**The acceptability of Artificial Intelligence (AI)-enabled chatbots, video consultations and live webchat as online platforms for sexual health advice**

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**Abstract**

Objectives: Sexual and reproductive health (SRH) services are undergoing a digital transformation. This study explored the acceptability of three digital services, (i) video consultations via Skype, (ii) live webchat with a health advisor and (iii) artificial intelligence (AI)-enabled chatbots, as potential platforms for SRH advice. Methods: A pencil-and-paper 33 item-long survey was distributed in three clinics in Hampshire, UK for patients attending SRH services. Logistic regressions were performed to identify the correlates of acceptability.

Results: In total, 257 patients (57% women, 50% below the age of 25 years) completed the survey. As the first point of contact, 70% preferred face-to-face consultations, 17% telephone consultation, 10% webchat and 3% video consultation. Most would be willing to use video consultations (58%) and webchat facilities (73%) for ongoing care, but only 40% found AI chatbots acceptable. Younger age (<25) OR=2.43 [95%CI:1.35-4.38], White ethnicity OR=2.87 [95%CI:1.30-6.34], past sexually transmitted infection (STI) diagnosis OR=2.05 [95%CI:1.07-3.95], self-reported STI symptoms OR=0.58 [95%CI:0.34-0.97], smartphone ownership OR=16.0 [95%CI:3.64-70.5] and the preference for a SRH smartphone application OR=1.95 [95%CI:1.13-3.35] were associated with video consultations, webchat or chatbots acceptability. Conclusion: Although video consultations and webchat services appear acceptable, there is currently little support for SRH chatbots. The findings demonstrate a preference for human interaction in SRH services. Policy-makers and intervention developers need to ensure that digital transformation is not only cost-effective but also acceptable to users, easily accessible and equitable to all populations using SRH services.

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| Key messages |
| * The majority (70%) of sexual health service attendees prefer face-to-face contact over digital communication channels as the first point of contact. * Most service users would be willing to use live webchat (73%) and video consultations (58%), but not an automated AI chatbot platform (40%). * An AI platform for sexual health advice was not acceptable amongst patients attending sexual health services who perceived having STI symptoms. |

**Introduction**

In England, the overall provision of sexual and reproductive health (SRH) services has been reduced by 14% between 2014 and 2018 due to austerity, with a 35% decrease in funding for education, advice and prevention [1]. There has been a 15% drop in access to contraceptive services, such as emergency contraceptives, amongst women and girls in the same period [2]. Rates of chlamydia, gonorrhoea and syphilis have been increasing since 2014with the latest statistics indicating a 5% increase in sexually transmitted infections (STIs) between 2017 and 2018, suggesting that such severe cuts are a major public health concern [3]. Some SRH services have been considering digital and online methods of disseminating educational material in an affordable way by encouraging patients to utilise self-learning and self-care websites and mobile phone applications [4]. These digital interventions, such as web pages social networking sites and text-based platforms, aim to provide information about STIs and risk factors as well as promote screening for STIs (self-sampling or self-testing kits by mail) [5]. They engage with marginalised or isolated individuals at higher risk of STIs, especially young people, men who have sex with men, and black minority ethnic groups that face multiple barriers in accessing SRH services.

Around 90% of adults in the UK now have access to the Internet and nearly 95% of those aged between 16 and 24 own a smartphone [6]. Thus, providing health education through digital communication channels could increase access to care, allowing better management of demand for SRH services. SRH promotional material has already been distributed online and a number of studies have shown that social media could be a useful tool for the dissemination of information, increasing patient awareness and knowledge of STIs as well as the motivation to adopt preventative methods [7]. Digital communication channels, such as the Solent NHS Trust – Let’s Talk About It service (www.letstalkaboutit.nhs.uk) allow individuals to understand their risk, recognise potential STI symptoms and the conditions that may require urgent medical attention. The objective of remote advice platforms is to examine individual needs and signpost users to the most appropriate remote or in-clinic SRH services. While telephone consultations have been an established method of triage in primary care and genito-urinary medicine (GUM) [8], other digital communication channels are being considered to offer a variety of ways in which patients can access SRH services.

