Getting Healthy by Catching Them All: A Study on the Relationship between Player Orientations and Perceived Health Benefits in an Augmented Reality Game

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Abstract

In recent years, location-based augmented reality games such as Pokémon Go have become increasingly popular. These games not only afford a novel gaming experience, but also have the potential to alter how players view their physical realities and alter the dynamics of traditional game play from its sedentary nature towards a more physical one. In this paper we investigate what kinds of players (achievement, immersion or social interaction -oriented) are more likely to derive health benefits from playing augmented reality games. We employ online survey data gathered among players of Pokémon Go (N=1190). The results show that playing location-based augmented reality games has a positive association with perceived mental, physical and social health outcomes overall. The results also suggest that the way in which players approach the game and what kinds of aspects of the game they emphasize can have a differential dynamic on how the health benefits of the game manifest. Results show that social gaming orientation is positively associated with physical, mental and social health outcomes, whereas achievement and immersion orientations are associated with physical and mental health outcomes.

1. Introduction

Augmented Reality (AR) refers to the interactive coexistence of computer generated assets within the physical reality [4]. Such coexistence creates a unique opportunity in video games scenery, especially by altering the traditional way of playing video games. One of the earliest examples of the mobile AR games was ARQuake [76], a Quake-like first person shooter game played with a handheld controller and a head mount display both indoors and outdoors. However, to make this possible, players had to carry around the entire system which weighs approximately 16kg. As the technology has advanced, AR games have become more mobile which has enabled their commercialization and widespread popularity. Today, we are able to play AR games with the comfort of our smartphones.

One of the most prominent examples of these advancements is Pokémon Go. Launched in the US on July 6 2016, Pokémon Go is a mobile game based on a Japanese transmedia franchise and built on a pre-existing mobile game platform by Niantic, Inc. During the first two months of its launch, the game was downloaded more than 500 million times [73]. That year, Pokémon Go won the titles of "best mobile/handheld game", as well as "best family game" [75]. Early statistics by Niantic Labs state that since the launch of the game, Pokémon Go players have collectively walked over 8.7 billion kilometers and caught 88 billion Pokémons [47]. The popularity of Pokémon Go is also evident in the fact that the term "Pokémon Go" was the leading search term in the recently published Google search trends 2016 [17]. Beyond being a Location-Based Game (LBG), Pokémon Go and others like it can also be classified as Augmented Reality Games (ARGs), games that are particularly focused on overlaying digital content onto everyday surroundings. Common to these games and

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activities is that they create hybrid spaces that challenge the dichotomy of the physical and the digital; spaces that "merge the physical and the digital in a social environment created by the mobility of users connected via mobile technology devices" [12].

While there has been a remarkable amount of research on players, player experiences and the gratifications they derive from games (e.g. [10][9][19][20][23][25][26][39][70][68][84]), as well as on player types and orientations [18][31][79][86], LBGs and ARGs are a novel and multifaceted development, not only in the games space, but also culturally. As such they can be seen to afford several kinds of experiences and gratifications for their users that are not necessarily found in more traditional forms of games or media, and especially not in such combinations. These include experiences such as outdoor adventures, communal activities and health benefits. Having recently broken through to a more mainstream audience with the success of Pokémon Go, these games and their players provide a culturally and historically opportune vector for closer study. All of these above-mentioned aspects prompt interesting and relevant research questions in the intersection of gaming and health; can LBGARGs promote healthy behaviors and what kinds of players may be more susceptible to derive these health outcomes.

With this spanning of physical and spatial boundaries in the field of play of LBGs, players are required to move their physical bodies considerable distances in order to play the game. In fact, exercise is not only considered a byproduct of playing LBGs/ARGs, but for many, a chief reason to start playing. For the individual health promotion all the above mentioned game mechanics have been a matter of focus in the domain of serious games studies [16][42]. As noted by O'Hara [49] in Geocaching, the primary motivation for playing was not necessarily achieving the objectives set by the activity, but rather participation in the activity itself. Pokémon Go uses game mechanics and achievements to incentivize walking outdoors and covering relatively long distances. Recent evidence indicate that novel gaming concepts such as Pokémon Go can lead to elevated physical activity [67][30][37]. In the context of the current study, the concept of outdoor activity not only addresses physical activity but also includes other linked activities including meeting friends and engaging in social activities outdoors, as well as visiting and exploring new places.

