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Commentary

National Telemedicine and Telehealth Policy Context in England and Introduction of Digital Innovations for Detection and Treatment of Sexually Transmitted Infections

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Abbreviations app: Smartphone Application; eHealth: Electronic Health; GP: General Practitioner/Community Physician; IT: Information Technology; mHealth: Mobile Health; NHS: National Health Service; SMS: Short Message Service; STI: Sexually Transmitted Infection; UK: United Kingdom; WHO: World Health Organization; WSD: Whole Systems Demonstrator

Abstract

Chlamydia is the most common Sexually Transmitted Infection (STI) among young people aged 16-24 years old. The infection is largely asymptomatic and therefore regular screening is required to detect, treat and identify those at risk. If left untreated, chlamydia can result in serious long term consequences, particularly for women. These include pelvic inflammatory disease, ectopic pregnancy and infertility. Current levels of screening in the England cover only a small proportion of the eligible population.

Technological advances offer the opportunity to redesign existing asymptomatic chlamydia screening/testing and treatment pathways in England, leading to increased testing uptake, higher treatment rates and reduced disease transmission. Innovations underway include self-tests networked through mobile phones, combined with online clinical care and other non-face-to-face care pathways. Two levels of integration of technology into mainstream sexual health services are possible. The most ambitious is a fully remote online pathway incorporating a self-test, plus online treatment and partner notification. A less ambitious service would consist of postal home sampling kits with a partial remote online pathway for results notification, treatment provision and partner notification.

In this article we discuss the current state of adoption of new technologies in the sexual health service delivery pathway within the overall context of digital technology use in England, the emergence of a national digital health policy, and challenges to the adoption of telemedicine and telehealth technologies. Consideration of these aspects should help technology developers, policy makers and service providers to optimize future technology adoption and service re-design in STI care or related clinical areas.

Introduction

Chlamydia (caused by the gram-negative bacterium *Chlamydia trachomatis*) is one of the most common infections reported in the United States [1] and Europe [2]. The highest rate of infection is reported in young people aged 15 to 24 years [3]. This Sexually Transmitted Infection (STI) is largely asymptomatic and so regular screening is required to detect, treat and identify partners at risk of infection. If left untreated, chlamydia can result in serious long term consequences, particularly for women. These include pelvic inflammatory disease, ectopic pregnancy and infertility [4]. Such complications result in a future economic burden to health services which can easily be avoided with cost-effective screening programmes [2]. For these reasons, a National Chlamydia Screening Programme was introduced in England for 16-24 year olds in 2003 [5]. However, despite the introduction of this national programme, and the fact that the infection is easy to treat with a single dose antibiotic, uptake of opportunistic screening for chlamydia remains low [6]. It has recently been highlighted that strategies for control and management of chlamydia will need to leverage approaches that go beyond conventional service delivery [7].

The internet has created opportunities for accessing services in ways that were previously unfeasible [8]. The transition to digital mobile networks in the early 1990s [9] and the introduction of third generation (3G) and 4G networks over the last ten years, coupled with a significant growth in smartphones since the launch of the iPhone in 2007, has led to an explosion in the growth of mobile phone use in health services (mHealth) [10]. This, coupled with the development of smartphone 'apps', has led to millions of apps available and billions of downloads to date [11,12]. Such advances have opened up a wide range of options to improve healthcare delivery processes [13].

For STI testing scientific advances are also underway to replace conventional diagnostic testing methods with the development of point-of-care tests which can be performed outside the laboratory [14], and the emergence of self-tests which can be performed in the home [15]. These scientific advances are occurring alongside the development of online treatment pathways either through eHealth clinics or smartphone applications [16]. Two levels of future integration of these technological advances into mainstream sexual health services are possible. The most ambitious would be a fully remote online testing and treatment pathway incorporating a self-test, plus online treatment and partner notification; a less ambitious partially remote telemedicine service would be postal home sampling kits with a partial online pathway for results notification, treatment provision and partner notification [7]. In the United Kingdom (UK), introduction of such technological advances might offer a number of benefits for the national chlamydia screening programme however, these need to be set within the changing national digital health policy context.

In this commentary we discuss digital technology use in England, the emergence of a national digital health policy, challenges to the adoption of telemedicine and telehealth technologies, and the current state of adoption of new technologies in the sexual health service delivery pathway.

