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EXI user characteristics associated  
with greater physical activity and  
exercise prescription adherence:  
A retrospective data analysis.

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## Introduction

The benefits of physical activity for individuals at risk of, or living with, long term health conditions are well established. These include reduced all-cause mortality, improved quality of life and better mental wellbeing [1]. EXI has been shown to be effective at increasing physical activity in large cohorts with a variety of health conditions and in a range of settings. However, to understand the mechanisms of action of the EXI prescription, and to provide best practice recommendations to organisations deploying EXI, it is important to identify which user characteristics are associated with greater success. The present analysis examined routinely collected data from over 30,000 EXI users to compare different types of users based on their use of the app and the context in which they have initiated an EXI journey.

## Methods

### Samples

The EXI user database stores all routinely collected data for individual users, and relevant data was extracted from the database for this analysis. All users who onboarded to EXI before June 2023, and had logged data relevant within their first 12 weeks of use, were included in each analysis. No personal identifying data was extracted from the user database, in-order-to maintain user anonymity during analysis.

This sample includes only users where no incentive was deployed to attract them to using EXI and to sustain engagement. Material rewards have been shown to be effective at increasing physical activity [2] and EXI now includes a variety of incentives to promote both immediate and long term engagement, to promote adherence to the prescription.

### User characteristics

Three characteristics were of interest.

#### 1. Organisation users vs. Consumer users

Organisation users are those who have been provided with EXI by a third party, typically a healthcare provider or as part of a public health service. For example, for some organisation users, EXI may be integrated into a more comprehensive lifestyle or health service, such as a multicomponent weight management programme, a cardiac rehab programme, or a health coaching service. For other organisation users EXI may be provided as a standalone service, but access would be provided by a healthcare professional following the identification of a health risk or need.

Consumer users are those who have independently accessed EXI via the Apple or Google app stores, outside of any health-related service.

#### 2. Users who track health data vs. Users who do not track health data:

All EXI users are prompted to enter relevant health data during onboarding with the EXI app, and weekly thereafter. This data includes resting heart rate, blood pressure, weight, waist circumference and the six-minute walk test. After onboarding some users enter health data, either regularly or irregularly, while some users enter no further data.

#### 3. Activity minutes tracked vs. Steps only tracked:

The EXI app tracks users' physical activity in two ways:

**Steps** are recorded using the accelerometer in the user's smartphone or wearable device. This is a passive method of measuring physical activity, as the user has to take no action for steps to be recorded.

**Activity minutes** can be recorded in several ways but all take some active engagement from the user, i.e. they must start an activity on their wearable device, start an activity in the EXI app, or manually log completed activities in the EXI app retrospectively.

## Outcome measures

Two outcomes were of interest.

### 1. Prescription adherence

This is measured as a percentage of the personalised exercise prescription completed each week by the user. As each user's prescription is tailored to their health and activity status, and progresses gradually each week, adherence to the target amount of physical activity enables fair comparison across users regardless of their prescription.

### 2. Physical activity

As described above, physical activity is validated in two ways by the EXI app; Steps and Activity Minutes.

Activity minutes are considered the most reliable of the two measures for several reasons, e.g., wearable devices use heart rate sensors to identify not just activity but activity in the correct heart rate intensity zone, and steps measured by smartphones may miss activity completed when the phone is not being carried by the user.

Therefore, activity minutes was the outcome measure for this analysis, except when users were grouped by whether they had activity minutes tracked, where steps were used as the outcome measure for physical activity.

## Data analysis

For each analysis users were allocated to a group based on a pre-specified criteria:

**1. Organisation users vs. Consumer users:** any user profile with an associated organisation (the entity who have commissioned EXI) was allocated to the Organisation group, and all users without an associated organisation on their profile were allocated to the Consumer group.

**2. Users who track health data vs. Users who do not track health data:** any user with data recorded for any of the prompted health metrics in any week from weeks 2 to 12 was allocated to the health tracker group, and users with no data recorded for any of the prompted health metrics in any week from weeks 2 to 12 were allocated to the non-Health Tracker group.

**3. Activity minutes tracked vs. Steps only tracked:** any user with activity minutes recorded in any of their first 12 weeks usage was allocated to the Activity Minutes group and any user with no activity minutes recorded in any of their first 12 weeks usage was allocated to the Steps Only group.

