A web-based personally controlled health management system increases sexually transmitted infection screening rates in young people: a randomized controlled trial

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ABSTRACT

Objective To determine if a web-based personally controlled health management system (PCHMS) could increase the uptake of sexually transmitted infections (STI) screening among a young university population.

Methods A non-blinded parallel-group randomized controlled trial was conducted. Participants aged 18–29 years were recruited from a university environment between April and August 2013, and randomized 1:1 to either the intervention group (immediate online PCHMS access) or control group (no PCHMS access). The study outcome was self-reported STI testing, measured by an online follow-up survey in October 2013.

Results Of the 369 participants allocated to the PCHMS, 150 completed the follow-up survey, and of the 378 in the control group, 225 completed the follow-up survey. The proportion of the PCHMS group who underwent an STI test during the study period was 15.3% (23/150) compared with 7.6% (17/225) in the control group ($P = .017$). The difference in STI testing rates within the subgroup of sexually active participants (20.4% (23/113) of the PCHMS group compared with 9.6% (15/157) of the control group) was significantly higher ($P = .027$) than among non-sexually active participants.

Discussion Access to the PCHMS was associated with a significant increase in participants undergoing STI testing. This is also the first study to demonstrate efficacy of a PCHMS targeting a health concern where susceptibility is generally perceived as low and the majority of infections are asymptomatic.

Conclusion PCHMS interventions may provide an effective means of increasing the demand for STI testing which, combined with increased opportunistic testing by clinicians, could reduce the high and sustained rates of STIs in young people.

Keywords: sexually transmitted infection, screening, personally controlled health management system, eHealth, young adult

BACKGROUND AND SIGNIFICANCE

Sexually transmitted infections (STIs) are an important public health issue for young people. Chlamydia continues to be the most common notifiable disease in the United States, Europe, and Australia, with more than 1.4 million new chlamydia diagnoses reported in the US in 2012,[1] almost 350 000 in Europe in 2011,[2] and over 82 000 in Australia in 2013.[3] Young people aged 15 to 29 years account for around 80% of notifications each year.[1–3] A recent prevalence study in over 50 Australian towns found the chlamydia prevalence to be 5.2% in men and 4.3% in women aged 16 to 29,[4] with similar estimates reported in other countries,[1] Untreated chlamydia is associated with an increased risk of pelvic inflammatory disease, and in turn reproductive morbidity including infertility and ectopic pregnancy.[5] Chlamydia also leads to poor maternal and neonatal outcomes including pre-ruptured membranes and low birth weight.[6]

A key prevention strategy is timely testing and treatment. Annual chlamydia screening for sexually active young adults is recommended in a number of countries including the United States, United Kingdom, Sweden, Denmark, and Australia, with screening for other STIs based on prevalence in the population and reported risk.[7,8] Most STIs are diagnosed by general practitioners (GPs) in Australia; however, actual screening rates are much lower than recommended, with only 8% of sexually active 16 to 29 year olds tested for chlamydia by an Australian GP between October 2007 and September 2008.[9]

Mathematical modeling predicts that chlamydia prevalence can be reduced by more than 80% in 10 years if 30% of both males and females, or 60% of females only, aged 16 to 29 are screened every 12 months.[10] A number of clinic-based interventions have demonstrated that opportunistic screening can increase testing rates among young people attending general practices.[11] However, clinicians commonly report one of the key facilitators to increasing testing is if more young people request STI testing.[12,13]

Considering that young people living in Australia enjoy nearly universal access to the Internet,[14] there is potential for the use of new 'eHealth' technologies for the targeted promotion and facilitation of STI screening in this population. In particular, personally controlled health

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management systems (PCHMSs) have the potential to simultaneously overcome some of the barriers to STI screening that young people have identified (such as STI-related stigma, low perception of risk, lack of knowledge, and perceived cons, fears, and worries regarding STI testing).[15,16] These systems incorporate features such as educational material and personal health records, as well as components that facilitate self-reflection, socialization, and simplified access to health services.[17] Some evidence currently exists to support the use of such systems to deliver interventions in areas such as diabetes management,[18,19] in-vitro fertilization support,[20] influenza vaccination,[21] and supporting positive physical and emotional well-being practices.[22] To our knowledge, there have been no studies which have assessed the impact of a PCHMS in relation to sexual health.

