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Web-Based and mHealth Interventions for Intimate Partner Violence Victimization Prevention: A Systematic Review

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Abstract

Mobile health (mHealth) technologies are increasingly used across health programming including intimate partner violence (IPV) prevention to optimize screening, educational outreach, and linkages to care via telehealth. We systematically evaluated current web-based and mHealth interventions, which include web- or mobile-based delivery methods for primary, secondary, and tertiary IPV victimization prevention. We searched MEDLINE/PubMed, Embase, CINAHL, PsycINFO, Open Grey, and Google Scholar for empirical studies published 1998–2019. Studies were included if they considered empirical data, participants in adult romantic relationships, IPV as a primary or secondary outcome, and an mHealth component. The Mixed Methods Appraisal Tool was used to record critical ratings of quality among studies selected for inclusion. We assessed variation in targeted populations, types of IPV addressed, and mHealth approaches used. Of 133 studies identified for full-text review, 31 were included. Computer-based screening with or without integrated education was the most common mHealth approach ($n = 8$, 26%), followed by safety decision aids ($n = 7$, 23%). Feasibility and acceptability were found to be generally high where assessed (23% of studies, $n = 7$). There was limited evidence around whether mHealth interventions better addressed population needs compared to conventional interventions. mHealth tools for IPV prevention are especially acceptable in health-care settings, on mobile phone platforms, or when connecting victims to health care. Despite enthusiasm in pilot projects, evidence for efficacy compared to conventional IPV prevention approaches is limited. A major strength of mHealth IPV prevention programming is the ability to tailor interventions to individual victim needs without extensive human resource expenditure by providers.

Keywords

intimate partner violence, mHealth, mobile health, violence prevention

Background

Intimate partner violence (IPV) is globally widespread, yet few public health approaches have been broadly successful in reducing its prevalence. IPV is typically defined as physical, sexual, psychological, or verbal control or injury by a spouse, partner, or other individual with whom the victim has a current or former romantic or sexual relationship (Centers for Disease Control and Prevention, 2018; World Health Organization, 2013). Risks of both IPV victimization and perpetration vary across the life span, but victimization experiences—including sexual assault, stalking, or physical violence—occur most frequently during emerging adulthood (ages 18–25; Basile et al., 2011). The seriousness of psychological and physical IPV experiences varies from less physically dangerous (e.g., name-calling or slapping) to more dangerous (e.g., sexual assault or battery) with the perpetration of physical harm often increasing in severity over the span of an intimate relationship. IPV victimization often co-occurs with exposure to infectious diseases including HIV, use of recreational drugs and alcohol, and unwanted pregnancy. Risk of abuse increases with intersectional characteristics including being a sexual or gender minority (Finneran & Stephenson, 2013), living in a low-resource community, or being a racial or ethnic minority (Breiding, Black, & Ryan, 2008).

IPV is a major cause of morbidity and mortality, especially for women, who are most likely to be victims (Basile et al., 2011). Close to half of women who are exposed to IPV report injury (Basile et al., 2011) including posttraumatic stress

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disorder (PTSD), anxiety and depression, gynecological problems, or physical harm (Beydoun, Beydoun, Kaufman, Lo, & Zonderman, 2012; Campbell, 2002). In comparison, 14% of male victims report physical, sexual, or psychological injury (Basile et al., 2011). Physical, sexual, and psychological victimization are all associated with stress-related conditions and mental health problems (Carvalho, Lewis, Derlega, Winstead, & Viggiano, 2011; Coker et al., 2002; Mills, Avegno, & Haydel, 2006). IPV exposure is also a significant predictor of women's mortality and is associated with more than a third of global homicides with female victims—6 times higher than for male homicide victims (Campbell, Glass, Sharps, Laughon, & Bloom, 2007; Stöckl et al., 2013). Victims of IPV have reduced work and social productivity, are more likely to be unemployed, are more frequent recipients of public assistance, utilize health-care resources at a higher rate, and are at greater risk of suicide and substance abuse (Campbell, 2002; Capaldi, Knoble, Shortt, & Kim, 2012). Conversely, protective factors for both victimization and revictimization include strong social support, high friendship quality, and having consistent access to health and social resources (Barrett, O'Day, Roche, & Carlson, 2009). Interventions to prevent IPV generally target one or more known risk factors for victimization or revictimization in isolation but do not attempt to holistically address complex social–ecological risk factors (Hackett, McWhirter, & Lesher, 2016).

IPV Prevention Interventions

Despite strong conceptual and empirical evidence of modifiable risk and protective factors for IPV, evidence-based interventions to reduce IPV are underutilized and there is limited consensus on best implementation practices (Decker et al., 2012). Furthermore, many interventions depend on one-size-fits-all approaches that have been broadly criticized (Messing, Ward-Lasher, Thaller, & Bagwell-Gray, 2015) and have a relatively low net effect on reducing the frequency of initial or repeat victimization or victims' ability to terminate contact with a perpetrator (Maxwell & Robinson, 2014). For example, primary and emergency care screening tools, which are among the most common secondary IPV prevention approaches, identify victimization with acceptable sensitivity, but there is little or no evidence that screening reduces IPV-related injury (Klevens, Sadowski, Kee, Trick, & Garcia, 2012), even when combined with other interventions (Maxwell & Robinson, 2014). Societal responses to IPV tend to focus on punitive criminal measures for perpetrators rather than restorative measures for victims, resulting in few primary perpetration prevention efforts compared to reactionary measures such as prosecution or recidivism programs that have little effect on likelihood of revictimization (Eckhardt et al., 2013).

Practical barriers to IPV prevention interventions, many of which are related to mode of delivery, additionally reduce likelihood of uptake or impact. Common barriers for victims wishing to initiate services include lack of knowledge of community resources, fears about privacy, and not having someone to whom they can privately disclose their experience (Fugate, Landis, Riordan, Naureckas, & Engel, 2005). Conventional services are used most frequently by educated white women (Violence Against Women Act Measuring Effectiveness Initiative, 2017) and are not framed to consider intersections of racism, socioeconomic barriers, cultural acceptability, language barriers, or risk of further marginalization following involvement of the state (e.g., prosecution, imprisonment, or deportation of perpetrators; Messing et al., 2015). Access to in-person or conventional telephonic services (such as primary care screening, battered women's shelters, or hotlines) may be limited for individuals with financial, linguistic, or transportation barriers (Vinton & Wilke, 2014). This is further compounded by reduced acceptability of these modes, as individuals increasingly prefer to get information from the Internet or their mobile phones, seek help outside of working hours, and select from a range of services (Koss, White, & Lopez, 2017).

