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Original Article

Wearable activity trackers and health awareness: Nursing implications

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ABSTRACT

Purpose: Wearable devices are commonly used to measure physical activity. However, it remains unclear the effect of wearing these devices on health awareness. Our aim was to provide evidence related to wearing physical activity trackers and health awareness.
Methods: A quantitative comparison study design was used comparing participants who wore physical activity tracking devices (n = 108) and those who did not (n = 112). A paper-based Physical Health Knowledge survey designed for the purpose of this research was used for data collection in 2018.
Results: A difference between participants who wore physical activity tracking devices and those that did not was identified in relation to activity levels and physical health awareness. Wearable devices are suggested as an opportunity for nurses to engage people in physical activity with the potential to improve their health awareness.
Conclusions: Nurses are well placed in the healthcare landscape to work with patients who own an activity tracker device concerning increasing activity self-monitoring. This information the patient has from the device can also form the basis of health discussions between nurses and the people in their care.

What is known ?

- With the technology explosion, more people have access to wearable technology such as FitBit and Apple Watch to monitor their health.
- Wearable technologies such as physical activity trackers are underutilised in nursing.

What is new ?

- People who wear a physical tracker are more health aware and active.
- We identified a positive effect that wearing a physical activity tracker had in relation to activity levels and the awareness.
- Nursing implications for using wearable devices in healthcare as a change agent is worth further investigation.

1. Introduction

Chronic conditions have a long lasting impact on health and includes cardiovascular disease, respiratory disorders, mental illness and obesity, with cardiovascular diseases remaining the top burden of disease globally [1]. Improved activity such as exercise is central to improving health and can improve cardiovascular function and other conditions. Nursing practice involves several key actions such as communicating, interpersonal relating, teamwork, decision making, and undertaking person centred care that addresses the physical and mental health of patients in their care [2]. Nursing practice also includes the implementation of interventions that meet the patient's needs in a timely manner while working with patients in a therapeutic alliance. With the recent explosion in health technologies including personal devices used by patients (such as Apple watch and Fit Bit), there is an opportunity for nursing practice to embrace working with patients towards using personal trackers to promote self-monitoring. Using personal technologies that patients already own offers a cost effective and ready to use option to facilitate nursing care that is personalised and accessible to patients. However, the benefits and/or merits of people wearing physical trackers has yet not been explored with regards to improvements in physically activity and health literacy and the implications for nursing practice.

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Wearable activity devices or activity trackers are becoming increasingly popular. The revenue from fitness and activity trackers worldwide has increased from under $5 Billion (USD) in 2014, to over $20 Billion (USD) in 2017 [3]. This trend demonstrates a significant uptake of wearable devices by people in the community. Such devices can be used to monitor sleep, dietary intake, the number of steps taken, speed of walking, pace and distance travelled, heart rate, and calorie usage [4]. This information can even be shared with friends when authorised by the wearer.

Evidence supports that physical trackers are used for health purposes by individuals [5] as well as for research [6], and by sporting groups [7]. Healthy behaviours such as monitoring physical activity and other aspects of health, such as sleep and heart rate, may indicate a degree of health or physical awareness by wearers [8,9].Patel, Asch [10] proposed that by monitoring physical activity using wearable devices, healthy behaviours may improve. However, they caution that improvements in health are not likely to be achieved by wearing the devices alone and that positive health behaviour engagement strategies are also essential. A recent review examining low cost wearable devices to assist people in monitoring their physical activity found few studies that examined the acceptability, usefulness and effectiveness of wearing these devices to promote health awareness and thus healthy behaviours [11].A definition of health awareness has been derived from the World Health Organization where the concept of health is being a state of physical, mental and social wellbeing and informed by opinion and active co-operation [12]. The research question that guided this study was: Does wearing a physical activity tracker improve health awareness and healthy behaviours in healthy adults?

