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# Role of activity trackers and competitive environment on walking activity of individuals

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## 1. Introduction

The fast paced lifestyle of individuals has made them increasingly reliant on technology to substitute their physical activities. Washing machines, dish washers, televisions have all replaced the tasks which once used to be done manually. The sedentariness arising due to this inactive lifestyle poses several health challenges. For example, a study by Lee et al.( 2012) claims that an inactive lifestyle has become the primary reason for several chronic conditions, for instance, type 2 diabetes and other types of cancer. Inactive lifestyle has also led to a sharp increase in obesity over the years, which is the main cause behind diseases like ischemic heart disease, one of the major causes of deaths in Australia (ABS, 2017). Thus, several experts and doctors are in favour of the latest pedometers and other step-counting devices (e.g. Fitbit, Garmin, etc.) as a means to motivate people to have more moderate physical activity in an effective and straightforward manner (Kang et al., 2009). These tracking devices record the number of steps and supply several forms of immediate feedback (e.g. heart rate, calories burnt, etc.) to individuals. These are linked to smartphones through applications which help maintain the activity profile of the person (Fritz et al., 2014). Individuals simply need to wear the device around their wrist, on their clothes or in their pockets. These devices allow for temporal tracking of a user's physical activity level which helps them in monitoring their activity trends.

The positive influence of activity trackers on individual's walking steps pattern has been extensively studied in the past. Several factors have been identified by researchers which motivate individuals wearing activity trackers to improve their physical activity in the form of walk score, i.e. daily step count recorded over a period. These factors not only include person-specific attributes like age and gender Cotter and Lachman, 2010) but also technological aspects of activity trackers like the kind of feedback, goal setting, etc. (Michie et al., 2011; Normand, 2008). However, the sample size used in these studies was limited and spanned over a short period of time. Furthermore, there has not been much research to date towards exploring the role of a competitive setting in further motivating individuals wearing activity trackers to improve their walk score and lifestyle. Instead, previous studies have only found competition to positively influence an individual's (not using activity tracker) physical activity (Frederick-Recascino and Schuster-Smith, 2003). Thus, the aim of this paper is to test the hypothesis that *putting individuals using activity trackers in an environment where they can compete against one another can further contribute*

*towards higher walk score*. The hypothesis testing is done by collecting the daily step count information (through activity trackers) of individuals between two scenarios: 1) participants of virgin Pulse global challenge 2018 (Global Challenge, 2018), and 2) individuals outside the competitive setting. The importance of this work lies in the fact walkable communities are not only made through infrastructural interventions, but also by altering individual behaviour. Results from this study could provide future directions to urban planners in formulating incentivised strategies aimed at healthier lifestyle and alleviating traffic congestion by motivating residents to walk more.

# 2. Available datasets

The first dataset used in this work is the daily step activity of individuals within a competitive setting. Global challenge is an annual competition organised by Virgin Pulse (Global Challenge, 2018). Teams from across the world participate in this challenge where their performance is ranked on the basis of total steps made by the participants (of a team). Participants have to wear activity trackers in wrists and regularly upload their daily step counts for a period of 100 days in a mobile application. The app also provides feedback on nutrition, sleep hours, nutrition, etc. A total of 1539 individuals from the University of New South Wales Sydney participated in this contest in the year 2018. The available data includes daily step counts of every individual (individuals were un-identified) and the step count equivalent for activities undertaken by the individual such as running, cycling, swimming, etc. However, the socio-demographic information of individuals was not made available due to ethics and privacy issues.

The second dataset involved collecting daily step count of individuals who were not part of global challenge. Individuals willing to participate in this study were given an activity tracker which they had to wear for the entire study duration. They were also asked to regularly record their daily step data. A total of 9 university students took part in it. The available information includes daily step counts and socio-demographic information. However, it did not include tracking of other physical activities. Table 1 shows the summary statistics of the two datasets.

**Table 1: Summary statistics for the two datasets**

| Item | Global Challenge 2018 | Outside challenge |
|---|---|---|
| Number of participants | 1539 | 9 |
| Duration of data collection (days) | 100 | 154 |
| Data available per participant on average (days) | 92 | 121 |

# 3. Results

Table 2 shows a comparison of the step counts of the two samples. The table shows that the participants within the challenge had twice the step count when compared to outside competition group. A one-way ANOVA test on the average steps rejects the null hypothesis implying that they are statistically different from one another

[F(1,251) = 1640, p = 0]. The 90$^{th}$ percentile value from the Global challenge dataset is 2.25 times higher than the outside competition group. Similarly, the bottom 10 percentile value is also higher (1.75 times) for the Global challenge data.

