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Effects of point-of-choice stair climbing interventions in Hong Kong

Key Messages

1. Only one of three stair climbing interventions changed stair climbing in the Hong Kong Chinese population; this 0.29% increase suggests that stair climbing interventions will have minimal impact on public health.
2. Climate and terrain may be major barriers to lifestyle physical activity interventions in Hong Kong.

Introduction

Increasing physical activity levels is a major public health target given the high prevalence of sedentary behaviour in the industrialised world.[1] The current recommendations are for at least 30 minutes of moderate-intensity physical activity on 5 or more days of the week, which can be accumulated throughout the day and does not need to be achieved in a single session.[1]

One simple way to achieve the current recommendations is to accumulate walking throughout the day. An additional way to further this aim is to accumulate stair climbing. Like walking, stair climbing requires no equipment and is freely available, at least in the developed world. Unlike walking, however, stair climbing is physiologically vigorous, requiring 9.6 times more energy than the resting state.[2] As obesity prevention is a major aim of physical activity promotion, the high energy expenditure of stair climbing can improve the balance between energy intake and expenditure. For example, an 80-kg man climbing a typical 3-m flight of stairs 10 times a day would expend approximately 27.5 Kcals a day, equating to 10 038 Kcals over a year, an energy expenditure equivalent to about 4 days worth of food.[3] From an energy expenditure perspective, the speed at which the stairs are climbed is of minimal importance; energy is expended in raising one's weight against gravity. Thus low levels of fitness, a common barrier to exercise in the overweight, are not a barrier to stair climbing. Indeed a recent worksite intervention revealed a greater response in overweight employees suggesting that stair climbing may be an acceptable type of physical activity for overweight individuals.[3]

Importantly, interventions to increase stair climbing are effective. Typically, a poster placed at the point-of-choice between stairs and the escalator encourages travellers to take the stairs for the benefit of their health.[2] Almost all published studies have successfully increased stair usage with 23 separate studies reporting positive effects. Nonetheless, most previous research has been conducted in either the UK or the US and only two studies have used non–English speaking populations. Thus, studies in a non-English context provide information on the generality of the success of stair climbing interventions. Here we report the results of three interventions in Hong Kong where 95% of the population is Chinese.

Compared to mainland China, Hong Kong is affluent and has many of the trappings of western culture, making it a reasonable non-English speaking comparison for the UK and the US. The Population Health Survey revealed that only 14% of males and 12% of females in a representative sample of 7084 Hong Kong Chinese were physically active at health enhancing levels, which is considerably lower than in the UK (males 37%, females 25%).[1,4] The territory itself includes a densely populated small island (18 000/km) with restricted opportunities for outdoor sport and exercise. Most of the population, however, live and work in high-rise buildings providing convenient opportunities for stair climbing. While this behavioural context makes Hong Kong island an ideal setting for accumulation of stair climbing, the climate is subtropical with high temperatures and humidity levels. We provide here preliminary data on the possible effects of climate on interventions that promote active transport.

Methods

This study was conducted from May 2005 to August 2006.

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Study design

All three studies used an interrupted time-series design. Thus, monitoring of stair use for a baseline period was followed by the interruption of the series by an intervention aimed to increase stair climbing. Monitoring was continued after this interruption.

Studies 1 and 2 were conducted on the Mid-Levels escalator system in central Hong Kong, a pedestrian transit system that reduces motorised traffic in the city. The interventions were installed on the section between Wyndham Street and Hollywood Road where a travellator, ie an escalator without steps, climbed 5.72 m over a horizontal distance of 51.5 m, with a total length of 57.5 m. Adjacent to the travellator were 44 stairs (stair riser height=13 cm) in groups of four separated by 4.12 m horizontal sections. While this site was shielded from the sun, open sides meant that pedestrians were subject to the effects of air temperature and humidity. Study 3 was conducted in an air-conditioned, indoor shopping mall (Lok Fu) where the effects of outdoor climate may have been nullified.

Sample size

There were 57 801 subjects in Study 1, 76 710 in Study 2, and 18 257 in Study 3.

Study instruments

In all studies, observers coded pedestrian choices between the travellator/escalator and stairs. While there was variation between studies, the categories used were gender, appearing to be over 60 years of age, ethnic grouping, presence of children or large bags, and whether the pedestrian was walking on the travellator. Observations were made around midday (11:00-13:00) and in the early evening (17:00-19:00).

Study 1

Following 2 weeks of baseline observations, a 73 cm x 53 cm poster was positioned at the choice point between the stairs and travellator and observations continued for a further 2 weeks. The poster contained a silhouette figure climbing stairs with a message above the figure in Chinese characters that read 'Get healthy – start with these steps'.

Study 2

Following 1 week of baseline observations, three banners (200 cm wide x 50 cm high) were hung above the heads of pedestrians on the travellator and monitoring continued for a further 5 weeks. The back-translated messages in order of ascent were (a) 'Just need 7 minutes a day, getting healthy and living longer is not a dream', (b) 'Doctors found that spending 7 minutes on stair climbing a day, the risk of heart disease is reduced by half in 10 years', and (c) 'There are 1440 minutes in a day, it only takes you 7 minutes to be healthy and live longer'. In the focus group phase, the '7 minutes stair climbing a day etc' message was rated as 4.1 on a 1-5 scale from least (1) to most (5) motivating.