Therefore, in this study we investigate what kinds of players (achievement, immersion or social - orientation) are more likely to perceive health benefits (mental, physical and social health outcomes) from playing augmented reality games. We employ online survey data gathered among players of Pokémon Go (N=1190).

2. Background hypotheses

2.1. Gamification of health and augmented reality games

Health is a subject that takes part in every stage of human life starting from birth to old age, and is a basic need for every individual. The main three dimensions of health defined by The World Health Organization are physical, mental, and social well-being [83]. These dimensions are concerned with the physical and mechanical functioning of the body, the ability of thinking clearly and coherently, and the ability to build and maintain relationships [65].

Promotion of health with all its dimensions through game play has gained a lot of attention in the academia (for reviews of the literature, see e.g. [28][5][51][54][62]). Health is in fact one of the most common domains were game design and gameful solutions have been employed (for reviews see [38][21][66]). Gamification refers to design that attempts to transform activities into ones that would afford similar experiences as games do and as such positively affect our motivations and behaviors [27]. As the main inspiration of gamification are games, gamification commonly employs game design mechanics and perspectives to various contexts. Gamification has become the umbrella concept [38] that includes and encompasses, to varying degrees, other related technological veins such as serious games, exergames, augmented-reality games, game-based learning, games with a purpose, human-based computation games, and persuasive technology, which all slightly vary in their emphases. While augmented reality games, such as Pokémon Go, might have not been intentionally designed to gamefully encourage people to improve their health, it regardless appears to fall into the domain of gamification even though the gamification may not be the main focus of the service.

Since the launch and immense popularity of the Pokémon Go, a sizable amount of research has already been conducted on the solution and its health-related aspects. Looking at the physical health benefits of Pokémon Go, Althoff et al. [1] determined a significant increase in physical activity of Pokémon Go players. Likewise, a number of later studies have confirmed that players are driven to spend time outdoors as the game facilitates socializing with friends, bonding with family members, and creating new social connections [37][30][43][77]. Furthermore, studies have also determined that the salient attributes of the game,

namely physical activity and social activity, improve mental health and provide support to people with social withdrawal, depression, autism, ADHD, and anxiousness [45][32][37]. In the workplace context, the game has been shown to improve psychological stress of adult workers leading to positive effects on mental health of Japanese workers [82]. Conversely, the game has also been noted to cause serious consequences such as traffic accidents, physical injuries, addictive and obsessive behaviors, and threats to child safety [3][43][56][71][77].

However, what is apparent from the body of related literature is that there remains a dearth of studies that would investigate the relationship between player types and health outcomes. The current body of research has mainly focused on the gratification players derive from playing augmented reality games.

2.2. Playing orientations

Within the game research field, there is a substantial vein of research examining and categorizing players based on their play styles, play preferences and orientations regarding play (for a metasynthesis of the research, see [18]. The most prevalent ways of categorizing players in academic research have been their in-game behavior and motivations for playing. One of the earliest models for categorizing players has been Bartle's taxonomy of MUD (Multi-user Dungeon) players [7]. Later on e.g. Yee's [86] works have expanded the focus to e.g. understanding the player motivations of online games. In addition to the behavioral and motivational models, player categorization and segmentation based on demographic and personality factors has also been conducted [18].

The motivation-based taxonomy by Yee [86] has been widely used to understand the rationales of people playing different types of video games [5][61] or using various game-like systems [44]. The taxonomy identifies three different motivational orientations for play: achievement, immersion, and social interaction [86][87]. As indicated by prior research on playing orientations, achievement oriented players seek to experience senses of competence and mastery manifested for example by reaching the top of the high score list or completing the game [86][87]. In the context of Pokémon Go the achievement orientation could manifest as the willingness to "catch them all", that is, to reach high levels within the game. Reaching high levels in the game requires physical activity and moving in one's environment. Consequently, the achievement orientation can be hypothesized to lead to physical health outcomes. Furthermore, satisfying one's achievement needs can also lead to mental satisfaction with one's performance, thus promoting mental health outcomes.