**Table 2: Comparison of step counts between the two datasets**

| Step count | Global Challenge 2018 | Outside challenge |
|---|---|---|
| Mean | 13173.1 | 6615.8 |
| Standard deviation | 4968.1 | 1705.8 |
| 90th percentile | 18825 | 8303 |
| 10th percentile | 8354 | 4780 |

**Figure 1: Comparison of average step counts across the two samples**

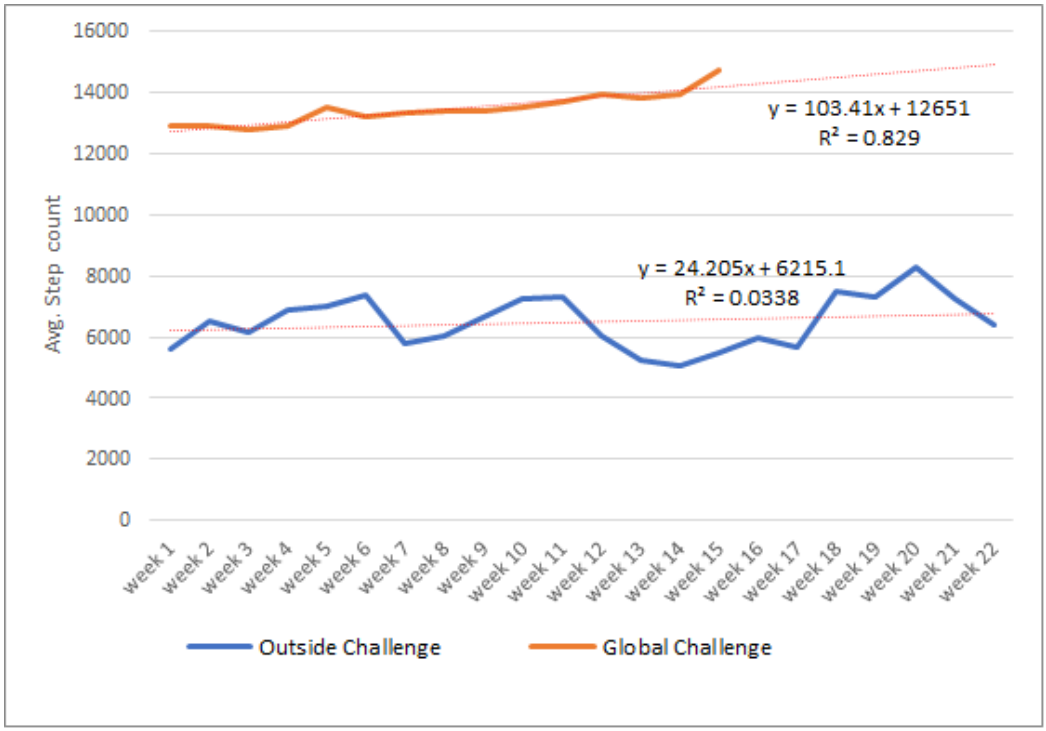


Figure 1 shows the distribution of average weekly step counts of individuals across the 2 groups. The figure shows that while the average step counts of the Global challenge participants see a steadier increase with time; a more fluctuating trend can be seen in the other dataset. Linear trend lines are also plotted on both samples which fit global challenge data with an R-squared of 0.829, showing that the growth in step counts closely follows a linear fashion. The slopes of both trendlines are positive showing the positive effect of activity trackers on the walk score. Furthermore, the slope of the Global challenge trendline is around 4 times higher than the trendline on outside challenge sample. Another one-way ANOVA test is conducted to check if the average steps for Global challenge participants are statistically different for week 1 (starting of the contest) week 7 (middle) and week 15 (end of the competition). The result [F(2,4239) = 13.87, p = 0] shows that the three

means are statistically different from one another, again showing that the average weekly steps increase as the contest progresses.

# 4. Discussion

The results support the research hypothesis that activity trackers along with a competitive environment both influence the walking activity of individuals, i.e. motivates them to improve their step count. It is also observed that the weekly walk steps of the participants within Global challenge showed linear and significant growth implying that the participants are motivated to further improve their step counts as the competition progresses. The slopes of trendlines also shows that they have a higher rate of increase of weekly step counts than the other sample, which also supports the research hypothesis. The results from this work can potentially have important policy implications and can provide vital information to urban planners in devising strategies to encourage local residents to walk more. Nowadays, the use of activity trackers is common among masses. Planners can take this into consideration and devise incentivised strategies that can further motivate people to take up walking for most of their daily activities. This would not only ensure healthier and sustainable societies but also greatly help in alleviating traffic congestion which continues to plague major metropolitan cities of the world. The implementation of this novel effort would also require collaboration among government, council and industry partners.

Future work will focus on acquiring socio-demographic information of the participants within the Global challenge and use them to explain individuals walk score within and outside a competitive setting.

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