Following group allocation Welch's t-test was used to compare the means of both outcomes' measures between groups.

### Organisation users vs. Consumer users

On average, organisation users (n = 9772) had a mean prescription adherence of 45.26% across 12 weeks (SD = 33.04) and consumer users (n = 17187) had a mean prescription adherence of 38.77% across 12 weeks (SD = 31.41). The mean difference was 6.48%, which was shown to be significant,  $t(19470) = 15.77$ ,  $p < .001$ , 95% of the difference = [-7.29, -5.68],  $d = 0.20$ .

On average, organisation users (n=5516) completed 118.5 activity minutes (SD = 149.06) per week and consumer users (n=7837) completed 90.29 activity minutes (SD = 117.64) per week. The mean difference of 28.22 minutes was found to be significant,  $t(10050) = 11.72$ ,  $p < .001$ , CI [23.50, 32.94],  $d = 0.21$ .

## Key Findings

Self-report of any health related data indicated a higher level of motivation for physical activity behaviour change.

## Results

## Results

### Continued

#### Users who track health data vs. Users who do not track health data:

On average, users who tracked (n = 6652) had a mean prescription adherence of 56.99% across 12 weeks (SD = 29.65) and users who did not track (n = 13555) had a mean prescription adherence of 35.92% across 12 weeks (SD = 31.24). The mean difference was 21.06% which was shown to be significant,  $t(11855) = 49.61$ ,  $p < .001$ , 95% of the difference = [20.23, 21.89]. The effect size was moderate,  $d = 0.68$ .

On average, users who tracked (n = 5749) completed 124.00 activity minutes (SD = 149.79) per week and users who did not track (n = 7604) completed 85.27 activity minutes (SD = 114.51) per week. The mean difference of 29.32 minutes was found to be significant,  $t(10413) = 16.33$ ,  $p < .001$ , CI [34.08, 43.38],  $d = 0.30$ .

#### Activity minutes tracked vs. Steps only tracked

On average, Activity Minutes users (n = 13399) had a mean prescription adherence of 54.35% across 12 weeks (SD = 28.66) and Steps Only users (n = 13560) had a mean prescription adherence of 28.05% across 12 weeks (SD = 31.41). The mean difference was 26.30% which was shown to be significant,  $t(26924) = 73.56$ ,  $p < .001$ , 95% of the difference = [25.60, 27.00]. This result had a large effect size of  $d = 0.90$ .

On average, Activity Minutes users completed 24,629.42 steps (SD = 22797.01) per week and Steps Only users completed 13,867.66 steps (SD = 1713.35) per week. The mean difference of 10,671.76 was shown to be significant,  $t(23462.9) = 42.99$ ,  $p < .001$ , CI [10271.11, 11252.41]. This result had a moderate effect size of  $d = 0.54$ .

Retrospective analysis of routinely collected data from EXI users has identified certain characteristics associated with higher adherence to the exercise prescription, and higher overall physical activity, over the first 12 weeks of use. Users who only passively track their physical activity through steps, users who do not track their health data, and users who engage with EXI independently rather than through a commissioning organisation all have significantly lower prescription adherence and lower overall physical activity.

When considering these findings there are some plausible explanatory factors. It is likely that some consumer users downloaded and onboarded with EXI out of curiosity, and may not have had strong intentions to increase their physical activity. For consumer users with genuine intentions to use EXI to get more active, this behaviour change can be more challenging to attempt without the support of a healthcare professional and/or others on the same journey. Organisation users may benefit from such support, for example where EXI is integrated into a group programme or is used by a healthcare or exercise professional to guide patients/members to increase their physical activity. **Additionally, Organisation users may be more motivated for physical activity behaviour change where EXI is recommended by a healthcare professional or organisation, and potentially following medical advice to increase their physical activity to manage their health condition(s).**