The immersion orientation towards playing commonly manifests as exploration of the game worlds, as a willingness to take the time to get to know storylines and uncover the contents of the game [86][87]. As an augmented reality game that encourages movement within one's own environment, while at the same time augmenting it with the additional layer created by the game and it's rich lore and narrative, Pokémon Go promotes heavily the exploration of one's surroundings and immersing into the content. The exploration is again a physical activity and thus requires being active. Therefore, we hypothesize that the immersion oriented players are also more likely to reach physical health outcomes. Similarly to the achievement orientation, satisfaction of the immersion needs is also considered to lead to mental health outcomes.

Players who are oriented towards social interaction seek to create social connections within the games and experience senses of community and relatedness [86][87]. Similarly to many current game products, Pokémon Go includes strong social elements and has large social communities both within and outside of the game. Potentially due to the popularity and even nostalgia related to the Pokémon franchise, enthusiastic players convene also outside the actual game context to discuss and share experiences regarding the game. Pokémon Go has however been extremely successful in engaging players to be social and create social connections when playing via its design. Game features such as the "lures" that can be bought and activated to increase spawn rates of Pokémons nearby have been reported to be powerful at inducing collaborative and even altruistic behaviors and strongly supporting social interaction in connection to the game play. Thus the game provides extensive opportunities for socially oriented players to satisfy social interaction needs through the game. Thus we hypothesize the social interaction orientation to play Pokémon Go to also lead to increased social health outcomes. Similarly to the other orientations, we also predict the satisfaction of social interaction needs to lead to increased mental health outcomes.

Moreover, as Pokémon Go contains elements which are connected to all of the three health outcomes, physical, mental and social, we expect the amount of playing the game to lead to increased health outcomes on a general level.

In summary, we hypothesize the following:

H1: *Achievement orientation is positively associated with physical and mental health outcomes of playing Pokémon Go (or at least more strongly associated than with social health outcomes).*

H2: *Immersion orientation is positively associated with physical and mental health outcomes of playing Pokémon Go (or at least more strongly associated than with social health outcomes).*

H3: *Social interaction orientation is positively associated with social and mental health outcomes of playing Pokémon Go (or at least more strongly associated than with physical outcomes).*

H4: *Daily playing hours of Pokémon Go are positively associated with the physical, mental and social health outcomes.*

3. Methods and data

3.1. Data and participants

The data was collected via a global online survey open for people who currently play or had recently played Pokémon Go. Launched in the US on July 6 2016, Pokémon Go is a mobile game based on a Japanese transmedia franchise and built on a pre-existing mobile game platform by Niantic, Inc. Starting as a GameBoy game in 1995, Pokémon has become a global cultural phenomenon with various video games, anime series, card games, and films. All these media assets have led to a grounded fan-base, that made it possible for the PG game to receive 65 million monthly active users only after 9 months of its release [74].

The survey was initially published on a number of gaming research mailing lists, as well as on the Twitter profiles of the authors. In the brief description text, we requested the readers to post links to the survey on relevant forums. During one month, the survey was tweeted by a number of gaming professionals, academics and research groups. Furthermore, the survey was posted on a number of Pokémon Go Facebook fan pages and by groups notably in the Philippines, Finland, USA, Canada and Australia.

Participation in the survey was completely voluntary and users were afforded the possibility to withdraw at any time. All of the questions in the survey were mandatory. During the one-month period (9-10/2016), 1315 respondents completed the survey. Out of these responses, 43 respondents who stated that they did not play Pokémon Go were removed from the usable data set. Based on the guidelines proposed for maintaining data quality [46], in total, 82 responses were excluded due to the following reasons. Participants providing careless responses with no variance between individual answers (e.g. all 1's or all 7's etc.), inconsistent responses to two control questions, and obvious outliers (using boxplots and histograms) were excluded from the data analysis. After the data cleaning process, the final data set for statistical analysis composed of 1190 valid responses. Table 2 reports the demographic and playing related characteristics of the respondents.

