Original Article

Chat-based hotlines for health promotion: a systematic review

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Background: Chat-based hotlines use online messaging services or popular chat applications such as WhatsApp, Facebook Messenger, and WeChat, to connect users to trained health providers or staff. Chat-based hotlines can provide real-time communication between health providers and patients.

Methods: The evidence for chat-based hotlines for health promotion has not been reviewed systematically. Electronic databases (PubMed, Cochrane Database, Google Scholar) were searched to identify English-language studies describing original research published from 2009 to 2020. This review was registered with Prospero Register of Systematic Reviews (ID: CRD42020156670).

Results: Twelve publications met our criteria. Ten studies reported on user characteristics, eight on comparing use of chat-based hotlines with different modes of support, six on health outcomes and six on user satisfaction. Included studies report that chat-based hotlines have been used primarily for crisis and emotional support in high-income countries. Chat-based hotlines using instant messenger applications were preferred over other modes of services such as email, text messaging, voice calls, and face-to-face counselling. Evaluations of health outcomes, although limited in rigor due to mostly observational study designs, indicate mostly positive and statistically significant effects on mental health outcomes such as anxiety, depression, well-being and suicidality. User satisfaction with chat-based hotlines were moderately high.

Conclusions: Chat-based hotlines may be effective ways to deliver crisis support services in high income settings. They may have the potential to be effective in low- and middle-income countries to expand the reach of mental health and crisis support services although such services have not yet been publicly evaluated.

Keywords: Chat-based hotlines; systematic review; crisis support

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Introduction

Traditional hotlines connect callers to service centers via phone call (1,2). Hotlines typically operate 24 hours a day and are commonly used for services such as crime tips, suicide crisis, and support for sexual assault and rape victims, bullying victims, runaway children, and human trafficking victims (1,2). Hotlines have been used for over half a century and were initially created to connect individuals in crisis to live, confidential and anonymous support services outside of normal business hours (2,3). The emergence of hotlines was a crucial step in connecting individuals to services in situations where getting access to in-person services was not possible due to distance, availability of providers, experiences of stigma and shame, the need for confidentiality or the timing of the crisis (1,2). Hotlines have now expanded into additional fields such as health promotion including support to quit smoking or curb other addictions and new modes of communication including instant messaging and app-based chatting (4).

Chat-based hotlines use online messaging services or popular chat applications such as WhatsApp, Facebook Messenger, and WeChat, to connect users to trained health providers or staff (5). Chat-based hotlines have

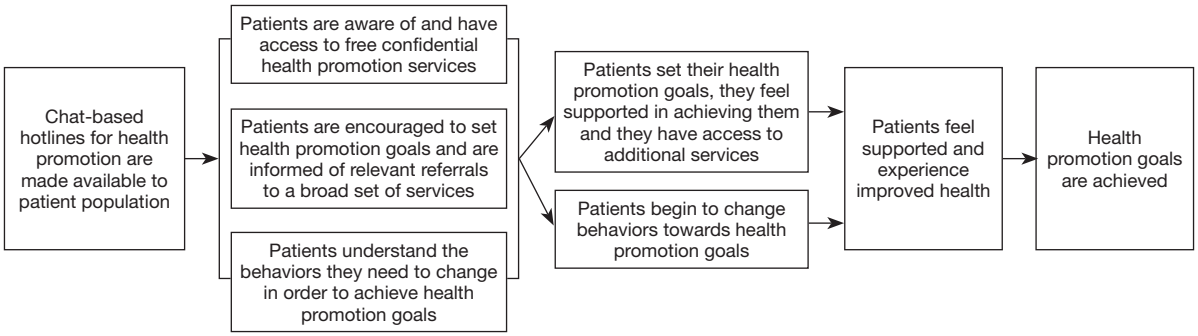

Figure 1 Theory of change for chat-based hotlines.

unique features that make them more attractive for some users. Chatting does not require users to find a private, sound-proof space to discuss private topics; users can be on the bus or at a public library computer. When chatting, users can control the pace of the conversations and discuss things that they may be hesitant to say aloud (6). Today, chat-based hotlines are being used worldwide for such health topics as rape crisis response in the US (6), HIV treatment retention in Peru (7) and remote health services in Malawi (8).

Individual studies evaluating the effectiveness of chat-based hotlines for health promotion demonstrate the growing prevalence of this mode of support. In the Netherlands, children experiencing anxiety and depression who accessed a confidential one-on-one online chat service experienced a higher sense of well-being and a reduced severity of their problems (9). Data from an evaluation of the US National Sexual Assault Online Hotline found that the chat-based hotlines reached more survivors than their call-in line due to the increased anonymity (10). Other studies have found chat-based hotlines to be an effective way to provide sexual and reproductive health advice in the US (11), provide addiction support for alcohol misuse in Hong Kong (12) and provide emotional support for colostomy patients in China (13).

The evidence for chat-based hotlines for health promotion has not been reviewed systematically. This review will assess the existing global evidence on the efficacy of chat-based hotlines for health promotion.

We present the following article in accordance with the PRISMA reporting checklist (available at http://dx.doi.org/10.21037/mhealth-2019-di-13).

Methods

The protocol of this review was registered with Prospero International Register for Systematic Reviews (ID: CRD42020156670).

Theory of change

The theory of change guiding chat-based health promotion hotlines for a specific patient population is as follows. If patients have access to free confidential health promotion chat-based services offered during and outside of business hours, they will use those services to set health promotion goals (i.e., quit smoking, adhere to HIV medication, heal after sexual assault) and get support to start or stop the behaviors they need to change in order to achieve those goals. If they use the services, they will feel supported in achieving those goals and will be able to change their behavior. Then, patients will feel supported and experience improved health which will lead to their health promotion goals being achieved (see *Figure 1*).