**The tracking of health data and the tracking of activity minutes are both behaviours that indicate more active engagement with the EXI program.** The small but significant effort required to measure and self-report any health-related data perhaps indicates a higher level of motivation for, or commitment to, physical activity behaviour change as a means of improving health. 'Self-monitoring of the outcomes of behaviour' is a recognised behaviour change technique (BCT)[3] that is theorised to support behaviour change through changing the underlying determinants of behaviour, specifically by improving the ability to regulate behaviour, improving self-efficacy for the behaviour and through goals, i.e. the mental representation of outcomes that the individual wants to achieve. Similarly, starting an activity on the EXI app or via a connected platform or device (or logging this retrospectively) indicates the individual is engaging in one or more of the following BCTs; Instruction on how to perform the behaviour, Demonstration of the behaviour and Self-monitoring of the behaviour, and Biofeedback. These BCTs are also theorised to improve both self-efficacy for the behaviour and behavioural regulation. Whereas users who only track steps would only be engaging in one BCT - Self-monitoring of the behaviour, which may reduce the effect on those underlying psychosocial determinants of an individual's physical activity behaviour.

## Conclusion & Implementation

Tracked activity minutes

54%

prescription adherence

Tracked steps only

28%

prescription adherence

## Conclusion & Implementation Continued

For ease of tracking activity and health data, EXI connects directly to HealthKit, Google Fit and Fitbit to leverage users data (with consent). Connecting directly to these data repositories, allows EXI to harmonise data from many other apps and connected devices including blood pressure monitors, continuous glucose monitors (CGMs), smart weighing scales, heart rate trackers and nearly all wearables. This enables the demonstration of activity and health improvements gained over time.

Overall these findings indicate a number of 'best practice' recommendations to maximise EXI users' success in their physical activity behaviour change journey.

1. EXI users should be encouraged more to track their physical activity behaviour actively and accurately. Wearable devices (e.g. Apple Watch and Fitbit) make this easy for the user to do, and so are highly recommended.

a. For business customers, EXI offers a wearable to be bundled with the prescription for each user. The wearable acts as the first incentive to attract and activate people who previously have not been active or tracked their physical activity. The wearable empowers people to understand their heart rate, to be active in the prescribed intensity zone and to track active minutes throughout the day and week.

2. EXI users should be encouraged to track their health data, as a means of reinforcing the connection between physical activity and the user's health goals, and to improve self-efficacy and behavioural regulation.

- a. For all users, EXI offers data insights into health improvement trends that can be shared with a health professional.
- b. For business customers, EXI offers Insights for an aggregated population view of physical activity adherence and health improvements.
- c. For business customers that offer a healthcare service and with user consent, EXI offers Insights for an aggregated population view and a per person view to support treatment decisions.

3. EXI is best introduced to users by healthcare professionals who can explain the benefits of increasing physical activity. Where appropriate (e.g. for people with complex conditions such as obesity and cardiovascular disease) EXI should be fully integrated into a care pathway.

## Conclusions & Implications

**The most successful EXI users in terms of both prescription adherence and total physical activity are affiliated to an organisation that is deploying EXI as part of their health or wellbeing service or care pathway, actively track their physical activity with a wearable and, and track health data in EXI.**

## Reference

1. Ekelund, U., et al., Dose-response associations between accelerometry measured physical activity and sedentary time and all cause mortality: systematic review and harmonised meta-analysis. *BMJ*, 2019. 366: p. 14570.
2. Mitchell, M.S., et al., Financial incentives for physical activity in adults: systematic review and meta-analysis. *British Journal of Sports Medicine*, 2020. 54(21): p. 1259.
3. Michie, S., et al., The behavior change technique taxonomy (v1) of 93 hierarchically clustered techniques: building an international consensus for the reporting of behavior change interventions. *Ann Behav Med*, 2013. 46(1): p. 81-95.

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#### About EXI

EXI is Exercise Intelligence – a Software as a Medical Device (SaMD), part of the emerging field of digital therapeutics, that supports professionals to programme and refer patients to exercise appropriately, and people with long-term health conditions to safely increase their physical activity. It's designed for people living with obesity and co-morbid physical and mental health conditions, including prevalent and serious non-communicable diseases (NCDs) such as cardiovascular disease, Type 2 diabetes, hypertension, stroke, asthma, COPD, depression, anxiety and stress.

Regulated and bringing together behaviour change science with the latest clinical physical activity guidelines, it delivers safe, scalable, measurable health interventions that are medically proven, achievable for the end user, and quick and simple to program and monitor. It also harnesses behaviour change support and rewards to engage people in their programme, drive adherence and support sustained physical activity. A smartphone app supports end users while a secure data portal allows the professional to monitor outcomes and adherence.

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