Terminology

Terms such as telemedicine, eHealth and mHealth are sometimes used interchangeably, with mHealth becoming more established following the new generation of smartphone and tablet technology. In this article we focus primarily on mHealth. The World Health Organization (WHO), recognizing the absence of a standardized definition of mHealth, defined it in 2011 as "Medical and public health practice supported by mobile devices, such as mobile phones, patient monitoring devices, personal digital assistants and other wireless devices" [17]. A more concise definition offered by Free and colleagues in 2013 is "the use of mobile computing and communication technologies in healthcare and public health" [13]. Mobile devices can enable existing technologies to be utilized in a different way, e.g. remote monitoring, as well as extending the scope of technologies available for use. In general terminology, mHealth can be considered a subset of eHealth which in turn can be considered a subset of telemedicine, a summary of their key features of and generic examples of their use is presented in Table 1.

Digital Technology Use in the United Kingdom

Data from the Office of Communications which regulates the communications market in the UK identified that at the end of 2015 there were 91.5 million active mobile phone subscriptions [18]. UK data on the reported use of the internet to find health information shows an increase from 18% in 2007 to 51% in 2016 [19]. There are a number of published studies which indicate a preference among patients and citizens for the use of the internet to source information about management of health conditions [20]. A literature review published in 2011 by the European Centre for Disease Prevention and Control found that use for this purpose was growing rapidly amongst patients, carers, and their friends and relatives, with women and those more highly educated most likely to search for health information online [21]. The quarterly 'Technology Tracker' trends survey identified that by the second quarter of 2016, among 15-24 year olds:

- Internet access across gender and socioeconomic status is consistently high, with the lowest access rate in females in the lowest socioeconomic group at 96%.
- Smartphone ownership across gender and socioeconomic status is also high with 94% of males and 95% of females aged 15-24 owning a smartphone. The lowest rates of ownership within this age group are males in the lowest socioeconomic group at 91% [22].

Disparities in overall mobile internet usage and smartphone ownership present an important consideration in the development of mHealth interventions for chlamydia screening. Whilst apps have the benefit of being able to utilise features of the phone such as the camera (a potential option for the analysis of test results), websites optimised for use on a mobile phone are accessible by all operating platforms therefore extending the user base [23].

Emergence of Digital Health Policy in England

The National Health Service (NHS) has incorporated technological advances into national health policy. Much of the early digital health policy in the NHS was centered on addressing Information Technology (IT) infrastructure and system deficits within hospitals and primary care. The NHS Plan was the first major general policy document to acknowledge the need for modern IT systems in both community and hospital settings [24]. The plan included a vision where self-care and self-management would be facilitated through IT enabling patients to email or phone clinicians for advice and support, and to receive their test results at home. Over the period 2000-2010, the focus remained on the integration of systems through the work of the Connecting for Health policy in delivering the National Programme for IT. This included the development and implementation of systems linking both primary and secondary care including the NHS Care Records Service, Choose and Book and the Electronic Prescribing Services [25-27].

In 2011, the publication of 'Innovation, Health and Wealth' led to a notable policy shift away from a focus on IT systems to the adoption of innovations which could impact directly on the provision of patient care. The 'digital by default' initiative was first introduced in this policy document and reinforced the vision in the original NHS Plan [24] that "for many people who use electronic media as part of their daily lives, the ability to … have a remote consultation using telephone or online technology would offer a much more convenient way of accessing NHS services". This could also enable the NHS to drive down the level of inappropriate and unnecessary face-to-face contacts and therefore costs [28].

More recently, this shift was reinforced by the publication of 'Digital First' in 2012 which aimed to "make available the digital means (channels, content, services) for the general public to manage their healthcare digitally wherever possible and provide the mechanisms and support that ensure they can migrate to these digital channels as their preferred manner to engage" [29]. Ten high impact digital initiatives were cited which incorporated the use of eHealth and mHealth solutions, including use of online and telephone triage, online/ remote consultation and Short Message Service (SMS) reminders which were expected to deliver an estimated £3bn in savings for the NHS [29].

During this period, digital health initiatives also began to be incorporated into healthcare contracting arrangements through service specifications, enhanced services and commissioning for quality and innovation schemes. The NHS five year forward view, published by NHS England in 2014, gave a commitment to expanding the use of digital technology in the NHS recognizing the role of a range of eHealth and mHealth solutions including health apps, online General Practitioner (GP) appointments and patients having full access to their electronic health record [30].

In order to influence the adoption of health apps, in 2013, the NHS launched an 'Apps Library', incorporating a range of approved apps which had been evaluated and endorsed by the NHS [31]. Little information was available on the accreditation process, and no indication that apps had been assessed for cost-effectiveness. The library was widely criticized with significant concerns raised regarding data privacy; 89% of apps that sent data to online services and 66% of apps that sent personal information were found not to use encryption and no apps encrypted information stored on the device [32]. The NHS apps library was removed in 2015 in order to enable the apps to be reviewed against set criteria, and is still being upgraded [31].