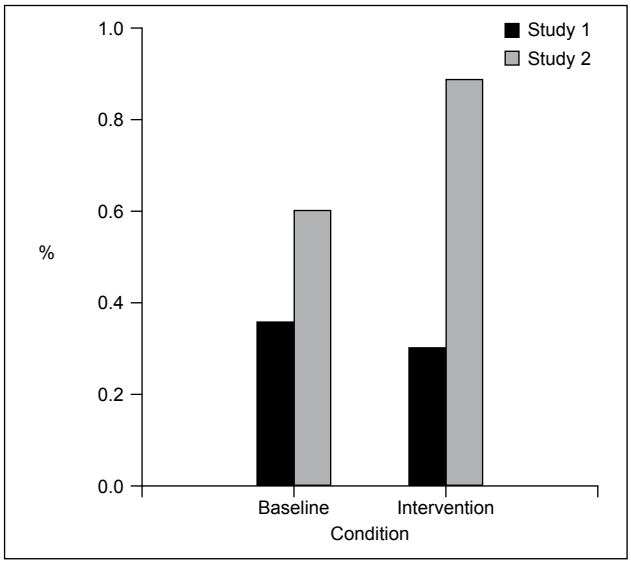

Fig 1. Percentage of stair climbing during baseline and following the intervention on the Mid-Levels escalator system

Study 3

Following 2 weeks of baseline observations, the intervention was affixed to 12 stair risers beginning five steps from the top on a 22 step staircase (riser height=14 cm). Hence the stair riser banner was 210 cm wide by 168 cm high. Messages (a) and (b) above were used with a cartoon of a smiling heart accompanying these messages. Monitoring continued for 2 weeks.

Results

Stair climbing

Figure 1 depicts the percentage of people climbing stairs during the baseline period and after installation of the poster (Study 1) and banners (Study 2) on the Mid-Levels system. No significant change in stair climbing occurred in Study 1 (P=0.29), whereas there was a modest increase in stair climbing when the more extensive intervention was tested in Study 2 (+0.29%, P=0.002).

The small magnitude of increase suggests that the intervention was of minimal public health relevance. Study 3 tested a similar intervention in a shopping mall, the main setting for previous stair climbing interventions outside Hong Kong.[2] It was possible that the mass transit nature of the Mid-Levels system produced unusual results. In addition, Lok Fu shopping mall was air-conditioned and hence potentially immune to the effects of climate on lifestyle physical activity (see below). As with the previous studies, however, there were no effects of the intervention (P=0.91; Fig 2).

Walking up the travellator

As outlined elsewhere, the poster used in Study 1 produced an increase in walking up the travellator in the Hong Kong

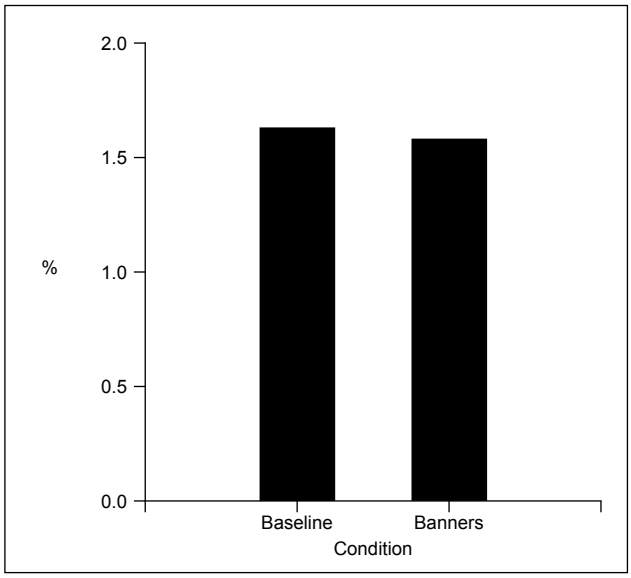

Fig 2. Percentage of stair climbing during baseline and following the intervention in Lok Fu shopping mall

Chinese population.[4] This result demonstrates that Hong Kong Chinese people can respond to physical activity promotion. For the non-Asian sample, however, walking up the travellator was reduced at higher levels of humidity.

In Study 2, the greater range of climate variables (eg humidity 28-93% vs 84-97%) revealed effects in Asian pedestrians. Figure 3 summarises the effects of humidity and temperature on walking up the travellator. The negative slope for both variables reveals that increases in humidity (P=0.009) and temperature (P=0.04) were associated with a reduction in walking.

Discussion

In summary, rates of stair climbing in Hong Kong were low and generally uninfluenced by the interventions; even the modest change in Study 2 (+0.29%) would have little public health impact. To put this in perspective, the rate for adults of 1.6% at baseline on a 3.08 m staircase in the air-conditioned shopping mall of Study 3 contrasts sharply with a baseline rate of 12.6% on an equivalent height staircase in a UK shopping mall.

