Original Paper

Outcomes Associated With a WhatsApp-Based Telehealth Education Program and Remote Follow-Up on Blood Pressure, Medication Adherence, and Self-Care: Formative Quasi-Experimental Pilot Study

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Abstract

Background: Hypertension is a common chronic condition associated with substantial morbidity globally. In Jordan, many patients struggle with sustained medication adherence and self-management, highlighting a need for accessible care strategies. Low-cost platforms such as WhatsApp may support telehealth education and remote follow-up, although formative pilot data are needed to assess feasibility in this context.

Objective: This study aimed to evaluate within-participant changes in blood pressure, medication adherence, self-care behaviors, and hypertension-related knowledge from baseline to postintervention among adults with primary hypertension who participated in a formative WhatsApp-based telehealth education program with structured remote follow-up in Jordan.

Methods: A quasi-experimental, single-group pretest-posttest pilot study was conducted. In total, 40 adults (aged 28-60 years) with primary hypertension were recruited from a university hospital. The 8-week hybrid mobile health (mHealth) intervention involved training participants in home blood pressure monitoring, delivering daily educational multimedia messages via WhatsApp (covering diet, exercise, and medication), and conducting biweekly structured telephone consultations with a nurse and dietitian. Validated tools (Hill-Bone Scale, Blood Pressure Self-Care Scale, and Blood Pressure Knowledge Scale) and electronic sphygmomanometers were used at baseline and after the intervention. Data were analyzed using Wilcoxon signed-rank tests.

Results: All 40 participants completed the 8-week pilot and contributed paired baseline and postintervention outcome data. Postintervention scores were higher for hypertension knowledge (r=0.840; P<.001) and self-care behaviors (r=0.524; P=.001); medication adherence scores were lower, indicating better adherence (r=0.805; P<.001); and systolic (r=.434; P=.006) and diastolic blood pressure (r=.684; P<.001) were lower than those at baseline.

Conclusions: This formative single-group pilot identified favorable pre-post differences in blood pressure, medication adherence, self-care behaviors, and hypertension-related knowledge among a selected sample of adults with primary hypertension. Because there was no control group, the findings do not establish intervention effectiveness or causality and should be interpreted as preliminary evidence supporting further controlled evaluation.

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KEYWORDS

WhatsApp; telehealth; mobile health; mHealth; hypertension; blood pressure; medication adherence; self-care; health education; quasi-experimental; Jordan

Introduction

Hypertension is a leading global health concern and a primary cause of cardiovascular disease and premature mortality. Approximately 1.28 billion adults aged 30 to 79 years are affected globally, with a significant burden in low- and middle-income countries [1,2]. In these regions, individuals face a higher risk of complications due to delayed diagnosis, limited health care access, and poor disease control [1]. Despite the preventable nature of hypertension, only 21% of patients globally achieve blood pressure control [1].

Hypertension is a critical public health challenge globally and regionally. In the Middle East, the crude prevalence of hypertension is estimated at approximately 29.5% [3,4]. In Jordan, hypertension is a leading contributor to cardiovascular morbidity and mortality. Cardiovascular disease is the country's leading cause of death, accounting for 18.6% of cause-specific mortality [5]. Furthermore, despite widespread access to antihypertensive medications, adherence and effective management remain suboptimal. In a Jordanian and Lebanese cohort, 44.1% of patients were nonadherent to antihypertensive therapy, and only 55.9% were adherent; in a Jordanian study, blood pressure was controlled in only 30.7% of men and 35.1% of women receiving antihypertensive medication [6].

Conventional in-person hypertension care faces multiple obstacles, including geographic inaccessibility, insufficient health care infrastructure, and patient nonadherence [7,8]. In Jordan, long wait times, overburdened clinics, and the inaccessibility of rural health services exacerbate these challenges [6].

Telehealth-based interventions offer a promising solution by delivering educational, monitoring, and self-management tools directly to patients' homes [9-12]. These interventions have demonstrated efficacy in improving patient engagement, reducing systolic and diastolic blood pressure, and enhancing medication adherence and self-care behaviors [13-15]. During the COVID-19 pandemic, telemedicine served as a vital link to care, particularly for patients with hypertension who were isolated [16-18].

Despite these advancements, most existing studies focus on high-income countries and lack integration of culturally tailored, multicomponent telehealth interventions [9-20]. Only a limited number of studies have examined these models in low- and middle-income countries such as Jordan [1]. Moreover, while many studies focus on single outcomes (eg, blood pressure or medication adherence), few comprehensively address knowledge, adherence, self-care, and blood pressure control within a single intervention [21,22].