IPV Prevention and Mobile Health (mHealth)

Connection to the Internet provides immediate and confidential access to both local- and Internet-community resources, increases privacy and anonymity, and connects providers to patients via various telehealth or mHealth mechanisms (Price et al., 2014). We define mHealth as Internet- or technology-mediated approaches to provision of health resources or interventions. Primary intervention through educational tools may be more easily disseminated over the Internet- and web-based media that are already used by target populations (Johnson et al., 2018). Physicians and other providers may have more success identifying individuals in need of IPV prevention services when waiting room screenings are completed on a computer or tablet rather than using a paper form (Klevens et al., 2012). Further, the traditionally prohibitive costs for individually tailored prevention interventions may be largely reduced when computer facilitated as compared to group or one-on-one interventions such as educational videos or text interventions that use branching logic to provide personal recommendations in response to user input (e.g., Glass, Eden, Bloom, & Perrin, 2010).

Victims of IPV are often isolated by their partners, have limited high-quality friendships or social supports, and low access to social resources (Capaldi et al., 2012), but increasing global access to the Internet provides an avenue to search for information, report experiences of violence (Westbrook, 2008), or receive treatment for IPV-related morbidities such as anxiety and depression (Fleming et al., 2018; Mehta, Peynenburg, & Hadjistavropoulos, 2018). For example, digital safety decision aids (SDAs) allow both privacy and real-time access to resources and may be appropriate for a hard-to-reach population disclosing information on a sensitive topic (Glass et al., 2017). Safe use of mHealth for IPV prevention should include considerations for exposure to misinformation (Marcolino et al., 2018), negative effects of underregulation (Barton, 2012), being "outed" online (Premarathne, Han, Liu, & Khalil,

2015), retaliation by an abusive partner, or expanded avenues for stalking and harassment (Finn & Banach, 2000).

Use of mHealth is further important as it subverts resource-related barriers to services. Ninety percent of Americans and 56% of individuals globally have regular access to the Internet, especially via smartphones, with the gap in smartphone ownership by socioeconomic status rapidly closing (Pew Research Center, 2017; Sanou, 2017). Previous research for IPV prevention online interventions has focused on the individual victim of IPV with little attention paid to broader socio-contextual factors (Rempel, Donelle, Hall, & Rodger, 2018), even though community and environmental risk factors for IPV (such as social connection or access to medical care) could potentially be key targets for mHealth approaches (Kazdin, 2017).

Public health prevention in both conventional and online formats is defined at three tiers of intervention. Primary prevention reduces the incidence of a health threat by addressing underlying causes such as school- or community-based healthy relationship programs targeting adolescents and families before victimization occurs (Niolon, 2017). Secondary prevention focuses on early detection after exposure and subsequent treatment in order to triage any resulting negative health consequences or recurrent exposure. Secondary prevention programs addressing IPV include universal IPV assessments and screening in health-care settings (e.g., Ahmad et al., 2009), SDAs (e.g., Glass et al., 2017), and connection to counseling, medical treatment, and legal action to prevent future victimization (e.g., Thomas, Miller, Hartshorn, Speck, & Walker, 2005). Tertiary prevention includes efforts to mitigate the impacts of previous or current experiences of IPV such as counseling for PTSD.

Study Aim

We performed a systematic literature review to identify the full spectrum of mHealth interventions that are designed for IPV victim use and provide insight into which populations are being served by mHealth interventions to prevent IPV. The purpose of our review was to identify and critically evaluate what, if any, benefits exist for participants, identify gaps that are a priority in future research, and describe methodological or programmatic deficits that, if addressed, would improve quality as the field matures.

Method

Study Design

We performed a systematic literature review of studies that examine the effectiveness of mobile technology in preventive services for IPV victimization. The protocol for this review (Anderson et al., 2019) included the following components: review question, search strategy, inclusion/exclusion criteria, and planned risk of bias assessment. Searches were developed in February 2019. The review was conducted, and the presentation in this report accords with the preferred reporting items for systematic reviews and meta-analyses (PRISMA) protocol (Moher, Liberati, Tetzlaff, & Altman, 2009).

Study Selection

Databases searched were PubMed, Elsevier Embase, Cochrane Controlled Registry of Trials (CENTRAL), EBSCO PsycINFO, and EBSCO CINAHL. Articles were limited to those published between January 1998 and February 2019 (with the last search occurring February 2019) and in the following languages: English, Spanish, French, and Portuguese (corresponding with the languages read by study authors). The search strategy utilized various terms such as "interpersonal violence," "domestic violence," "rape," "mHealth," "Internet," "email," "risk reduction," "crisis intervention," and "prevention." Controlled vocabulary (i.e., the National Library of Medicine's Medical Subject Headings and Embase Emtree) was also used. Both randomized controlled trials (RCTs) and nonrandomized trials—including pre- or quasi-experimental designs or RCT protocols—were considered given the review objective to summarize all existing efforts to use mHealth for IPV prevention. The full search strategy of the MEDLINE/PubMed search strategy is included in the Online Appendix. Gray literature was searched in Open Grey (opengrey.eu) and ProQuest Dissertations and Theses Global. The first 100 results identified by a hand search on Google Scholar (scholar.google.com) were additionally screened. Finally, we reviewed the reference lists of studies identified for inclusion (but identified no additional studies). The search strategy was designed with the assistance of a medical librarian and content experts.

Inclusion Criteria

We restricted identified articles by the following inclusion criteria: considered empirical data, included human adults or adolescents in adult romantic relationships, described an intervention to reduce IPV either as a primary or secondary outcome, and included a "mobile" component where delivery of the intervention was mediated by the use of technology (e.g., smartphone, tablet, or computer). The scope of mHealth was predicted to include stationary and portable computers, tablets, smartphones, or cell phones where one or more aspect of the delivery method depended on the recipient using the hardware (e.g., texting, e-mailing, filling out a screening form, or receiving tele- or video therapy, or other health service), but our definition was open-ended to include other approaches defined by the study authors as mHealth, telehealth, or web-based delivery including social media or other apps. Following title- and abstract-level screenings of these criteria, full-text articles were reviewed and included if they reported on efficacy (e.g., clinical benefit, reduction in IPV experiences or effects) and/or feasibility (e.g., acceptability) of the intervention via any quantifiable measure of success (e.g., retention rate). Studies reporting only incidence or prevalence of IPV or that used a computer-based delivery method with no bearing on the

outcome (e.g., web-based recruitment for a face-to-face intervention) were excluded.