Table 2. Respondents descriptives regarding demographic and playing related factors (N=1190)

Measure		**N**	**%**	**Measure**		**N**	**%**
Gender	Male	698	58.7	Occupation	Working full-time	550	46.2
	Female	492	41.3		Student	401	33.7
Age	Under 15 years	36	3.0		Working part-time	102	8.6
	16-20 years	179	15.0		Unemployed	98	8.2
	21-25 years	388	32.6		Full-time homemaker	33	2.8
	26-30 years	302	25.4		Retired / Pensioner	6	0.5
	31-35 years	132	11.1	Country of residence	Philippines	402	33.8
	36-40 years	74	6.2		Finland	375	31.5
	41-45 years	36	3.0		United States	93	7.8
	46-50 years	25	2.1		Sweden	42	3.5
	Over 51 years	18	1.5		United Kingdom	42	3.5
Education	College degree	421	35.4		Singapore	41	3.4
	University degree	413	34.7		Canada	38	3.2
	High school	240	20.2		Australia	36	3.0
	Vocational degree	116	9.7		Malta	21	1.8
					Others	100	8.4
Average Pokémon Go play hours/typical day							
	< 15 minutes	88	7.4		2-3 hours	140	11.8
	16-30 minutes	149	12.5		3-4 hours	101	8.5
	31-45 minutes	125	10.5		4-5 hours	45	3.8
	46-60 minutes	157	13.2		5-6 hours	41	3.4
	1-2 hours	279	23.4		> 6 hours	65	5.5

Table 3. Convergent and discriminant validity

	Average Variance Extracted (AVE)	Composite Reliability	Cronbach's Alpha	ACHE	IMMER	MH	PH	PMH	SH	SOC
ACHE	0.810	0.944	0.922	**0.900**						
IMMER	0.781	0.934	0.907	0.574	**0.883**					
MH	0.847	0.917	0.820	0.293	0.283	**0.920**				
PH	0.937	0.967	0.933	0.281	0.279	0.842	**0.968**			
PMH	na	na	na	0.165	0.07	0.351	0.284	**na**		
SH	0.702	0.943	0.929	0.284	0.276	0.769	0.734	0.315	**0.838**	
SOC	0.882	0.968	0.955	0.562	0.57	0.347	0.298	0.211	0.451	**0.939**

- ACHE = Achievement orientation, IMMER = Immersion orientation, SOC = Social interaction orientation, MH = Mental health outcomes, PH = Physical health outcomes, SH = Social health outcomes, PMH = Average Pokémon Go play hours/typical day
- Square roots of AVEs are reported in bold in the diagonal., na = not applicable, single-item
- Numbers below the diagonal refer to correlations between the constructs

3.2. Measurement, validity and reliability

The playing orientations as well as the health outcomes were measured using previously validated instruments adapted from prior literature. See the Appendix for the constructs and their included items as well as the sources. The independent variables Achievement (ACHE), Immersion (IMMER), and Social Interaction (SOC) included four items each. Of the dependent variables, the physical health outcomes (PH) and the mental health outcomes (MH) included originally 4 items and the social health outcomes (SH) included 7 items. Two items from both PH and MH were omitted due to a low loading. All of the variables were measured using a 7-point Likert scale (for independent variables: not at all important - extremely important; for dependent variables: strongly disagree - strongly agree).

The model-testing was conducted using the component-based PLS-SEM in SmartPLS 3 [59]. Convergent validity (see Table 3) was assessed with two metrics: average variance extracted (AVE) and composite reliability (CR). Convergent validity was met (the AVE of each construct should be >0.5, and the CR of each construct should be >0.7: [15]). Discriminant validity was assessed firstly through the comparison of the square root of the AVE of each construct to all of the correlations between it and other constructs (see [15]), where all of the square roots of the AVEs should be greater than any of the correlations between the corresponding construct and another construct [29] (see Table 3). Secondly, we assessed the discriminant validity by confirming that each item had the highest loading with its corresponding construct. From these tests, we can conclude that the discriminant validity and reliability was acceptable. The sample size (N = 1190) also satisfies several different criteria for the lower bounds of sample size for PLS-SEM analysis [2].

4. Results

In order to confirm the hypotheses of the study, all of the relationships between the playing orientations and health outcomes as well as the playing time and health outcomes were included in the path model. The path model accounted for 16.7% of the variance of physical health outcomes, 21.9% of the variance of mental health outcomes and 25.5% of the variance of social health outcomes (see Figure 1). The results indicate that the achievement orientation is slightly positively associated with the physical (β=.098**) and mental (β=.080*) health outcomes, but there is no significant association with the social health outcomes. The immersion orientation is similarly, and more strongly, positively associated with the physical (β=.142***) and mental (β=.118**) health outcomes. The immersion orientation is not associated with the social health outcomes. Interestingly, the social interaction orientation was positively associated with all the health outcomes. The social interaction positively predicts physical (β=.112**) and mental (β=.172***) health outcomes. Understandably, the social interaction is most strongly positively associated with the social health outcomes (β=.371***). Furthermore, the estimated daily playing hours of Pokémon Go were used in the model as a control variable. The playing hours were positively associated with all of the outcomes, the physical (β=.234***), mental (β=.293***) and social (β=.232***) health outcomes. We also examined the effect sizes of the health outcomes without the control variable. The effect sizes are reported in Figure 1.

