres/second ², the time spent walking one stop is estimated to be 4.42 minutes. Walking at this speed (1.4metres/second) for 1 minute is equivalent to 4 MET.minutes^{2,3}.

For the Dublin Bus commuter population walking one extra stop twice a day, five days a week, walking one extra bus stop at every trip leads to an increase of 44.21 minutes/week of physical activity (44.21 minutes/week = 176.84 MET.minutes/week = 2.95 MET.hours/week).

Graph: Dose-response relationship for a range of walking exposures in MET.hours per week and the associated all-cause mortality RR ³



A comparison is made between doing 0 MET.hours per week and doing 2.95 MET.hours per week. Assuming a linear dose response relationship, all-cause mortality RR is 0.96 for 2.95 MET.hours per week.

Life gained

The risk reduction associated with an increase of 2.95 MET.hours per week was applied to Irish life tables⁵ for the male and female population from age 16 to 65 years (the commuting population). The estimated increase in life for the male population was 50 days (7 weeks) and 33 days (5 weeks) for the female population.

This apparent difference between male and female populations in estimated life gained is a result of the methodology of using Irish life tables to estimate life gained and should not necessarily be interpreted as demonstrating a greater health benefit of physical activity for men. For almost all age groups in Ireland, the mortality rate for the male population is greater than for the female population; and therefore any reduction in mortality rate applied will have an apparently greater impact on the male population than the female population.

Discussion

Considering the health benefits at this dose of physical activity, bouts of moderate physical activity of less than 8 minutes' duration have rarely been studied, although there is some evidence that their cumulative effect is similar to longer bouts⁶. For the purposes of this estimation, the assumption is made that the sum of short bouts (10*3mins=30mins) of physical activity has the same effect as the sum of longer bouts of physical activity (3*10mins=30mins).

At the lower end of the dose response curve for physical activity, health benefits include: reduced risk of cardiovascular disease, reduced risk of diabetes, psychosocial benefit, reduced risk of musculoskeletal problems. For the prevention of weight gain and some cancers, activity at the upper end of the range (1000 MET.min/week, approximately 300 minutes of walking/week) is thought to be required⁷.

This estimate operates on the assumption that the population riding on the bus goes from doing no activity to 44 minutes' walking per week. It also assumes that the population riding the bus walks the extra bus stops morning and

evening, Monday to Friday, from age 16 to 65 and then stops walking after that. The assumption is made that the relative reduction in the risk of death associated with an increase in physical activity is the same in all age categories, although there is more benefit in the older age group. This assumption was necessary as the age specific risk reductions were not available for calculation.

The resulting somewhat crude prediction of population level benefit tends to underestimate the benefit of physical activity for a population who are inactive, and potentially over-estimate the benefits for a population who are already physically active. In the Irish adult population 67.4% are fairly/just active or sedentary and do not meet the guideline weekly recommended amount of physical activity⁸.

The benefit of walking one extra bus stop will of course be different for each individual, and the reported estimation of benefit represents the population as a whole.

For the concerned reader that worries that all of the life-time gained from an increase in physical activity might be spent walking extra bus stops; it is important to note that with current traffic congestion in Dublin city it is possible that walking the last stop of a Dublin Bus journey may take less time than riding that distance on the bus. Walking is also not necessarily an unpleasant way to spend time or a mutually exclusive activity. Time spent walking is often enjoyable in itself and this enjoyment can be supplemented by a number of other pleasant activities like listening to music or conversing with a friend.

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