2. Materials and methods

2.1. Design

The study design used was a quantitative comparison study between two groups, those who wore a physical health activity tracking device and those who did not. This aim of this study was to investigate if wearing activity trackers improved health awareness in healthy adults. The potential benefits of gaining knowledge from this research is the idea that evidence for improved health awareness from using a wearable device could be an used as an opportunity to inform practice of nurses in promoting self-monitoring in patients who own a personal activity trackers. The Health Belief Model informed the development of the survey for the study. The Health Belief Model (HBM) is commonly used by healthcare providers to understand and explain health behaviours of people, and suggests that people's beliefs about their health informs their subsequent actions [13]. The fundamental premise of the HBM is that people will engage in health behaviours if they think they are at risk for a disease, that their condition has serious consequences, that their behaviour could be of benefit in reducing illness susceptibility or harm and that there are benefits to taking action (i.e. being physically active). Recent evidence examining the HBM in relation to technology further proposes that people who engage with technology for health purposes are already undertaking a proactive health behaviour [14]. The questions for the survey used were generated by two experienced registered nurses and centred on the key outcomes of interest (health awareness, health behaviours and the influence of wearing a physical activity tracker on the person's health awareness and behaviour). The reliability of the items in the scale were analysed as part of the study after the survey was completed by participants and presented in this paper in the results section.

2.2. Method

Participants in this study were adults (>18 years) in the general community of Melbourne recruited by students enrolled in an undergraduate nursing degree. The population of Melbourne has approximately 4.8 million residents [15], accounting for almost 20% of the population of Australia. With a confidence interval of 6.6 and a confidence level of 95% a sample size of 220 would provide adequate power. The sample consisted of 220 participants, with $n = 108$ self-identified as wearing an activity tracking device and $n = 112$ who did not wear a device. Data collection was undertaken using a paper-based survey designed specifically for the purpose of this research.

Participants who consented to join the study completed the survey which included two sections, the first was information related to demographics and the second physical health awareness. The demographic section contained 4 questions about age, gender, qualification, and use of a wearable activity tracker. The remaining 11 questions were related to participant's awareness of their physical health and health behaviours. Participants were required to respond to statements on a 5-point Likert scale ranging from "strongly agree" to "strongly disagree". An example question in the survey was "I change my activity levels in response to my beliefs about my physical health". The content and face validity for the survey was considered high as it was developed by two experienced registered nurses and checked for face validity by a third nurse practitioner with expertise in primary health care.

2.2.1. Data analysis

Data were collected between March and June 2018 and written informed consent was obtained prior to data collection. Analysis included descriptive statistics of demographic data, reliability analysis for the tool, and chi square testing. Data were analysed using SPSS version 24. Characteristics of the study participants were analysed using descriptive statistics at first. Independent sample t tests were used to determine existence of association for the individual responses of the item and statistical significance was determined by the P value < 0.05. The individual responses were then categorised for further analyses. Responses on 'Strongly agree' and 'Agree' were grouped to 'Agree', 'Strongly disagree' and 'Disagree' were grouped to 'Disagree', and 'Neutral' were moved to missing values. Chi-squared tests were then used to determine association between users and non-users of trackers. Bivariate analyses were conducted to determine strength of association by calculating odds ratios (*OR*s) and 95% confidence intervals (CIs).

2.2.2. Ethical considerations

Ethical approval was given by the Human Research Ethics committee of the university (No. 2017/291). Informed consent was sought prior to participation in the survey and data is presented here in aggregate format to protect the anonymity of participants.

3. Results

A total of 220 participants was included in this study. About half of them ($n = 100$, 46%) belonged to the age group of 18–34 years and two-thirds ($n = 132$, 60%) were males. More than one-third of the study participants ($n = 88$, 40%) had Technical and Further Education (TAFE) certificate of Diploma as their highest qualifications (Table 1). About half of the study participants ($n = 108$, 49%) used a physical health activity tracking device. Most of the tracker users belonged to the age group of 18–34 years ($n = 52$, 48%) and were males ($n = 68$, 63%). However, there was no statistically significant difference between the users and non-users of tracker in terms of gender and age groups. There was a significant association

Table 1
Characteristics of study participants($N = 220$).

Variables	*n*(%)
Age (years)	
18–34	100 (45.5)
35–55	99 (45.0)
≥56	21 (9.5)
Gender	
Male	132 (60.0)
Female	88 (40.0)
Highest qualification	
Year 9–12	60 (27.3)
TAFE certificate or Diploma	88 (40.0)
Bachelor's degree	60 (27.3)
Master's degree	12 (5.5)
Use of tracker	108 (49.1)

between use of tracker and highest qualification of the study participants. Those with TAFE certificate or Diploma (*OR*s 2.47, 95% CIs 1.24–4.91) and bachelor's degree (*OR*s 3.24, 95% CIs 1.52–6.85) were more likely to use tracker (Table 2). However, there was no difference of variables of those with a Master's degree when comparing users and non-users of trackers. The total score (*Mean* ± *SD*) of the 220 participants was 36.52 ± 4.37, followed a normal distribution.

