



Project report: Exploring the effect of an intervention on families using an intelligent personal system to deliver behaviour change techniques

Angela Carlin and Caomhan Logue
Ulster University
On behalf of the project team

a.carlin1@ulster.ac.uk

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Background

Approximately one quarter of children living in Northern Ireland are overweight or obese [1]. This, coupled with low levels of physical activity (PA), highlights the need for effective interventions that target the promotion of positive health behaviours (PA and healthy eating) in this population [2]. Most interventions aimed at promoting healthy behaviours in children have focused on the school setting; however, the influence of parents and other family members at this stage of the lifecycle is well-established.

Alongside family involvement, incorporating technology within interventions may present further opportunity to increase both their effectiveness and reach [3]. The rise in internet connectivity, and ownership of smart devices, has led to the rapid integration of technology into everyday life. Intelligent personal systems (IPS) (e.g. Amazon Echo, Google Home) have become increasingly integrated into the home setting and therefore, may facilitate behaviour change via novel interactions or as an adjunct to conventional interventions.

Objectives

- To compare the effects of an IPS (Amazon Echo) alongside an existing intervention or as a standalone intervention.
- To evaluate the potential of IPS for promoting and maintaining PA and other health-related behaviours in both parents and children.
- To assess the feasibility of a home-based technology intervention amongst participating families.

The study

The study recruited 26 families with at least one child aged 5-12 years, and was completed in two phases:

Phase 1: Families (n=11) attending a community-based obesity prevention programme (SWEET project), were randomly allocated to also receive an IPS for 10 weeks (n=6) or received no technology support (n=5).

Phase 2: Families (n=15) were randomly allocated to receive an IPS for 10 weeks (n=8) or no technology support (n=7). Recruitment for Phase 2 was not restricted to families attending the SWEET project.

Across both phases of the study, intervention families were provided with an IPS (Amazon Echo) to use within the home. The device was monitored by the research team, who were able to provide facts on healthy eating and PA, set reminders, generate 'To do lists' and download device features i.e. 'Skills' onto the IPS for families to use. An example of the tools utilised within the intervention is highlighted below.



Outcomes

We evaluated the potential of the IPS for changing health-related behaviours within the home setting before and after the intervention by:

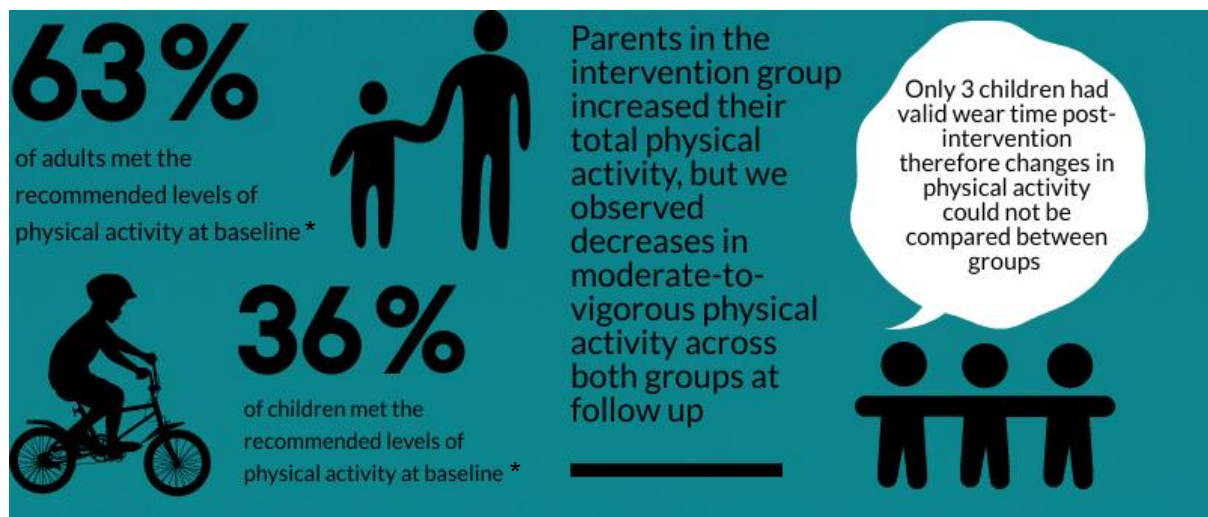
- Objectively measuring PA (using an Actigraph accelerometer),
- Assessing motivations and barriers to exercise,
- Assessing how obesogenic the family environment was.