Search terms

The following search terms were used in combination to search the literature: “chat-based”, “facebook messenger”, “WhatsApp”, “weChat”, “instant messenger”, “online hotline”, “real-time”, “mobile instant messaging (MIM)”, “online chat”, “Chat”, “health”.

For example, the PubMed search strategy was as follows: (("health"[MeSH Terms] OR "health"[All Fields]) OR "health s"[All Fields]) OR "healthful"[All Fields]) OR

"healthfulness"[All Fields]) OR "healths"[All Fields]) AND "chat-based"[All Fields]) OR "facebook messenger"[All Fields]) OR "WhatsApp"[All Fields]) OR "weChat"[All Fields]) OR "instant messenger"[All Fields]) OR "online hotline"[All Fields]) OR "online chat"[All Fields]) OR "Chat"[All Fields].

The literature search occurred in two phases:

- Phase 1: we searched the following electronic databases: (I) PubMed; (II) Cochrane Database; (III) Google Scholar;
- Phase 2: researchers used the bibliographic back referencing technique. Two researchers reviewed reference lists of included studies and studies that had cited the included studies for additional studies.

We also conducted a supplemental keyword search in google.com based on leads generated by the search described above. For example, if a search identified an article mentioning (but not evaluating) a chat-based hotlines for smoking cessation for key populations through an NGO called iQuit, a search of google.com and google.scholar using the term "iQuit" and several related keywords such as "health" or "chat-based hotline" was conducted to determine whether there was any additional information on the program that might have included evaluation information relevant to the analysis.

Titles and abstracts of search hits were read and excluded when obviously irrelevant. Duplicate references were also excluded. Disagreements about inclusion at this stage were resolved through discussion. If no agreement could be reached, a third independent member of the team was brought in to resolve the disagreement.

Any study identify during this phase were determined to be eligible for full-text review and were then read by two researchers and evaluated based on the below inclusion and exclusion criteria. Researchers who were blinded to each other's decisions and discrepancies were decided through discussion mediated by a third party. The first time inter-rate reliability rate between the two blinded researchers was 85%.

Inclusion criteria

Participants

We included studies of chat-based hotlines where users engaged in one-on-one interactions with healthcare providers, trained staff or trained volunteers.

Type of chat-based hotline

we included studies of chat-based hotline where clients or patients have access to live/real-time chatting during extended hours outside of business hours up to 24 h. We included studies of chat-based hotlines that use text messages, a mobile instant message application (Facebook messenger, weChat and WhatsApp) or a live chatting feature through a website.

Study types

We included all trial protocols, pilot studies, observational, quasi-experimental and experimental quantitative evaluations as long as there is a documented and pre-determined methodology guiding the evaluation.

Outcomes

We included any outcomes that measured the reach of the chat-based hotline such as characteristics of users, utilization data, utilization of referral services and satisfaction by participants as well as effectiveness of the chat-based hotline through measures such as participants' knowledge, attitude, behavior or health outcomes. We also looked for cost-effectiveness outcomes such as the incremental cost-effectiveness ratio.

Time period

We included articles published since 2009 when WhatsApp was initially released (Facebook messenger and weChat were released in 2011 and 2010 respectively).

Exclusion criteria

Participants

We excluded studies about chat-based hotlines that connected two or more staff member such as between supervisors and staff. We also excluded studies about group chat-based hotlines (i.e., a chat room or group chats).

Type of intervention

We excluded studies of chat-based hotlines that required clients or patients to make appointment for chatting or could only chat during certain time periods. We excluded those that examined one-way chat-based hotlines that only provided health education messages or reminders; and we excluded those that used artificial intelligence or chatbots. We excluded chat-based hotlines that used text messages or emails that did not have a live person ready to provide an immediate response.

Study design

We excluded case studies, qualitative studies and modeling

analyses.

Outcomes

We excluded outcomes on staff experiences running the chat-based hotline.

Time period

We excluded articles published before 2009.

Data collection process

Those studies included at this stage underwent a data extract process guided by an electronic data extraction form created using the Google form application. Data was entered into the form which then populated a table with all study details including: author, year of publication, health promotion activity, chat-based hotline details, study population, study location, study type, outcome categories, outcome measures and effects. From this master database, individual tables were then created for study characteristics and the four outcome categories (user characteristics, modes of support, health outcome and user).

Data synthesis

The researchers performed a narrative synthesis that describes the nature, scope and evidence base for chat-based hotlines. Multiple tables are presented in the results section that provide details on the health promotion activity, the type of chat-based hotlines, the population groups, the outcome categories and the effects. If chat-based hotlines were being compared to other types of hotline formats, this was noted and described in the table. The direction of main effect was coded as either positive, negative, or no effect and as either significant or non-significant.

Analysis of outcome categories

We examined four outcomes categories: user characteristics, modes of support, health outcome and user satisfaction based on the data trends from included studies. Summary measures included difference in proportions and means, risk ratios, and odds ratios.

Risk of bias assessment

Two researchers worked independently to assess the rigor of each study using the National Institute of Health Study Quality Assessment Tools specific to the study design (available at: https://www.nhlbi.nih.gov/health-topics/study-quality-assessment-tools). Using these tools, reviewers assigned a quality rating of good, fair or poor to each study. If there was a disagreement between reviewers, it was resolved through discussion. The results of the risk of bias assessment is included in the results section.