Data Extraction Process

Data extraction methods followed Cochrane guidelines for systematic literature reviews (Furlan, Pennick, Bombardier, & van Tulder, 2009). As recommended, two independent researchers screened titles and abstracts resulting from all searches to identify potentially eligible studies. A full-text review of each study was then performed by two independent researchers; a third independent researcher settled any discrepancies. Two raters individually extracted the following data from the full text and compiled in table form: study design, study country, number of participants, participant demographic data, scope and type of IPV addressed, target population (i.e., victims, perpetrators, or both), intervention type, level of public health prevention, length of intervention and follow-up, experimental and control conditions with respective treatment arms, type and description of mHealth component, setting of intervention delivery, primary and secondary outcomes with effect size where reported, and rate and causes of dropout. The data were verified by one or more other authors. Where multiple reports were published using the same study data, the data were extracted from the most comprehensive publication only and not duplicated. Where interventions using the same methods but different participants (e.g., feasibility study followed by RCT) were published in duplicate, data were extracted for all relevant publications but grouped together and annotated to indicate that the approach was comparable. Studies that were not included after full-text review were recorded along with the reason for exclusion (Figure 1). One or more of the authors verified the accuracy of the tabularized data and resolved any discrepancies. Excluded studies (those considered for full-text review) and reasons for exclusion are available in the Online Appendix. While the protocol (Anderson et al., 2019) indicated inclusion of perpetration–prevention interventions, those identified ($n = 2$) introduced superfluous heterogeneity and were relegated to the Online Appendix.

Analytical Approaches

Eligible studies were assessed using inductive, summative content analysis, a systematic technique for describing data and outcomes using qualitative methods (Finfgeld-Connett, 2014; Hsieh & Shannon, 2005), as well as reports of effect size where possible. We determined usage (i.e., frequency) of emergent and predicted themes related to mHealth and IPV prevention interventions and additionally assessed latent meanings based on the results of the included studies. Given the heterogeneity of included study types and study designs, a meta-analysis was not performed. Two authors independently performed a study-level risk of bias appraisal using the Mixed Methods Appraisal Tool (MMAT; Hong et al., 2018) to address qualitative, quantitative, and mixed-methods outcomes and to estimate the overall scientific strength of evidence available on the study topic (Online Appendix). The MMAT has been previously evaluated for content validity and methodological quality (Pace et al., 2012; Souto et al., 2015) and contains five distinct, validated subscales to evaluate a wide range of empirical studies (i.e., qualitative, quantitative RCTs, quantitative nonrandomized trials, quantitative descriptive, and mixed methods). Each subscale evaluates aspects of study methodological quality that may introduce bias relevant to a systematic assessment of the literature.

Results

Of 7,003 deduplicated articles, abstracts, and gray literature documents including theses and dissertations, 133 full-text documents were reviewed; of these, 31 met inclusion criteria and included unduplicated data, representing 23 unique intervention designs. All included studies were published in English. Two studies came from gray literature sources (i.e., doctoral dissertations). Study types included RCTs ($n = 16$), RCT protocols (for prospective trials unpublished as of 2019; $n = 5$), quantitative nonrandomized ($n = 3$), quantitative descriptive ($n = 5$), qualitative ($n = 1$), and mixed-methods ($n = 3$) approaches (Table 1). Twenty-three studies were performed (or are being performed; $n = 4$) in the United States, with only one qualifying study occurring in a low- or middle-income country (Cambodia). Three studies used primary prevention approaches, with 18 and 10 studies using secondary and tertiary prevention approaches, respectively. Six studies included IPV prevention as a secondary focus in the context of an intervention that more broadly addressed sexual health or sexual violence focus. Sixty-one percent ($n = 19$) of studies or protocols were published in or after 2015.

Participant Characteristics

Twenty-six studies (84%) enlisted only female participants; all victim-oriented programs ($n = 28$) targeted only women and excluded other genders. Braithwaite and Fincham (2014) considered both perpetrators and victims who could be male or female but limited participation to heterosexual married couples. Participants in completed studies (i.e., excluding four protocols) had a mean age of 29.8 years; 24 studies (77%) specified that they were delivered exclusively in English, with only one study (3%) delivered in Spanish (Table 2).

mHealth Characteristics

Table 2 illustrates the populations, interventions, and contexts of included studies. The most commonly identified mHealth components were web-based educational content that was not responsive to user input (e.g., self-paced, click-through tutorials; $n = 9$ studies) and interventions where the outcome was dependent on use of computer hardware (e.g., tablet-based screening that automatically flagged a health-care provider; n