We also collated data on device usage (number of interactions, type of interaction etc.). Interactions were defined as any engagement with the device made by a parent or child in addition to the reminders and information provided by the device from the research team. Waking up the device, controlling volume and prompts such as 'Next song', and instances where the device was unable to record the voice command 'Text not recorded' were not recorded as interactions for the purposes of the present study. We also conducted semi-structured interviews with parents in the intervention arm of

the study to gain further insights into the acceptability of using IPS within the home setting to promote PA and healthy eating.

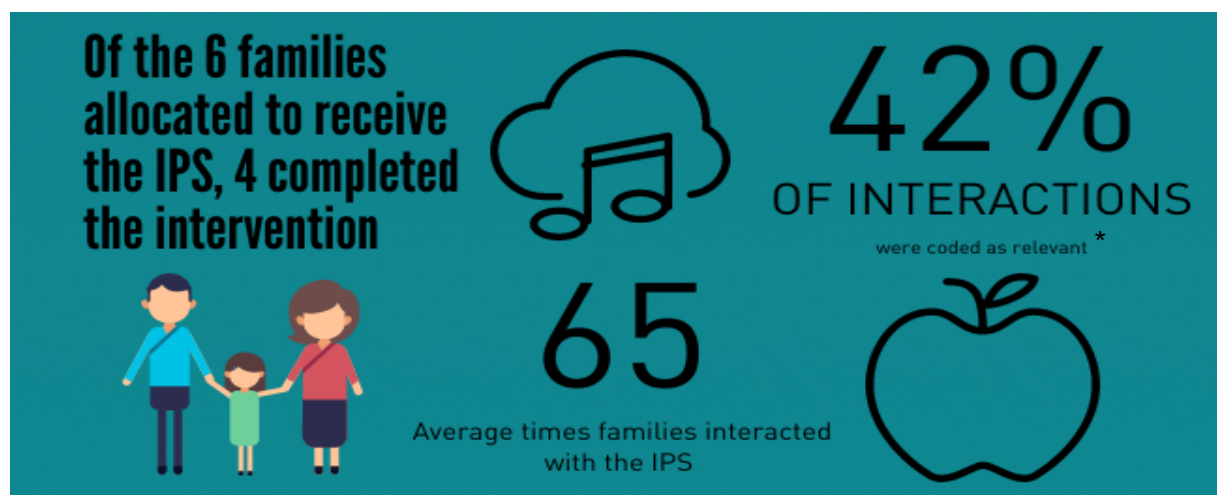
Key findings

In **Phase 1** of the study, 91% of adults and 69% of children met the valid wear-time criteria for the accelerometer at baseline. At follow up, this had decreased to 55% of adults and 19% of children.



* Adults are recommended to take part in at least 150 minutes of moderate intensity activity per week. Children (aged 5-18 years) should engage in moderate-to-vigorous intensity physical activity for at least 60 minutes and up to several hours every day [4]

In addition to the increased levels of total PA in the intervention group, both groups demonstrated an increase in how positively they perceived exercise, and lower scores for how obesogenic the family environment was at follow-up. However, observed changes should be interpreted with caution, given the small sample size.