Results

A total of 4,406 records were identified in the initial screening process; 151 duplicates were removed and 4,142 records were excluded based on the inclusion and exclusion criteria listed above. The remaining 113 full-text articles were read and assessed for eligibility; 102 articles were removed based on a closer examination of their fit with the inclusion and exclusion criteria and 11 studies were included in the final analysis. Five additional articles were identified through bibliographic back referencing; 4 were excluded and 1 was included in the final analysis. A total of 12 studies were included in the final narrative synthesis for this review. *Figure 2* provides the screening and inclusion process for this review.

Study type, health promotion activity, location, chat-based hotline details, program additions, and primary study population per each study are listed in *Table 1*. Study types included 6 cross-sectional (10,14-18), 4 pre-post with no control group (9,11,19,20), one study protocol (2), and one randomized control study (13).

Seven studies focused on emotional support (9,10,13-16,19); two studies focused on sexual and reproductive health information (11,20); two studies focused on addiction support (12,17); and one study focused on enhancing service accessibility (18). Studies emphasized on problem gambling (14,17); sexual assault (10); mental health and suicide (15,16,19); lesbian, gay, bisexual, transgender and questioning (LGBTQ) youth (16); alcohol and other substances (12,18); and colostomy patients (13). Additionally, some studies served specific age groups, such as children (9), adolescents and youth (16,19,20), teens and young adults (11), and adults (12,13). Studies were only located in high income countries: Australia (14,17,18); United States of America (10,11,16,20); Netherlands (9,15), Canada (19), China (13), and Hong Kong (12).

Nine programs had 24-hour or continuous methods for the chat-based hotline (9,10,12,13,15-18,20) and three programs had extended times for chat-based services (11,14,19). Of the three chat-based hotlines with extended

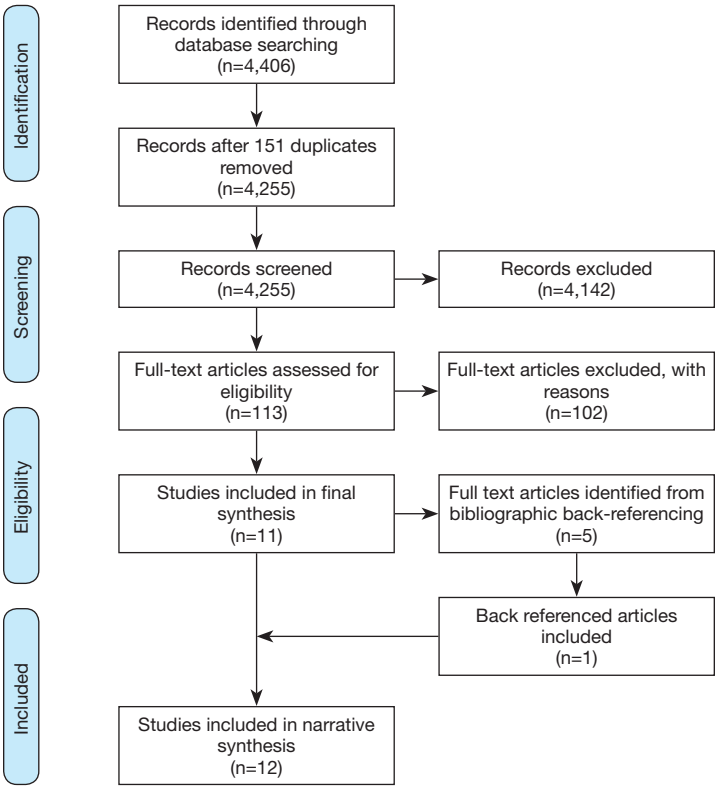

Figure 2 Screening and inclusion process.

times, two were available during and after business hours (11,14), one was available on weekends (11), and one was supplemented with a 24-hour voice line (19). Chat-based hotline respondents included trained counselors (14,16-19), volunteers (9,10,15), and other professionals (11,13,20).

One study utilized WhatsApp as the communication platform (12); one study utilized WeChat and QQ (13); and ten studies utilized helplines or other web-based platforms (9-11,14-20). Nine studies had additional interventions to the chat-based hotline program (9,11-13,15-17,19,20). Chat-based hotline additions included voice call and telephone support (9,13,15,16,19); text messaging (11,20); email support (17); and educational/informational resources (12,13,15,16).

User characteristics

Ten studies measured characteristics of the chat-based applications and its users (9,11,13-20). All ten studies contributed information on the gender of users and user age (9,11,13-20); five studies included user ethnicity (11,14,16,19,20); and three included information regarding first time users (9,14,17).

Seven studies compared user characteristics between chat-based hotlines and other hotlines (9,11,13,17-20). Most studies found that chat users were more likely to be female (9,11,14-16,18-20) with the exception of one who found that males were more likely to be chat users (17). Among studies that reported on race/ethnicity, the majority of participants were white/Caucasian (11,14,16,19,20). Of studies that reported on age, a majority found that younger participants were the primary users: under 40 years old (14,17); average of 13.8 years (9); 18–24 years (11); 14–17 years (19); 15–19 years (20); 18–34 years (15); average of 17.6 years (16); and under 24 years (18) (*Table 2*).

