



Sexual trauma and interest in mobile health among women with mental illness in Ghana

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ABSTRACT

Sexual violence against vulnerable populations is common worldwide. Many survivors of sexual assault experience long-term mental health difficulties. This study evaluated sexual violence exposure among women with mental illness in Ghana and examined their readiness to engage in mobile health interventions. We surveyed 200 women receiving inpatient or outpatient treatment at a large psychiatric hospital. Survey results indicated that 41.0 % reported having experienced sexual violence in the past. Over two-thirds of respondents had a high probability of PTSD (68.4 %) and these proportions were higher among those who experienced sexual violence (77.5 %). The majority were interested in mobile health resources that could provide them with support (73.2 %). Respondents' top topics of interest were information about managing stress and improving mood. The skill they were most interested in was relaxation. Video and audio content were rated as preferred intervention modalities. Most of the sample reported owning a mobile phone (86.4 %), with most being smartphones (76.1 %). Almost all respondents reported having access to electricity (99.5 %), a majority had a data plan (86.2 %), and all reported daily mobile phone use (100.0 %). Our findings suggest that there are significant unmet mental health needs among female survivors of sexual violence who are already receiving care in Ghana; most female survivors of sexual assault are open to using mobile health interventions; and most women with mental illness have access to the resources necessary for deployment of mobile interventions in their communities. Smartphone applications that leverage video and audio content may be particularly suitable for this context.

1. Introduction

Globally, approximately one in three women experience sexual assault over the course of their lifetime (Garcia-Moreno et al., 2013). The prevalence of sexual violence against women in Africa is high (Xianguo et al., 2023; Muluneh et al., 2020). Approximately 3.4 % of African women report being sexually assaulted annually (Borumandnia et al., 2020). Experiencing sexual violence puts women at increased risk for a range of significant mental health problems including posttraumatic stress, depression, anxiety, substance abuse, and suicidality (Dworkin et al., 2017). Evidence-based psychosocial interventions can help mitigate the negative mental health impacts of sexual assault (Kim and Kim,

2020). However, factors such as shame, fear, stigma, and limited availability of local treatment options prevent survivors of sexual violence from receiving care (Wright et al., 2022; Bach et al., 2021; Smith et al., 2010; Kaminer et al., 2024).

Digital health can help overcome barriers to treatment seeking and access to care by bringing digital support resources directly to users via broadly available technologies (Torous et al., 2021). A recent scoping review of 85 studies published since 2010 found that a variety of digital health strategies, including mobile apps, websites, texting/SMS services, chatbots, video therapy platforms, and virtual reality programs, have been deployed successfully with survivors of sexual assault (Hardeberg Bach et al., 2024). These studies suggest that a range of digital health

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approaches are acceptable and helpful to women who have experienced sexual assault. Notably, none of those studies were conducted in Africa, where digital health resources for sexual trauma remain largely unavailable.

Digital health interventions may be particularly useful in low-and-middle-income countries (LMIC), which are characterized by low numbers of trained mental health providers, high penetration of mobile phones, and relatively robust telecommunication infrastructure (Ben-Zeev and Atkins, 2017; McCool et al., 2022;). In Africa, approximately 63 % of the population owns a mobile phone and the gaps between men and women in mobile device ownership, are progressively narrowing (International Telecommunication Union, 2024). For most African adults, mobile phones serve as their primary access point to digital information and resources. Digital health approaches that leverage mobile phones, specifically—i.e., mobile health or ‘mHealth’—can potentially support delivery of interventions and support resources to women who have experienced sexual violence in Africa.

Given the barriers to seeking care following sexual assault, the scarcity of mental health services, the increasing rates of mobile phone ownership, and the lack of available digital health resources, the current study sought to determine the viability of mHealth services for sexual assault survivors in the African nation of Ghana. To do so, we evaluated: a. sexual violence exposure among women experiencing psychopathology, b. the severity and manifestations of trauma in this group, c. the proportion of this population that has interest in mHealth interventions, and d. whether the target population has access to technologies and other material resources that can support the deployment of mHealth in their environment (Ben-Zeev et al., 2017; Ben-Zeev et al., 2024a; Maloney et al., 2020).