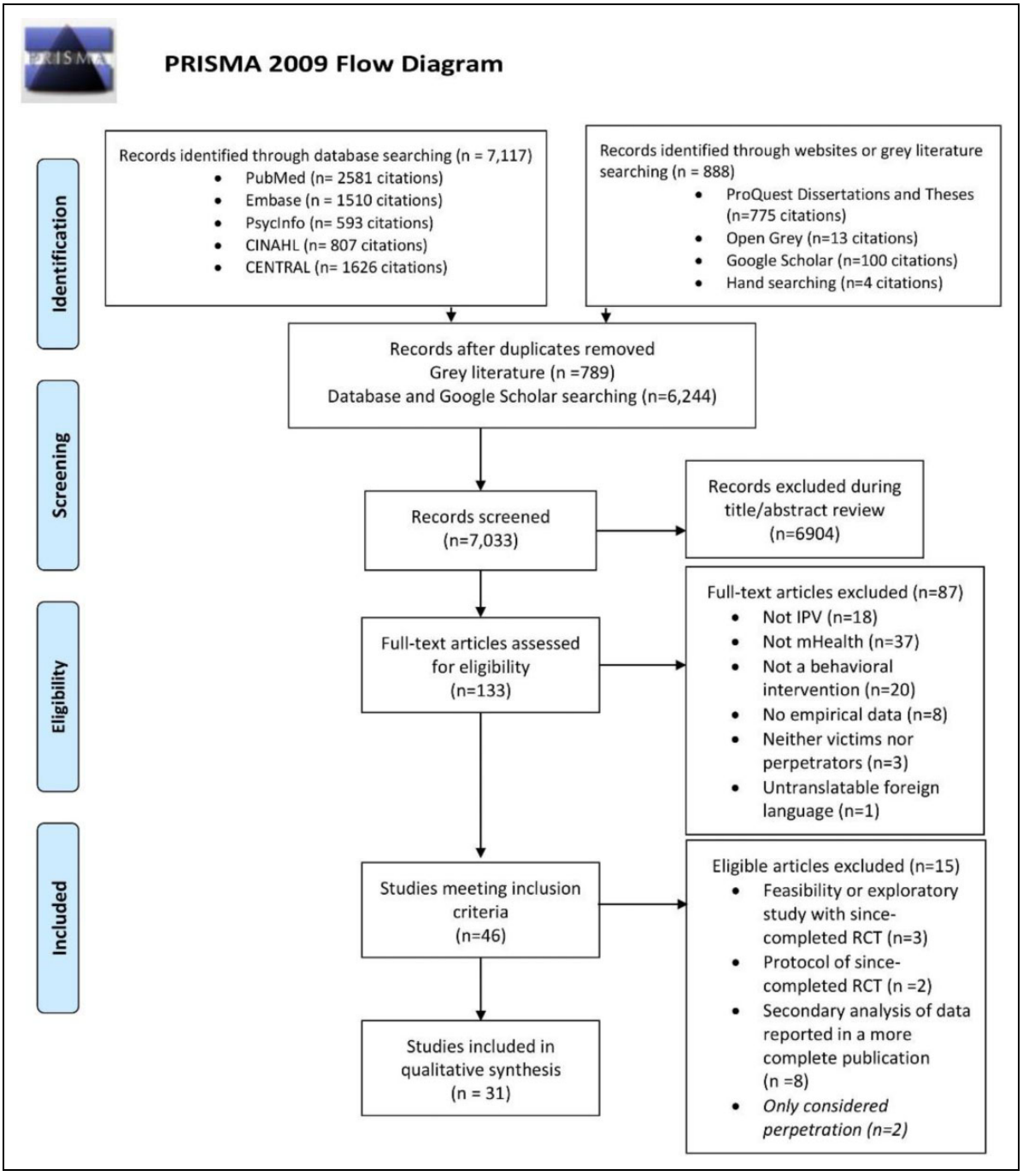

Figure 1. Preferred reporting items for systematic reviews and meta-analyses flow diagram of study selection.

= 9 studies). We identified studies that used mHealth to screen, assess risk, deliver support or education, or facilitate psychotherapy. Only two studies developed or tested a proprietary or made-for-purpose prevention app (including one proof-of-concept study with no field testing; Roy, 2018), and no studies used major social media/communication platforms (e.g., Facebook, Instagram, and WhatsApp) to deliver their respective interventions. The remaining studies programmed web- or hardware-accessible platforms (e.g., e-mail) without developing new software (or else did not describe the platform). Six studies screened for IPV prevalence (e.g., in emergency department [ED] or outpatient medical waiting rooms) using existing screening instruments on a computer or tablet to mediate participant acceptance of the screening and to flag providers in real time about the possible need for intervention. Four studies (Choo et al., 2016; Humphreys, Tsoh, Kohn, & Gerbert, 2011; Klevens et al., 2012; Klevens, Sadowski, Kee, Garcia, & Lokey, 2015) additionally enhanced the waiting-room screening tools via personalized feedback using written messages or animated avatars (including a cartoon parrot and a video

Table 1. Summary of Critical Findings From Included Studies.

Author	Total Sample Size	Type of IPV	Mean Age (Range)	Length of Intervention	Length of Follow-Up	Description of mHealth Component	Primary Focus (If Not IPV Prevention)	IPV Prevention Outcome	IPV Outcome Measure	Dropout Rate
Primary prevention										
Avina (2006)[a]	174	S	20 NR	<1 hr	12 weeks	Web-based, self-paced tutorials	Campus sexual assault prevention	High-risk sexual communication strategies High-risk alcohol use strategies	Sexual communication survey Alcohol control (Q-FAU #4-10)	25%
Johnson et al. (2018)	420[b]	P/S	NR	1 year	NA	Tablet-based modules and homework (group setting)	HIV/STI prevention	Condom usage	Count data	NA
Villegas et al. (2014)	40[c]	S	19.9 (18–24)	4 weeks	NA	Web-based, self-paced modules	HIV/STI prevention	Acceptability	Quantitative participant feedback	30%
Secondary prevention										
Ahmad et al. (2009)	314	P/S	44 (NR)	<1 hr	NR	Computer-based assessment in waiting room, positive IPV screen alerted physician	—	IPV discussion rate	Count data (AAS, PVS) CESD-R	9%
T. L. Bloom et al. (2014)	59[c]	P/S	25.4 (18–35)	NA	NA	Logon-requisite website with interactive/responsive steps of SDA	—	Feasibility	Quantitative participant feedback	32%
T. Bloom, Gielen, and Glass (2016)	13[c]	P/S	NR (18–24)			Proprietary app with interactive/responsive steps of SDA	—	Feasibility	Quantitative participant feedback	NA
Braithwaite and Fincham (2014)	104	E/P	32.4 (NR)	6 weeks	1 year	E-mail-delivered links to online resources, video intervention	—	Physical aggression Psychological aggression	CTS-2	4%
Eden et al. (2015)	708	E/P/S/V	33.3 (NR)	<1 day	1 year	Web-based login-requisite site with modules that build on user input	—	Reduction in decisional conflict	DCS Danger assessment Relationship intention	15%
Gilbert et al. (2015)	191	E/P/S	34.2 (NR)	<1 hr	3 months	Computer-based, self-paced IPV screening, and intervention module	—	Identification of IPV victimization Receipt of IPV services	CTS-2 PMWI	10%
Gilbert et al. (2016)	306	S	41.5 (NR)	4 weeks	1 year	Computer-based, self-paced IPV prevention modules during group sessions	HIV prevention	IPV victimization Substance use	CTS-2 Risk behavior assessment	NR
Glass, Eden, Bloom, and Perrin (2010)	90	P/S	34 (17–63)	<1 day	NA	Proprietary app with interactive/responsive steps of SDA		Safety-seeking behaviors Danger assessment	Decisional Conflict Scale Danger assessment	NR
Hegarty et al. (2019)	422	E/P/S/V	34 (16–50)	<1 hr	1 year	Web-based login-requisite site with modules that build on user input	—	Self-efficacy Depression	General Self-Efficacy Scale CESD-R	NA
Hesser et al. (2017)	65	E/P	36.9 (NR)	8 weeks	1 year	Asynchronous web-based CBT (text/picture/video)	—	IPV or aggression experiences Anxiety/depression	MMEA CTS-2 PHQ-9	3%
Humphreys, Tsoh, Kohn, and Gerbert (2011)	50	P	27.7 (NR)	<1 hr	2 months	Video doctor encourages patients to talk to the doctor about abuse if positive, positive screens cued the provider	—	IPV discussion rates Participant satisfaction	Count data (AAS) Quantitative participant feedback	16%
Klevens, Sadowski, Kee, Trick, and Garcia (2012)	126	ND	35.8 (NR)	<1 hr	1 week	Computer-assisted screening with video intervention when indicated	—	IPV disclosure rates	PVS	19%
Klevens, Sadowski, Kee, Garcia, and Lokey (2015)	2,700	ND	38.7 (NR)	<1 hr	3 years	Computer-assisted screening with video intervention when indicated	—	Mean number of medical visits/hospitalizations	PVS	NR
Koziol-McLain et al. (2018)	412	E/P/S/V	29 (16–60)	<1 hr	1 year	Logon-requisite website with interactive/responsive steps of SDA	—	Mental health IPV exposure	CESD-R SVAWS	13%
MacMillan et al. (2006)	2,461	E/P/S/V	37.1 (18–64)	<1 hr	NA	Tablet-based screening for IPV in ED	—	Prevalence	PVS, CAS CTS-2, WAST	NA
Rhodes et al. (2006)	1,281	E/P/S/V	33.3 (18–65)	<1 hr	NA	Computer-assisted screening for IPV in ED	—	IPV disclosure rates IPV-related services provided	PVS	29%
Roy (2018)[a]	18[a]	E/P/S/V	NR	<1 hr	NA	Proprietary app to identify abusive texts using machine learning	—	Acceptability	NA	NA
Sabri et al. (2019)	1,250[b]	E/P/S/V	NR	<1 hr	1 year	Logon-requisite website with interactive/responsive steps of SDA	—	Safety Mental health Empowerment	CTS-2 PHQ-9	NA
Tertiary prevention										