Mode of support comparisons

Eight studies compared chat-based programs with other modes of support (9,11-13,17-20). Of those eight, two studies compared chat to voice call (9,19), two studies compared chat to text messages (11,20), one study compared chat to email (17), two studies compared chat to standard care (12,13), and one study compared

Table 1 Characteristics for studies describing chat-based hotlines

Study citation	Study type	Health promotion activity	Location	Chat-based hotline details	Program additions	Study population
Dowling 2014	Cross-sectional study	Emotional support for Concerned Significant Other (CSOs) of people with problem gambling	Australia	Business & after hours web-based chat available by counselors from Gamble Help Online	N/A	'Concerned Significant Others' (CSOs) of people with problem gambling
Finn 2011	Cross-sectional study	Emotional support for survivors of sexual assault	United States of America	24/7 internet-based chat available by trained volunteers from NSOAH	N/A	Volunteers and users of NSAOH
Fukkink 2009	Pre-post study with no control	Emotional support for children	Netherlands	Online Chat (chatters) available by a trained volunteer from Kindertelefoon	Voice call (caller) available by a trained volunteer from Kindertelefoon	Children between the ages 8 - 18 years
Giorgio 2013	Pre-post study with no control	Sexual and reproductive health info and advice for adolescents	United States of America	Mon–Thur 9 am–12 am, Fri 9 am–10 pm, Sat 9 am–5 pm, & Sun 2 pm–12 am web-based chat available by trained agents about reproductive and sexual health	Mon–Thur 9 am–12 am, Fri 9 am–10 pm, Sat 9 am–5 pm, and Sun 2 pm–12 am Text Message available by trained agents about reproductive and sexual health	Teens and young adults in need of sexual and reproductive health info
Haner 2016	Pre-post study with no control	Emotional support for adolescents with mental health and suicidal problems	Canada	5 days a week from 6 pm to 2 pm ET available Live Chat with trained counselors from Kids Help Phone	24/7 voice call available by counselors from Kids Help Phone	Adolescents using Kids Help Phone line with mental health and suicidal problems
Levitz 2018	Pre-post study with no control	Sexual and reproductive health information and advice for adolescents	United States of America	Web-based and mobile phone chat available by health educators from Planned Parenthood Chat/ Text program	Text message available by health educators from Planned Parenthood Chat/ Text program	Adolescents and young adults
Mokkenstorm 2017	Cross-sectional study, examining reach and outcomes of chat-based hotline	Emotional support for those experiencing suicidal crisis	Netherlands	For persons in suicidal crisis with volunteer helpers from 133Online Suicide Prevention Crisis Chat Service	Helplines, online self-help course, self-assessment tests, and brief online psychotherapy	Persons in suicidal crisis

Table 1 (*continued*)

Table 1 (*continued*)

Study citation	Study type	Health promotion activity	Location	Chat-based hotline details	Program additions	Study population
Rhoades 2018	Cross-sectional study, comparing youth in study to organization's overall chat contacts	Emotional support for suicidal LGBTQ youth (12–24 years)	United States of America	Daily chat or text crisis services staffed by trained counselors from a suicide crisis services organization	24/7 crisis phone line, and an online social networking platform and resource center	LGBTQ youth (12–24 years) utilizing suicide crisis prevention services
Rodda 2014	Cross-sectional Study, comparing chat-based hotline to email	Addiction support for those experiencing problem gambling	Australia	24 h chat available with trained counselors from Gambling Helpline website	Email support: delayed response with registered psychologists or social workers from Gambling Help Online website	Anyone concerned about problem gambling
Swan 2009	Cross-sectional Study, comparing web-based to telephone to traditional counseling	Enhance service accessibility for alcohol and other drug (AOD) users	Australia	24/7 web-based counseling service with AOD professionals/counselors from CounsellingOnline website	N/A	Community members in-need of specialist AOD interventions
Wang 2019	Study protocol	Addiction support for alcohol misuse	Hong Kong	Continuous interactive chat-based intervention via WhatsApp	Face-to-face Alcohol Brief Intervention (ABI) and alcohol leaflet from Dept. of Health (DH)	Hong Kong adults (18–65 years) who scored 8 or more on the Alcohol Use Disorder Identification Test (AUDIT)
Xia 2019	RCT	Emotional support for colostomy patients	China	Continuous care model where patients can communicate with colostomy therapist via WeChat and QQ	Telephone; self-management manual; video on colostomy care; education program on colostomy care; home visits; designated caregiver (family member)	Adults (18–70 years) with a permanent colostomy