2. Materials and methods

2.1. Study procedures

We surveyed 200 participants in the African nation of Ghana. To get a better understanding of the needs and treatment preferences of those who experienced sexual violence and who struggle with impairing mental health symptoms, we recruited our study sample from the population of female patients receiving services at the largest psychiatric hospital in the country. Data were collected between June 2024 and August 2024 at Accra Psychiatric Hospital in Ghana. The project was approved by the Institutional Review Boards at the University of Washington (#00020450) and Accra Psychiatric Hospital. Hospital staff were trained by the investigative team to administer a battery of questionnaires to women receiving services at the hospital's inpatient wards and outpatient clinics. Study personnel explained that participation was entirely voluntary. Individuals who indicated that they were interested in participating completed informed consent. All study participants were compensated 70 Ghanaian Cedis immediately after their participation. Participants were surveyed individually in-person on hospital grounds by staff members fluent in English and Twi, the most common languages in Ghana. Staff administered the survey verbally and recorded participants' responses on study tablets. Data were stored locally on the tablets until staff were in a location at the hospital with WiFi-enabled internet connectivity, which enabled data upload and storage on the REDCap cloud platform. Survey responses were analyzed descriptively. Counts and proportions for respondent endorsements are reported for all available data. We report total responses received per survey item for transparency of missing data; all statistics are presented only for those who reported data for that construct or survey item. Most survey items had <5 % missing data. Response rates were similar across groups of individuals with and without a history of sexual violence. We examined differences between women with and without histories of sexual violence using independent Wilcoxon rank-sum tests for continuous variables and chi-squared tests for categorical variables.

2.2. Measures

2.2.1. Demographics

We evaluated demographic characteristics of age (years), sex at birth, marital status, educational attainment, employment status, primary and other spoken languages, literacy in English and Twi, and religion. Additionally, we assessed household characteristics of their living situation (urban, peri-urban, or rural settings), number of children, and household crowding (number of people living in household), as well as if they were homeless or incarcerated in the previous year.

2.2.2. Sexual violence experiences

Participants completed the *Sexual Severity of Violence Against Women Scale (SVAWS)* (Marshall, 1992). The SVAWS was developed to measure the severity of violence experienced by individuals in intimate partner relationships and designed to be used in both research and clinical settings. The measure consists of 46 items assessing the frequency of psychological, physical, and sexually abusive events experienced by the respondent. Participants are asked “How often has someone...” and are then presented with a list of experiences (e.g., “Hit you with an object”, “Made you have oral sex against your will”). Participants choose from response options ranging from 1- “Never” to 4- “Many times”. Subscales for physical violence, sexual aggression, and mild, minor, moderate, and serious violence are comprised of the sum of specific items (higher scores indicate higher-severity of violence experiences). We defined “any sexual violence experience” as responding “once”, “a few times”, or “many times” to at least one item about unwanted sexual experiences: “made you have oral sex against your will”, “made you have sexual intercourse against your will”, “physically forced you to have sex”, “made you have anal sex against your will”.

2.2.3. Trauma

Participants completed the *Global Psychotrauma Screen (GPS)* (Olf et al., 2020). The GPS is a measure designed to assess trauma exposure, transdiagnostic symptom reactions, and risk and protective factors known to predict adjustment following trauma exposure. It consists of 17 symptom items covering a variety of domains (e.g., posttraumatic stress disorder [PTSD], dissociation, suicidality), five risk and protective factor items (e.g., childhood trauma exposure, social support), and one functioning item assessed on a scale from 1- “poor” to 10- “excellent”; the GPS has been found to be a valid screener for trauma-related transdiagnostic outcomes (Frewen et al., 2021). The measure has been used with general population, refugees, and student samples in multiple countries and has good reliability (Cronbach's alpha 0.72–0.90) and concurrent validity with measures of PTSD symptoms (PCL-5 $r = 0.64$ – 0.84 ; CAPS-5 $r = 0.53$ – 0.86) (Olf et al., 2020).

2.2.4. Technology access and use

Participants completed questions focusing on technological access, available resources, and interest in various modalities of mHealth adapted from previous mHealth for mental health needs assessment surveys in global settings (Ben-Zeev et al., 2017; Ben-Zeev et al., 2024a, 2024b). Respondents reported on aspects of their personal technology access and use, such as whether they had electricity, cellular service, WiFi, and generator access within their household. Mobile phone usage was reported by respondents including the functions they utilized (e.g., calling, texting, video chatting, social media), mobile phone ownership status, type of mobile phone (i.e., smartphone, basic phone), and whether their device was shared with other members of the family.

2.2.5. Interest in mobile health

Participants were asked to rate their level of interest in different mHealth intervention domains (e.g., information about treatment options, symptom tracking, goal acquisition tracking, skills training, peer vignettes) and mHealth intervention modalities (e.g., text, videos, audio, journaling) on a 3-point scale (1-not at all; 2-Moderately; 3-Extremely).