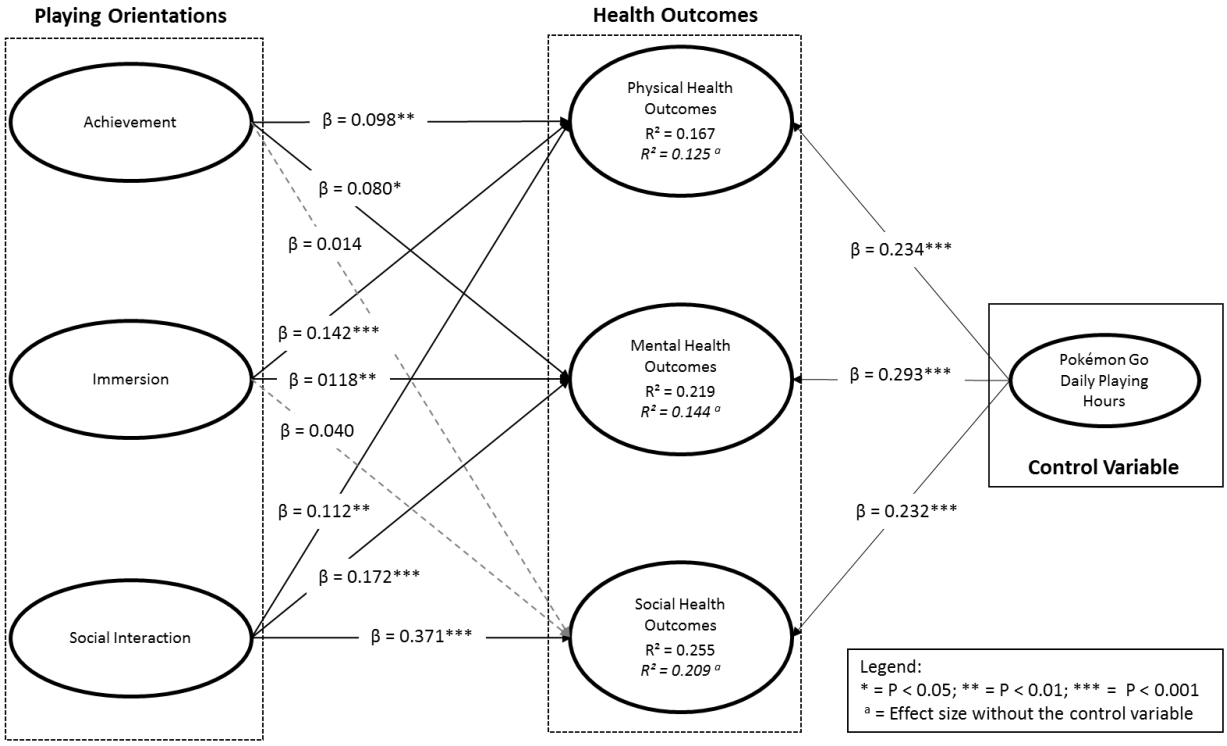

Figure 1. The research model with the results of the analysis

5. Discussion

In this study we have investigated the relationship between playing orientations and health outcomes in the context of location-based augmented reality mobile game Pokémon Go. All of the hypotheses were supported by the data. Achievement and immersion orientations were shown to be most strongly positively associated with physical and mental health outcomes from playing Pokémon Go (H1, H2). Social interaction orientation was shown to be associated with all of the health outcomes, however, the strongest associations were expectedly with the social and mental health outcomes, thus supporting the hypothesis (H3). Finally, the daily playing hours of Pokémon Go were shown to be positively associated with all of the physical, mental and social health outcomes (H4). However, it should be noted that model explained between 12.5% - 25.5% of the variance of the dependent variables, indicating that there remain many more variables that would explain health outcomes besides playing orientation.