(continued)

Table 1. (continued)

Author	Total Sample Size	Type of IPV	Mean Age (Range)	Length of Intervention	Length of Follow-Up	Description of mHealth Component	Primary Focus (If Not IPV Prevention)	IPV Prevention Outcome	IPV Outcome Measure	Dropout Rate
Brody et al. (2018)	600[b]	P/S	NR	1 year	1 year	Text or voice messages to cell phones	Sexual/Reproductive health services	Condom usage Frequency of violence victimization	Count data	NA
Choo et al. (2016)	40[c]	P/S	30 (18–59)	<1 hr	3 months	Tablet-based screening in ED, text intervention on tablet where indicated	—	Feasibility	Quantitative participant feedback	25%
Constantino et al. (2015)	34	P/S/V	40 (NR)	6 weeks	NA	E-mail-embedded software for victim–therapist text communication	—	Anxiety/depression Anger Support	PROMIS short form, Personal Resource Questionnaire	6%
Ford-Gilboe et al. (2017)	450[b]	E/P/S	NA	NR	1 year	Web-based login-requisite site with modules that build on user input	—	Depression PTSD symptoms	CES-D-R PTSD Checklist	NA
Gray et al. (2015)	21	P/S	32.9 (NR)	<6 months	NA	Telehealth (video) CBT	—	Depression PTSD symptoms	PTSD Checklist CES-D	19%
Hassija and Gray (2011)	15	P/S	30.2 (19–52)	<6 months	NA	Telehealth (video) CBT	—	Depression PTSD symptoms	PTSD Checklist CES-D	NR
Littleton, Grills, Kline, Schoemann, and Dodd (2016)	87[c]	S	22 (18–42)	14 weeks	3 months	Web program with ongoing therapist/participant interaction	Rape survivor support	PTSD symptoms Depression/anxiety	CES-D-R, FDAS	15%
Thomas, Miller, Hartshorn, Speck, and Walker (2005)	38	E/P/S/V	33 (19–60)	6 weeks	NA	Telehealth triage (video)	—	Acceptability Entry into care Psychiatric conditions	Quantitative participant feedback Count data SCL-90-R	8%
Roddy, Georgia, and Doss (2018)	2,797	E/P/S/V	NR (18–64)	6 weeks	NA	Web-based, self-paced modules	—	Relationship distress Frequency of violence victimization/ perpetration	Classifying Relationship Distress and Physical Abuse Interview	NR
Zlotnick, Wernette, and Raker (2018)	53	E/P/S	27.6 (NR)	<1 hr	4 months	Tablet-based educational content with proprietary avatar	—	Acceptability IPV risk	Quantitative participant feedback WAST, CAS	8%

Note. E = emotional or psychological; P = physical; S = sexual; V = verbal; CBT = cognitive behavioral therapy; ED = emergency department; CAS = Composite Abuse Scale; CESD = Center for Epidemiological Studies Depression Scale; CESD-R = Center for Epidemiological Studies Depression Scale–Revised; CTS-2 = Revised Conflict Tactics Scale; DCS = Decisional Conflict Scale; FDAS = Four Dimensional Anxiety Scale; MMEA = Multidimensional Measure of Emotional Abuse; SCL-90-R = Symptom Checklist-90-Revised; PHQ-9 = Patient Health Questionnaire-9 Item; PMWI = Psychological Maltreatment Against Women Inventory; PVS = Partner Violence Screen; SVWAS = Severity of Violence Against Women Scale; WAST = Woman Abuse Screening Tool; AAS = abuse assessment screen; PTSD = posttraumatic stress disorder; IPV = intimate partner violence; NR = Not Reported; NA = Not Applicable; STI = Sexually Transmitted Infection; PROMIS = Patient-Reported Outcomes Measurement Information System.

[a]Dissertation or gray literature. [b]Protocol of future or ongoing RCT. [c]Proof-of-concept or feasibility study.

Table 2. General Study Characteristics.