3. Results

3.1. Demographics

The study sample consisted of 200 female participants with an average age of 38.0 (Interquartile range [IQR] 30.5, 47.0). Most respondents reported being single or never married ($n = 98$, 49.2 %), followed by married or co-habiting ($n = 59$, 29.6 %), then divorced, widowed, or separated ($n = 41$, 20.5 %), with the majority of respondents living in an urban setting ($n = 144$, 72.0 %) and having children ($n = 113$, 56.8 %). Over half of respondents reported being employed ($n = 119$, 60.4 %), with approximately a third having received tertiary education ($n = 69$, 34.7 %) and a third having received primary school or lower education ($n = 69$, 34.7 %). The majority of participants reported being able to read and write in English ($n = 148$, 74.0 %) and a third ($n = 75$, 37.5 %) reported being able to read and write in a local language (Twi). Twi was the most commonly reported primary spoken language ($n = 78$, 39.6 %), followed by English ($n = 29$, 14.7 %) and Ewe ($n = 29$, 14.7 %). All study respondents spoke Twi, English, or both, and were able to respond to study staff's questions without difficulty. Christianity was the most common religion ($n = 179$, 89.5 %) among respondents, followed by Islam ($n = 16$, 8.0 %). A few respondents reported being homeless ($n = 14$, 7.0 %) or incarcerated ($n = 6$, 3.0 %) in the previous year (Tables 1, 2 and 3).

3.2. Sexual violence experiences

A large proportion of our sample reported having experienced sexual violence during their lifetime ($n = 82$, 41.0 %). These women had significantly higher ratings on each SVAWS subscales as compared to women who did not report experiencing sexual violence, including sexual aggression subscores (12.0 [IQR: 10.0, 14.0] vs. 6.0 [IQR: 6.0, 6.0]), physical violence subscores (38.5 [IQR: 29.5, 51.5] vs. 24.0 [IQR: 21.0, 31.0]), moderate violence subscores (7.0 [IQR: 3.0, 9.0] vs. 3.0 [IQR: 3.0, 5.0]), and serious violence subscores (14.0 [IQR: 11.0, 21.0] vs. 9.0 [IQR: 9.0, 13.0]). Over a third of women reporting sexual violence endorsed this as the most traumatic lifetime event still affecting them today ($n = 31$, 37.8 %).

3.3. Trauma

Over two-thirds of respondents ($n = 117$, 68.4 %) endorsed responses that align with a high probability of PTSD, with those reporting sexual violence having a significantly higher proportion with probable PTSD ($n = 55$, 77.5 %) compared to those who did not report sexual violence ($n = 62$, 62.6 %). Findings were similar for Complex PTSD ($n = 42$, 61.8 % vs. $n = 41$, 42.7 %) and Dissociation ($n = 42$, 54.5 % vs. $n = 39$, 38.2 %), as defined by the GPS. Over half of all respondents endorsed responses on the GPS aligning with a high probability of depression ($n = 147$, 83.1 %), anxiety ($n = 153$, 83.6 %), and sleep problems ($n = 106$, 57.3 %) which did not differ by sexual violence experience. Trans-diagnostic overall symptom burden was significantly higher for respondents with a history of sexual violence (11.0 [IQR: 8.0, 13.0] vs. 9.0 [IQR: 6.0, 12.0]).

3.4. Technology access and use

Most respondents reported owning a mobile phone ($n = 171$, 86.4 %), with the majority owning a smartphone capable of downloading applications and using the internet ($n = 137$, 76.1 %). All respondents reported using their devices 7 days a week, with most being able to pay for mobile data most months ($n = 156$, 86.2 %). Mobile phones were reported being used for a variety of activities including calling ($n = 181$, 90.5 %), SMS ($n = 116$, 58.0 %), social media ($n = 116$, 58.0 %), listening to music ($n = 115$, 57.5 %), watching videos ($n = 103$, 51.5 %), video chatting ($n = 89$, 44.5 %), playing games (74, 37.0 %), emailing (n

= 60, 30.0 %), and studying or attending classes ($n = 60$, 30.0 %). We did not see differences in technology access and use by sexual violence status. Complete technology access and use data are reported in Table 2.

