Wearable Technology Use and Quality of Life among Adults with Hypertension in the 2022 US NHWS Population

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Introduction

- People with hypertension often face challenges in managing their condition, which can affect overall quality of life (QoL).
- Wearable technology (WT) can be an aid for those suffering from hypertension as a reinforcement tool for symptom and disease management.
- Many respondents from the US 2022 National Health and Wellness Survey (NHWS) population have self-reported using WT (such as devices from fitbit®, Garmin® Vivofit, iFit®, Jawbone®, Xiaomi®) to manage their health or to stay informed and updated about the health of their disease.
- Examining the differences between adopters of WT to non-adopters on QoL scales may generate evidence to inform care among patients with hypertension and other chronic conditions.

Objective

- To examine whether wearable technology (WT) use can impact overall self-reported quality of life (QoL) among adults living with hypertension in the US.

Methods

Data Source

- Data was sourced from the 2022 US NHWS, an internet-based and self-reported survey designed to represent the general adult population, relative to age, gender, and race/ethnicity distributions in the US Census Bureau's International Database (N=75,261).

Key Variables

Variable	Operationalization
WT User *(binary)*	The 2022 US NHWS asks respondents, "Which [technologies] do you or have you used to manage your health or to stay informed and updated about your health or your disease?". If any technology is selected, then respondent is classified as a WT user.
Hypertension *(binary)*	All patients from the 2022 US NHWS who have self-reported a diagnosis for hypertension.
Global Health Score *(continuous)*	Composite score generated from the RAND 36-Item Health Survey (v1.0)[3] measuring overall QoL.
Physical Health Composite (PHC) *(continuous)*	Summary scale derived from the RAND 36-Item Health Survey (v1.0)[3] measuring physical well-being.
Mental Health Composite (MHC) *(continuous)*	Summary scale derived from the RAND 36-Item Health Survey (v1.0)[3] measuring mental well-being.
EQ-5D-5L[2] *(continuous)*	EuroQol-5D instrument for measuring the generic QoL.

Eligibility

Inclusion:
- Eligible to participate in the 2022 US NHWS
- Self-reported a diagnosis of hypertension

Exclusion:
- Did not self-report a diagnosis for hypertension
- Had missing data for any variable relevant to analytic strategy

Statistical Analyses

- Respondents were matched using the greedy match technique using a 1:2 propensity score match (WT users to WT non-users) on age, sex, and Charlson Comorbidity (CCI) scores to create the overall study population.[1] Standardized differences for pre- and post-match characteristics were assessed to ensure a good match.
- Descriptive (means, standards deviations [SD], percentages, sample sizes) and bivariate (Chi-square tests and one-way ANOVA) statistics were used to characterize the sample overall and according to WT use for the matched population.
- Generalized linear models were implemented on the matched cohort for each QoL outcome of interest. Covariates included in the models were gender, race/ethnicity, marital status, employment status, income level, education level, insurance status, smoking status, exercise frequency, and alcohol use. Least squares means regression was used to compare QoL scores between WT users and WT non-users.

Results

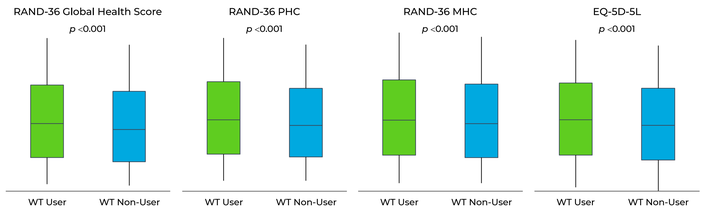
Sample Characteristics

- Our analytic sample consisted of 7,770 respondents who self-reported a diagnosis of hypertension, of which 2,590 (33.3%) WT users were matched to 5,180 (66.6%) WT non-users.
  - Mean age=62.16 years, 60.4% female
  - Race: 71.3% White, 14.5% Black, 6.4% Hispanic, 7.9% Other
  - After the matching of the groups on age, sex, and CCI, WT non-users had a higher BMI than WT users (p =<0.001).
  - More WT users self-reported exercising regularly compared to WT non-users (p =<0.001).