Variables	Categories	*n* (%)
Study design	Randomized controlled trial	12 (39)
	Randomized controlled trial protocol	4 (13)
	Preexperimental	15 (48)
Publication year	1998–2008	4 (13)
	2009–2014	8 (26)
	2015–2019	19 (61)
Sample size	<50	8 (26)
	<100	6 (19)
	<500	10 (32)
	<1,000	2 (6)
	>1,000	5 (16)
Study setting	Outpatient medical	8 (26)
	Psychology/therapy	3 (10)
	Academic/research	16 (52)
	Community organization	4 (13)
Target population	Female	26 (79)
	All genders	5 (15)
	>50% non-White racial/ethnic minorit(ies)[a]	9 (27)
	Sex workers	1 (3)
	Same-sex couples	1 (3)
	Pregnant or perinatal victims	3 (9)
	Victims	28 (85)
	Both perpetrators and victims	3 (9)
Type of mHealth component	Web-based communication w/ intervention provider	4 (13)
	Proprietary app	2 (6)
	Web-based educational	9 (29)
	Web-based interactive w/other participants	1 (3)
	Prevention outcome depended on use of a computer	9 (29)
	Web-based interactive/responsive to participant	6 (19)
Scope of IPV	Current or recent relationship, unspecified cohabitation	13 (42)
	Cohabiting couples only	1 (3)
	Married cohabiting couples only	1 (3)
	Dating violence	2 (6)
	Not restricted	14 (45)
Language	English	24 (77)
	Spanish	1 (3)
	Other/not specified	6 (19)

Note. IPV = intimate partner violence.
[a]Not reported for protocols.

doctor) to encourage victims to speak to their providers during their visit. One study (Littleton, Grills, Kline, Schoemann, & Dodd, 2016) described an online support group for victims of sexual assault, including those assaulted by a current or former intimate partner; other group-involved interventions included women using tablets individually to complete self-paced modules during a group educational session (Gilbert et al., 2015, 2016; Johnson et al., 2018). Solutions to connect health-care providers—specifically mental health-care providers—to current or former victims of IPV included e-mail- and video-delivery of cognitive behavioral therapy (CBT; Gray et al., 2015; Hassija & Gray, 2011; Hesser et al., 2017) or else video-mediated triage into appropriate services (Thomas et al., 2005), particularly for rural IPV victims.

Outcomes Assessment

IPV experiences were measured using a wide variety of instruments. The Revised Conflict Tactics Scale (CTS-2) was used most frequently ($n = 7$ studies). Other assessment tools included the Partner Violence Screen (PVS; $n = 4$ studies), Composite Abuse Scale ($n = 2$ studies), and Psychological Maltreatment Against Women Inventory ($n = 1$ study). Commonly used measures of mental health conditions associated with IPV experiences included the PTSD Checklist ($n = 3$), Center for Epidemiological Studies Depression Scale–Revised (CESD-R; $n = 6$), and the Patient Health Questionnaire-9 Item ($n = 2$). The strength of empirical evidence provided by included studies was widely varied, with five studies reporting only participant feedback instruments with no measurement of treatment effect, qualitative participant feedback, or rates of dropout as evidence of program feasibility or acceptability (Table 1). Health-care-setting screening interventions most frequently used the PVS via a tablet or computer to flag those participants reporting IPV, with success based on comparative disclosure rates versus face-to-face or paper delivery (e.g., Klevens et al., 2012), rate of patient–provider discussion of IPV following a positive result on the PVS (e.g., Ahmad et al., 2009), or tested the development of simultaneous IPV screening and educational intervention using an author-constructed mHealth screening instrument (e.g., Choo et al., 2016). Web-based educational interventions with prespecified content generally relied upon behavioral change outcomes such as self-reported changes in substance use (e.g., Avina, 2006; Gilbert et al., 2016). Educational interventions that modified content based on user input tended to focus on mental health outcomes measured by the CESD-R or similar, well-validated instruments (e.g., Ford-Gilboe et al., 2017; Hegarty et al., 2019). Telehealth interventions similarly tended to use the CESD-R or PTSD Checklist to measure influence on tertiary prevention (e.g., Constantino et al., 2015; Gray et al., 2015).

Attrition from studies that reported rates of noncompletion ($n = 19$ studies) ranged from 4% to 36% (median = 15%). Studies using a web-based method of participant–provider communication (e.g., telemedicine) had the lowest median rate of dropout (median: 8%; range: 3–19%; $n = 3$ studies), while interventions with a computer-mediated outcome had the highest median rate of dropout (median: 19%; range: 9–36%; $n = 5$ studies).

Empirical studies using the same or similar interventions with different participant groups were reported separately, though the overlapping mHealth platforms are notable. Two studies used the same telehealth platform with the same community partner to deliver CBT to IPV victims in a rural, medically underserved area, where clinicians assessed improvements in PTSD and depression symptomatology (Hassija & Gray, 2011) and satisfaction with telehealth

delivery (Gray et al., 2015). Klevens, Sadowski, Kee, Trick, and Garcia (2012) and Klevens, Sadowski, Kee, Garcia, and Lokey (2015) performed separate RCTs with small ($n = 126$) and large ($n = 2{,}700$) samples using similar methods (computer-assisted screening with a video intervention for those who screened positive for IPV victimization) but distinct primary outcomes. In the smaller RCT (2012), women who received a computerized screening at their primary care visit were 2½ times more likely to disclose IPV than those screened face-to-face by a health-care provider, although the difference was not statistically significant. Although the larger trial (2015) of the same mHealth screening was better powered, it found no differences in hospitalizations, ED visits, or outpatient care visits in the 3 years for computer versus face-to-face screening among those who reported IPV prior to enrollment. Two RCTs performed by Gilbert et al. (2015, 2016) provided a similar computerized screening and brief intervention to different female participants in community supervision. The computerized intervention compared to a computerized control did not differ in outcomes for the intervention. Specifically, there were no between-group differences in IPV prevention self-efficacy at follow-up nor was there a reduced risk of IPV after 1 year. Most notably, one study design for an SDA designed for women currently experiencing IPV was repeated at least 7 times either with a website format or in an app developed specifically for the SDA. Another study was a large RCT (Eden et al., 2015) of a generalized sample of U.S. women using the web-based SDA. T. L. Bloom et al. (2014) and T. Bloom, Gielen, and Glass (2016) conducted pilot versions with rural/urban pregnant women and college women in same-sex relationships. Three other studies or protocols used the SDA in RCTs with Australian women (Hegarty et al., 2019), New Zealander women (Koziol-McClain et al., 2018), and immigrant, refugee, and indigenous women in the United States (Sabri et al., 2019). Only three RCTs using the SDA or a variant have yet published results. Eden et al. (2015) found that U.S. women who received the intervention reported significantly less decisional conflict and uncertainty versus control group women. Koziol-McClain et al. (2018) reported improved mental health and reduced IPV exposure among Māori New Zealander women who completed the SDA versus controls as well as versus non-Maori participants in the intervention arm. However, the largest implementation of the SDA (Hegarty et al., 2019; $n = 422$ participants) found no improvements in self-efficacy or depression compared to controls at any time point following the delivery of the SDA. Of the listed studies repeating use of the same SDA, no two studies used the same outcome or effect measures.