3.5. Interest in mobile health

When asked participants about their interest in mHealth resources to support their mental health needs using a 5-point scale (range: 1- "not at all" to 5- "extremely"), most respondents reported being "very" ($n = 97$, 49.0 %) or "extremely" ($n = 48$, 24.2 %) interested. Respondents then responded to their interest in different mobile application topics using a 3-point scale (1- "not at all", 2- "moderately", 3- "extremely"). Respondents reported "extremely" to their interest in information in the following order: information about managing stress and improving mood ($n = 146$, 73.7 %), information about medications ($n = 144$, 73.1 %), information about counseling, therapies and psychological treatments ($n = 137$, 69.5 %), and information about mental illness ($n = 136$, 68.3 %). Additionally, respondents reported "extremely" to their interest in supporting tracking changes over time and practicing skills in the following order: practicing relaxation ($n = 144$, 72.4 %), managing stress and improving mood ($n = 130$, 65.3 %), improving sleep ($n = 121$, 62.4 %), tracking progress toward goals ($n = 110$, 55.3 %), tracking symptoms ($n = 100$, 50.8 %), hearing stories from people like them ($n = 92$, 46.7 %), help communicate with loved ones about sexual violence ($n = 92$, 46.5 %) and relationship skills ($n = 87$, 44.2 %). When asked which activities they would be interested in completing in a digital mental health resource, respondents reported being extremely interested in each activity in the following order: watching videos ($n = 147$, 73.9 %), listening to audio ($n = 123$, 61.2 %), reading written content ($n = 49$, 24.6 %), and completing written prompts in response to questions ($n = 32$, 16.2 %). Overall, groups with and without sexual violence experience endorsed moderate or extreme interest in similar topics, skills, and modalities proposed for a digital mental health resource. However, some categories differed slightly by sexual violence status in distribution of responses across "moderate" or "extreme" categories suggesting tailoring of a digital resource may be beneficial to address the preferences of the specific target population. Complete digital mental health interest data are reported in Table 3.

4. Discussion

People with mental illness are a highly vulnerable group that is more likely to be victimized than the general population (Latalova et al., 2014). This study contributes to the growing literature on exposure to sexual violence among women with mental illness in LMICs (Mpango et al., 2023; Chandra et al., 2003). To our knowledge, it is the first to examine lifetime exposure to sexual violence among psychiatric patients in Ghana and to evaluate their interest and readiness for mHealth interventions. Our findings suggest that 41.0 % of our survey respondents had experienced sexual violence, a rate that is markedly higher than the global lifetime exposure rate in the general population (Li et al., 2023). Among survivors of sexual violence in our sample, 37.8 % reported being affected by the experience to this day and 76.5 % indicated that they would be interested in a mobile health resource that could provide them with mental health support. Notably, none of the study participants were evaluated or treated for mental health difficulties related to their experience of sexual violence as part of the services they received at the hospital; this remains an unmet need. Most of our sample (86.4 %) reported owning a mobile phone and most of those devices (76.1 %) were smartphones that can support mHealth apps. Almost all our survey respondents reported having consistent access to electricity (99.5 %) and a data plan (86.2 %), and all reported using their device daily. Taken together, these findings suggest that: a. there are significant unmet mental health needs among Ghanaian women who experienced sexual violence; b. most would be open to mHealth interventions to support their mental health; and c. most have access to the material resources

Table 1
Sample demographic and clinical characteristics.