* Relevant = related to diet/physical activity/wellbeing

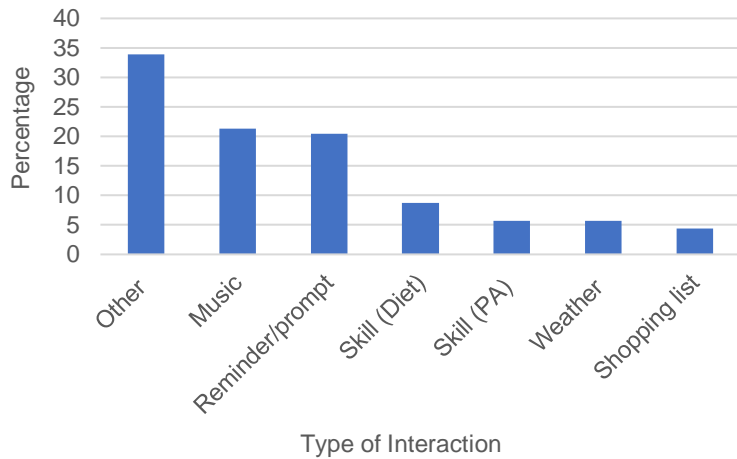
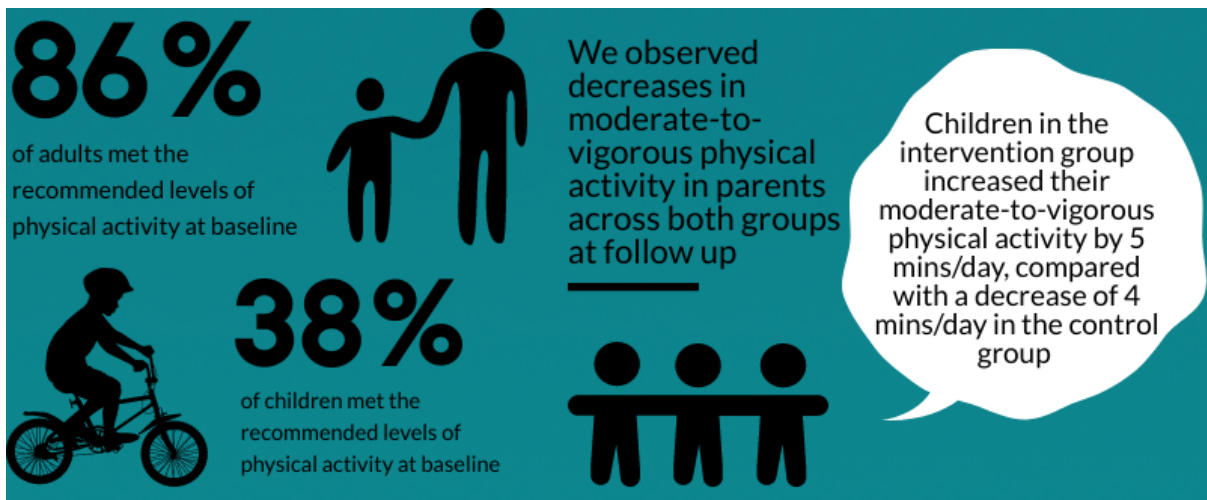


Figure 1: Device interactions across the intervention period

In Phase 1, just under half of all interactions with the IPS were coded as relevant. Figure 1 provides further detail on the type of interaction, with ‘Other’, which grouped together aspects including general knowledge questions, and ‘Music’ the most frequently observed interaction across the intervention.

In **Phase 2** of the study, 93% of adults and 89% of children met the valid wear-time criteria for the accelerometer at baseline. At follow up, this had decreased slightly to 86% of adults and 83% of children, indicating that compliance to the accelerometer protocol was greater across Phase 2 of the study.



As highlighted above, there were positive improvements in moderate-to-vigorous PA for children who were in the intervention arm of the study, suggesting that the IPS may have had a positive influence on PA across the intervention. We observed a slight decrease in how positively parents/guardians perceived exercise across both groups at follow up. Similar to Phase 1, families in the intervention group had lower scores for how obesogenic the family environment was, with a slight increase observed for the control families in Phase 2. These findings demonstrate positive trends in relation to PA and other obesity-related behaviours within the family setting, but further studies that are appropriately powered are needed before we can firmly conclude on the impact IPS may have on health-related behaviours.