OBJECTIVE

This RCT evaluated the efficacy of the web-based *Healthy.me* PCHMS,[17,21,22] developed by the Centre for Health Informatics at the University of New South Wales (UNSW), to host an intervention designed to increase STI screening, and the accessing of healthcare services for other sexual-health-related concerns, among a young university population.

The Health Belief Model,[23] a prominent model of behavioral change, was used to guide the design and structure of the intervention content, and provides a conceptual framework with which to consider the features of the intervention.[24]

METHODS

Trial Design

In this non-blinded parallel-group randomized controlled trial, participants were gender-stratified and randomized 1:1 to have immediate PCHMS access (intervention) or no PCHMS access (control) from their date of recruitment until follow-up in October 2013. Recruitment took place between April and August 2013.

Participants and Setting

Eligible study participants were young adults aged 18–29 years, who had at least monthly access to the internet and email, and had sufficient English language skills to complete self-administered surveys.

Participants were recruited from three Australian universities: the University of New South Wales, the University of Sydney, and the University of New England. Participants engaged in this study online between April and October 2013. The nature and frequency of interaction with the PCHMS was left to the individual discretion of intervention group participants.

Recruitment

A variety of methods were employed to recruit students and staff for participation in the study. These included: (i) advertisements circulated in online newsletters and university associated Facebook groups; (ii) online announcements on university-related websites and eLearning portals; (iii) email invitations sent to Heads of Schools, Heads of University Departments, Heads of Residential Colleges, and delegates of student societies for dissemination to student and staff mailing lists; and (iv) printed flyers with promotional condoms handed out to students and staff on the university campus.

The promotional materials directed people to a website which provided additional information about the study. In order to encourage participation and to reduce attrition,[25,26] eligible participants who successfully enrolled in the study and completed the follow-up survey were entered into a prize draw for 1 of 30 gift vouchers, each with a value of $40.

Consent and enrolment procedures

All participants who volunteered to take part in the study were required to complete an online registration process that involved reading the participant information statement, providing consent, completing an eligibility survey, and providing a contact email address. Registered, eligible participants were then contacted via an automated email message which contained a link to access a 5- to 10-minute baseline survey.

Intervention Group

Upon completion of the baseline survey, participants randomly allocated to the intervention group were presented with a mandatory 3-minute online tutorial that provided information about how to use the various features of the *Healthy.me* PCHMS. After completing the tutorial, these participants were redirected to the *Healthy.me* PCHMS to create a user account.

The length of time that participants in the intervention group had access to the *Healthy.me* PCHMS varied, dependent on the date of recruitment. During the study, the *Healthy.me* PCHMS provided participants in the intervention group with evidence-based information about sexual health, and indications and procedures for STI testing. The intervention was not intended to modify the standard procedures of healthcare provision by the healthcare providers that participants may have chosen to visit during the study.

Control Group

Upon completion of the baseline survey, participants randomly allocated to the control group were redirected to a static webpage informing them of their allocation. They were advized that they would be contacted to complete a follow-up survey upon conclusion of the study.

Description of Intervention

The *Healthy.me* PCHMS intervention employed in this study consisted of a variety of features and was intended to educate participants and facilitate a change in their health-seeking behaviors. Figure 1 demonstrates the PCHMS interface and several of its features which included: a Personal Health Record (1), a 'Pillbox' (2) to record medication details, a schedule (3) for recording and reminding of health-related tasks, a location to record details of the participants' healthcare team (4), educational content (5) adapted from NSW Health resources,[27] social features (6), and an online appointment booking service (7).The online appointment booking service and forum were the primary methods via which access to health providers was facilitated and simplified for participants in the intervention group. Further information regarding these features can be found in the previously published articles discussing other health-related applications of the *Healthy.me* PCHMS.[17,21,22,28]

Outcomes

The primary outcome was the proportion of participants who self-reported being tested for STIs during the time that they were enrolled in the study.

The secondary outcomes were:

1. Proportion of participants who report having visited a healthcare professional for any sexual-health-related concerns during the time that they were enrolled in the study.

Figure 1: Features of the *Healthy.me* PCHMS.
1 = personal health record; 2 = pillbox; 3 = schedule; 4 = team; 5 = educational content; 6 = social features; 7 = appointment booking.

2. Participants' attitudes and intentions toward accessing healthcare services for STI screening.

Data Collection

Data were collected through survey instruments at two time-points during study.