Demographic characteristics	n	Overall n (%) or median (interquartile range [IQR])	No sexual violence		Any sexual violence		P value
			n	n (%) or median (IQR)	n	n (%) or median (IQR)	
Age (years)	200	38.0 (30.5, 47.0)	114	38.0 (31.0, 47.0)	82	39.5 (30.0, 45.0)	0.73
Marital status							0.03
Married/Cohabiting	199	59 (29.6 %)	113	34 (30.1 %)	82	23 (28.0 %)	
Divorced/Widowed/Separated	199	41 (20.5 %)	113	20 (17.7 %)	82	20 (24.4 %)	
Single	199	98 (49.2 %)	113	59 (52.2 %)	82	38 (46.3 %)	
No response	199	1 (0.5 %)	113	0 (0.0 %)	82	1 (1.2 %)	
Educational attainment							0.62
Primary or lower	199	69 (34.7 %)	114	42 (36.8 %)	81	26 (32.1 %)	
Secondary	199	53 (26.6 %)	114	32 (28.1 %)	81	20 (24.7 %)	
Tertiary	199	69 (34.7 %)	114	35 (30.7 %)	81	32 (39.5 %)	
Vocational training/Other	199	8 (4.0 %)	114	5 (4.4 %)	81	3 (3.7 %)	
Literacy							
Twi	200	75 (37.5 %)	114	38 (33.3 %)	82	34 (41.5 %)	0.24
English	200	148 (74.0 %)	114	85 (74.6 %)	82	60 (73.2 %)	0.83
Primary language							0.42
English	197	29 (14.7 %)	113	12 (10.6 %)	80	17 (21.3 %)	
Twi	197	78 (39.6 %)	113	44 (38.9 %)	80	32 (40.0 %)	
Ga	197	24 (12.2 %)	113	15 (13.3 %)	80	8 (10.0 %)	
Ewe	197	29 (14.7 %)	113	19 (16.8 %)	80	10 (12.5 %)	
Fante	197	15 (7.6 %)	113	9 (8.0 %)	80	5 (6.3 %)	
Other	197	22 (11.2 %)	113	14 (12.4 %)	80	8 (10.0 %)	
Religion							0.04
Christian	200	179 (89.5 %)	114	100 (87.7 %)	82	75 (91.5 %)	
Islam	200	16 (8.0 %)	114	13 (11.4 %)	82	3 (3.7 %)	
No religion	200	3 (1.5 %)	114	0 (0.0 %)	82	3 (3.7 %)	
Traditional religion	200	1 (0.5 %)	114	1 (0.9 %)	82	0 (0.0 %)	
Other	200	1 (0.5 %)	114	0 (0.0 %)	82	1 (1.2 %)	
Employed	197	119 (60.4 %)	111	68 (61.3 %)	82	49 (59.8 %)	0.83
Duration of travel to Accra Psychiatric Hospital (hours)	183	80.0 (50.0, 120.0)	104	75.0 (52.5, 120.0)	75	80.0 (50.0, 120.0)	0.96
Homeless within prior year	200	14 (7.0 %)	114	5 (4.4 %)	82	9 (11.0 %)	0.08
Jail/prison within prior year	200	6 (3.0 %)	114	1 (0.9 %)	82	5 (6.1 %)	0.04
Household characteristics							
Living situation							0.85
Urban (city)	200	144 (72.0 %)	114	84 (73.7 %)	82	58 (70.7 %)	
Peri-urban (town)	200	47 (23.5 %)	114	26 (22.8 %)	82	20 (24.4 %)	
Rural (village)	200	9 (4.5 %)	114	4 (3.5 %)	82	4 (4.9 %)	
Household crowding (≥ 3 people/room)	195	28 (14.4 %)	109	13 (11.9 %)	82	15 (18.3 %)	0.22
Has children	199	113 (56.8 %)	113	64 (56.6 %)	81	47 (57.3 %)	0.92
Psychosocial symptom domains ^a							
Post-traumatic stress disorder (PTSD)	171	117 (68.4 %)	99	62 (62.6 %)	71	55 (77.5 %)	0.04
Complex PTSD	165	83 (50.3 %)	96	41 (42.7 %)	68	42 (61.8 %)	0.02
Anxiety	183	153 (83.6 %)	106	87 (82.1 %)	76	65 (85.5 %)	0.54
Depression	177	147 (83.1 %)	102	86 (84.3 %)	74	60 (81.1 %)	0.6
Sleep problems	185	106 (57.3 %)	105	59 (56.2 %)	79	46 (58.2 %)	0.78
Self-injurious behavior	186	32 (17.2 %)	106	13 (12.3 %)	79	19 (24.1 %)	0.04
Dissociation	180	81 (45.0 %)	102	39 (38.2 %)	77	42 (54.5 %)	0.03
Other physical, emotional, social problems	183	128 (69.9 %)	105	67 (63.8 %)	77	60 (77.9 %)	0.04
Global Psychotrauma Score	146	10.0 (7.0, 12.0)	84	9.0 (6.0, 12.0)	61	11.0 (8.0, 13.0)	0.02
Risk and protective factors score	177	3.0 (2.0, 4.0)	103	3.0 (2.0, 4.0)	74	3.0 (2.0, 4.0)	0.01
Functioning score	194	6.0 (5.0, 8.0)	110	6.0 (5.0, 8.0)	82	6.0 (5.0, 9.0)	0.76
Sexual violence experiences							
Any exposure to sexual violence ^b	196	82 (41.0 %)	114	0 (0.0 %)	82	82 (100.0 %)	
Sexual aggression subscore ^c	188	6.0 (6.0, 11.0)	114	6.0 (6.0, 6.0)		12.0 (10.0, 14.0)	<0.001
Physical violence subscore ^c	180	29.0 (22.0, 41.0)	108	24.0 (21.0, 31.0)	72	38.5 (29.5, 51.5)	<0.001
Mild violence subscore ^c	192	6.0 (4.0, 11.0)	111	4.0 (4.0, 8.0)	80	10.0 (6.0, 12.0)	<0.001
Minor violence subscore ^c	192	6.0 (5.0, 9.0)	112	5.0 (5.0, 7.0)	77	9.0 (6.0, 12.0)	<0.001
Moderate violence subscore ^c	189	4.0 (3.0, 7.0)	113	3.0 (3.0, 5.0)	75	7.0 (3.0, 9.0)	<0.001
Serious violence subscore ^c	190	11.0 (9.0, 15.0)	111	9.0 (9.0, 13.0)	79	14.0 (11.0, 21.0)	<0.001
Sexual violence is the lifetime traumatic event that currently affects you most ^d					82	31 (37.8 %)	