Of the 8 families allocated to receive the IPS, all completed Phase 2 of the study. On average, families interacted with the IPS 312 times across the intervention period

(31.26 interactions per week), with 11% of interactions coded as relevant (related to diet/ PA/ mental wellbeing). Interestingly, the frequency of interactions across Phase 2 was much greater, but a higher proportion of interactions were coded as relevant in Phase 1.

Of the interactions that were coded as relevant (shown below), the most frequent interactions were when families asked questions about nutrition (healthy eating) or used 'Skills' related to healthy eating. For the purposes of this intervention, families were utilising the features already built into these devices, i.e. the research team were not able to control the content, or indeed validity, of the responses families received. Assessing the accuracy of this information would be an important methodological consideration moving forward.



Qualitative findings

A number of key points emerged from the semi-structured interviews, with parents acknowledging the prominent role of technology in their everyday lives, and the need to utilise it in a positive way;

“Technology is there, and it can be used for good and evil. And it’s not going to go away. The way they are growing up, they can’t avoid it really so might as well try and use it for good.”

“... probably because she’s so into technology and children tend to be, they are probably highly motivated by it, so it probably is the future for the younger generation maybe more so than the older generation, where we know we have to do it anyway. But when it’s through this means [technology], it probably means more to children and young people”

In relation to the use of IPS within the home, parents highlighted examples of how the prompts and reminders encouraged them to consider their behaviours more, and make changes to their family’s PA and eating habits:

“I felt when we had Alexa the constant reminders were really useful, erm and the easy access to the workouts so that you could just do it at a time that suited you. And plus I think it motivated the children more because it was technology.”

“I think a nice wee prompt or reminder about 8 o’clock in the morning. We got a prompt, quick do 10 sit ups, and I’m like come on children, everyone on the floor, let’s do it! It was some craic [fun] like, and everybody just downed the phones and going to do that challenge. They loved it.”

The semi-structured interviews also provided insight into some technical and methodological challenges when delivering this type of intervention, which will be useful in informing future studies utilising IPS within the home. While parents felt the prompts and reminders were useful, they noted the importance of ‘closing the circle’ and being able to feed back to the device once tasks had been completed:

“... it’s fair enough, you can say right go for a family walk, but you know, then if you come back and it says, how many kms did you do or whatever, it’s kind of a, to close the loop on it as such. And to kind of provide the evidence that you done it, because you could just say yeah we done the family walk, but we didn’t move a muscle.

“The technology on it’s own, there’s no support with the technology on its own, and there’s no erm, you don’t have to answer the technology. It can talk away and if you don’t want to listen you don’t have to listen.

Methodological Considerations

In addition to the findings outlined above, this novel intervention has provided valuable insights into some ethical and methodological challenges when utilising this type of technology as an intervention tool. The implementation of the intervention was dependent on a number of factors. An important practical consideration was the capacity of the research team to access the family’s device remotely. If the device was switched off, or the family had Wi-Fi connection issues, the delivery of the intervention was affected as the research team were unable to set new reminders and prompts during these periods. A protocol was also put in place to cover the potential issue of disclosure of information and unintended collection of data; however, no scenarios arose within the present study.

Dissemination

Findings have been disseminated at two international academic conferences (ISBNPA 2019, HEPA 2019) and will be presented at FENS in Dublin, October 2019. A dissemination event with key stakeholders, researchers and participants will be held in October 2019. A research article is also in preparation to present findings from this feasibility study.

A short video highlighting the project can be viewed here:

<https://www.youtube.com/watch?v=0-hW2CYi81Q>

Conclusions

This feasibility study has demonstrated that the use of IPS to promote health-related behaviours within the home setting is possible, and acceptable to families. This novel work has provided valuable insights into how researchers can use IPS as a tool to promote PA and healthy eating within families. The study has also identified important ethical and methodological considerations around the implementation of such interventions and in how data may be analysed, which will inform future studies that plan to use IPS.

Acknowledgements

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