Challenges to Adoption of 'Telemedicine' in England

To date, the adoption of telemedicine (including eHealth and mHealth, see Table 1) at a system level within the NHS and other health systems has proved to be a challenge. Evidence on their adoption within the NHS for the diagnosis, treatment and management of long-term medical conditions indicates that widespread adoption is minimal. The Department of Health report published in 2014 acknowledged that, despite commitments given over the previous years in national policy, from a patient perspective "the consumer experience of care services remains much as it was before the mobile phone and the internet became commonplace. For care professionals, from social workers to doctors and nurses, the arrival of the digital age has often been experienced not as a force for good but rather as an intrusive additional burden in an already pressured existence" [33]. A 2011 WHO global survey was the first to comprehensively identify barriers to adoption of mHealth by health systems internationally. Competing priorities within the health system were identified as the most significant barriers to the adoption of mHealth (52%), with lack of knowledge about how mHealth can be utilised and its contribution to health outcomes, lack of policy on mHealth initiatives at a national level, and poor data on cost-effectiveness of mHealth interventions being the most commonly cited reasons for not pursuing mHealth interventions [17].

Table 1: Terminology Telemedicine, eHealth and mHealth: Summary of key features and generic examples of their use.

	Telemedicine	eHealth	mHealth
Key Features	Linked directly to clinical service delivery	Broad scope including other non-clinical IT solutions within health	Subset of eHealth involving use of mobile devices such as phones or tablets
Examples	Virtual clinics; Remote monitoring.	Electronic health records (EHR); ePrescribing; eCommerce within health; Health information; Delivery of web-based services/ interventions.	SMS Appointment Reminders; Apps (health information, public health interventions, monitoring); Remote monitoring; Diagnostics.

In England, with the exception of a few major initiatives that have been adopted fairly consistently across the NHS, for example text message appointment reminders, the adoption of eHealth and mHealth has followed a path of small scale, localised, initiatives with minimal structured evaluation, this is not dissimilar to that of other nations [17]. Sustained adoption has been heavily influenced by clinicians with for example, access to the system for booking online hospital appointments, reducing when the financial incentive for GP practice participation ceased. The Whole System Demonstrator (WSD) project was the largest randomised controlled trial ever undertaken in England designed to explore the costs and benefits of using telehealth and telecare alongside standard care [34]. The trial covered patients in three areas with one or more of the following long-term conditions – chronic obstructive pulmonary disease, heart failure or diabetes. It considered the barriers to participation and adoption of telehealth and telecare within the WSD trial [35] and the effect on use of hospital care and mortality [36]. The economic evaluation identified that telehealth was unlikely to be cost-effective in these conditions where it was provided as an addition to standard care, instead of a replacement [37].

Adoption of New Technologies in Sexual Health Service Delivery Pathways

Internet searches for 'online NHS clinics' undertaken as part of this commentary identified that a high proportion of results in the top 100 related to one of three clinical areas: general practice, mental health or sexual health. In the first area, since 2013, there are increasing examples of the use of e-consultation in general practice with an evaluation identifying that 60% of e-consultations were closed remotely, 80% that required a call back were also closed remotely, and 18% of users who had planned to book a face-to-face appointment no longer required one [38,39]. In the second area, mental health, online clinics have used innovative services such as Big White Wall leading the way with online therapy appointments delivered by instant message, video or audio services [40]. The final area, sexual health, is a service which is experiencing numerous simultaneous technological advances.

For mainstream NHS chlamydia testing and treatment services, the most ambitious fully remote online pathway incorporating a self-test, plus online treatment and partner notification has not yet been realized. There are currently no self-tests available for chlamydia which have a suitable accuracy. Similarly, there is limited evidence of the use of point-of-care (non-laboratory) tests in mainstream sexual health services for chlamydia. A published service evaluation of the use of the Cepheid GeneXpert undertaken in a UK sexual health clinic found that due to the 90 minute processing time only 14.3% of males and 28.6% of females waited to receive their results [41]. Further developments in chlamydia point-of-care tests include low cost handheld devices [42], and the exploration of 'accelerated partner therapy' for improving partner notification and treatment uptake [43,44]. In contrast, in April 2014 regulations were relaxed to allow the sale of CE marked self-test HIV kits in England [15]. Although these kits indicate that a person may have HIV, a confirmatory laboratory test is still required in the UK, and also in the United States [45]. To date, none of the technological advances in the UK support

the provision of a fully remote NHS service, including treatment. Less ambitious provision of partially remote STI services, including online pathways for results notification, treatment provision and partner notification, does now exist. The main model of online NHS service provision for STIs involves online ordering of postal home sampling test kits with, for those who test positive, either signposting to the clinic for treatment or a telephone consultation followed by a GP prescription or postal treatment.