Among 17 RCTs and four RCT protocols, control arms included the following conditions: waitlist control ($n = 4$), usual care without computer/tablet-mediated screening or intervention delivery ($n = 4$), paper-based screening ($n = 1$), face-to-face screening or intervention delivery ($n = 4$), IPV-specific informational materials ($n = 2$), general health information materials not specific to IPV ($n = 7$), and information or messages not related to health ($n = 3$). Results reported by included RCTs were highly heterogeneous in outcomes of interest, presentation of effect size, and type of control condition used. One secondary IPV prevention RCT (Ahmad et al., 2009) reported an adjusted relative risk of 2.0 (95% confidence interval [0.9, 4.1]) for detection of IPV in a primary care waiting room following a computer-based assessment versus controls who did not complete the assessment. Braithwaite and Fincham (2014) demonstrated that an email-delivered intervention to couples experiencing mild IPV was associated with significantly lower male-perpetrated aggression after 1 year. Physical IPV risk was not statistically different for women in corrections who completed a computerized HIV risk reduction program compared to women who received a face-to-face version (Gilbert et al., 2016).

Quality Review

Study quality review was stratified by type as designated by the MMAT (Online Appendix). Of the 31 studies included in the review, 10 (32%) were rated as having low risk of bias (i.e., met all five criteria based on study type). The remaining studies were rated as having moderate risk of bias (i.e., met between 20% and 80% of the MMAT criteria). The quality review was performed at the publication level based on information available at the time of writing; that is, for RCT protocols, although the limited reported information and lack of results resulted in a reduced MMAT score, it did not necessarily reflect a poor study design. RCT protocols generally had unclear quality for most criteria such as the comparability of intervention and control groups at baseline, even if plans to appropriately randomize groups were described. Among 17 RCTs, only 41% met all five quality criteria, with common pitfalls including insufficient description of randomization processes or lack of masking; however, only 3 (19%) RCTs were rated as having missed more than one fundamental criterion so the overall quality of identified RCTs was acceptable to high. Inclusion of non-peer-reviewed gray literature (e.g., articles published in non-commercial form such as conference proceedings, preprints, dissertations, or theses) such as study data available in dissertations may introduce additional bias. Additionally, publication bias cannot be determined via the MMAT.

Discussion

This systematic literature review sought to examine empirical data on IPV prevention efforts that involved some technology-driven component or in various degrees were delivered and/or evaluated using mHealth web-based or mobile phone technology including e-mail, live video interaction, or mobile app. The number of evidence-based interventions meeting these parameters is still relatively small given both the recent advent of widely available Internet and the rapidity with which Internet platforms are developing. The 31 studies identified in this report clustered in secondary and tertiary prevention interventions that facilitate screening for female victims or encourage

women to leave violent relationships, but few involved primary prevention. Most studies ($n = 21$, 67%) were RCTs or RCT protocols. Despite limitations to the quality of these trials, there is sustained interest in testing the efficacy of mHealth for IPV prevention under controlled conditions with a variety of victim populations.

Extent of Utilization and Feasibility of mHealth Approaches

Although mHealth interventions to prevent IPV circumvent barriers such as desire for anonymity, a mechanism for on-demand access to resources, and the cost of personalized, responsive interaction with participants, the state of the art for interventions at each prevention level is unclear. The relative value of proprietary or made-for-purpose apps compared to existing web-based or mobile-based platforms (as well as issues related to implementation costs or availability to outside researchers to study them) is unclear given that only two included studies attempted to use such an app. A consistent barrier to mHealth success has been unacceptable platforms, especially if participants have to download software or learn how to use new hardware (Peiris, Praveen, Johnson, & Mogulluru, 2014). Some aspects of a made-for-purpose IPV prevention app, such as password protection, may be well suited to mHealth IPV prevention.

Causes of dropout and barriers to uptake were not well-documented in studies reporting rates of dropout, thus limiting interpretability. However, our results were consistent with trends in dropout from mHealth interventions in other fields of study. Analyses in the early 2000s found that attrition rates reached up to 50% for Internet survey research and RCTs (Christensen, Griffiths, & Farrer, 2009). More recent web-based interventions show high compliance rates and reduced attrition rates compared to in-person interventions (Helsel, Williams, Lawson, Liang, & Markowitz, 2018; Mehta et al., 2018; Rootes-Murdy, Glazer, Van Wert, Mondimore, & Zandi, 2018). People are more likely to disclose sensitive information on computer- versus paper-based or face-to-face questionnaires (Herrero & Meneses, 2006), which is compatible with our finding that computer-mediated IPV prevention interventions had the lowest median rate of dropout.

Gaps in Identified Literature

Several gaps and inconsistencies identified by this review limited the overall evidence supporting mHealth interventions for IPV victimization prevention. Lack of standardization of measurement tools between interventions was a major problem, partially stemming from the overall lack of a gold standard measurement for experiences of IPV. While the CTS-2 is commonly used as a reference standard, data demonstrate that it does not account well for the context and purpose of IPV perpetration (Archer, 2000; White, Smith, Koss, & Figueredo, 2000): the scale consistently overestimates frequency of physical IPV perpetration by women (much of which is self-defense) and underestimates men's IPV perpetration (due to reporting bias). This is particularly problematic in evaluation of mHealth effectiveness as self-reported behaviors and outcomes are often the only mechanism for remote measurement. Additionally, while the proportion of studies in preexperimental phases using measures of participant acceptability indicates strong interest in mHealth for IPV prevention, the small number of reportable outcome measurements is insufficient to demonstrate an overall statistical effect. Further, there was a disconnect between intervention activity and rigorous research: first, many identified interventions were academic-community program evaluations with limited outcome assessment (e.g., Gray et al., 2015) and second, the reported acceptability of tested interventions generally did not include feedback from community or provider partners, though this is a critical component to justify scaling up interventions (Kazdin, 2012).

mHealth approaches may be a potential intervention strategy in closing the treatment gap (i.e., the discrepancy between interventions known to be effective and those actually delivered to recipients) in IPV prevention through rapid expansion and dissemination of new avenues to increase access to care for victims, reduced deviation from evidence-based practices (e.g., improved record-keeping, access to automatic prompts, or computer-generated feedback), and reduced incentive to rely upon non-evidence-based practice interventions given lowered costs and increased accessibility to mHealth. Indeed, the key features of intervention models that can close the research-practice gap as outlined by Kazdin (2017) are mediated by inherent characteristics of mHealth approaches—namely, improved reach to underserved individuals overlooked by traditional service delivery models, feasibility and affordability of scaling interventions, expansion of the nonprofessional workforce (including peer feedback and artificial intelligence where appropriate), and implementation in appropriate and flexible (web-based) settings that increase the number of available choices to recipients. Therefore, greater consistency in reporting aspects of these characteristics may improve the quality of evidence for new and ongoing research in evidence-based IPV prevention via mHealth.

