



# Empowering WHISE women: usability testing of a mobile application to enhance blood pressure control

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**Background:** High blood pressure (hypertension) disproportionately affects African American/Black (Black) women. Previous research suggests that self-managing hypertension may be challenging, yet mobile applications (apps) can help to empower patients and increase medication adherence. We developed questions to test the usability of evaluating the WHISE (Wellness, Hypertension, Information Sharing, Self-Management, Education) mobile app for Black women with hypertension.

**Methods:** Fifteen participants completed usability testing; five were potential app users (Black women with hypertension); each invited two of their peers to participate. Each testing session (n=5) included a brief overview of the app, time for participants to complete surveys and have an active discussion about the app (concurrent and retrospective think-aloud, concurrent and retrospective probing, per usability.gov), and observation of participants' body language during the session. Testing sessions were designed to familiarize participants with the app's features and examine their navigating ability.

**Results:** The app received overwhelmingly positive feedback, with 80% of participants finding it to be a valuable tool in hypertension management. Participants praised the app's user-friendliness and educational value, with one stating, 'It is a good educational piece for helping people manage hypertension, at least to understand its basics.' Another participant highlighted the potential for community support, saying, 'Having a community, having some people to be accountable, to check in with and see how things are going, could encourage and motivate people to be more diligent about managing their hypertension.' Some participants also provided constructive feedback, suggesting font size adjustments (73%) and color scheme changes (60%) for certain screens.

**Conclusions:** Based on the feedback we received, we were able to mitigate the participants' concerns about font size and color and create tutorial videos to guide future users in using the app. We completed these changes prior to deploying the app in our randomized clinical controlled trial.

**Keywords:** Mobile application; African American/Black; women; hypertension; usability

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## Introduction

### Background

In the United States, 54% of African American (Black) women have hypertension (high blood pressure), which correlates with exceptionally high morbidity and mortality rates for cardiovascular conditions (1-4). Despite the evidence-based interventions that have been developed to aid in the self-management and control of hypertension, the prevalence of hypertension in Black women continues to increase. Though available treatments have been shown to improve clinical health outcomes, only about half of the individuals diagnosed with hypertension have adequate blood pressure control (5). The Dietary Approaches to Stop Hypertension (DASH) diet, which emphasizes fruits, vegetables, whole grains, and lean proteins, has been shown to lower blood pressure levels effectively (6). Regular physical activity and a healthy diet are crucial in managing high blood pressure. Exercise helps to improve cardiovascular health, lower blood pressure, and maintain a healthy weight (7). In some cases, medication may be prescribed to help control blood pressure levels. Adhering to a prescribed medication regimen is essential for African American women in managing and controlling high blood

pressure effectively (8). Although these strategies to manage hypertension exist, Black women still have the highest rate, indicating that new strategies, such as those to assist patients with medication adherence and tracking of healthcare information to improve the management of hypertension, are needed (9).

Mobile health (mHealth) initiatives employing support and symptom-monitoring technologies are among the most practical interventions for controlling hypertension. Likely owing to their multitude of features, the exponential increase in the use of mobile devices in recent years supports the feasibility, generalizability, and reproducibility of mHealth devices (10). Specifically, mHealth interventions that combine custom-made messages with interactive communication work effectively in helping patients with hypertension self-manage their condition by providing personalized support and guidance tailored to individual needs (11,12). Custom-made messages deliver targeted information, reminders, and motivational content that resonate with the patient's health goals and preferences. These messages can include medication reminders, lifestyle recommendations, and educational resources related to hypertension management. By receiving personalized messages, patients are more likely to engage with the intervention and adhere to their self-management plan (13). According to previous research, about 80% of Black women own smartphones and use mHealth applications and tools to manage their health (14,15). While physical, social, economic, and structural barriers prevent access to care and services, mobile applications may be helpful resources for Black women to learn about chronic illness self-management and medication adherence (16,17).

Social support from family, friends, and the community can significantly improve hypertension control and management. Support systems provide emotional encouragement, practical assistance, and accountability in adopting and maintaining healthy lifestyle behaviors, such as adherence to medication regimens, dietary modifications, and engagement in physical activity (18,19). Furthermore, social support enhances feelings of connectedness and belonging, which can reduce stress levels and improve mental well-being, both of which are vital for hypertension management (4). Family and community involvement in health promotion initiatives can also facilitate access to healthcare resources and information (20). By fostering a supportive environment, individuals may be encouraged to effectively control their hypertension and reduce their risk of cardiovascular complications.