An initial, self-administered baseline survey was used to measure the eligible participants' demographic characteristics, sexual activities, and sexual-health-related behaviors and status.

Upon conclusion of the study, a self-administered follow-up survey was used to measure the primary and secondary outcomes listed above.

The demographic and sexual-health-related questions included in these surveys were adapted from previously published sexual health surveys [15,29] and previous surveys utilised in studies of the *Healthy.me* PCHMS. Surveys were hosted by the 'KeySurvey' platform available to UNSW researchers, and responses were securely stored on UNSW servers. Participants' patterns of use and data input into the *Healthy.me* system were automatically logged and securely stored for de-identified analysis.

Sample Size Considerations

It was estimated that a minimum sample size of 440 participants, with 220 in each arm of the study, would be required to detect a difference of 10% points in the proportion of participants who were screened at least once in a year for STIs between the control group (8%) and intervention group (18%). The sample size was calculated for power of 80%, with a two-sided 5% significance level, and allowing for an anticipated participant attrition rate of 20%.

The estimated difference between control and intervention arms of 10% points was based on the outcome of a previous study of the *Healthy.me* PCHMS, which also assessed uptake of preventative healthcare measures,[21] and the outcomes of other studies which applied online interventions to promote the uptake of STI screening.[30,31]

The estimated annual baseline rate of STI screening for the control group was informed by the estimated annual general practice chlamydia testing rate of 8% for sexually active young people aged 16–29.[9]

Study Procedures

Randomization and Allocation Concealment

Eligible participants were randomly allocated to either the intervention or control group in a 1:1 ratio. Group allocation was stratified by gender, using a block randomization method with permuted blocks which randomly varied between sizes of 2, 4, and 8. The blocks were generated using a computer random number generator. The allocation process was concealed through its automation, being carried out online after each participant successfully completed the eligibility component of the online registration process and without input from the investigators.

Blinding and Assessment

The nature of the *Healthy.me* intervention, and the use of a waitlist control group, means that it was not possible to blind participants

regarding their allocation to the intervention or control group. Participants were informed of their allocation following registration and completion of the baseline survey.

Through the use of automated computerized processes for group allocation and communication with participants, and self-administered online surveys for outcome measures, the investigators were blinded to the participants' allocations.

Statistical Methods

Statistical significance is defined as a *P*-value of less than .05 (two-sided test). Effect sizes are reported with 95% confidence intervals. Where any cross-over of participants between the intervention and control groups was identified (i.e., where a participant was allocated to both the intervention and control groups through repeated registration), these participants were analyzed in the groups to which they were originally allocated. Strict adherence to the intention-to-treat principle was not possible owing to participant attrition.[32] Data were analyzed using IBM SPSS Statistics version 20.[33]

Primary Analysis

A complete case analysis was performed using the data of all eligible participants who completed the follow-up survey. Pearson's chi-square test was used to identify any significant difference between the proportion of participants in the control and intervention groups who reported being tested for STIs during the study. The inverse of the absolute risk difference was then used to determine the 'number needed to treat' (NNT).

Binary logistic regression was employed to adjust for potential confounding factors or differences in baseline characteristics that were expected to be predictive of the outcome, including: age, gender, university faculty, sexual activity, number of sexual partners, condom use, previous STI testing, and previous infection.[34] Both adjusted and un-adjusted analyses are presented.

Secondary Analyses

A single pre-specified subgroup analysis, using a statistical test of interaction,[35] was conducted to assess the heterogeneity of intervention effect between those participants who reported a history of sexual activity and those who reported having never been sexually active at follow-up.[36,37] This provided an estimate of the intervention effect size among those participants for whom the primary outcome is most relevant.

Complete case analysis of the secondary outcomes was conducted using (i) Pearson's chi-square test to identify any significant difference between the intervention and control groups in relation to the proportion of participants who reported visiting a healthcare professional for any sexual-health-related concerns during the study, and (ii) the Mantel-Haenszel chi-square test for comparing participants' attitudes and intentions regarding getting tested for STIs.

Ethics

The study received ethical approval from the UNSW Human Research Ethics Committee (approval number HC10109).