Video consultations, live web chat and chatbots have been proposed as supplementary digital platforms for patient-clinic communication. The advances in telemedicine, with parallel widespread access to essential technology such as smartphones with a high-quality camera, offer valuable opportunities for the provision of remote care via Skype or FaceTime for those patients who are not able to engage with clinicians due to distance or the lack of time. A qualitative study of primary care patients’ views on video consultations showed positive attitudes, especially amongst those with mobility or mental health problems [9]. They were also seen as superior in improving communication, providing visual cues and building rapport when compared to telephone consultations. Live web chat or ‘live texting’ that allow communication between concerned Internet users and trained health advisors have also been proposed as an alternative method, especially for those who experience embarrassment or discomfort discussing sensitive issues face-to-face or via phone [10]. Usually, these platforms offer anonymity and professional SRH advice for those who experience high levels of anxiety and concern. Users might be advised to access SRH services when it is recognised that they require screening or treatment. This form of intervention could be particularly effective for discussing stigmatised high-risk behaviours such as same-sex intercourse, condomless sex or drug use (chemsex) where patients might not want to be identified [11]. Recent developments in artificial intelligence (AI) have offered the possibility of highly personalised and patient-centred care. Conversational agents or ontology-based chatbot systems enable verbal and textual communication imitating human interactions in an affordable way. The number of chatbots used in healthcare is rapidly growing, with several already used in SRH [12, 13]. Chatbots may provide access to reliable information at times when contact with health professionals is not possible, especially amongst patients experiencing anxiety, embarrassment or who typically brows popular but less reliable search engines to look for SRH information.

Self-care can be limited by sexual health literacy, where individuals have difficulties in understanding and absorbing relevant information. Low health literacy has been associated with poorer health outcomes and reduced use of health services [14]. Due to difficulties in recognising and understanding symptoms, online self-diagnoses, typically conducted using Google search engines, can be incorrect and harmful if potential STIs are left untreated [15]. Thus, online services that enable easy and comprehensible access to SRH information, particularly for those with low levels of health literacy, are needed to enable better access to in-clinic SRH services. To date, the acceptability of these various digital platforms for SRH advice has not been comparatively examined in a clinical population. Thus, this study aimed to assess the acceptability of video consultations, live web chats and chatbots as potential advice platforms among patients attending SRH services.

**Methods**

**Design and Participants**

A cross-sectional, self-administrated pencil-and-paper survey was distributed to service users of three SRH clinics in Hampshire (Southampton and Portsmouth), under Solent NHS Trust, between May 2017 and March 2018. They were asked about their views on novel digital platforms for online sexual health advice with the aim to help users to under their sexual health needs.

Hampshire is the largest county in the UK, with mostly rural populations outside the two big cities, and with 11% identifying as other than White British. The potential respondents were regular and new patients attending SRH services that at the time of the study offered a range of specialist clinics such as contraception, psychosexual counselling, HIV care, STI screening and treatment. Potential participants were approached with a request to complete the survey during the registration for their appointment. The survey was anonymous and completed mostly in the waiting area before the consultation. A clinic population was chosen over Internet users to estimate baseline acceptability rates of digital interventions being developed as part of clinical services.

The survey was approved as a service evaluation and development project by Solent NHS Trust Clinical Governance (ref:SE-260).

**Data Collection**

The research questions and the survey content were developed in relation to the digital transformation of Solent NHS Trust sexual health services aiming to increase access, equality and cost-effectiveness. The survey was first piloted with a dozen service users where a think-aloud technique was used to assess its coherence and understanding.

The survey contained 33 items assessing: i) demographic factors (i.e. gender, age, ethnicity, employment, education, past diagnosis of STI/HIV, the distance from an SRH clinic and the perception of having an STI symptom at the time of the clinic visit); ii) the utilisation of technology (smartphone ownership, preferred media for health promotion and the use of online systems to book an appointment); iii) the willingness to use an app for SRH, to enter STI symptoms onto an online form, to consent for the digital consultation to be recorded; iv) confidence in the security of digital health records and v) the preferred method for a ‘first point of contact’ for SRH advice, with 4 options (‘face-to-face’, ‘telephone’, ‘video consultations’ and ‘live webchat’). The acceptability of the three digital services (i.e., video consultations, live webchat, AI-enabled chatbots) used the ‘willingness’ binary “yes”/”no” responses e.g., “*Would you be willing to use an automated web-chat with a computer or a bot (not an actual human) to assist you with finding sexual health information?*”. The participants were given short descriptions of how they could engage with each digital service, for example, AI-chatbot was conceptualised as a discussion with a computer and not a human. The survey took 5-10 minutes on average to complete.

The participants were asked to return completed surveys to the reception and completion of the survey indicated consent for their data to be used, as stated on the study information sheet. It was not possible to estimate the response rate as the total number of patients approached was unknown. Nevertheless, around 600 blank surveys were printed and distributed across the three locations (Royal South Hants Hospital in Southampton, St Mary’s Hospital in Portsmouth and Crown Heights Sexual Health in Basingstoke). The reasons for declined participation were not explored.