### Highlight box

#### Key findings

- The WHISE (Wellness, Hypertension, Information Sharing, Self-Management, Education) app was rated favorably by a group of 15 total participants, with significantly positive indications in user experiences of usability, novel social group interactions, and hypertension self-management.

#### What is known and what is new?

- Previous literature has displayed the wide-spread utility of mobile interventions as a medium for enhancing self-health management, and recent studies have highlighted the potential of mobile applications in helping increase the efficacy and adherence of blood pressure self-management, albeit varied. Here, we report the successful usability testing of the novel WHISE app intervention for hypertension self-management within the specific population group context of African American women and analyze several data-driven aspects of the WHISE user experience.

#### What is the implication, and what should be change now?

- The positive findings of user friendliness, community engagement, as well as indicated technical improvements, provides needed input for the advancement and expansion of WHISE into randomized clinical trials.

### *Rationale and knowledge gap*

Testing is typically conducted before release to ensure a mobile application is effective and efficient. Usability testing is used to assess a product or service through feedback given by representative users (21). This includes both verbal responses received from the user and fluctuations in their behavior observed by a constructed staff during the testing period, using concepts like concurrent & retrospective think-aloud and concurrent & retrospective probing (22). These techniques are commonly employed in cognitive psychology and usability testing to gain insights into participants' cognitive processes and decision-making while performing tasks. Concurrent think-aloud requires participants to verbalize their thoughts and actions in real time as they engage in a task, providing immediate insights into their cognitive processes. This approach enables researchers to comprehend how participants approach and resolve problems. In contrast, retrospective think-aloud involves participants recalling and verbalizing their thoughts after completing a task. This method offers a more reflective and detailed understanding of participants' cognitive processes, as they have had time to reflect on their thoughts and actions. Concurrent probing entails researchers posing questions or prompts to participants during a task to extract more detailed information about their cognitive processes. This technique aids in revealing underlying motivations, preferences, and decision-making strategies in real time. Similarly, retrospective probing, akin to retrospective think-aloud, involves researchers asking participants questions after task completion to delve deeper into their thoughts and decision-making processes. This method facilitates a comprehensive understanding of participants' cognitive processes, uncovering insights that may not have been evident during the task itself (23).

Mobile applications are crucial in reaching and engaging patients who may be challenging to reach through traditional healthcare settings. Mobile applications offer convenience, personalization, health education, and real-time communication (24). Mobile applications make healthcare more accessible for a broad range of individuals who are often straddled by barriers that prevent them from receiving the needed care and attention (25). Recent studies have corroborated the widespread uses and evident potential of smartphone applications and their effectiveness regarding hypertension management, especially within patient-driven self-care (26). Specific to this study, community involvement and social support are crucial elements when developing mobile health apps for underrepresented

populations. Including community members in the design and testing process ensures that the app meets the specific needs of the population it aims to serve. This involvement helps create a culturally sensitive app that resonates with the target audience and increases the likelihood of adoption and sustained use (27). Additionally, social support from within the community can help promote the app, raise awareness, and encourage its use among individuals who may benefit from its features (28). By involving the community and fostering social support, researchers and developers can create mobile health apps that are more effective, accessible, and impactful for underrepresented populations, making it a key aspect of the rationale for this study.

### *Objective*

The disproportionately high rate of hypertension in Black women necessitates the exploration of alternative health services. This includes novel interventions to improve symptom self-management within this targeted population. In our study, we designed the Wellness, Hypertension, Information Sharing, Self-Management, Education (WHISE) mobile application (app) for this purpose. Before its deployment in a larger patient population, usability testing for the WHISE app was conducted. In addition to gathering information on their general impressions, we focused on examining the users' ability to navigate through and utilize different components of the WHISE app. Thus, the objective of this paper is to summarize the process involved in this usability testing trial to evaluate the WHISE app's functionality and maximize user satisfaction (29-31).