^a Global Psychotrauma Screen scoring for domains and risk and protective factors.

^b In the Sexual Violence Against Women Scale, responded at least “once” to any sexual violence questions: “demanded sex whether you wanted it or not”, “made you have oral sex against your will”, “made you have sexual intercourse against your will”, “physically forced you to have sex”, “made you have anal sex against your will”, “used an object on you in a sexual way”.

^c Sexual Violence Against Women Scale published subscore.

^d In the Global Psychotrauma Screen, responded “sexual violence happened to me” to describe the lifetime traumatic event that currently affects them the most.

Table 2
Technology access and use.

Technology access and use	Overall		No sexual violence		Any sexual violence		p-Value
	n	n (%) or median (IQR)	n	n (%) or median (IQR)	n	n (%) or median (IQR)	
Mobile phone access							
Owns a mobile phone	198	171 (86.4 %)	113	96 (85.0 %)	82	72 (87.8 %)	0.57
Mobile phone is shared	181	26 (14.4 %)	105	16 (15.2 %)	73	9 (12.3 %)	0.58
Mobile phone type							
Smartphone	180	137 (76.1 %)	104	81 (77.9 %)	73	54 (74.0 %)	0.55
Basic phone	180	43 (23.9 %)	104	23 (22.1 %)	73	19 (26.0 %)	
Mobile phone use (days per week)	176	7.0 (7.0, 7.0)	102	7.0 (7.0, 7.0)	71	7.0 (7.0, 7.0)	0.92
Ability to pay for mobile data most months	181	156 (86.2 %)	103	91 (88.3 %)	76	63 (82.9 %)	0.30
Mobile phone used for:							
Calls	200	181 (90.5 %)	114	104 (91.2 %)	82	74 (90.2 %)	0.81
SMS	200	116 (58.0 %)	114	65 (57.0 %)	82	49 (59.8 %)	0.70
Email	200	60 (30.0 %)	114	29 (25.4 %)	82	31 (37.8 %)	0.06
Video chat	200	89 (44.5 %)	114	48 (42.1 %)	82	41 (50.0 %)	0.27
Watching videos	200	103 (51.5 %)	114	60 (52.6 %)	82	43 (52.4 %)	0.98
Listening to music	200	115 (57.5 %)	114	66 (57.9 %)	82	48 (58.5 %)	0.93
Social media	200	116 (58.0 %)	114	67 (58.8 %)	82	48 (58.5 %)	0.97
Playing games	200	74 (37.0 %)	114	41 (36.0 %)	82	33 (40.2 %)	0.54
Studying or attending classes	200	60 (30.0 %)	114	33 (28.9 %)	82	27 (32.9 %)	0.55
Other	200	6 (3.0 %)	114	3 (2.6 %)	82	3 (3.7 %)	0.68
Household technology access							
Electricity	198	197 (99.5 %)	114	113 (99.1 %)	81	81 (100 %)	0.40
WiFi	198	19 (9.6 %)	114	10 (8.8 %)	81	9 (11.1 %)	0.59
Power generator	198	17 (8.5 %)	114	11 (9.6 %)	82	6 (7.3 %)	0.57
Mobile phone service	193	107 (55.4 %)	114	64 (58.2 %)	80	41 (51.2 %)	0.34
Interest in mobile health resource							
Interest in a mobile app providing mental health support ("Very" or "Extremely")	198	145 (73.2 %)	114	83 (72.8 %)	81	62 (76.5 %)	0.89

necessary for deployment of an mHealth for mental health intervention in their communities.