For chlamydia (and in some cases gonorrhoea) testing services, such as freetest.me and checkurself.org.uk, enable online ordering of a test kit for self-sampling for the 16-24-year-old population and provide a freepost envelope for the sample to be sent to the laboratory for analysis. Freetest.me also provides an online results notification service. However, data published by Public Health England indicate that only 5% of chlamydia tests undertaken as part of the National Chlamydia Screening Programme were ordered online [46]. Extension of online ordering to include a wider range of STI test kits for self-sampling is now underway e.g. HIV, gonorrhoea, Hepatitis B and C, and syphilis [47]. Results notification by text message has been adopted in many NHS clinics since the mid-2000s in response to the drive to achieve a 48-hour access target [48].

Looking at sexual health services beyond the UK, there are limited examples of reported studies involving telemedicine, eHealth and/ or mHealth in high income countries. A pilot of telemedicine for sexual health for young people in rural Australia reported that most preferred the telemedicine service to attending a clinic [49], and a pilot of an online chlamydia testing and treatment service in California was found to deliver high patient satisfaction at a potentially lower cost [50].

Whilst some examples exist of the adoption of eHealth and mHealth across England, similarly to the WHO survey, to date the evidence of adoption is sporadic, with variations in availability of options dependent on geographical area.

Discussion

Although NHS services do not currently incorporate an online treatment (antibiotic prescription) stage, the findings of a feasibility study of an online NHS chlamydia treatment and management system have recently been reported demonstrating a safe and feasible alternative with similar outcomes to traditional services [51]. This eHealth service differs from existing interventions aimed at reducing prevalence and transmission of chlamydia in that more elements of the service were delivered electronically. The service provided a web link to results, an online consultation, links to online health promotion, online partner notification, and an e-prescription for treatment. Patients judged to be unsuitable for online care (for example, those with symptoms) were automatically signposted to telephone support and clinic care. Internet and mobile phone delivery could be particularly appropriate for sexual health interventions, for which sensitivity, non-judgmental support, and privacy are required [7]. These developments show promise for improving the clinical and/ or cost-effectiveness of current chlamydia screening pathways.

Early trials of eSexual health promotion interventions also indicate possible benefits in terms of increased safe sex behaviours, as well as increased testing for sexually transmitted infections and service use, although some of these trials could have been prone to bias [52]. However, the views of young people about new clinical pathways incorporating telemedicine and telehealth will be important for their successful introduction. These are currently being explored in the UK [53]. Finally, internet and mobile phone service delivery pathways could be particularly effective for promoting safe sex behaviours while individuals are waiting for test results and this is currently also being explored [54].

Interventions based on information and communication technologies (i.e. eHealth) have the potential to increase access to care, change behavioural risk factors, and increase self-management of disease with low costs with interventions for smoking-cessation support and diabetes management cost-effective and feasible on a national scale[55,56].

To date, there has been little published in respect of methods for evaluation of the effectiveness and cost-effectiveness of eHealth and mHealth technologies. Existing health technology assessment methods, which were primarily developed for the evaluation of discrete interventions such as drugs and devices [57], are not optimal for eHealth and mHealth interventions owing to the pace of base technology development (e.g. smartphones, smartphone consumables and apps/ software), the lack of experience with adoption, and the lack of tools to measure outcomes. This has recently been acknowledged as one of the main limiting factors for amassing an evidence base for eHealth interventions [56].

The pace of technology development means that there are constantly new products being developed, with the potential for new technology to improve chlamydia screening services, particularly given the high proportion of the population aged 15 to 24 years with access to the base technology e.g. the internet and a smartphone. There is also an opportunity for manufacturers and health services to learn across these developments to further enhance the delivery of care. However, there is also a risk that development of new technologies in isolation will lead to fragmented solutions to individual aspects of the service pathway and that traditional evaluation methods will mean that the technology is obsolete before the research findings are published. In addition to awareness of these developments, collaboration will be needed to ensure the development of more effective products and to refine evaluation methods to develop the knowledge base to inform decisions on the adoption of eHealth and mHealth technologies by the NHS.

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