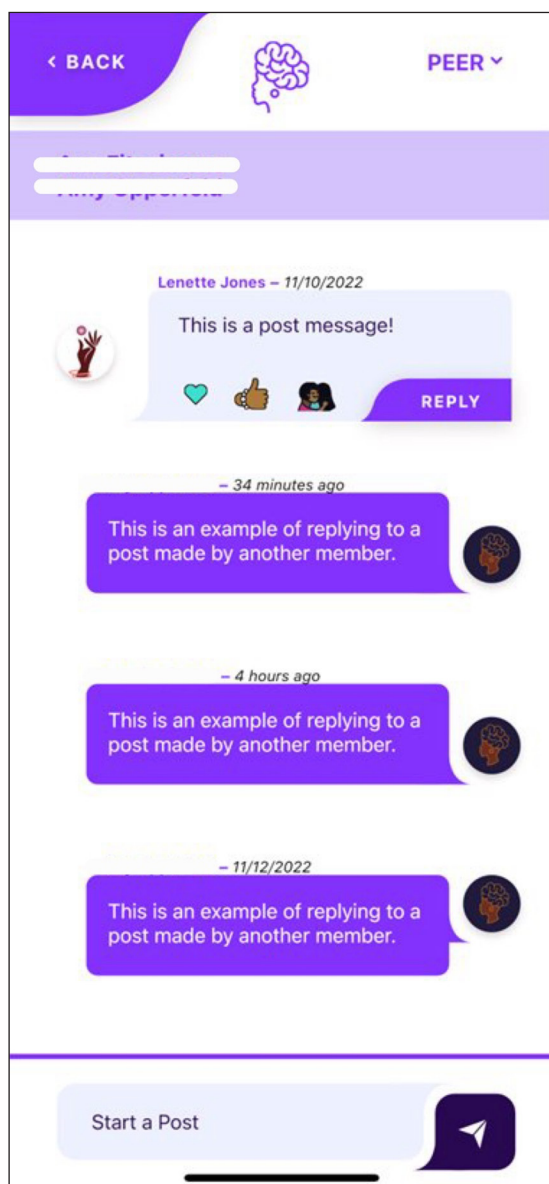
## **Methods**

### *Overview*

Working with a software development company, the WHISE app was created over 2 years ago. The mobile app features tools to track blood pressure and heart rate readings, medication reminders, and weekly modules that provide education on medication adherence, diet (specifically the DASH diet), and physical activity. The WHISE app also has an integrated chat function for users to share what they have learned with others (*Figure 1*).

### *Terminology*

Participants involved in the WHISE usability testing sessions are referred to as potential users or peers. Potential



**Figure 1** A screenshot of the peer chat function within the WHISE application in early stages of development. WHISE, Wellness, Hypertension, Information Sharing, Self-Management, Education.

users are Black women with hypertension who completed our Qualtrics survey and met the eligibility criteria (24). Each potential user was required to have two peers above 18 years of age who owned smartphones; all participants were required to have reliable internet access and be willing to participate in a web-based videoconferencing (Zoom) call (25).

### Study design

Usability testing was conducted with 15 Metro-Detroit (Southeastern Michigan) participants. Usability for the WHISE app was assessed through a combination of interview and survey questions, using usability guidelines provided by the United States government digital services (26). Utilizing the framework—concurrent & retrospective think-aloud and concurrent & retrospective probing concepts were used to gauge responses from participants. We followed the guidelines outlined by the United States Government’s digital services and the Office of Management and Budget (OMB), which stated that six to eight users are often enough to identify significant problems during usability testing. According to Nielsen, five test users are needed in usability studies (29). Therefore, we included five potential users from our targeted population, Black women, for the WHISE app usability testing. Each potential user invited two of their peers, who also provided feedback on the WHISE app’s peer functions. Over a month, the testing sessions were conducted using web-based videoconferencing. Each call had seven people: one potential user, two peers, one interviewer, and three additional research team members. The study was conducted according to the guidelines of the Declaration of Helsinki (as revised in 2013) and approved by the University of Michigan – Ann Arbor Institutional Review Board (No. HUM001963896, 1/26/22). All study participants consented before enrolling in this study.

### Recruitment

To recruit individuals for this usability study, our research team designed a flyer for our social media pages (see *Figure 2*). We included images representing Black women to engage our target audience. The recruitment flyer included information for the testing sessions, eligibility criteria, and a weblink to the survey. If individuals clicked on the advertisement, they were redirected to a five-screening survey based on study inclusion criteria. Interested individuals had to identify as a Black woman, be 21 or older, be diagnosed with hypertension by a health care provider and prescribed medication for hypertension, and reside in Southeastern Michigan. Due to the design of this study, internet access was also a requirement for eligibility. Following the initial screening questions, those interested in the study were required to have two peers who also used smartphones and would be willing to participate in a Zoom call (*Figure 3*).

Study ID: HUM00193896 IRB: Health Sciences and Behavioral Sciences Date Approved: 9/7/2022



Are you interested in testing a new mobile application to help African American women enhance their blood pressure control?