**Patient and public involvement**

Patients were not directly involved in the design, recruitment and the conduct of the survey. Posters will be disseminated in the waiting areas outlining the results of the study.

**Data analysis**

All surveys were collected by the lead author and data were inserted by hand into SPSS statistical software for the analysis. All responses were dichotomised into two categorical variables and the p-value was set at 0.05. Binary logistic regressions, using the enter method, were performed to identify factors associated with the acceptability of the three communication methods as candidates for an online advice system. The model was adjusted by selecting relevant variables.

**Results**

In total, 257 service users completed the survey (Table 1). The majority of the sample was White, women, holding an A/AS level education or higher and in full-time employment. About a quarter of clinic attendees had been diagnosed with an STI in the past and 5% reported being HIV positive. Around 47% believed they had STI symptoms at the time of the survey and 28% attempted to self-treat these. About 37% searched the Internet for SRH information prior to their visit and 16% booked their clinical appointment online. Only 4% of the sample reported not having access to the Internet and about 1 in 10 not owning a smartphone device.

**Acceptability of digital services**

The majority of participants were willing to use a website (96%) or a smartphone application (57%) for SRH information. As a first point-of-contact to discuss SRH, most (70%) preferred face-to-face consultation at a clinic, 17% preferred telephone consultations, 10% live webchat, and 3% video consultation via Skype or Facetime. Most participants were willing to use video consultations (58%), and webchat (73%) in the future, but only 40% found an AI-enabled chatbot acceptable. The majority of participants (83%) found entering symptoms onto an online form acceptable and 66% would consent for the digital consultations to be recorded. Around 55% were willing to download software or app for video consultation and 66% would consent to be contacted by a health professional via Skype or Facetime. About half of the participants were concerned about the security for storing medical information and the privacy of digital communication channels. Only a small proportion (4%) reported the lack of confidence in the security of digital health records in the NHS.

The regression analysis revealed that the acceptability of video consultations was associated with younger age (under 25 years), being diagnosed with an STI in the past and STI symptom perception at the time of clinic attendance (Table 2). Those who owned a smartphone and had stronger preferences for using an app for SRH information were more willing to use video consultations. The acceptability of live webchat was associated with younger age (under 25 years), identifying as White and owning a smartphone. The acceptability of using an SRH chatbot was positively associated with owning a smartphone and negatively associated with perceptions of STI symptoms while attending the clinic. The analysis also demonstrated that the acceptability of the three digital communication platforms showed significant correlations with one another. Those who were more willing to use an app for SRH, consent for the consultation to be recorded and to enter symptoms onto an online form were more likely to accept all three communication platforms. In general, owning a smartphone and consenting for the consultation to be recorded were the strongest predictors of acceptability.

**Discussion**

The vast majority of attendees preferred face-to-face contact, although they were receptive to remote forms of consultations. Our findings demonstrate high acceptability of webchat services and moderate acceptability of video consultations. This could be due to the familiarity of Solent NHS Trust service users with the webchat facility that was launched in April 2017, while the remaining two platforms were not available at the time of the study. Most participants were not in favour of SRH chatbots, especially patients that thought they had an STI symptom and thus, these platforms may not be suitable for high-risk populations. An automated chatbot platform might be less desirable for those already attending the clinic; however, it could enable clinicians to triage patients waiting and might improve the overall service delivery. Previous studies identified hesitancy towards AI-led chatbots due to concerns about confidentiality and cyber-security as well as the lack of empathy and trust in the autonomous decisions made by computers based on predefined algorithms [16]. Another explanation is a typical reluctance towards novel technologies, outlined in the Diffusion of Innovation theory [17], which indicates that the adaptation of new digital solutions is dependent on individual decision-making processes, their promotion, time since the introduction and social systems. Therefore, low or moderate acceptability could be expected for innovative services that patients have little awareness of. Further studies should explore the level of engagement with these technologies amongst SRH patients as well as assess the acceptability rates in non-clinical and high-risk populations that face barriers to accessing SRH services.

The analysis offers insight into the potential digital divide, as 1 in 10 respondents reported not owning a smartphone, indicating that a substantial proportion of service users might have difficulties accessing digital services if they were only available through apps or smartphones. The current transformation of SRH services through increased digitalisation may lead to reduced service costs, but it may also limit access for those who are most in need of in-clinic services. Failing to develop services that reach people with no access or capacity to use technologies is likely to increase health inequalities [18]. In addition, our study demonstrates the importance of face-to-face interactions, as preferred by the majority of the patients and consistent with other recent studies [19]. Previous research demonstrated that individuals from lower socioeconomic backgrounds had lower e-health literacy, restricted access to technologies and were less likely to use digital health interventions [20]. Literacy-related disparities in technology access and use are widespread, with lower literacy patients being less likely to own smartphones or to use the Internet [21]. Therefore, digital SRH services should be considered as a supplement to clinical services rather than their substitute.