Table 2 Characteristics of users from studies describing chat-based hotlines

Study citation	Characteristics measured	Results
Dowling 2014	Characteristics of users accessing web-based counselling (real time chat) (n=366)	Most identified as Australian (65.6%); female (83.6%); under 40 years (75.1%); first time accessing counselling about the gambling problem (81.1%). 42.6% accessed after hours; 33.9% during business hours; 23.5% during weekends
Fukkink 2009	Characteristics of Kindertelefoon records for chat and telephone groups (compared)	More girls accessed services (chat =80%; phone =71%); no statistical significance between gender, chat and phone. Chatters were older (13.8 years) than callers (12 years). Emotional problems brought up more during chat (52% *vs.* 40%). Online chat conversations lasted longer than phone (28.3 *vs.* 8.3 min). Majority were first time contacts (chat =97%; phone =93%)
Giorgio 2013	Characteristics of program users and conversations by mode (IM *vs.* texting)	General users were mostly white (46.17%); 18–24 years (51.2%); female (89.29%)
		Texting users more likely male than IM users (14.15% *vs.* 10.19%); Latino/ Hispanic (24.65% *vs.* 18.41%); and 17 years or younger (39.02% *vs.* 20.90%)
Haner 2016	Characteristics	Majority were 14–17 years (65.7% of chatters and 56.6% of callers); female (chat =87.39% and call =73.80%); significantly larger proportion of male youth who chose phone than chat (P=0.00028). 35.9% of chatters and 20.4% of callers identified with non-heterosexual orientations. Majority identified with dominant Caucasian, western European, Canadian, or Quebécois cultures (67.8% chatters, 67.9% callers)
Levitz 2018	Differences in characteristics between mobile phone web-based chat and desktop web-based chat	Majority of users were female (90.35% = mobile chat; 89.84% = desktop chat); white (47.37% = mobile chat; 54.55% = desktop chat); aged 15-19 (65.85% = mobile chat; 58.61% = desktop chat).
Mokkenstorm 2017	Chat and chat visitor characteristics	Most chat visitors were female (72.6%); and under 34 years (75.8%), where most were between 18–34 years (53.6%)
Rhoades 2018	Participant characteristics	On average 17.6 years; mostly cisgender female (34%); white (63%); gay/ lesbian (36%). 32% were free or reduced-priced lunch eligible; 32% had ever experienced homelessness; 59% reported their parents were aware of LGBTQ identity; 49% had experienced parental rejection
Rodda 2014	Characteristics of people who access real time chat and email support	Email users significantly more likely to be new treatment seekers (78.0%) compared with chat (68.1%). Chat users were more often male (60.6% *vs.* 53.8%, P<0.001) and under 40 years (72.2% *vs.* 56.9%) compared to email users. Over 70% of chat users used services during evening, overnight, or weekend times
Swan 2009	Client Characteristics between CounsellingOnline, DirectLine telephone, and conventional AOD counselling	CounsellingOnine and DirectLine clients more likely to be female (68.3% and 58.3%); conventional clients more likely to be male (66%). CounsellingOnline clients were more youthful than other interventions (30.4% under 24 compared to 11.2% and 14%). Majority of CounsellingOnline clients were employed (67.5% *vs.* 45.3% and 30%)
Xia 2019	Characteristics for enterostomy patients	No statistically significant differences between the two groups in terms of gender, age, levels of education, marriage status, medical insurance situation, monthly income, status of employment

chat to voice call and standard care (18). Chat was a preferred method of intervention among 5 of the studies (9,13,17,19,20); 1 study yielded mixed results (11); 1 study did not specify user preference (18); and there were no results for the study protocol (12). Between the two studies that compared chat to voice call, chat was preferred (9,19). Between the two studies that compared chat to text message, one study showed preferences to text message among racial minorities (11), whereas the other study preferred mobile phone and desktop chat over text

Table 3 Comparing chat to other modes of service from studies describing chat-based hotlines

Study citation	Chat-based hotlines compared to other modes of support	Results of comparison
Fukkink 2009	Voice Call	Chat was more preferred than telephone (P<0.001). More effective in improving well-being (P=0.02) and decreasing burden (P<0.001)
Giorgio 2013	Text Message	Younger racial minorities preferred text than chatting via instant message. No difference in levels of worry post-chat for text *vs.* IM
Haner 2016	Voice Call	Larger proportions of adolescents chose chat over phone. High-school aged chose chat was greater (P=0.01242) & male youth chose phone was larger (P=0.00028) & more non-heterosexual in chat (P=0.00084)
Levitz 2018	Text Message	Most preferred mobile phone & desktop chat, only 0.70% used text. All 3 modes weren't significantly associated with user confidence. Desktop chat compared to mobile phone had a non-sig neg effect on confidence and sig with a pos effect
Rodda 2014	Email	Chat more popular than email (85% chose chat over email). Males accessed chat more than email (P<0.05). Participants <40 years preferred chat over email (72.2% *vs.* 56.9%). Over 70% accessed real time chat during evening, overnight or weekend; email was used more often during business hours than chat [37.8% *vs.* 30.7%, v2(1) =5.98, P=0.014]
Swan 2009	Voice call and conventional counselling	Preference between modes unknown. 62% accessed online service for privacy component and 78.6% chose to engage in services anonymously
Wang 2019	Face-to-face counseling	Unknown (study protocol)
Xia 2019	Routine standard of care	Experimental group had significantly better physical and psychological outcomes and suffered fewer colostomy complications. The continuous care model improved the quality of life of patients at 1 and 3 months. More patients were satisfied with continuous care model than the control model (P=0.0015)

message (20). For the study comparing chat to email, users preferred chat (17). For the two studies comparing chat to standard care, only one had results: one study yielded significant results in utilizing chat (13), whereas we were unable to determine the results for the study protocol (12). Lastly, the study comparing chat to voice call and standard care resulted in chat being utilized more however user preference was not specified (18) (*Table 3*).

Health outcomes

Six studies contributed data on health outcomes. Six articles yielded health outcomes (9,11,13-16). Each of the studies used different scales to measure health effect. One study uses the Problem Gambling Significant Other Impact Scale (PG-SOIS) to measure emotional impact on concerned significant others and found a positive non-significant correlation between problem gambling and emotional impact (14). Another study uses the Cantrill Scale to measure well-being and Strengths and Difficulties Questionnaire (SDQ) to measure quality of life of children, which resulted in a positive non-significant correlation for well-being and positive significant correlation for quality of life (9). One study uses pre-post surveys to measure levels of worry, which resulted in a positive non-significant correlation in feeling less worried post-chat (11). Additionally, one study uses the Crisis Call Outcome Rating Scores (CCORS) to measure emotional states and suicidality of callers, which resulted in most callers (86.1%) were in a suicidal crisis and a positive significant correlation between CCORS and improvements in emotional state and suicidal ambivalence (15).