Dr. Lenette M. Jones at the University of Michigan School of Nursing is looking for African American women between the ages of 18-65, who have been diagnosed with hypertension and are currently taking medication.

Click on the link below to see if this study is right for you!

[https://umich.qualtrics.com/jfe/form/SV\\_6VegvL4gSvWqVfM](https://umich.qualtrics.com/jfe/form/SV_6VegvL4gSvWqVfM)

HUM00193896

We are looking for volunteers to give feedback on the WHISE mobile application (Wellness, Hypertension, Information Sharing, Self-Management, Education). This app is designed to educate users on diet, physical activity and medication adherence.

**Time required**

Approximately 1 hour and 15 minutes is needed to meet in a Zoom call to:

- Complete surveys
- Review screens and clickable comp
- Share feedback

**Compensation**

- You and your two chosen peers will each receive \$50 for completing all study activities

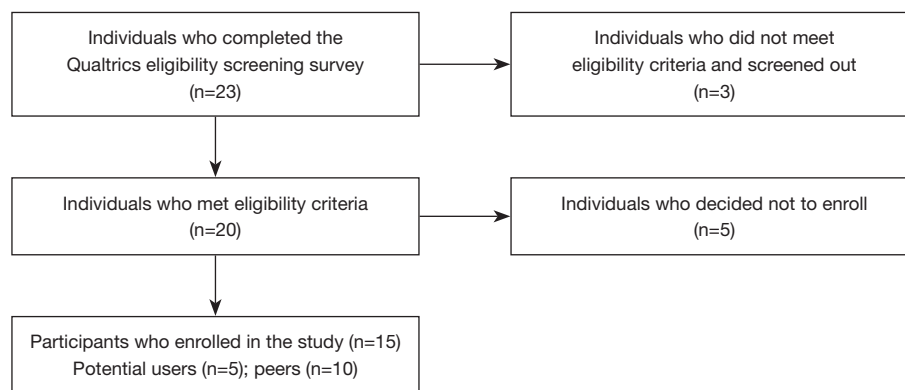
**Eligibility to participate**

Women who:

- Self-identify as an African American woman (ages 18-65)
- Have been diagnosed with high blood pressure (or hypertension)
- Own and regularly use a smartphone
- Take medication(s) to help to control blood pressure
- Live in the metro-Detroit area
- Able to invite people two peers who are willing to join a Zoom meeting
- Willing to download Adobe XD: <https://www.adobe.com/products/xd.html>

HUM00193896

Figure 2 Advertisement flyer for usability testing.



**Figure 3** Participant flow diagram for enrolling in the WHISE usability testing. WHISE, Wellness, Hypertension, Information Sharing, Self-Management, Education.

### Protocol

If an interested individual was eligible to participate in the study, a research team member contacted them by phone. After obtaining their consent to participate in the study, the team members confirmed the potential user's contact information and requested email addresses for their peers. Next, the team member explained how to download Adobe XD on their mobile device (to use the prototype of the WHISE app) and how to use Zoom (for any participant unfamiliar with web-based videoconferencing). The team members and participants then agreed on a date and time to meet via Zoom based on the participants' availability and open time slots on the research study's calendar. The initial call, on average, lasted 20 minutes to ensure that the participant was fully set up and prepared for the usability testing. After scheduling the call, participants (potential users and peers) were emailed information about the testing session and their involvement in the study, along with a link to the Zoom call. Participants received an email reminder the day before their testing session. The average time for the usability Zoom call was approximately 1 hour and 30 minutes.

### Team responsibilities

To conduct usability testing, all team members completed the Program for the Education and Evaluation of Responsible Research and Scholarship research training provided by the University of Michigan. Before the start of usability testing, team members were also trained by the senior lab staff on how to call participants, safely

record information, and what to look for when observing participants during usability sessions per the guidelines set by the United States government's digital services (26). Training for usability sessions was completed over 2 months. Due to this approach in training, team members could complete all roles in the study. Roles were assigned based on preference and availability, with the senior staff leading all sessions. For each usability Zoom call, four research team members served in a specific role:

- (I) One team member led the usability testing, which included providing an overview of the WHISE app and its functionalities and guiding participants through the interview guide.
- (II) One team member recorded participants' verbal responses to questions asked.
- (III) One team member recorded participants' reactions (facial expressions, body language, etc.).
- (IV) One team member sent a Qualtrics link with survey questions and monitored responses for completion.