Table 1a. Characteristics of Analytic Sample Overall and According to WT Use after 1:2 Propensity Match

Demographic and Health Characteristics	WT User	WT Non-User	Total Sample	*p*-Value
	N=2,590 (33.3%)	N=5,180 (66.6%)	N=7,770	
	n (%)	n (%)	n (%)	
Age, mean ± SD	**62.11 (12.88)**	**62.19 (12.71)**	**62.16 (12.76)**	***0.783***
Sex				
Female	1,565 (60.4%)	3,131 (60.4%)	4,696 (60.4%)	*0.987*
Male	1,025 (39.6%)	2,049 (39.6%)	3,074 (39.6%)	
Race/Ethnicity				
White	1,895 (73.2%)	3,644 (70.3%)	5,539 (71.3%)	***0.002***
Black	319 (12.3%)	806 (15.6%)	1,125 (14.5%)	
Hispanic	166 (6.4%)	330 (6.4%)	496 (6.4%)	
Other	210 (8.1%)	400 (7.7%)	610 (7.9%)	
Marital Status				
Single/widowed/divorced/separated	923 (35.6%)	2,244 (43.3%)	3,167 (40.8%)	***<0.001***
Married/living with partner	1,667 (64.4%)	2,936 (56.7%)	4,603 (59.2%)	
Employment Status				
Unemployed	1,508 (58.2%)	3,229 (62.3%)	4,737 (61.0%)	***<0.001***
Employed	1,082 (41.8%)	1,951 (37.7%)	3,033 (39.0%)	
Household Income				
<$25,000	187 (7.2%)	885 (17.1%)	1,072 (13.8%)	***<0.001***
$25,000 to <$50,000	487 (18.8%)	1,200 (23.2%)	1,687 (21.7%)	
$50,000 to <$75,000	473 (18.3%)	969 (18.7%)	1,442 (18.6%)	
$75,000+	1,336 (51.6%)	1,901 (36.7%)	3,237 (41.7%)	
Declined to answer	107 (4.1%)	225 (4.3%)	332 (4.3%)	
Educational Level				
Less than 4-year degree	1,137 (43.9%)	2,942 (56.8%)	4,079 (52.5%)	***<0.001***
4-year degree or higher	1,453 (56.1%)	2,238 (43.2%)	3,691 (47.5%)	
Insurance Status				
Insured	57 (2.2%)	221 (4.3%)	278 (3.6%)	***<0.001***
Uninsured	2,533 (97.8%)	4,959 (95.7%)	7,492 (96.4%)	
BMI, mean (SD)	30.33 (6.86)	31.05 (7.61)	30.81 (7.38)	***<0.001***
CCI, mean (SD)	0.87 (1.40)	0.85 (1.27)	0.85 (1.31)	*0.406*
Smoking Behavior				
Never smoked	1,505 (58.1%)	2,789 (53.8%)	4,294 (55.3%)	***<0.001***
Former smoker	853 (32.9%)	1,578 (30.5%)	2,431 (31.3%)	
Current smoker	232 (9.0%)	813 (15.7%)	1,045 (13.4%)	
Exercise				
Does not exercise regularly	718 (27.7%)	2,304 (44.5%)	3,022 (38.9%)	***<0.001***
Exercises regularly	1,872 (72.3%)	2,876 (55.5%)	4,748 (61.1%)	
Alcohol Use				
Does not drink alcohol	729 (28.1%)	1,818 (35.1%)	2,547 (32.8%)	***<0.001***
Drinks alcohol	1,861 (71.9%)	3,362 (64.9%)	5,223 (67.2%)	

Figure 1. Quality of Life Traits between WT Users and WT Non-Users



Results, continued

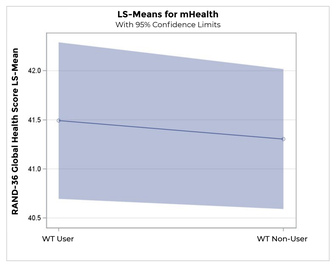
Table 1b. Overall Quality of Life Results with Bivariate Testing for WT Use after 1:2 Propensity Match