The low levels of stair usage in these studies were remarkable compared with average rates of 5.4% for public access staircases in the UK and US.[2] Informal observations suggest that stair climbing was also rare in the underground rail system whereas average rates of 11.6% (range, 5.6-31.1%) have been reported for the UK and US.[2] Further, a recent intervention to increase stair climbing in public housing estates in Hong Kong revealed that only 1.7% of pedestrians climbed stairs prior to the intervention.[5] Nonetheless, 90% of respondents on the housing estates thought stair climbing was good for their health prior to the intervention. Therefore low rates of stair climbing were not accompanied by negative perceptions of the behaviour. Taken together, these studies suggest low rates of stair usage may be characteristic of Hong Kong. Two aspects of Hong Kong island itself may be relevant. First, the high humidity of a sub-tropical climate could be a barrier. Set against this, neither study revealed any effects of climate variables on stair climbing. Further, transposing the intervention to an air-conditioned shopping mall did not improve the outcome of the intervention. Hence concurrent levels of humidity and temperature do not explain the failure to increase stair climbing. Alternatively, the topography of Hong Kong may be relevant. Hong Kong island is hilly/mountainous,

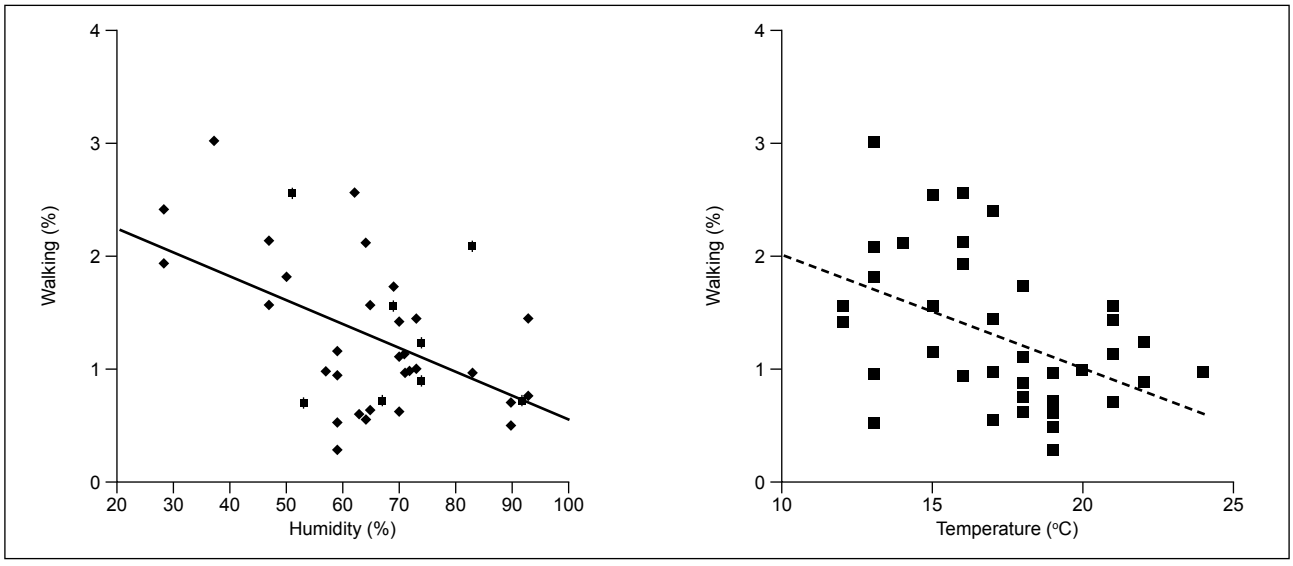

Fig 3. The effect of humidity and temperature on walking up the travellator by the Hong Kong Chinese population

with much of the island associated with steep slopes. The densely populated area of Hong Kong means that there is little space available for parking cars. At 47 cars per 1000 inhabitants, Hong Kong has a very low rate of car ownership compared to other major cities (Tokyo=266, New York=206, London=413). This lack of private cars means that active transport and regular negotiation of the hilly terrain are an inevitable consequence of residence in Hong Kong. Objective measures of hills in other cities have been associated with reduced use of active transport. Against such a backdrop of prior negotiation of hilly terrain, additional ascent of stairs when there is a motorised alternative may seem a profligate waste of energy to Hong Kong pedestrians.

Consistent with previous effects, active transport by Hong Kong pedestrians was reduced as humidity increased and climate may be a major barrier to lifestyle physical activity.[4] We argued elsewhere that the choice of an escalator rather than stairs reflects the repeated reinforcement of escalator use by reduced energy expenditure[4]; minimisation of energy expenditure is characteristic of human locomotion. By the same logic, repeated pairing of any behaviour with punishment reduces the likelihood of the behaviour. Physical activity in humid conditions is associated with increased ratings of discomfort relative to the same activity in low humidity at the same temperature. Hence high rates of humidity in Hong Kong would act to punish lifestyle physical activity and the low rates of stair climbing may reflect a prior history of punishment when attempting physical activity in humid conditions rather than any differences in attitude to physical activity compared to UK and US pedestrians. The hilly terrain of Hong Kong can only compound this problem.

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