### Testing overview

The purpose of usability testing was to gather feedback on the WHISE app and participants' thoughts about its critical components. This included evaluating the user's ability to navigate the tools and features within the app, the effectiveness of the information, and the overall aesthetic. Participants were instructed to follow the lead team members on their phones while guided through the app prototype. While navigating each section, participants were asked to share their thoughts using concurrent think-aloud

**Table 1** List of questions used in usability testing for the WHISE application

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Level 1: interview-based questions that were asked during the clickable comparison portion of the usability testing sessions via Zoom

Participant questions:

1. What do you think you can use this app for?
2. If you wanted to record your blood pressure, where would you do that in the app?
3. If you wanted to use the chat function, how would you access that?
4. Do you find the information presented in the module to be useful?
5. Does the layout of the module make sense?
6. If you were using this app, would you use the medication reminders?
7. If you were using this app, would you use the medication reminders?
8. What do you like least about the app?
9. Do you have any recommendations to improve the app?

Peer questions:

1. Do you feel that the chat function is easy to use?
2. Do you think you could navigate to the chat function?
3. How do you think you could use this function to help your loved one or friend to improve their blood pressure?

Level 2: questions that were included on the Qualtrics survey that were sent at the end of usability testing sessions to receive feedback on the overall aesthetic of the clickable comparison (images, layout, etc.)

Scaled questions:

1. I find this screen visually appealing
2. I like the color combination on this screen
3. I can easily read all the text on this screen

Open-ended questions:

1. If you were a participant/user, what would you think you could do on this screen?
  2. How do you feel about the font?
  3. Is there anything else you want to tell us about this screen?
- 

WHISE, Wellness, Hypertension, Information Sharing, Self-Management, Education.

methodology. The lead team member queried participants on the functionality and purpose of each feature and how they envisioned themselves using it, using concurrent probing. Eighteen questions were asked, nine for potential users, three for peers, and three for all participants (*Table 1*).

Following the completion of testing, participants were asked for their overall opinions on the WHISE app using retrospective probing and think-aloud methodologies. Additionally, they completed a Qualtrics survey to provide further views and feedback after interacting with the app. The research team used this data to make improvements to the final versions of the app. The survey included questions on functionality, aesthetics, and content. A team member

shared a link to the Qualtrics survey through Zoom chat and monitored its completion. Once finished, participants verified their contact information to receive a \$50 gift card for their participation. The results from the survey were examined and integrated into later versions of the WHISE app.

### *Measures*

Following the usability guidelines outlined by the United States government digital services, participants in this study engaged in surveys and responded to inquiries about the WHISE mobile app (26). The primary purpose of the

questions posed during the usability sessions was to assess participants' ability to navigate the app, elicit feedback for identifying issues and obtaining suggestions for app improvement, gauge their overall satisfaction with the app, and evaluate the visual appeal of images within the WHISE app. The usability testing encompassed two tiers of measurements: interview-based questions at level one for participants and peers, which were open-ended, and level two questions included in the post-session Qualtrics survey that were both scaled (0–2 for requiring improvement, 3–5 for average, 6–7 for good, and 8–10 for meeting standards) and open-ended (Table 1).

- ❖ Level 1: interview-based questions: after briefly explaining the images, information, and related features within the WHISE app, participants were asked questions to identify any concerns associated with the layout or functionality.
- ❖ Level 2: survey-based questions: using the chat function in Zoom, a Qualtrics survey link was sent to all participants toward the end of the call. There were three questions for each image, and participants could select Likert-type responses, ranging from 0 to 10, with 0= “needs improvement” and 10= “excellent”.

### *Data analysis*

The responses recorded in the usability sessions were transcribed and coded by senior staff on the research team. Coding for the usability sessions was completed manually, and no software was utilized. Categories for coding were aesthetic (overall look and design of the WHISE app), content, representation, and functionality and features. Qualtrics survey data was analyzed using SPSS version 28.0.1.1 (30). A descriptive analysis was conducted for data obtained from the Qualtrics surveys, obtaining frequencies and percentages for categorical questions, and means with standard deviations were recorded for continuous measures (31).

## **Results**

### *Overall summary*

Participants found the WHISE app helpful and were satisfied with their experience interacting with it. When asked what the WHISE app could be used for, one participant replied, “Keeping myself accountable for checking my blood pressure.” The participants liked other

features such as blood pressure and medication reminders, blood pressure reading history, and educational modules (n=12). Participants provided positive feedback regarding the ease of use, educational content, and representation (n=14). In contrast, when participants were asked to identify how and when to use certain features, further guidance was needed from a team member (n=3). Participants also suggested areas that could be improved, including the colors and font size on some of the screens (n=9). Regarding images, all 15 of the participants found them to be visually pleasing.

