CLAIRE SAMBOLINO
CLARE GRUNDEL

# FEATURE ARTICLE

## WEARABLES AND HEALTH APPS IN NUTRITION PRACTICE:

### REVIEWING THE EVIDENCE FOR EMERGING TOOLS IN PERSONALISED AND PREVENTION-LED HEALTHCARE

# WEARABLES AND HEALTH APPS IN NUTRITION PRACTICE:

## REVIEWING THE EVIDENCE FOR EMERGING TOOLS IN PERSONALISED AND PREVENTION-LED HEALTHCARE

**Authors:**
**Claire Sambolino MSc MBANT**
**Clare Grundel MSc MBANT**

WEARABLE DEVICES

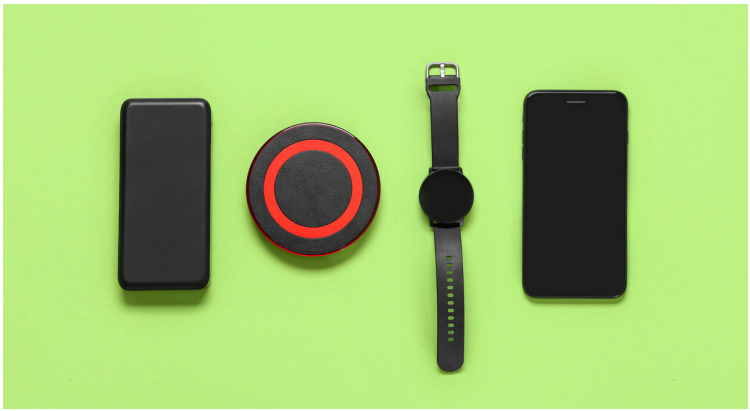
### OVERVIEW

Whilst it may feel that personal wearable devices (PWD) are novel, wearable technology has roots spanning centuries, with inventions dating back to Leonardo da Vinci's pedometer, the Holter monitor, and pacemakers. The recent market expansion now sees it worth an estimated USD $92.90 billion, which is projected to grow at a rate of over 12% from 2026 to 2033 (1). The launch of smart phones in the early 2010's has further facilitated the acceleration of PWD development, combining devices with health apps.

This new generation of wearables are emerging as potential tools in preventative medicine, offering individuals continuous 'real-time' data and personalised insights that can be delivered outside of clinical settings. Though this provides individuals with notable benefits including greater agency and access to data, it also presents a new model of working for clinicians and practitioners, for which there is currently no framework. This short article explores the current evidence on PWDs, the benefits to individuals, and their application in prevention-led healthcare as delivered by nutrition and lifestyle practitioners.

### MEDICAL DEVICES VS. PERSONAL WEARABLES: AN IMPORTANT DISTINCTION

Medical-grade devices (MGDs), such as blood oxygen sensors, and electrocardiogram (ECG) monitors, are strictly regulated, clinically-validated tools approved for diagnosing, tracking and managing conditions. This is distinctly different to the PWD market, designed for fitness and lifestyle tracking, where the level of regulation varies in accordance with a product's classification as either a consumer-grade wellness device or consumer electronics. MGDs must comply with government or medical regulations - The Medical Devices Regulations 2002 (UK MDR 2002) - and be registered with the Medicines and Healthcare products Regulatory Agency (MHRA) before being sold (2). In contrast, PWDs must adhere to standard safety and consumer protections standards, as well as general advertising laws and self-regulatory codes of practice.



WEARABLES IN ACTION

### WHAT CAN BE TRACKED?

PWDs have seen a period of rapid growth and development over the past decade. Devices are now available to track physical activity, nutritional intake, sleep, cardiovascular and pulmonary biomarkers and metrics related to stress. A national survey in Canada, using a representative sample of 4109 adults, revealed that 66% of respondents regularly self-track one or more aspects of their health with mobile apps and digital self-tracking devices (3). PWDs are also being explored for use in public health as part of the UK National Health Service (NHS) Fit for the Future: 10-Year Health Plan (4). The NHS plan proposes to make 'wearables and biometric sensors standard tools for preventative care, disease detection, and remote patient monitoring' (4). With use at these levels and

plans to incorporate into public healthcare provision, an assessment of the validity and accuracy of the data gathered is warranted.

## VALIDITY OF WEARABLE DATA

## ACCURACY & VALIDITY FACTORS

Accuracy is important when considering the validity of data derived from PWDs, and its potential use in clinical practice. These devices use non-transparent algorithms that are often proprietary to the manufacturer. Whilst data from PWDs is generally not considered equivalent to medical-grade devices, the following validation findings are emerging:

### CARDIOVASCULAR BIOMARKERS

A 2019 validation study of two popular wearable devices compared to electrocardiogram (ECG) concluded that Apple Watch 3 (95% mean accuracy) and the Fitbit Charge 2 (91% mean accuracy) provided acceptable heart rate accuracy (<±10%) across a 24 hour period and during each activity being monitored (sitting, walking, running, chores and sleeping) (5). However, a systematic review concluded that PWDs were more accurate for measuring steps and heart rate in laboratory settings, with higher error rates in real-life conditions (6).