Another study uses Beck Hopelessness Scale Short Form to measure hopelessness, Abbreviated posttraumatic stress disorder (PTSD) Civilian Checklist to measure PTSD, Center for Epidemiologic Studies Depression Scale Short Form (CES-D-4) to measure depression, Interpersonal Needs Questionnaire (INQ) to measure belonging and burdensome, and Columbia-Suicide Severity Rating Scale (C-SSRS) and Suicide Behaviors Questionnaire-Revised (SBQ-R) to measure suicidality in LGTBTQ youths,

which resulted in a positive significant correlation in feeling hopelessness, PTSD, depression, suicidal ratings and behaviors, and a positive nonsignificant correlation in feelings of belonging and burdensome (16). The last study uses the State-Trait Anxiety Inventory (STAI) to measure anxiety, Stoma Care Self-Efficacy Scale to measure self-efficacy, and Stoma-QOL to measure quality of life for colostomy patients, which resulted in a positive significant correlation for anxiety after three months, self-efficacy after one and three months, quality of life after one and three months (13) (*Table 4*).

User satisfaction

Table 5 describes the user satisfaction measures and results. Six studies used questionnaires to measure perceived helpfulness and satisfaction of the service (9-11,13,18,20). From the six studies, participants reported high levels of satisfaction with the services provided (9-11,13,18,20).

Risk of bias assessment results

Table 6 shows the risk of bias assessment results for all studies included in the review. Risk of bias was measured for 11 of the studies. Risk of bias was not measured for the study protocol. Each article was assessed using the appropriate guidelines using the Study Quality Assessment Tools. Six studies were assessed using the Quality Assessment Tool for Observational Cohort and Cross-Sectional Studies (*Table S1*), 4 studies were assessed using the Quality Assessment Tool for Pre- and Post-Interventions (*Table S2*), and the remaining study was assessed using the Quality Assessment of Controlled Intervention Studies tool for randomized control trials (*Table S3*).

Each study was given an overall quality rating as shown in *Figure 2*. Quality ratings were evaluated on a scale of Good, Fair, or Poor. Four studies were given an overall rating of Good (9,11,13,17) and seven studies were rated as Fair (10,14-16,18-20). No studies were rated as poor.

Discussion

The findings of this review show that chat-based hotlines have been used for health promotion mostly in the area of emotional support especially for younger (12–24 years old) and female user and have only been evaluated and published in high-income countries. Chat-based hotlines using instant messenger applications were generally preferred by users over other modes of services such as email, text messaging, voice calls, and face-to-face counselling. Evaluations, although limited in rigor due to mostly observational study designs, indicate mostly positive significant effects on mental health outcomes such as anxiety, depression, well-being and suicidality. None of the studies reviewed had a negative effect or no effect. Additionally, we found that user's satisfaction with the services to be moderately high.

The majority of individuals who accessed chat-based hotlines were seeking urgent emotional support services, demonstrating that chat-based services can be instrumental in crisis settings. Additionally, chat-based hotlines included in this study were used for other health promotion activities such as sexual reproductive health advice, addiction support, and a range of other health advice. From the broader literature, we know that telephone hotlines in the US have been used for a much broader range of health promotion services such as the safety for runaways, domestic violence, poison control, eating disorders, HIV treatment, addiction and shoplifting (21). There may be potential for the expansion of chat-based hotline applications to a wider range of health services.

We found that chat-based hotlines have only been evaluated in high-income countries and that evaluation designs lacked rigor. Systematic reviews of telephone-based hotlines or helplines in specific health areas have been conducted including hotlines for cancer caregiver support (22), cancer patient support (23) tobacco smoking cessation (24,25) and alcohol use (24). Results from these hotline reviews also found that published evaluations mostly come from high income countries. These reviews also found that there was limited ability to claim efficacy of the hotlines due to lack of rigor in evaluation designs. The handful of randomized trials that were included in these reviews demonstrated positive findings (22,23).

We did not find any information on cost or cost effectiveness of chat-lines in the included studies in this review but other studies have found telephone hotlines to be cost-effective such as in Belgium where a suicide hotline was found to be cost-saving for the national health insurance plan (26), in New Zealand where a national smoking quitline service was found to be cost saving for the national health system (27) and in Denmark where a national smoking quitline was found to be cost-effective in comparison to other smoking cessation interventions (28). Assessing the cost effectiveness of chat-based hotlines as compared to telephone hotlines is an important research area for funding and scaling this type of intervention.

Table 4 Health outcomes from studies describing chat-based hotlines

Study citation	Study design	Scale or concept	Outcomes measured	Direction and significance of effect
Dowling 2014	Cross-sectional	Problem Gambling Significant Other Impact Scale (PG-SOIS)	Friends significantly lower (emotional, P=0.001), partners (emotional, P=0.001), and parents (emotional, P=0.002) than children. Females significantly higher emotional impacts (P=0.01)	Positive, significant
Fukkink 2009	Pre/post without controls	Well-being (Cantrill Scale); Quality of life (SDQ)	Increase well-being and decrease of the burden was associated with greater satisfaction (P<0.001 & P=0.008) Follow-up showed increase in well-being (P<0.001) and decrease in burden of the problem (P<0.001)	Positive, significant Cantrill Ladder—positive, ns; SDQ—Positive, significant (P<0.001)
Giorgio 2013	Pre/post without controls	Levels of worry	Levels of worry: Pre-chat: 43.22% felt very worried, 45.12% felt somewhat worried, and 11.65% felt not worried. (P<0.001) Post-chat: 19.77% felt very worried, 51.93% felt somewhat worried, and 28.74% felt not worried (P<0.001). Feeling better post-chat was associated with <17 years (AOR 1.42) and Latino/Hispanic (AOR 1.31)	Positive, significant Pre-post survey for levels of worry (P<0.001)
Mokkenstorm 2017	Cross-sectional	CCORS (Crisis Call Outcome Rating Scores); emotional state; suicidality	CCORS: mixed results (27.6% dissatisfied and 28.7% satisfied). Emotional state: mental health problems were mentioned most frequently by 59.7% of the visitors Suicidality: most visitors were in suicidal crisis (86.1%). Females and those under 18 years old were more often in suicidal crisis and mentioned mental health problems	Positive, significant CCORS and number of improvements in emotional state (P<0.001) CCORS and suicidal ambivalent groups (P=0.017) CCORS whose suicidal ambivalence deteriorated during chat sig. lower than no change in ambivalence (P=0.014) and wanting to live (P=0.005)