### *Study participants*

There were a total of 15 participants (5 potential users and 10 peers) who participated in usability testing of the WHISE app based on the guidelines for this method of testing (29). The five potential users were the individuals who met all requirements for the study (Black, woman, hypertensive, etc.). All participants within the study self-identified as Black. The mean age of participants was 45.6 years [standard deviation (SD) =13.7] and ranged from 18–73 years. From the sample, 10 (66%) participants had a 4-year degree from a university. By design, all the potential users had to be diagnosed with hypertension; 7 (70%) of the peers also reported having hypertension. Also, 12 participants overall (80%) reported having hypertension for more than 5 years (Table 2).

### *Feedback on the app*

Participants were prompted to answer and complete survey questions to provide feedback on the WHISE app. Most responses were positive, but some stated that further development was needed to improve the intervention. When participants were asked what they could use the WHISE app for, 80% replied that they could get “helpful” information about monitoring blood pressure, following a diet, and establishing healthy habits. They thought the intervention could aid in learning strategies for controlling and managing their hypertension. Participants found the blood pressure and medication reminders, tips, and educational modules valuable for controlling hypertension. For example, one participant said, “It’s a good educational piece for helping people manage hypertension, at least to understand the basics of it...”.

Our research team designed the WHISE app to



**Table 2** Demographic characteristics of the sample (n=15)

Characteristics	Values, n (%)
Gender	
Male	3 (20.0)
Female	12 (80.0)
Education level	
Some college	4 (26.7)
Associate's degree	1 (6.7)
Bachelor's degree	1 (6.7)
Master's degree	8 (53.3)
Doctorate or professional degree	1 (6.7)
Household income	
≤\$75,000	6 (40.0)
>\$75,000	9 (60.0)
Do you have high blood pressure?	
Yes	12 (80.0)
No	3 (20.0)
How long have you had high blood pressure?	
Less than 5 years	3 (25.0)
Five years	–
More than 5 years	9 (75.0)
Do you take medication to treat your hypertension?	
Yes	10 (83.3)
No	2 (16.7)

represent our target population. Of the participants, 12 (80%) stated more than once that the images in the app were visually appealing. Participants indicated they found the photos informative, attractive, and reflective of the community. One participant stated, “So, it’s geared towards Black women. And there are lots of pictures that are relatable. I think every screen has a picture of a Black woman on there. So, that’s good.”

Another aspect that our research team focused on was community and social support involvement. By design, the WHISE app has community and peer chat functions where “potential users” can share the information they learned with others. Based on our teams’ written observations, participants were surprised when they learned about these functions. They felt that chat features would help

users to be held accountable by others and share helpful information that will aid others in managing their health. One participant shared, “Having a community, having some people to be accountable to, to check in with and see how things are going, could provide encouragement and motivation for people to be more diligent about managing their hypertension.”

### *Ability to navigate the app*

One research team member asked participants about the purpose and use of the app’s features. All participants were able to identify how to navigate and access the chat features and the learning modules; they were also able to describe how to set medication reminders. While they seemed comfortable with these functions, 2 (13%) participants could not identify how and where to record their blood pressure within the app. Participants also seemed to have difficulty navigating the back to the home screen. Some participants were stuck in other areas of the app until they received assistance from a team member. Participants mentioned that the scroll speed in the app was too fast at times. However, with the clickable comparison (a limited functioning prototype of the WHISE app) being used for usability, issues other than navigating back to the home screen could not be addressed until the final version was released.

### *Recommendations to improve and enhance the app*

Although most of the feedback was positive, a few suggestions were given for enhancing the app. The two main areas of improvement mentioned by participants were to increase the font size and to simplify color combinations. Eleven (73%) participants found the text size of the educational modules hard to read. They stated that the font size needed to be increased. Additionally, some participants found the modules to be text-heavy. In the peer chat, 9 (60%) participants also thought that the font size needed to be increased and that the color combination required to be improved. On the blood pressure chart, participants reported that they had a hard time following the colors and legend. When asked what the least likable feature of the app was, participants mentioned the community chat feature (talking to other users they did not know), being unable to see different variations of tips, and only being limited to two peers. Further recommendations to improve the app