The results of the study suggest that playing location-based augmented reality games can indeed be associated with perceived health benefits. While prior research has mainly focused on one or two types of health in each study (see e.g. [1][37][85][88]), in this study the perspective on health was expanded to include physical, mental and social health. The results of the study indicate that playing the location-based augmented reality games may promote mental and social health benefits in addition to the physical health outcomes. A noteworthy finding regarding the perceived health benefits of the location-based augmented reality games is especially the effect of the amount of playing time to the health outcomes. While the time spent playing the game has a positive association with all of the health outcomes, a considerable increase can be noted especially in the effect size of mental health outcomes due to the time spent playing the game.

Moreover, the results of the study indicate that there are differences in the relationship between the different playing orientations and the dimensions of health; an aspect that has not been examined in prior literature to a sufficient degree. The current study suggests that the ways in which players approach the game and what kinds of aspects of the game they emphasize and thus potentially mostly engage with can have a differential dynamic on how the health benefits of the game manifest. This conclusion was particularly supported by the findings indicating that achievement and immersion oriented players were reporting higher

perceived physical and mental health benefits and no social health outcomes to a significant degree. Conversely, the socially oriented players reported high perceived social and mental health outcomes, but clearly lower physical health benefits.

Interestingly, the achievement orientation was the weakest predictor of the health outcomes. This finding potentially suggests that the achievement need satisfaction of the players does not translate as directly to health benefits. The stronger associations between the immersion and social interaction orientations and the health outcomes on the contrary seem to indicate that these approaches to the game more directly manifest in the health aspects.

There are some limitations that need to be acknowledged regarding our study. The data has been gathered via an online survey which means the responses are self-reported and the respondents are self-selected, which is common to the given methodology. It has been noted that individuals tend to, for example, over- or underestimate their physical activity when self-reporting [55]. Thus, the potential effects of the data gathering method must be taken into account when evaluation the results. In order to confirm the results of this study based on self-reported data, experimental study designs and use of behavioral data e.g. related to actual physical activity are recommended. With a multi-method approach combining both survey and behavioral data, more accurate understanding of the health benefits of location-based augmented reality games could be gained. Likewise, despite a strong relevance to the game, some of the activity based questionnaire items (e.g. have walked more, have cycled more, have spent more time outdoors, have visited new places) display poor loadings. These results require further investigations preferably by employing log data. Furthermore, it is common in self-reported data that the respondents are likely to be highly engaged users of the service at hand. If this is the case, it potentially leads to the representation of the active users' perceptions in the resultant data. Thus, future studies should seek to include also less active users in order to gain further understanding of the perceptions of that population regarding the service and their reasons for not being actively involved with the service.

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Appendix. Full list of employed constructs and their items as well as the sources for the constructs.

Construct	**Items**	**Loading**	**Sources**
Playing Orientations – "In general, how would you rate the importance of the following aspects in games?"			
Achievement	ACHE1: becoming powerful	0.863	[86][87]
	ACHE2: winning	0.899	
	ACHE3: getting the top score/level/points	0.913	
	ACHE4: being the best	0.924	
Immersion	IMMER1: story and theme	0.882	[87]
	IMMER2: feeling immersed	0.859	
	IMMER3: exploring the game-world	0.905	
	IMMER4: background and history of characters	0.887	
Social interaction	SOC1: chatting with other players	0.925	[87][68][35][84]
	SOC2: keeping in touch with friends	0.929	
	SOC3: feeling connected to other people	0.959	
	SOC4: interacting with other players	0.942	
Health outcomes- "How much do you agree with the following statements? Since I started playing Pokémon Go, because of the game I …"			
Physical health outcomes	PH1: Feel more energized	0.969	[81][58]
	PH2: Feel more physically active	0.967	
	PH3: Have walked/jogged more - omitted	-	
	PH4: Have cycled more - omitted	-	
Mental health outcomes	MH1: Feel more mentally active	0.931	[53][40]
	MH2: Feel less depressed and anxious	0.910	
	MH3: Spent more time outdoors - omitted	-	
	MH4: Visited new places/landmarks - omitted	-	
Social health outcomes	SH1: Have made new friends	0.839	[24][34][78]
	SH2: Interacted more with my existing friends	0.838	
	SH3: Interacted more with strangers	0.800	
	SH4: Interacted more with my family members/relatives	0.758	
	SH5: Strengthen existing relationships	0.830	
	SH6: Feel more social	0.893	
	SH7: Feel more connected with others	0.899	