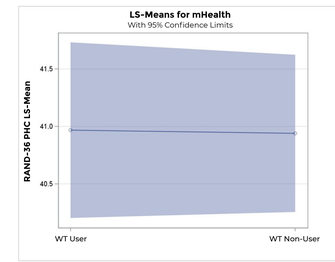
QoL Measure	WT User	WT Non-User	Total Sample	*p*-Value
	N=2,590	N=5,180	N=7,770	
RAND-36 Global Health Score, mean (SD)	44.87 (11.87)	42.78 (12.38)	43.48 (12.25)	***<0.001***
RAND-36 PHC, mean (SD)	44.50 (10.66)	42.21 (11.43)	42.98 (11.23)	***<0.001***
RAND-36 MHC, mean (SD)	46.36 (11.95)	44.75 (12.21)	45.29 (12.15)	***<0.001***
EQ-5D-5L, mean (SD)	0.798 (0.14)	0.775 (0.16)	0.783 (0.155)	***<0.001***

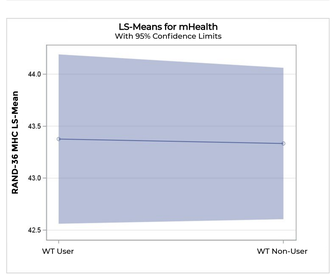
- All QoL measures were found to be statistically different at an α=0.05 level.
  - For each patient-reported outcome (PRO), the mean was higher among WT users than WT non-users, signifying that WT users in this study population are experiencing higher QoL regarding their health.
  - This testing was adjusted for age, sex, and CCI by way of a greedy match technique.

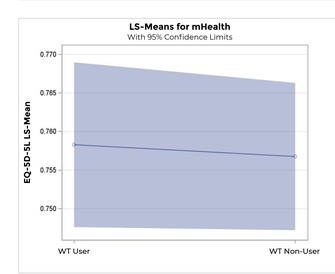
Table 2. Least Square Means Multivariable Results of Quality of Life Scores WT Users and WT Non-Users

QoL Measure	WT User	WT Non-User	*t*-Value	*p*-Value
RAND-36 Global Health Score, mean (SE)	37.41 (0.85)	37.55 (0.76)	-0.26	0.793
RAND-36 PHC, mean (SE)	37.09 (0.80)	36.76 (0.72)	0.63	0.527
RAND-36 MHC, mean (SE)	40.34 (0.84)	40.81 (0.76)	-0.84	0.399
EQ-5D-5L, mean (SE)	0.706 (0.013)	0.691 (0.012)	1.68	0.094









- After adjustment for demographics and comorbidities, there was not a significant difference between the adjusted estimated QoL scores between WT users and WT non-users in this study population.
  - Adjusted means of RAND-36 global and RAND-36 MHC scores were lower among WT users whereas RAND-36 PHC and EQ-5D-5L scores were higher among WT users, but the results were not significant at the α=0.05 level.
  - Both continuous variables (age and BMI) were significant predictors of QoL score in all four models.

Limitations

- As the NHWS is cross-sectional, the temporality of the association between WT use and QoL cannot be determined, nor can changes in WT use be assessed over time.
- While the NHWS is representative of the US population, it may not represent the precise subpopulation of those diagnosed with hypertension. The internet-based survey administration may be more likely to overrepresent younger and healthier individuals.

Conclusions

- While the regression results did not conclusively detect a difference among respondents who use wearable technology to manage their disease compared to those who do not, **the bivariate results found these differences to be notable, specifically in quality of life**. More disease-specific application of wearable technology should be encouraged as the field of precision medicine is growing in individualized care.
- While hypertension is prevalent, **the use of mobile technology may be more valuable in more severe chronic conditions such as diabetes, cancer, COPD, etc.**, where disease progression has greater time-sensitivity. Further sensitivity analyses are recommended to understand the health of the population who implements wearable technology into their disease management.



Acknowledgment

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References

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