This is the first study exploring the acceptability of digital platforms for SRH advice, notably an AI chatbot, in a clinical population. The generalisability of these findings is limited to one NHS trust and patients in other local authorities may have different views on these platforms. Also, the reasons for low acceptability rates were not explored and this additional information would allow a better understanding of barriers to digital SRH services. Future studies should compare these acceptability rates with Internet users who face difficulties in accessing SRH services as well as patients in various geographical locations.

This study demonstrates low-to-moderate acceptability of AI chatbots and moderate-to-high acceptability of video consultations and webchats as platforms for SRH advice. Thus, there is a need to address patients’ perspectives when developing online SRH services. Low acceptability is likely to translate into low uptake of these interventions. More research is required to evaluate potential reach, equality, engagement and cost-effectiveness of these interventions.

**Competing Interest:** None declared.

**Contributors:** TN and JB designed the study. CL, CG and SK contributed to the analyses and the interpretation of findings.  All authors contributed to the drafting of the manuscript and approved the final version of the manuscript.

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**Table 1 Sample characteristics and attitudinal variables on acceptability (N=257)**

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| --- | --- | --- | --- |
| **Variable** | N (%) | **Variable** | N (%) |
| Gender  Man  Women  Age  Under 18  18-24  25-34  35-44  45-54  55-64  Over 64  Ethnicity  Asian  Black (African/Caribbean)  Mixed  White  Employment status  Full-time  Part-time  Student  Unemployed  Education  GNNQ/HNC/HND or lower  GCSE  A/AS level/Highers  Degree or above  Registered with GP  Yes  No  Previously diagnosed with an STI  Yes  No  HIV positive  Yes  No  How did you get appointment?  Walk-in  Booked online  Booked by phone  Sent by GP/A&E  Perceived STI symptoms  Yes  No  Duration of STI symptom  Up to 7 days  1-12 weeks  Over 3 months  Attempted to self-treat STI symptoms  Yes  No  Visited other service before SRH  Yes  No  Alternative resources for SRH advice  GP  Pharmacy  Internet  Other  Travel distance to SRH clinic  Less than 15 minutes  Less than 30 minutes  Less than 1 hour  Less than 2 hours | 111 (43)  146 (57)  7 (3)  119 (46)  70 (27)  25 (10)  26 (10)  5 (2)  4 (2)  10 (3)  13 (4)  8 (3)  227 (90)  136 (56)  30 (12)  65 (24)  19 (8)  14 (4)  59 (23)  93 (37)  84 (36)  225 (98)  4 (2)  58 (23)  197 (77)  14 (5)  239 (95)  47 (19)  40 (16)  152 (62)  8 (3)  120 (47)  132 (53)  30 (25)  49 (43)  37 (32)  37 (28)  93 (72)  85 (34)  161 (65)  56 (50)  2 (2)  33 (37)  10 (11)  106 (41)  110 (44)  35 (14)  6 (2) | **Utilisation of technology**  Access to the Internet  Yes  No  Smartphone ownership  Yes  No  Preference for first point-of-contact to discuss SRH issues  Face-to-face consultation  Telephone  Video consultation (Skype/FaceTime)  Live web chat (texting service)  Device preference for online appointments  Smartphone  PC  Tablet  Webcam  Laptop  **Acceptability/willingness variables**  To use a website for SHR information  Yes  No  To use an app for SHR information  Yes  No  To use live webchat with an advisor  Yes  No  To be contacted via Skype/FaceTime by a health professional  Yes  No  To use video consultation (e.g. Skype)  Yes  No  To download software for video consultation  Yes  No  To consent for consultation to be recorded  Yes  No  To enter symptoms onto an online form  Yes  No  To use AI-enabled chatbot for SRH advice  Yes  No  **Cyber-security variables**  Concerned about security for storing medical information  Yes  No  Concerned about privacy of digital communication with health professionals  Yes  No  Confidence in the security of digital health records in the NHS  Completely  Mostly  Not at all | 246 (96)  9 (4)  232 (91)  23 (9)  171 (70)  42 (17)  7 (3)  23 (10)  178 (51)  26 (7)  56 (16)  9 (3)  79 (23)  230 (94)  15 (6)  147 (57)  109 (43)  177 (73)  66 (27)  167 (66)  87 (34)  144 (58)  104 (42)  136 (55)  111 (45)  129 (52)  120 (48)  200 (83)  41 (17)  100 (40)  149 (60)  137 (57)  104 (43)  114 (47)  127 (53)  94 (39)  137 (67)  11 (4) |