### SLEEP MONITORING

Using a 4-stage sleep categorisation (wake; light sleep; slow-wave sleep; REM) and data from 86 sleeps, a 2025 study comparing Whoop to polysomnography concluded Whoop is reliable and non-invasive for estimating sleep (approx. 89% agreement) and has acceptable accuracy for cardiac biomarkers (7,8).

### DISEASE DETECTION

A 2024 systematic review and meta-analysis evaluating whether PWDs (Apple Watch, Oura ring, Samsung Galaxy, Fitbit, Empatica) could detect disease and medical events found trackers show promise in disease detection, with notable accuracy 87.5% (95% CI 81.6%-93.5%) in identifying COVID-19, and predictive value 87.4% (95% CI 75.7%-99.1%) in atrial fibrillation (9).

### NUTRITION

A 2014 RCT of self-monitoring dietary intakes found no statistically significant absolute or percentage differences between energy intake and total energy expenditure: computer, -510±389 kcal/day (78%); smartphone, -456±372 kcal/day (80%); and paper, -503±513 kcal/day (79%) (10). However, a 2022 validation study found a tendency for wristbands to overestimate lower calorie intake, and underestimate a higher intake (11).

### PHYSICAL ACTIVITY

According to Chan et al.(12), wearable devices represent a promising intervention tool for population-wide physical activity promotion, providing remote monitoring of users' physical fitness. Authors reviewed data from 514,418 and 1,186,530 subjects from observational and interventional studies respectively, to measure adherence and validity and found physical activity intensity and step count the most frequently measured metrics.

Whilst some studies express concerns about accuracy and validity (6,11), technology is evolving and PWD manufacturers continue to research and innovate. Apple launched three longitudinal Women's Health Studies in 2020 with the objective of leveraging insights from 10 years of activity, exercise and sleep data, and providing improved behaviour change algorithms and data sets for practitioners (13). Companies in this marketplace will innovate and improve as their databanks grow.

## WHAT CURRENT DATA REVEALS

The available, peer-reviewed evidence for PWDs is limited, given the novel nature of these healthcare tools. Acknowledging the low levels of published research, the following use case scenarios show promise as an adjunct tool in nutrition practice.

### DIET & NUTRITION

There are many mobile apps in the diet and nutrition space and analysis shows high scores on levels of usability (82%) and results that are consistent with the Nutrition Data System for Research references for calories, carbohydrates, fats, and proteins (14). Dietary trackers offer promising features allowing individuals to set goals, plan meals, record meals across the day, and track kilocalories, macronutrients and micronutrients (15). A 2019 study found frequency of self-monitoring is associated with weight loss: those losing ≥10% of weight logged in to the journal web page more times per day than those losing ≥5% (1.6 vs. 2.4, P <0.001 for <5% vs. ≥5%; 1.7 vs. 2.7, P <0.001 for <10% vs. ≥10%) (16,30).

In a 2023 assessment of 11 apps, Cronometer was ranked as the most consistent, however all reviewed apps were found to consistently underestimate daily calories and macronutrients (14). Researchers could also not draw firm conclusions on efficacy of the diet apps in terms of health outcomes (17).


### PHYSICAL ACTIVITY

Evidence suggests a positive association between using PWDs and levels of physical activity (PA). A 2021 systematic review and meta-analysis of 3793 participants with cardiometabolic conditions found a positive association of wearable tracker use with increased PA levels (standardised mean difference (MD), 0.72; 95% CI 0.46-0.97; I2 = 88%; 84.3%-90.8%; P < .001) (18). Similarly, Kirk et al. (2019) found that Fitbits increased physical activity, as measured by steps/day (MD = 2592 steps/day; 95% CI: 1689-3496) and time spent exercising (MD = 36.31 min/wk; 95% CI: 18.33-54.29) in 4528 cardiometabolic patients (19).

Brickwood et al. (2020), found an increase in daily step count (standardised mean difference [SMD] 0.24; 95% CI 0.16 to 0.33; P<.001), moderate and vigorous physical activity (SMD 0.27; 95% CI 0.15 to 0.39; P<.001), and energy expenditure (SMD 0.28; 95% CI 0.03 to 0.54; P=.03) and a statistically non-significant decrease in sedentary behavior (SMD -0.20; 95% CI -0.43 to 0.03; P=.08) (20).