In the context of this study, telehealth was defined as a hybrid mobile health (mHealth) approach combining asynchronous educational multimedia messaging (including WhatsApp messages and reporting of home blood pressure readings) with synchronous, structured biweekly telephone consultations with health care providers. Although these approaches show potential, evidence on integrated telehealth-based education in Jordan remains limited. Therefore, this formative, single-group pre-post pilot study aimed to evaluate changes in blood pressure, medication adherence, self-care behaviors, and hypertension-related knowledge observed from baseline to postintervention among adults with primary hypertension participating in the program.

The specific objectives of this study were as follows: (1) to assess changes in systolic and diastolic blood pressure from baseline to postintervention, (2) to assess changes in medication adherence from baseline to postintervention, (3) to assess changes in hypertension self-care behaviors from baseline to postintervention, and (4) to assess changes in hypertension-related knowledge from baseline to postintervention.

Methods

Study Design

This study used a quasi-experimental, single-group pre-post design to evaluate within-participant changes in hypertension management outcomes from baseline to postintervention. The completed Transparent Reporting of Evaluations with Nonrandomized Designs (TREND) statement checklist is provided in Multimedia Appendix 1.

Recruitment and Setting

Participants were recruited from the outpatient clinic of a university-affiliated teaching hospital in northern Jordan. Recruitment took place from August 1 to September 30, 2021. Potential participants were identified using the hospital's electronic medical records system and were approached during routine clinical appointments. The researcher introduced the study, assessed eligibility, and obtained informed consent. Of the 205 patients screened, 70 (34.1%) met the inclusion criteria, of whom 40 (57.1%) agreed to participate.

Inclusion Criteria

Eligibility was determined through literature review and expert consultation. Participants were eligible if they had been diagnosed with primary hypertension for at least 6 months, were aged 18 to 60 years, were actively using antihypertensive medication, were free from hypertension-related complications or comorbidities, were literate in Arabic, were able to use messaging apps such as WhatsApp, and had access to a smartphone or computer with internet connectivity.

Sample Size Determination

An initial power analysis using G*Power (version 3.1.9.7; Heinrich Heine University Düsseldorf) was used to guide recruitment for this formative, single-group pilot study. Assuming a medium effect size (Cohen d=0.50) informed by prior telehealth literature [23], 80% power, and a 2-sided

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significance level of α=.05, the analysis suggested a minimum of 34 participants. This calculation was used as a pragmatic recruitment guide rather than as evidence that the study was powered for confirmatory efficacy testing.

Data Collection

Data were collected at baseline and after the 8-week intervention. The validated questionnaires assessing hypertension knowledge, self-care practices, and medication adherence were administered electronically using Google Forms and completed by participants in person in a supervised clinical setting. Baseline blood pressure was measured in the outpatient clinic using a study-provided automated electronic upper-arm blood pressure monitor (Yuwell Smart Blood Pressure Monitor, model YE680A). Each participant was assigned 1 monitor for the baseline clinic measurement and subsequent home monitoring; all participants received the same model. Participants received standardized in-person training on the correct operation of the device, including appropriate resting time, body positioning, cuff placement, and arm positioning, and they were instructed to measure and record their blood pressure twice daily, in the morning and evening. Postintervention blood pressure values were calculated by averaging the twice-daily home readings recorded during the final week of the 8-week intervention.

Intervention

The 8-week telehealth pilot program was designed and facilitated collaboratively by a trained community nurse and a clinical dietitian. The program comprised home blood pressure monitoring, structured educational messaging, and biweekly telephone follow-up.

Home Blood Pressure Monitoring

Participants received standardized, in-person training on how to use their assigned automated electronic upper-arm blood pressure monitor in accordance with American Heart Association guidance on resting time, posture, and arm placement [24]. Participants were instructed to record blood pressure twice daily (morning and evening). To support adherence to the monitoring protocol, the community nurse sent prompts every 3 days via WhatsApp or text message requesting submission of recorded readings, after which the clinical team provided individualized feedback.