The questionnaire with 11-items had low internal consistency (Cronbach's α 0.403), therefore the questionnaire did not seem reliable. It was determined that removing Q2, 3, 9, 11 would improve the reliability of the survey based on item–total correlations. Most items appeared to be worthy of removal except for Q5 and Q10, as the item–total correlations were between >0.3 and < 0.8 (Table 3) which is considered satisfactory according to Lindahl, Elmqvist [16]. While assessing the variability by examining floor and ceiling effects, it was found that >15% of scores were assigned to the highest score across five items (Q1, Q2, Q5, Q10 and Q11) and to the lowest score across three items (Q3, Q4 and Q9). This indicated no substantial ceiling or floor effects (Table 3).

Given that only questions 5 and 10 total correlations were acceptable these were combined and retained for further analysis. The questions were as follows: "I change my activity levels in response to my beliefs about my physical health" and "I regularly exercise as I know this will improve my physical health" respectively. The responses were compared between the users and non-users of trackers. Analyses of individual responses indicated that there was a significant difference in the mean values for change of activity levels between the users (*Mean* 3.95) and non-users of tracker (*Mean* 3.70) ($P < 0.05$). There was also a significant difference in the mean values for doing regular exercise between the users (*Mean* 4.04) and non-users of tracker (*Mean* 3.65) ($P < 0.01$) (Table 4). Analyses of the categorical responses indicated that the study participants who changed their levels of activity were more likely to use tracker (94% vs. 83%, $P < 0.05$, *OR*s 2.97, 95% CIs 1.11–7.96) and those who did regular exercise were more likely to use tracker (92% vs. 74%, $P < 0.01$, *OR*s 3.92, 95% CIs 1.59–9.71).

Table 2
Comparing the users and non-users of tracker ($N = 220$).

Variables	Use of tracker, *n*(%)		*P*	*OR*	95% CI
	Yes	No			
Total participants	108	112			
Age (years)					
18-34	52 (48.1)	48 (42.9)		1	
35–55	49 (45.4)	50 (44.6)	0.724	0.90	0.52–1.58
≥56	7 (6.5)	14 (12.5)	0.125	0.46	0.17–1.24
Gender					
Male	68 (63.0)	64 (57.1)		1	
Female	40 (37.0)	48 (42.9)	0.383	1.28	0.74–2.19
Highest qualification					
Year 9–12	19 (17.6)	41 (36.6)		1	
TAFE certificate or Diploma	47 (43.5)	41 (36.6)	**0.010**	**2.47**	**1.24–4.91**
Bachelor's degree	36 (33.3)	24 (21.4)	**0.002**	**3.24**	**1.52–6.85**
Master's degree	6 (5.6)	6 (5.4)	0.230	2.16	0.61–7.57

4. Discussion

The findings showed only two items/questions (question 5 & 10) had item-total correlations that were acceptable for further analysis in relation to our research question. The subsequent analysis between participants who used wearable activity trackers compared to those who did not use a wearable tracker revealed a significant difference regarding activity levels and physical health awareness.

Much of the burden of disease is caused by unhealthy behaviours and the use of media campaigns to trigger healthy choices people make are generally passive, albeit commonplace in public health campaigns [17]. While these public health campaigns contribute to the better life choices that people make, the use of wearable devices offers an opportunity for nurses engage patients who wear wearable activity trackers in activities that improve their healthy behaviours and health awareness. In the past 5 years wearable devices have been tested with a number of groups for example, pregnant women for the purpose of increasing physical activity in pregnancy [18], for weight loss [19–21] and for physical activity for people who are obese and have a serious mental illness [22]. While a number of devices are readily available to the community, no studies have examined whether wearing the device improves a person's health awareness [11]. The results of our study provide an initial understanding about the potential advantage wearable devices can have regarding health awareness. Our findings suggest that people who wear a physical tracker are more health aware and active, as we identified a positive effect that wearing a physical activity tracker has in relation to activity levels and the awareness.