Diversity in Research

Web-based approaches to IPV prevention show promise, but improvements in scope and diversity of focus are necessary. Culturally, linguistically, and socially appropriate interventions are critical for any mHealth intervention but especially a phenomenon such as IPV where sociodemographic factors strongly influence risk of exposure and capacity to respond. Sexual and gender minorities (especially where they overlap with vulnerable groups including racial or ethnic minorities), those involved in sex work, individuals who are pregnant or may become pregnant, individuals with HIV or whose intimate partners have HIV, are at especially high risk of IPV victimization (Capaldi et al., 2012). Of 31 studies identified, only three considered pregnant women and three (Koziol-McLain et al., 2018; Sabri et al., 2019; Villegas et al., 2014) focused on

minority women with the intent of cultural adaptation. T. Bloom et al. (2016) considered women in same-sex relationships, but no interventions were identified that attempted to reduce IPV victimization experiences for men in same-sex relationships. Finally, only one study was identified in a low-income country (Cambodia) despite high global cell phone penetration. This may either indicate that mHealth intervention strategies are not being uniformly adopted or, more likely given limitations identified in other systematic reviews of mHealth in low-income settings, that any existing interventions are unlikely to be evaluated or published (Peiris et al., 2014).

Limitations

Despite our rigorous systematic review methods following PRISMA guidelines, this systematic review has several limitations. First, it only included interventions given to adults and may have excluded primary prevention initiatives created for youth. Second, the heterogeneity of identified study designs and lack of consistency of outcome measures, even among RCTs, prevented conduct of a meta-analysis of the effect of mHealth interventions on IPV prevention. Although our search strategy was broad reaching, highly sensitive (i.e., 2.1% of identified citations were considered for full-text review), and conducted with a medical librarian, it is possible that some studies were overlooked, especially given the broad variety of possible terms used to describe both mHealth and IPV (terms which may be culturally bound or nuanced). While articles in multiple languages were screened for this review, many more languages were not considered. This may especially introduce selection bias for gray literature which is less likely than peer-reviewed literature to be translated into English. The inclusion of nonrandomized studies was justified given the intent of summarizing intervention attempts.

Implications for mHealth in IPV Prevention

Sustained interest in large-scale RCTs for IPV prevention via mHealth indicates that web-mediated interventions will increasingly emerge alongside current and future mobile technology. Therefore, we propose the following recommendations for best practices based on the findings of this systematic review: first, expansion of existing platforms; second, inclusion of purposeful mHealth intervention outcomes; and third, incorporation of cost-effectiveness analyses and noninferiority trials (demonstrating that the test intervention is not worse than a comparator known to be effective) relative to evidence-based, conventional IPV prevention programming (Table 3).

Existing mHealth platforms that have been deemed acceptable and desirable where tested should be expanded to larger and more diverse populations because research can only be as good as the quality and availability of programs. Future iterations of programs identified in this review may benefit from adopting methods of implementation science including focus on quality, effectiveness in real-world settings, and feedback from the community and policy makers to broaden evidence of suitability (Bauer, Damschroder, Hagedorn, Smith, & Kilbourne, 2015). Novel and emerging mHealth approaches may benefit from a priori incorporation of community-level considerations, opportunities for feedback from health-care providers and local advocacy groups, and monitoring of training and fidelity to identify barriers to large-scale feasibility.

Table 3. Implications for Improvements to Practice, Policy, and Research.

- Interest in RCTs for IPV prevention using mHealth indicate that that web-mediated interventions will continue to develop in tandem with mobile technology.
- Evidence for efficacy compared to conventional IPV prevention approaches is limited.
- Future research should include:
  - Expansion of existing platforms;
  - Inclusion of purposeful mHealth intervention outcomes; and
  - Incorporation of cost-effectiveness analyses and noninferiority trials relative to evidence-based, conventional IPV prevention programming.

Note. IPV = intimate partner violence.

Throughout the studies identified in this report, evaluations of mHealth components were overwhelmingly dependent on acceptability as an outcome. Participants from a variety of identified populations indicated that mHealth approaches were highly acceptable, yet despite the hypothetical benefits of mHealth for IPV prevention (e.g., increased privacy, on-demand access to desirable resources) the impact is currently unclear. The paucity of mHealth-specific evidence may potentially be corrected through the development of an mHealth quality measure or through tracking uptake of secondary services following IPV screening and provision of highly customizable recommendations, which may be enhanced through improved capacity for follow-up contact with participants via a digital identity.

Finally, while a key benefit of mHealth approaches is the ability to engage populations that may otherwise have received no relevant prevention services, few RCTs compared mHealth approaches to in-person approaches. Future RCTs should consider comparing mHealth to an analog control group in order to facilitate cost-effectiveness analyses and noninferiority trials to ultimately develop evidence that mHealth prevention interventions are a worthwhile use of IPV prevention resources. There is an overall need to improve the rigor of novel mHealth approaches to IPV prevention, including through the use of quasi-experimental and qualitative studies.

Conclusion

Web-based approaches to IPV prevention have the capacity to reduce risk: evidence-based interventions identified in this review demonstrate effective web-mediated access to telehealth services such as CBT, online support groups for victims, and changing behavior expectations through educational programming. This review emphasizes the need for consistency in

outcomes measurement across IPV prevention studies and for mHealth approach feasibility measurements. The low cost of mHealth interventions in general, once developed and tested (Marcolino et al., 2018), supports personalization of IPV prevention programming for minority and marginalized groups that face barriers to conventional IPV prevention services. Further investment in evidence-based mHealth strategies to prevent IPV is warranted.

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