Table 4 (*continued*)

Table 4 (*continued*)

Study citation	Study design	Scale or concept	Outcomes measured	Direction and significance of effect
Rhoades 2018	Cross-sectional with comparison group	Beck Hopelessness Scale (Short Form)	Beck hopelessness Scale: Average scores on the mental health disorder symptom scales were 1.8 (SD =1.4)	Positive, significant
		Abbreviated PTSD Civilian Checklist	Abbreviated PTSD civilian checklist: 20.7 (SD =5.8)	Beck Hopelessness Scale—pos./sig. (P<0.05); Abbreviated PTSD Civilian Checklist—pos./sig. (P<0.05); CES-D-4—pos./sig. (P<0.05); INQ—pos./ns (P>0.05); C-SSRS and SBQ-R—pos./sig. (P<0.05)
		Depression Scale Short Form (CES-D-4)	CES-D-4: 6.9 (SD =3.6)	
		Interpersonal Needs Questionnaire (INQ)	INQ on belonging: 21.5 (SD =6.9)	
		Columbia-Suicide Severity Rating Scale (C-SSRS)	INQ on burdensome: 15.1 (SD =9.4)	
		Suicide Behaviors Questionnaire-Revised (SBQ-R.		
Xia 2019	RCT	State-Trait Anxiety Inventory (STAI)	STAI: no difference in anxiety levels of the experimental and control groups before surgery; statistical significance at 3 months	Positive, significant
		Stoma care self-efficacy scale	Self-efficacy: at 1 month, experimental group's self-efficacy score was significantly higher and even higher at 3 months	STAI (P<0.0001) after 3 months; self-efficacy (P<0.0001) at 1 and 3 months; quality of life (P<0.0001) at 1 and 3 months
		Stoma-QOL	Quality of life: no statistically significant difference in either group at discharge. After 1 month, QoL increased and decreased in the experimental group (P<0.0001). No statistically significant difference in overall health status dimension (OHSD) and the cognitive and social functions (CFandSF) in either group (P>0.05). Statistically significant differences in all dimensions of quality of life scale were found in both groups at 3 months (P<0.05)	

Pos., positive effects; ns, not significant.

Table 5 User Satisfaction from studies describing chat-based hotlines

Study citation	Satisfaction measures	Results of satisfaction measures
Finn 2011	Questionnaire using five Likert-type for overall satisfaction	Positive, significant: 70% are satisfied overall with the NSAOH services, whereas 19% were dissatisfied (P<0.01)
Fukkink 2009	1 to 9 scale Questionnaire on satisfaction	Positive, non-significant: online chat group were more satisfied: feeling supported (6.8), knowing what to do (6.2), being taken seriously (7.8), made to feel at ease (7.2), comprehensible (7.8), not organized (7.1), and thinking along (6.6)
Giorgio 2013	Post-chat survey to rate helpfulness	Positive, significant: 61.91% of users reported overall satisfaction with helpfulness (P<0.001)
Levitz 2018	Post-survey on helpfulness satisfaction	Positive, non-significant: overall Satisfaction: 52.44% strongly agreed, 31.35% agreed, 7.50% disagreed, and 8.70% strongly disagreed
Swan 2009	Survey measuring client satisfaction	Positive, non-significant: 64.5% reported the service was very easy to use, 19.2% reported easy to use, and 73.3% experienced no difficulties using the service
Xia 2019	Post-survey using five Likert-type Scale	Positive, significant: patients receiving continuous care was 4.15±0.21, and was 3.97±0.45 for patients receiving control model (P=0.0015). Most patients were satisfied with the continuous care model

Table 6 Risk of bias assessment rating for included studies describing chat-based hotlines

Study name	Quality rating
Dowling 2014	Fair
Finn 2011	Fair
Fukkink 2009	Good
Giorgio 2013	Good
Haner 2016	Fair
Levitz 2018	Fair
Mokkenstorm 2017	Fair
Rhoades 2018	Fair
Rodda 2014	Good
Swan 2009	Fair
Xia 2019	Good

There are some limitations of this review. First, our systematic review only included studies available in English. Although a majority of the studies found were in English, there were two studies which were excluded due to language limitations. Second, this review only included studies where full text articles or study protocols were available. Although a majority of the articles requested were available, one study was excluded due to the researchers' inability to obtain a copy of the full text of the article. Third, as with any review, there is potential for publication bias; only peer-reviewed articles published in accessible sources were considered. Organization reports and news articles that discuss chat-based hotlines were not included. Finally, as with most systematic reviews, there is also potential for research bias when applying inclusion criteria and risk of bias assessment criteria. We attempted to minimize this bias by having two researchers work independently and a third researcher to decide in the case of discrepancies.

While the evidence base for the effectiveness of chat-based hotlines in the peer-reviewed literature is limited, they are becoming more popular in the US and in other high-income countries. Large US-based crisis support hotlines such as the National Suicide Prevention Lifeline, RAINN and the National Domestic Violence Hotline have developed chat-based options in response to user preferences. In 2014, many police stations across the US started offering a texting option for 911 callers (29). Expansion of chat-based hotlines to low- and middle-income countries has potential given that mobile phone and mobile application use have grown exponentially over the last fifteen years (30).