Our study respondents' top areas of interest for a novel mHealth resource were gaining information about managing stress and improving their mood and practicing relaxation skills. There are significant clinical workforce shortages in Ghana, especially as it pertains to professionals trained in evidence-based psychosocial interventions (e.g., Accra Psychiatric Hospital has only one full-time Clinical Psychologist). As a result, patients receiving services seldom receive sufficient psychoeducation or training on how to manage their mental health, and there is an overreliance on pharmacotherapy as the sole intervention. An mHealth intervention that could provide women with mental illness who experienced sexual violence with psychoeducation about their condition and treatment options, as well as useful tips about coping strategies to improve mental health and reduce stress, could be a lower-cost method of bridging this gap. Staff that do not have more specialized psychosocial intervention training could perhaps be more readily trained as digital navigators, providing scaffolding and treatment engagement support for patients who receive the relevant training content from a digital resource (Ben-Zeev et al., 2015; Buck et al., 2022; Wisniewski et al., 2020).

The intervention delivery modalities rated highest by our study participants were video and audio. A third of our sample (34.7 %) had a primary school education or lower. These formats may be ideally suited for people with limited literacy or comfort with reading materials. These findings are consistent with the preferences indicated by stakeholders with mental illness and similar levels of education in the United States (Ben-Zeev et al., 2018) and paraprofessionals who provide services to people with mental illness in Ghana (Ben-Zeev et al., 2021). Notably, most smartphones, including those used in Ghana, have audio-video media players. Specialty mHealth apps can leverage these to deliver psychoeducational, skills training, or guided practice (e.g., emotion regulation, relaxation, cognitive restructuring) video and audio content. Ghana's mobile-broadband speed is lower than global averages (Digital

Quality of Life Index, 2023), which may make it difficult and costly to stream high-quality video and audio content at the point-of-use via the internet. Creating mHealth app software packages with embedded video and audio files that are downloaded and stored on the device, would increase intervention functionality, content accessibility, and affordability (Ben-Zeev et al., 2024a; Ben-Zeev et al., 2024b).

4.1. Limitations

This study has several limitations. First, the study sample size was limited to 200 Ghanaian women, predominantly with a Christian religious background who were receiving care at Accra Psychiatric Hospital, which is located in a densely populated urban environment in the Southern Coastal section of the country. As a result, our findings may not be generalizable to populations in other parts of Ghana (e.g., Northern Region which is primarily Muslim and rural) or other West African countries. Future research can be conducted among a larger and more diverse nationally representative sample. Second, we relied on self-reports of sexual violence that were not verified by official records. This may have led to recall bias or underreporting (Barrios and Caspi, 2022). Notably, it is unlikely that patients would be screened for or disclose experiencing sexual violence during a standard clinical consultation (Berry and Rutledge, 2016). Events of sexual violence often go unreported due to survivor stigma, shame, and embarrassment (Carson et al., 2020). Third, it is challenging to establish causal relationships from cross sectional survey data, as it is unclear if sexual violence increased the likelihood of psychopathology or more vulnerable people with mental illness more likely to be victimized. Additional important biopsychosocial factors may interact and influence an individual's response to sexual violence in complex ways.

5. Conclusions

Sexual violence against women is a global public health threat.

Table 3
Interest in digital mental health.