RESULTS

Participant Recruitment, Flow and Exclusions

Recruitment was conducted over a period of 5 months between April and August 2013, during which 747 eligible participants completed the registration process (Figure 2). The trial ended as scheduled and follow-up was conducted in October 2013. Three hundred and seventy-five participants provided sufficient data in the follow-up survey to allow their inclusion in the primary analysis; 150 in the PCHMS group and 225 in the control group. No participants with available data were excluded from the analyses. Two participants were identified to have participated in both the PCHMS and waitlist groups, and these participants were analyzed in their original allocated groups.

Baseline Data

The baseline characteristics for those participants in the PCHMS and waitlist groups who provided sufficient data to allow their inclusion in the primary analysis are presented in Table 1. Baseline characteristics for all allocated participants (including those lost to follow-up) are also shown. These baseline characteristics, specifically the rates of previous STI testing and sex without condoms, are similar to the rates identified in a recent online survey of sexually active young people in NSW (after adjusting for the rates of sexual activity in our cohort).[15]

Numbers Analyzed

Analyses of the primary outcome (undergoing an STI test during the study) and one secondary outcome (visiting a healthcare professional for any sexual-health-related concerns during the study) were conducted using the data of 375 participants who completed the relevant questions in the follow-up survey.

Analyses of secondary outcomes relating to participants' intentions and attitudes regarding STI testing were conducted using the data of 374 (intentions) and 371 (attitudes) participants who completed the relevant questions in the follow-up survey.