Educational Messaging

Participants received 3 structured WhatsApp messages daily, including text, visuals, and short videos, sent by the community nurse and clinical dietitian. The educational content addressed a low-sodium diet, physical activity, medication timing, stress reduction, and smoking cessation. A typical day might include a morning infographic on medication reminders, an afternoon video demonstrating how to read sodium labels on locally available foods, and an evening visual guide to deep-breathing exercises. A detailed curriculum with translated examples and multimedia formats is provided in Multimedia Appendix 2.

Biweekly Phone Calls

Participants engaged in scheduled synchronous telephone consultations with the health care providers every 2 weeks. These 10- to 15-minute calls followed a structured agenda: reviewing submitted blood pressure logs, assessing medication adherence and barriers, reinforcing educational topics delivered through WhatsApp, and answering participant questions to provide tailored behavioral support.

Measures

Sociodemographic

Researcher-developed items captured age, a binary male or female demographic variable reported as sex in this manuscript, education level, marital status, employment status, residency (urban or rural), weight status, tobacco use, health insurance, BMI, time since hypertension diagnosis, number of antihypertensive medications, home blood pressure monitoring, and reported effects of the COVID-19 pandemic on blood pressure monitoring, medication access, and medical appointments.

Hill-Bone Adherence to High Blood Pressure Therapy Scale

Medication adherence was assessed using the 14-item Hill-Bone Scale [25]. Each item is scored on a 4-point Likert scale. Total scores range from 14 to 56, with lower scores indicating better medication adherence. One example item asks, “How often do you forget to take your high blood pressure medicine?” This study demonstrated good internal consistency (Cronbach α=.87).

Blood Pressure Knowledge and Self-Care Scales

Blood Pressure Knowledge and Self-Care Scales developed by Peters and Templin [26], these scales measure hypertension knowledge and the frequency of self-care behaviors. Both scales use 7-point response scales, with each item scored from 1 to 7. The knowledge scale includes 11 items (score range 11-77; Cronbach α=.97); one example item asks, “What is considered a normal blood pressure reading?” The self-care scale includes 10 items (score range 10-70; Cronbach α=.83); one example item asks, “How often do you limit eating fast food?” Higher scores indicate greater knowledge or more frequent self-care behaviors.

Statistical Analysis

Statistical analysis was conducted using SPSS for Windows (version 25.0; IBM Corp). Descriptive statistics summarized participant demographic and clinical characteristics. Data distribution was assessed using the Shapiro-Wilk test, which indicated nonnormality (P<.05). Therefore, Wilcoxon signed-rank tests were used to compare baseline and postintervention outcomes. For each paired comparison, the effect size was calculated as $r=|z|/\sqrt{N}$, where N=40. Statistical significance was set at P<.05 (2-sided). All 40 participants contributed paired baseline and postintervention data for the 5 outcomes; therefore, no participant-level outcome data were missing from these paired analyses, and no imputation was performed.

Ethical Considerations

This study received ethics approval from the Ethics Committee of Jordan University of Science and Technology (approval 197/132/2020; June 25, 2020). All participants provided written

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informed consent before enrollment. Participants could be identified by the study team through direct WhatsApp communication and telephone follow-up; confidentiality was maintained throughout the study. Findings are reported in aggregate, with no direct personal identifiers in the tables or manuscript. No financial compensation was provided. In-person interactions followed World Health Organization guidance on COVID-19 safety measures [27].

Results

Characteristics of Study Participants

Participant demographic and clinical characteristics are summarized in Table 1. The sample was predominantly female and married. Most participants had health insurance, reported no tobacco use, were classified as obese, had lived with hypertension for more than 5 years, used 1 antihypertensive medication, and reported home blood pressure monitoring. Participants also reported COVID-19–related difficulties with blood pressure monitoring, medication access, and medical appointments (Table 1).

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Table 1. Participant characteristics (N=40).

Characteristics	Participants
Age (y), mean (SD; range)	47.2 (9.5; 28-60)
BMI (kg/m²), mean (SD; range)	32.8 (4.9; 22.8-45.0)
Sex, n (%)[a]	
Male	14 (35)
Female	26 (65)
Marital status, n (%)[a]	
Married	34 (85)
Single, widowed, or divorced	6 (15)
Education level, n (%)[a]	
High school or less	21 (53)
Bachelor's or master's degree	19 (48)
Employment status, n (%)[a]	
Employed	16 (40)
Retired	8 (20)
Unemployed	16 (40)
Health insurance, n (%)[a]	
Yes	31 (78)
No	9 (23)
Tobacco use, n (%)[a]	
Yes	8 (20)
No	32 (80)
Residency, n (%)[a]	
Urban	22 (55)
Rural	18 (45)
Weight status, n (%)[a]	
Normal weight	3 (8)
Overweight	7 (18)
Obese	30 (75)
Time since diagnosis, n (%)[a]	
6 mo to 1 y	4 (10)
2 to 5 y	12 (30)
>5 y	24 (60)
Antihypertensive medications, n (%)[a]	
1	24 (60)
2	12 (30)
≥3	4 (10)
Home BP[b] monitoring, n (%)[a]	
Yes	28 (70)
No	12 (30)
BP monitoring during COVID-19, n (%)[a]	