SRH – sexual and reproductive health; HIV – human immunodeficiency virus; STI – sexually transmitted infection; AI – artificial intelligence; GNNQ/HNC/HND/GCSE – level of education; GP – general practitioner; A&E – accident and emergency department

**Table 2. Factors associated with the acceptability of video consultations, webchat and chatbot**

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| --- | --- | --- | --- |
| **Variable** | **Video consultation**  **OR [95% CI]** | **Webchat**  **OR [95% CI]** | **AI chatbot**  **OR [95% CI]** |
| **Demographic variables**  Gender  Men  Women  Age  Under 25 years  Over 25 years  Education  A/AS Level or below  Degree or above  Ethnicity  White  Non-white  Employment  Employed (full and part-time)  Unemployed or student  Diagnosed with an STI in the past  Yes  No  Diagnosed with HIV  Yes  No  Perceived having STI symptoms  Yes  No  Distance from GUM clinic  Up to 30-minute drive  Over 1-hour drive  **Utilisation of technology variables**  Smartphone ownsership  Yes  No  Preferred medium for health promotion  Mobile phone application  Website  Method of booking appointment  Using online booking system  By phone or walk-in  **Acceptability/willingness variables**  To use video-consultation (e.g. Skype)  Yes  No  To use live webchat with an advisor  Yes  No  To use AI-enabled chatbot  Yes  No  To have an app for sexual health  Yes  No  To consent for consultation to be recorded  Yes  No  To enter symptoms onto an online form  Yes  No  Confidence in the security of digital health records in the NHS  Yes  No | 1.11 [0.71-1.98]  1.77 [1.06-2.93]\*  1.00  0.79 [0.45-1.36]  1:00  1.10 [0.49-2.47]  1.00  1.38 [0.89-2.32]  1.00  2.05 [1.07-3.95]\*  1.00  1.15 [0.35-3.63]  1.00  1.68 [1.01-2.84]\*  1.00  1.09 [0.54-2.17]  1.00  16.0 [3.64-70.5]\*  1.00  1.95 [1.13-3.35]\*  1.00  1.44 [0.71-2.91]  1.00  0.00  0.00  18.7 [8.52-41.0]\*  1.00  3.86 [2.17-6.84]\*  1.00  2.44 [1.45-4.11]\*  1.00  26.6 [6.09-11.6]\*  1.00  2.70 [1.35-5.40]\*  1.00  1.15 [0.68-1.94]  1.00 | 0.99 [0.93-1.21]  2.43 [1.35-4.38]\*  1.00  0.86 [0.46-1.62]  1.00  2.87 [1.30-6.34]\*  1.00  1.03 [0.57-1.85]  1.00  1.18 [0.58-2.39]  1.00  0.75 [0.22-2.56]  1.00  0.97 [0.54-1.75]  1.00  0.66 [0.28-1.53]  1.00  6.46 [2.47-16.8]\*  1.00  1.49 [0.82-2.69]  1.00  2.41 [0.96-6.04]  1.00  18.7 [8.52-41.0]\*  1.00  0.00  0.00  3.74 [1.90-7.37]\*  1.00  3.73 [2.05-6.79]\*  1.00  15.6 [7.83-31.1]\*  1.00  3.75 [1.81-7,74]\*  1.00  1.24 {0.69-2.24]  1.00 | 1.38 [0.91-2.01]  1.00  1.01 [0.61-1.68]  1.00  1.40 [0.83-2.44]  1.00  1.33 [0.59-3.00]  1.00  1.68 [0.98-2.90]  1.00  0.71 [0.38-1.33]  1.00  1.76 [0.55-5.23]  1.00  0.58 [0.34-0.97]\*  1.00  0.92 [0.46-1.82]  1.00  4.58 [1.31-16.0]\*  1.00  1.45 [0.86-2.45]  1.00  1.79 [0.90-3.56]  1.00  3.86 [2.17-6.84]\*  1.00  3.74 [1.90-7.37]\*  1.00  0.00  0.00  2.24 [1.30-3.79]\*  1.00  4.13 [2.23-7.65]\*  1.00  3.86 [1.63-9.17]\*  1.00  1.36 [0.80-2.29]  1.00 |

NHS – National Health Service; STI – sexually transmitted infection; AI – artificial intelligence; OR – odds ratio; GUM – genitourinary medicine; 1.00 – reference category for logistic regression; \* p<0.05, CI – 95% confidence interval