	Overall			No sexual violence			Any sexual violence		
	Not at all	Moderately	Extremely	Not at all	Moderately	Extremely	Not at all	Moderately	Extremely
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
Interest in mobile health topics:									
Mental illness	13 (6.5 %)	50 (25.1 %)	136 (68.3 %)	10 (8.8 %)	31 (27.2 %)	73 (64.0 %)	2 (2.4 %)	18 (22.0 %)	62 (75.6 %)
Medications	8 (4.1 %)	45 (22.8 %)	144 (73.1 %)	5 (4.4 %)	30 (26.3 %)	79 (69.3 %)	2 (2.5 %)	14 (17.5 %)	64 (80.0 %)
Managing stress and improving mood	7 (3.5 %)	45 (22.7 %)	146 (73.7 %)	5 (4.4 %)	28 (24.6 %)	81 (71.1 %)	2 (2.5 %)	15 (18.5 %)	64 (79.0 %)
Counseling/therapies/psychological treatments	9 (4.6 %)	51 (25.9 %)	137 (69.5 %)	6 (5.3 %)	28 (24.6 %)	80 (70.2 %)	3 (3.8 %)	20 (25.0 %)	57 (71.3 %)
Support tracking changes in:									
Symptoms over time	12 (6.1 %)	85 (43.1 %)	100 (50.8 %)	8 (7.1 %)	47 (41.6 %)	58 (51.3 %)	3 (3.7 %)	36 (44.4 %)	42 (51.9 %)
Progress toward goals	9 (4.5 %)	80 (40.2 %)	110 (55.3 %)	8 (7.0 %)	48 (42.1 %)	58 (50.9 %)	1 (1.2 %)	31 (37.8 %)	50 (61.0 %)
Skill practices about:									
Managing stress and improving mood	8 (4.0 %)	61 (30.7 %)	130 (65.3 %)	5 (4.4 %)	34 (29.8 %)	75 (65.8 %)	2 (2.4 %)	26 (31.7 %)	54 (65.9 %)
Relaxation	7 (3.5 %)	48 (24.1 %)	144 (72.4 %)	3 (2.6 %)	31 (27.2 %)	80 (70.2 %)	4 (4.9 %)	16 (19.5 %)	62 (75.6 %)
Social relationships	16 (8.1 %)	94 (47.7 %)	87 (44.2 %)	11 (9.8 %)	58 (51.8 %)	43 (38.4 %)	5 (6.1 %)	35 (42.7 %)	42 (51.2 %)
Help communicating with your loved ones about sexual violence	30 (15.2 %)	76 (38.4 %)	92 (46.5 %)	19 (16.8 %)	47 (41.6 %)	47 (41.6 %)	10 (12.2 %)	28 (34.1 %)	44 (53.7 %)
Strategies to improve sleep	13 (6.7 %)	60 (30.9 %)	121 (62.4 %)	7 (6.3 %)	40 (36.0 %)	64 (57.7 %)	6 (7.5 %)	19 (23.8 %)	55 (68.8 %)
Stories from other people like me	21 (10.7 %)	84 (42.6 %)	92 (46.7 %)	11 (9.8 %)	53 (47.3 %)	48 (42.9 %)	8 (9.8 %)	30 (36.6 %)	44 (53.7 %)
Interest in mobile mental health modalities									
Video content	12 (6.0 %)	40 (20.1 %)	147 (73.9 %)	5 (4.4 %)	24 (21.1 %)	85 (74.6 %)	6 (7.3 %)	15 (18.3 %)	61 (74.4 %)
Audio content	13 (6.6 %)	62 (31.3 %)	123 (61.2 %)	6 (5.3 %)	41 (36.3 %)	66 (58.4 %)	6 (7.3 %)	20 (24.4 %)	56 (68.3 %)
Written content	61 (30.7 %)	89 (44.7 %)	49 (24.6 %)	32 (28.1 %)	56 (49.1 %)	26 (22.8 %)	27 (32.9 %)	32 (39.0 %)	23 (28.0 %)
Completing written prompts	82 (41.4 %)	84 (42.4 %)	32 (16.2 %)	44 (38.9 %)	50 (44.2 %)	26 (22.8 %)	35 (42.7 %)	34 (41.5 %)	23 (28.0 %)

Digital tools that reduce barriers to care associated with the stigma and discrimination linked to mental illness and sexual victimization could play an important role in public mental health for prevention and care. Design of digital tools that support women with mental illness should be tailored based on their preferences—some of which were expressed by participants in the current study. We envision a health care system in which mHealth innovations with embedded video and audio files are part of the toolkit of care offered at public health institutions to patients and their supporting families with relevant content to reduce these vulnerabilities. mHealth interventions that can deliver content remotely and in a privacy-preserving manner may be particularly relevant in Ghana, where stigma and fear of repercussions associated with reporting are major barriers to treatment seeking among women who experience sexual violence (Apatinga and Tenkorang, 2022).

There are policy implications to our findings. Holistic care for women with mental illness requires attention to their sexual *health* as well as their vulnerability to sexual violence through codification of routine assessment. Clinical guidelines and even novel digital tools for providers could support implementation of these routine assessments, providing clinicians with culturally appropriate prompts for inquiring about women's sexual health and experiences of sexual violence, assessing their strengths and vulnerabilities, and integrating prevention into routine mental health care. We advocate for participatory design of these digital packages and for rapid testing and implementation to meet urgent public health needs.

Declaration of competing interest

Dr. Ben-Zeev has financial interests in Merlin LLC and FOCUS technology. He has provided consultation services to Trusst Health, K Health, Boehringer Ingelheim, eQuility, Deep Valley Labs, Butler Hospital, and Otsuka Pharmaceuticals.

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work in this article.

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