Health promotion organizations, particularly those providing crisis support services through telephone hotlines, may also want to consider how chat-based hotlines can expand the reach of their services and user types. In addition, providing an alternative to voice-based hotlines may increase user satisfaction. For researchers monitoring and evaluating chat-based hotline user health outcomes, using standardized metrics such as the CCORS (31) will

improve our ability to determine the efficacy of chat-based hotlines among different health outcome categories and modalities. Determining the cost-effectiveness of chat-based hotlines compared to existing interventions is also recommended.

Program planners and funders should consider evaluating whether or not this scalable and potentially cost-effective services may improve health in other contexts and for other types of health promotion activities especially in low- and middle-income countries.

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Footnote

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Supplementary

Table S1 Risk of bias assessment for observational studies (n=6)

Question	Yes	No	Cannot determine
1. Was the research question or objective in this paper clearly stated?	100%	0%	0%
2. Was the study population clearly specified and defined?	100%	0%	0%
3. Was the participation rate of eligible persons at least 50%?	33.2%	33.2%	33.2%
4. Were all the subjects selected or recruited from the same or similar populations (including the same time period)? Were inclusion and exclusion criteria for being in the study prespecified and applied uniformly to all participants?	100%	0%	0%
5. Was a sample size justification, power description, or variance and effect estimates provided?	16.6%	83.3%	0%
6. For the analyses in this paper, were the exposure(s) of interest measured prior to the outcome(s) being measured?	16.6%	83.3%	0%
7. Was the timeframe sufficient so that one could reasonably expect to see an association between exposure and outcome if it existed?	0%	100%	0%
8. For exposures that can vary in amount or level, did the study examine different levels of the exposure as related to the outcome (e.g., categories of exposure, or exposure measured as continuous variable)?	0%	0%	100%
9. Were the exposure measures (independent variables) clearly defined, valid, reliable, and implemented consistently across all study participants?	33.2%	33.2%	33.2%
10. Was the exposure(s) assessed more than once over time?	0%	83.3%	16.6%
11. Were the outcome measures (dependent variables) clearly defined, valid, reliable, and implemented consistently across all study participants?	50%	50%	0%
12. Did the authors report that the sample size was sufficiently large to be able to detect a difference in the main outcome between groups with at least 80% power?	0%	0%	10%
13. Were outcomes reported or subgroups analyzed prespecified (i.e., identified before analyses were conducted)?	0%	0%	100%
14. Were all randomized participants analyzed in the group to which they were originally assigned, i.e. did they use an intention-to-treat analysis?	0%	0%	100%

Table S2 Risk of bias assessment for pre-/post-test studies (n=4)

Question	Yes	No	Cannot determine
1. Was the study question or objective clearly stated?	100%	0%	0%
2. Were eligibility/selection criteria for the study population prespecified and clearly described?	100%	0%	0%
3. Were the participants in the study representative of those who would be eligible for the test/service/intervention in the general or clinical population of interest?	50%	25%	25%
4. Were all eligible participants that met the prespecified entry criteria enrolled?	100%	0%	0%
5. Was the sample size sufficiently large to provide confidence in the findings?	50%	25%	25%
6. Was the test/service/intervention clearly described and delivered consistently across the study population?	75%	25%	0%
7. Were the outcome measures prespecified, clearly defined, valid, reliable, and assessed consistently across all study participants?	50%	50%	0%
8. Were the people assessing the outcomes blinded to the participants' exposures/ interventions?	50%	0%	50%
9. Was the loss to follow-up after baseline 20% or less? Were those lost to follow-up accounted for in the analysis?	25%	0%	75%
10. Did the statistical methods examine changes in outcome measures from before to after the intervention? Were statistical tests done that provided P values for the pre-to-post changes?	100%	0%	0%
11. Were outcome measures of interest taken multiple times before the intervention and multiple times after the intervention (i.e., did they use an interrupted time-series design)?	0%	100%	0%

Table S3 Risk of bias assessment for randomized control trials (n=1)

Question	Yes	No	Cannot determine
1. Was the study described as randomized, a randomized trial, a randomized clinical trial, or an RCT?	100%	0%	0%
2. Was the method of randomization adequate (i.e., use of randomly generated assignment)?	100%	0%	0%
3. Was the treatment allocation concealed (so that assignments could not be predicted)?	100%	0%	0%
4. Were study participants and providers blinded to treatment group assignment?	100%	0%	0%
5. Were the people assessing the outcomes blinded to the participants' group assignments?	100%	0%	0%
6. Were the groups similar at baseline on important characteristics that could affect outcomes (e.g., demographics, risk factors, co-morbid conditions)?	100%	0%	0%
7. Was the overall drop-out rate from the study at endpoint 20% or lower of the number allocated to treatment?	100%	0%	0%
8. Was the differential drop-out rate (between treatment groups) at endpoint 15 percentage points or lower?	100%	0%	0%
9. Was there high adherence to the intervention protocols for each treatment group?	0%	0%	100%
10. Were other interventions avoided or similar in the groups (e.g., similar background treatments)?	100%	0%	0%
11. Were outcomes assessed using valid and reliable measures, implemented consistently across all study participants?	100%	0%	0%
12. Did the authors report that the sample size was sufficiently large to be able to detect a difference in the main outcome between groups with at least 80% power?	0%	0%	100%
13. Were outcomes reported or subgroups analyzed prespecified (i.e., identified before analyses were conducted)?	100%	0%	0%
14. Were all randomized participants analyzed in the group to which they were originally assigned, i.e., did they use an intention-to-treat analysis?	100%	0%	0%