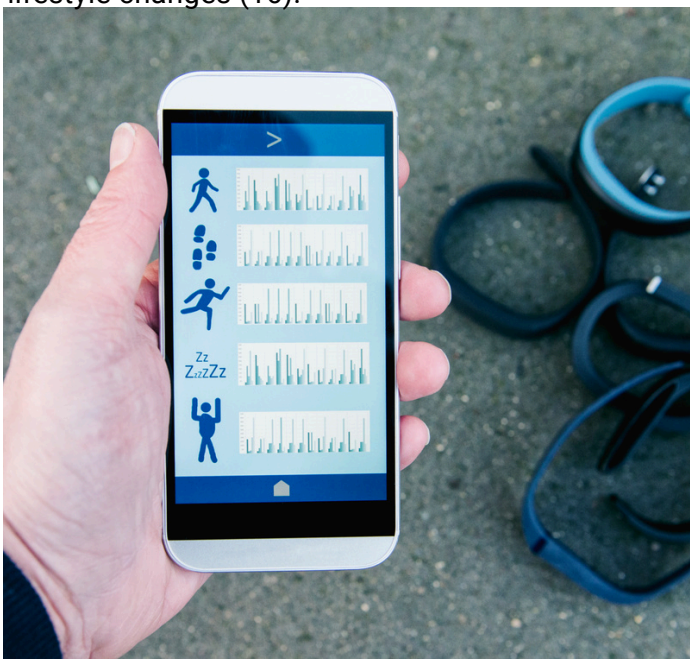
### SLEEP

A 2025 longitudinal study reported associations between Whoop metrics and mental health outcomes. Individuals with better sleep characteristics (ie, longer sleep durations and more consistent wake and sleep times), higher heart rate variabilities (HRV), lower resting heart rates (RHR), and higher levels of physical activity, reported lower levels of depression, anxiety, and stress (21). Gathering these metrics is the first part of the puzzle; using the data to make the necessary behaviour changes to shift the metrics for improved mental health outcomes requires knowledge and support.

### BEHAVIOUR CHANGE

Findings in a 2022 scoping review of 20 studies suggest PWDs empower individuals by assisting with behaviour change and self monitoring (22). PWDs are able to offer a safe environment to set goals, foster self-efficacy and support self-management (22). Furthermore, a 2025 umbrella review found PWDs contribute to healthier lifestyles, extend life expectancy, and reduce healthcare costs. By focusing on behaviour change and integrating habits into daily life, this review found positive impacts on health outcomes, including body weight, metabolic and anthropometric parameters, and dietary quality (23).

A 2018 study of 344 health apps found a limited number of behaviour change techniques embedded in programmes, concluding that improvements in app designs are needed to promote sustainable lifestyle changes (16).



## CLINICAL UTILITY

## NUTRITION PRACTICE: THE CASE FOR WEARABLE DEVICES AND HEALTH APPS

In the last 10 years, PWDs have evolved from simple fitness trackers into more sophisticated tools. They now provide promising features of interest to nutrition practitioners and are capable of tracking metabolic, physiological and behavioural trends (15).

### EMPOWERMENT & MOTIVATION

Nutrition practitioners face the challenge of maintaining client motivation and adherence to nutrition and lifestyle protocols between consultations. PWDs offer a non-invasive and time-efficient solution for individuals to monitor and track health parameters and activities in their daily lives. They are able to measure sleep, activity levels, heart rate, nutrition and other vital signs – in real world settings, which can be empowering for patients (24). Ease of use further enhances user experience as a predictor of consistency (25).

A review of emerging technology in cardiovascular medicine found PWDs hold promise for shifting healthcare from reactive to proactive, thereby ushering in a new era of personalised proactive healthcare (26).

### PRACTITIONER INTERFACE & ACCESS TO CLIENT DATA: CLINICAL APPLICATIONS

Standalone devices are often paired with an app interface to provide greater functionality, and provide practitioner access to their client's data – Cronometer, Keto-Mojo and Whoop for example, all offer this. The ability to share data in real-time opens the possibilities for remote supervision. PWDs may also contribute to better-informed clients, facilitating discussions and joint decision-making about therapeutic protocols (22).

## CONSIDERATIONS

## WHEN WEARABLE DEVICES AND DATA MAY NOT BE APPROPRIATE

As with CGMs in the preventative health setting, PWDs may not be suitable for everyone. Consideration should be made for individuals with a history of health anxiety. A retrospective study by Rosman et al reported higher rates of symptom monitoring and preoccupation (P=0.03) in users, compared to non-users, with 20% of users reporting anxiety or fear from alerts and notifications (27).

Similar caution should be taken in individuals with a history of an eating disorder (ED). A 12 week trial of PWDs on physical activity in a cohort of clinical transdiagnostic binge eating and restrictive eating

participants found a small percentage of individuals perceived the tracker to influence ED symptoms (28). Similarly, a longitudinal study exploring MyFitnessPal app for 8 weeks found fitness tracking frequency to be positively associated with concerns about weight and shape (29).

A final consideration should be given to the risk of some users conflating health tips with medical advice. Whilst data derived from PWDs and apps could be used to inform medical opinion and recommendations, they cannot replace it.

## CONCLUSION

### WEARABLES IN CLINICAL PRACTICE

The research on PWDs and health apps is currently limited. However, there is a growing body of evidence which suggests that they can be empowering, motivational, and beneficial in behaviour change and promoting healthy lifestyles (16,19,22,23,25).

As the PWD market continues to grow, the use of devices is likely to become an important aspect of self-care which can be harnessed for preventive health and used by nutrition practitioners as a tool for behaviour change and motivation.



### AUTHOR CONTRIBUTIONS

CS and CG jointly conceived of the review. CS wrote the review and revised drafts based on editorial comment and peer review. CG provided editorial comment prior to peer review. Both authors reviewed and accepted the final manuscript.

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