**Table 3** Highlighted responses from participants in WHISE usability testing

Topic	Positive responses	Constructive feedback
Aesthetic	“The colors are engaging.”	“Make the font bigger if possible or make the option available to zoom in or out.”
	“It flows reasonably, it makes sense.”	“Allow for color variations screen and color personalization within it.” “Older people would like it better if the text were less busy.”
Content	“It’s a good educational piece for helping people manage hypertension, at least to understand the basics of it...”	“If there is an opportunity to add – I would love to see different options. For example, the variation of tips.”
	“Includes nice features, like blood pressure and medication reminders, blood pressure readings history, and sharing options using email.”	“Need to simplify words, it feels serious.”
	“Valuable tips and module information regarding exercise and sodium intake.”	
Representation	“So, it’s geared towards African American women, and there are lots of pictures that are relatable.” “People (in the photos) are people of color.”	None received
Functionality and features	“Simple to use!”	“It’s easy enough to use based on the prototype. However, some features could be an issue, like scrolling through to see how quickly things scroll or don’t scroll for older people.”
	“Includes nice features, like blood pressure and medication reminders, blood pressure readings history, and sharing options using email.”	
	“User-friendly”	“I’d like to be able to communicate with my doctor directly through the app.” “The ability to add more peers (family members)”

WHISE, Wellness, Hypertension, Information Sharing, Self-Management, Education.

consisted of having direct communication with their health care providers, building an audible narration option, and quick meal ideas for healthier eating on the go.

## Discussion

### Key findings

Participants shared that the WHISE mobile app was a valuable tool to help manage their blood pressure levels and learn more about maintaining overall health. Using representative media and a population-based approach increased engagement throughout the usability sessions. Through usability testing, we gained insight into the informational and aesthetic aspects of the WHISE app. Responses from participants, both verbal and nonverbal, were recorded by team members (*Table 3*). By ensuring that our sample was representative of the targeted population for our following study, responses that participants shared

were incorporated in the refining of the WHISE app before releasing it to participants in our current randomized clinical trial.

### Strengths and limitations

These findings should be considered within the limitations when interpreting this study. Within a group context, some participants’ responses may have dominated the flow of discussion and influenced the opinions of others. However, our team members were aware of the instances where some participants shared more than others and ensured that all participants had a chance to report their views on the app. Following the usability testing guidelines, participants were engaged and provided detailed feedback on the app, maximizing our session results. Our sample’s average age of 45 years may have impacted their experience with the mobile app due to their level of knowledge and comfort

with technology. Another limitation is that participants were limited to viewing and interacting only with certain app features, compared to being able to test the full version. As a result, participants could not evaluate and provide feedback on all features. The sample for this study was representative of our targeted population, providing insight from individuals who would be like those who enrolled in our randomized clinical trial. When interpreting the results of this study, the limitations of using Zoom should also be considered, such as potential distractions (pets, family members, doorbells) and connectivity issues that may impact the ability of participants to remain focused. Other possible limitations of Zoom usage for usability testing include being unable to fully observe participants' body language, given that a webcam only captures a limited view of users. Despite these limitations, the content identified in this study provided beneficial information for the further development of the WHISE mobile app.

### *Comparison with similar research*

This study's findings were consistent with those outlined in previous studies. The novelty of the WHISE app intervention stems from unique studies on information sharing and peer social support among Black women (17,32,33). Thus, testing this specific component's functionality and usability was essential to accurately assess the potential impact of the WHISE intervention, an aspect unique to this study. In constructing the WHISE mobile app, we focused on representation to create deeper user engagement. We included photos of Black women performing healthy behaviors and considered culture while developing our educational content. A previous study found that users were more engaged when the appearance and content within a health-focused app aligned with their goals and identities (34). The goal of the WHISE app is to empower and teach Black women methods of self-management for their hypertension. Recent literature supports the idea that mobile apps may have the ability to influence better practices of self-management and self-efficacy in women to affect a more balanced lifestyle (9,12,35). Additionally, other studies have suggested that mobile app features, such as reminders for individuals to take their medications, have shown promise in facilitating self-management behavior to control hypertension (36).