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Characteristics	Participants
Yes	27 (68)
No	13 (33)
Medication access during COVID-19, n (%)[a]	
Yes	28 (70)
No	12 (30)
Medical appointments during COVID-19, n (%)[a]	
Yes	29 (73)
No	11 (28)

[a]Percentages may not total 100% because of rounding.

[b]BP: blood pressure.

Changes in Study Outcomes

Hypertension Knowledge

Hypertension knowledge scores were higher after the intervention than at baseline. Scores increased in 37 participants, decreased in 1 participant, and were unchanged in 2 participants (Table 2).

Table 2. Wilcoxon signed-rank test results comparing baseline and postintervention blood pressure, knowledge, self-care, and medication adherence outcomes (N=40).

Outcome	Baseline, median (IQR)[a]	Postintervention, median (IQR)[a]	*z* score[b]	*P* value	Effect size (*r*)
BP[c] knowledge score	66.5 (62.0-70.8)	73.0 (68.3-75.0)	−5.316	<.001	0.840
Self-care behavior score	42.5 (30.0-52.8)	53.0 (38.3-57.0)	−3.317	.001	0.524
Medication adherence score[d]	24.0 (22.0-33.8)	21.0 (20.0-26.0)	−5.090	<.001	0.805
Systolic BP (mm Hg)	131.8 (125.8-135.3)	126.8 (121.3-135.4)	−2.742	.006	0.434
Diastolic BP (mm Hg)	83.2 (78.2-86.3)	78.3 (71.7-83.4)	−4.329	<.001	0.684

[a]Data are presented as median (IQR).

[b]The *z* statistics are reported as generated by SPSS; their signs do not necessarily indicate the direction of change, which is determined by comparing baseline and postintervention scores. Effect sizes (*r*) are reported as absolute values.

[c]BP: blood pressure.

[d]Lower scores in medication adherence indicate better adherence.

Blood Pressure Control

Both systolic and diastolic blood pressure were lower after the intervention than at baseline. A total of 26 participants had lower systolic blood pressure, and 32 had lower diastolic blood pressure (Table 2).

Medication Adherence

Medication adherence scores were lower after the intervention than at baseline, indicating better adherence. A total of 36 participants had lower adherence scores, 2 had unchanged scores, and 2 had higher scores (Table 2).

Self-Care Behaviors

Self-care behavior scores were higher after the intervention than at baseline. A total of 29 participants had higher self-care scores (Table 2).

Discussion

Principal Findings

This formative pilot study evaluated within-participant outcomes over an 8-week WhatsApp-based telehealth education program with remote follow-up among adults with primary hypertension in Jordan. From baseline to postintervention, participants had higher hypertension-related knowledge and self-care scores; lower medication adherence scores, indicating better adherence; and lower systolic and diastolic blood pressure. These pre-post differences are descriptive of change within the cohort and do not establish that the intervention caused the observed outcomes.

Comparison With Prior Work

The observed patterns in knowledge and blood pressure are consistent with previous research on digital, multicomponent educational interventions in chronic disease management [19,20]. Idris et al [19] and Katz et al [14] reported that telehealth approaches integrating personalized education and

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digital communication can support patient comprehension and engagement. The lower postintervention blood pressure observed in this study is also consistent with evidence on home monitoring combined with remote clinical support, including among populations experiencing health disparities [14,28].

The blood pressure pattern observed in this study is consistent with a meta-analysis by Duan et al [28], which reported decreases in systolic and diastolic blood pressure among patients using home blood pressure telemonitoring. Katz et al [14] likewise found that digital interventions incorporating remote monitoring and multicomponent strategies were associated with lower blood pressure in populations experiencing health disparities. Choi et al [29] also emphasized the role of regular home blood pressure measurement in hypertension management.