Our findings also show an association between the use of a wearable physical tracker and the person's highest qualification. Evidence suggests education can have protective health effects [23] and potentially improve health literacy. Health literacy is the degree to which individuals have access to and understand basic health information. Improvements in health literacy have shown improved medication adherence in those with asthma [24], better adherence to treatment for cardiovascular disease patients [25] and better glycaemic control in people with type 1 diabetes [26]. However, no difference in variables for Master's degree comparing user and non-user of trackers, which may be attributed to the low numbers of participants ($n = 6$) in that educational group. However, the findings offer an opportunity for nurses to extend their practice by incorporating self-monitoring activities using physical trackers owned by the patient to improve health awareness and healthy behaviours. There is the potential that this can impact a large group of people particularly those living in developed countries and who are more likely to wear such a device.

Limitations: This study provides new understanding of the relationship between wearing of physical health trackers and health awareness in healthy adults. Limitations were identified in association with the reliability of the survey instrument. For future use it is suggested the tool be modified and retested to improve the reliability. The study did, however, include a large sample size and therefore provides new information related to activity levels and health awareness in adults who use a wearable activity device.

Table 3
Item performance and reliability estimates of the questionnaire($N = 220$).

Item No.	Item content	*Mean* ± *SD*	Floor (% with lowest score)	Ceiling (% with highest score)	Corrected Item − total correlation	Cronbach's α if item deleted
1	Aware of own physical health	3.89 ± 0.905	0.90	24.5	0.225	0.357
2	No need to use a tracker to know physical status	3.67 ± 0.972	1.40	19.5	−0.188	0.484
3	Use of tracker to know physical status	2.37 ± 1.071	23.2	2.30	0.050	0.416
4	More aware of physical status due to use of a tracker	3.02 ± 1.317	16.8	14.5	0.135	0.388
5	Change of activity levels due to own beliefs	3.82 ± 0.917	2.70	19.1	0.363	0.310
6	Knowledge of physical health from formal education	3.02 ± 1.127	9.10	8.20	0.236	0.345
7	Knowledge of physical health from family background	3.26 ± 1.073	5.50	8.60	0.212	0.356
8	Knowledge of physical health from media	3.06 ± 1.104	8.60	6.40	0.237	0.346
9	Not concerned of physical health	2.19 ± 1.143	33.2	3.60	−0.083	0.467
10	Do regular exercise as being aware of the benefits	3.84 ± 1.067	1.80	32.7	0.310	0.318
11	Aware of lifestyle affecting physical health	4.37 ± 0.726	0.90	47.3	0.277	0.351

Note: Total Cronbach's $\alpha = 0.403$.

Table 4
Comparing users and non-users of trackers for Q5 and Q10.

Item content		Levene's Test for Equality of Variances		*t*-test for Equality of Means						
		F	*P*	*t*	*df*	*P* (2-tailed)	Mean Difference	Std. Error Difference	95% CI of the Difference	
									Lower	Upper
Change of activity levels due to own beliefs	Equal variances assumed	16.217	<0.001	−2.097	218	0.037	−0.257	0.123	−0.499	−0.015
	Equal variances not assumed			−2.110	200	0.036	−0.257	0.122	−0.498	−0.017
Do regular exercise as being aware of the benefits	Equal variances assumed	11.752	0.001	−2.715	218	0.007	−0.385	0.142	−0.665	−0.106
	Equal variances not assumed			−2.726	212	0.007	−0.385	0.141	−0.664	−0.107

6. Conclusion

Our findings offer an opportunity for nurses to augment practice by incorporating the patient's personal activity tracker into interventions to improve health awareness and thus healthy behaviours in people who use them. This point has implications for using wearable devices in healthcare and use of such devices as a change agent. Wearable devices are commonly worn as watches (i.e. Apple watch) and are therefore readily accessed by patients. Nurses are well placed in the healthcare landscape to work with patients who own an activity tracker device concerning increasing activity self-monitoring. This information the patient has from the device can also form the basis of health discussions between nurses and the people in their care. This is especially significant for patient populations where activity and health choices can alter the trajectory of their recovery.

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Karen-Leigh Edward: Conceptualization, Methodology, Writing - original draft, Project administration, Supervision. **Loretta Garvey:** Data curation, Writing - review & editing. **Muhammad Aziz Rahman:** Formal analysis, Writing - review & editing, Writing - review & editing.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ijnss.2020.03.006.

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