The WHISE mobile app was made specifically for Black women, making it unique; part of that novelty is due to the community and peer chat functions. Through these

functions, potential users can communicate with each other and their two identified peers for the duration of the intervention. The intended use is to share information and to create accountability within the cohort to influence better hypertension management practices. This is in line with a previous study that reported peer support can significantly improve an individual's well-being (37). Previous literature regarding technology-related interventions to target various chronic conditions such as hypertension and obesity discusses the use of short message service (SMS) text messaging, phone calls, email, or multiple/other communication mediums to contact and communicate with participants to obtain usability data (38-40). Specifically, the recent pandemic-driven explosion in popularity of the video-telephony software program Zoom and other video-calling software has allowed us to utilize face-to-face communication through this online medium. The software's chat functionality also allowed us to employ our "Interview and Survey" methodology rapidly, augmenting our usability study timeframe.

Our usability testing methodology's interview survey question structure shares fundamental similarities with other usability studies but some key differences. While the "Think-Aloud" protocol was a standard protocol used in different studies (40-42). For gathering usability data from participants, our methodology had our participants briefly explain various features of the WHISE app before answering direct questions about usability and functionality from study team members, employing a more "interview-like" style for participants. The WHISE app is a mHealth intervention, and we used a prototype for usability testing by our participants. Subsequently, surveys and an interview guide were used to assess different dimensions of usability similar to other mHealth intervention usability studies (40,43).

### *Explanations of findings*

Overall, participants enjoyed using the WHISE app and believed it could assist them in managing their hypertension. With features like educational information and tips, blood pressure and medication reminders, and blood pressure tracking, participants liked having multiple resources in one space. We conducted usability testing to examine the WHISE app's functionality and users' ability to navigate it before the launch of our clinical trial. The responses received provided valuable insight into the WHISE app's content, design, and layout. Guided by these findings, we identified and mitigated potential problems in the WHISE app before testing it in a clinical trial,

which saved time and additional costs (44). We changed the WHISE app to provide a better user experience based on what we learned from the participants. For example, font size was increased to improve readability for users, and color combinations were simplified. In the educational modules, the amount of text was reduced, and language was also simplified. In addition, we created tutorial videos to assist participants in navigating the WHISE app and using features such as recording blood pressure and how to share their blood pressure readings with their on-file healthcare providers.

### ***Implications and actions needed***

The prevalence of hypertension among Black women continues to rise and is a pressing public health concern. Existing barriers that hinder access to health information and services for Black women and other minorities need to be addressed. Additional research and initiatives must be pursued to effectively address this issue and reduce morbidity and mortality in Black women. The development of the WHISE app presents an opportunity to help mitigate health disparities and promote health equity for the Black community. By women being the majority of the sample in the usability testing, we have ensured representation and inclusivity of those who may use the WHISE app in the future. The WHISE app specifically targets Black women with hypertension, aiming to enhance self-management and medication adherence for better blood pressure control. Utilizing a mobile app aligns with modern technology trends and accessibility. This app builds upon existing evidence-based recommendations and leverages the widespread use of mobile devices. By providing accessible health information within the mechanisms already familiar to Black women, we contribute to their overall health improvement and help to empower them to make evidence-based decisions about maintaining their health. This research sheds light on how health information sharing can enhance participation in self-management interventions, benefiting other scientists and researchers.

### **Conclusions**

This study was conducted to assess the usability of the WHISE app for an upcoming randomized controlled trial. The primary objective of this research study was to evaluate the functionality and overall aesthetic of the WHISE app while summarizing the processes used to

conduct usability testing for future research. Recruiting a sample representative of our intended target population gave us valuable feedback on how to implement changes before deploying the app. These improvements include refining the app's user interface, simplifying navigation, and streamlining the overall user experience. In this paper, we have presented a detailed account of the usability testing sessions, highlighting the methodology used, participants, and the actions taken by our team. With the data collected and participant feedback, we have comprehensively analyzed the findings, highlighting strengths and areas of improvement in the WHISE app. The app provides a convenient and easily accessible platform for Black women to monitor and manage their hypertension, empowering them to take control of their health and make informed decisions about their well-being. Evidence-based practices such as following the DASH diet, adhering to prescribed medication, and increasing physical activity are all included in the WHISE app. This study has provided valuable insight regarding the potential of the WHISE app to bridge health and wellness to a marginalized population. These findings establish a foundation for future studies on self-management and blood pressure control in Black women with hypertension, further advancing our understanding in this field.

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### **Footnote**

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*Ethical Statement:* The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. The study was conducted according to the guidelines of the Declaration of Helsinki (as revised in 2013) and approved by the University of Michigan – Ann Arbor Institutional Review Board (No. HUM001963896, 1/26/22). All study participants consented before enrolling in this study.

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