The adherence and self-care patterns observed here are also consistent with previous research linking hypertension knowledge, adherence, and self-management. Alruwaili [30] reported associations between hypertension knowledge and medication adherence. Ye et al [31] reported better self-management and blood pressure control following telehealth education. Farahmand et al [32] and Matsumoto et al [33] reported favorable outcomes associated with self-care education and pharmacist-led remote follow-up, respectively.

Evidence supporting the use of digital messaging, video content, and teleconsultation is also relevant to the intervention components used in this study. Pour et al [34] and Bijani et al [35] reported favorable adherence and blood pressure–related outcomes with interactive SMS and multimedia education. Taken together, prior studies provide context for the pre-post patterns observed in this formative pilot, while the current single-group design does not permit attribution of those changes to the intervention.

Although data for this study were collected during the COVID-19 pandemic in 2021, low-cost and widely available messaging platforms remain relevant to digital health strategies. This may be particularly pertinent in low- and middle-income countries, where substantial gaps in internet use, connection quality, and affordability persist [36].

Clinical and Practical Implications

The findings have preliminary implications for the design of accessible hypertension support. A low-cost model combining messaging-based education, home blood pressure monitoring, and scheduled nurse and dietitian follow-up may be suitable for further evaluation as an adjunct to routine care in settings where dedicated digital health platforms are difficult to access. However, this uncontrolled pilot study does not establish clinical effectiveness or support replacing standard care. Future controlled implementation studies should assess clinical outcomes together with acceptability, intervention fidelity, health care workload, equity of access, and cost before broader implementation is considered.

Limitations

This study has several important methodological limitations. First, the single-group, quasi-experimental pre-post design lacks a control group; therefore, the study cannot distinguish observed change from time effects, practice effects, regression to the mean, or other concurrent influences. In addition, the multicomponent intervention design precludes isolating the contribution of WhatsApp messaging from those of home blood pressure monitoring and biweekly telephone consultations. Second, the sample of 40 participants was drawn from a single center, and eligibility required Arabic literacy, digital access, and the absence of comorbidities, limiting generalizability to older adults, people with limited literacy or connectivity, and patients with multimorbidity. Third, although the same study-provided blood pressure monitor was used for each participant at baseline and during home monitoring, baseline blood pressure was obtained in the clinic, whereas postintervention blood pressure was derived from repeated home measurements averaged over the final intervention week. Differences in measurement setting and in the number of readings contributing to each assessment may therefore have influenced the observed pre-post blood pressure differences.

Conclusions

This formative pilot identified favorable pre-post differences in blood pressure, medication adherence, self-care behaviors, and hypertension-related knowledge among a selected group of adults with primary hypertension. The single-group design does not establish causality or clinical effectiveness. These findings support further evaluation of the multicomponent model in larger, controlled studies that use comparable blood pressure assessment procedures across time points and include more diverse patient populations. Future studies should also examine longer-term outcomes, intervention fidelity, acceptability, equity of access, implementation workload, and cost.

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Data Availability

The data supporting the findings of this study are available from the corresponding author on reasonable request. The data are not publicly available because of participant privacy and ethical restrictions.

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Generative AI Use

The authors declare that generative AI was used in the creation of this manuscript. Generative AI (ChatGPT) was used for proofreading, editing, or language polishing; reference formatting. The authors verified all outputs of the tool(s) used in the preparation of this manuscript and take full responsibility for the final content of the manuscript.

Authors' Contributions

NMAA contributed to conceptualization, methodology, investigation, formal analysis, validation, supervision, project administration, funding acquisition, resources, software, visualization, data collection, writing—original draft, and writing—review and editing. ZYA-N contributed to methodology, formal analysis, validation, interpretation of the findings, writing—original draft, and writing—review and editing. DS contributed to investigation, data curation, project implementation, writing—original draft, and writing—review and editing. AAJ contributed to investigation, including assistance with data collection, data curation, and writing—review and editing. All authors reviewed and approved the final version of the manuscript.

Conflicts of Interest

None declared.

Multimedia Appendix 1

Completed TREND statement checklist.
[DOCX File , 22 KB-Multimedia Appendix 1]

Multimedia Appendix 2

Telehealth intervention curriculum and representative WhatsApp message examples.
[DOCX File , 29 KB-Multimedia Appendix 2]

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Abbreviations

mHealth: mobile health
TREND: Transparent Reporting of Evaluations with Nonrandomized Designs

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