Analysis of Primary Outcome

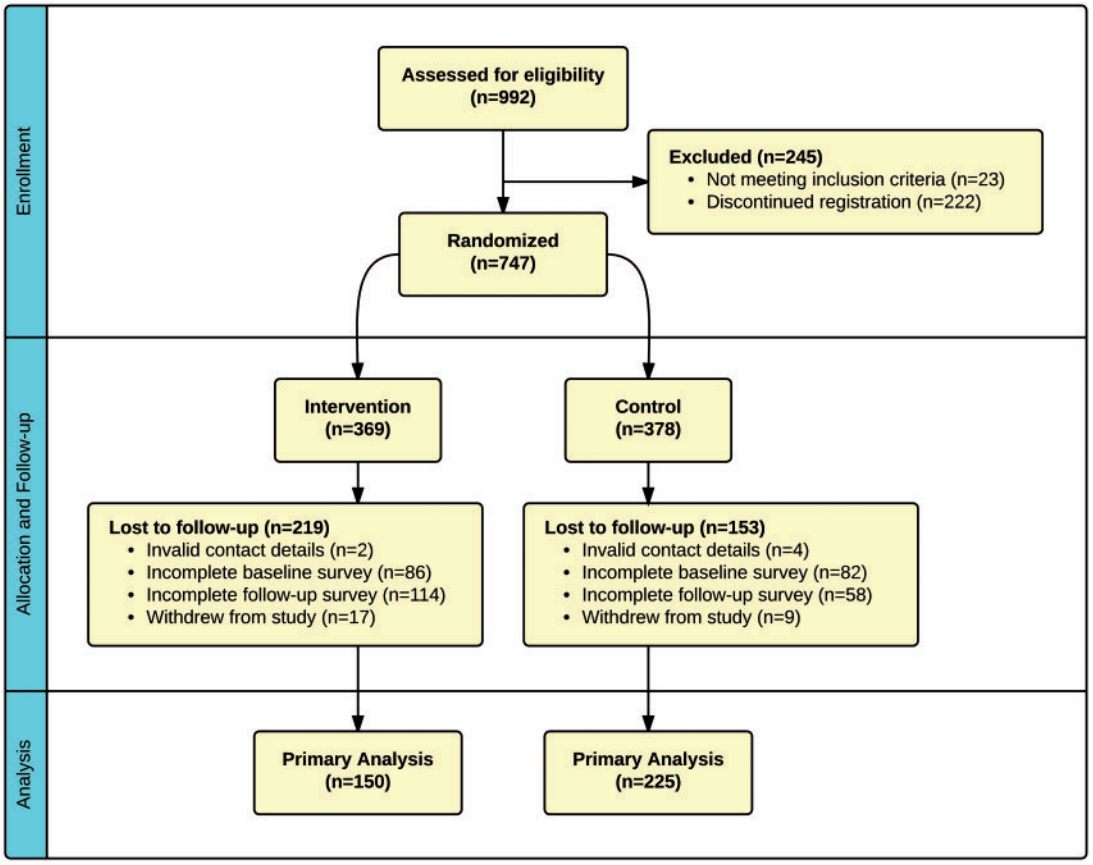
STI testing

The proportion of participants who reported being tested for STIs during the study was significantly higher (absolute risk difference = 7.8% (95% CI, 1.3–15.0)) in the PCHMS (15.3%, 23/150) than in the waitlist (7.6%, 17/225) group (χ^2 (1, $n = 375$) = 5.7, $P = .017$). The relative risk of PCHMS group participants reporting having been tested for STIs during the study was 2.0 (95% CI, 1.1–3.7). Approximately 13 participants (95% CI, 7–76) would therefore need to have access to the PCHMS for the mean duration of study exposure to result in 1 additional participant reporting having been tested for STIs.

Subgroup analysis identified heterogeneity of intervention effect between those participants who reported a history of sexual activity and those who reported having never been sexually active. The difference in STI screening rates in the sexually active subgroup (absolute risk difference = 10.8% (95% CI, 2.3–19.9); RR = 2.1 (95% CI, 1.2–3.9); PCHMS (20.4%, 23/113); waitlist (9.6%, 15/157)) was significantly greater (interaction test $P = .027$) than among those participants who had never been sexually active (absolute risk difference = −2.9% (95% CI, −10.1 to 6.7); RR = null; PCHMS (0.0%, 0/37); waitlist (2.9%, 2/68)).

Binary logistic regression was employed to adjust for differences in baseline characteristics and potential confounding factors that might influence the primary outcome measure, providing a stratified estimate of intervention effect (Supplementary Table S1). Four independent variables were found to make a statistically significant contribution to the regression model. These were age, history of sex without condoms, previous STI testing, and allocation to the PCHMS group. The adjusted odds ratio for participants reporting having undergone STI testing during the study for the PCHMS vs. waitlist groups was 2.3 (95% CI, 1.1–4.9).

Figure 2: Participant flowchart.



Analysis of Secondary Outcomes

Analyses of the secondary outcomes of visiting a healthcare professional for any sexual-health-related concerns during the study, and participants' attitudes and intentions regarding getting tested for STIs, reported in the follow-up survey, are presented in Table 2.

Healthcare visits for any sexual-health-related concerns

The proportion of participants who reported at least one visit to a healthcare professional for any sexual-health-related concerns (Table 2) was significantly higher (absolute risk difference = 12.0% (95% CI, 3.2–21.0)) in the PCHMS group (30.7%, 46/150) than in the waitlist group (18.7%, 42/225) (χ^2 (1, $n = 375$) = 7.2, $P = .007$). The relative risk of 1.6 (95% CI, 1.1–2.4) indicates that the proportion of participants who reported at least one sexual-health-related healthcare visit was 60% higher in the PCHMS group.

Attitudes and intentions

Participants' intentions toward being tested for STIs in the 6 months post study, measured on a 5 point Likert scale, were significantly greater (χ^2 (1, $n = 374$) = 6.8, $P = .009$) in the PCHMS group (Table 2).

Participants' attitudes regarding whether being tested for STIs was of relevance to them, measured on a 5-point Likert scale, were significantly more positive (χ^2 (1, $n = 371$) = 5.0, $P = .025$) in the PCHMS group (Table 2).

DISCUSSION

Our findings indicate that having access to this implementation of the *Healthy.me* PCHMS was associated with a significantly greater proportion of participants engaging in sexual health-seeking behaviors. These differences were observed in both the percentage of participants who reported having undergone STI testing (absolute difference of 7.8%) and having accessed any sexual-health-related services (absolute difference of 12.0%) over the duration of their enrolment in the study. As was expected, subgroup analysis identified that the intervention had a significantly greater effect among those participants who were sexually active. The intervention effect persisted after adjusting for differences in baseline characteristics and potential confounding factors.

This is also likely the first study to demonstrate efficacy of a PCHMS targeting a health concern where susceptibility is generally perceived as low and the majority of infections are asymptomatic.[5,16,38] Many previous studies of the utility of PCHMS and other Internet interventions for preventative healthcare initiatives have focused on issues where previous experience of the condition and/or perceived susceptibility are generally high, such as influenza vaccination, smoking cessation, and weight management,[21,39] which may act as motivators for engagement and a behavioral change. In addition, other trials of PCHMSs were conducted in settings where individuals were *aware* of their conditions and/or care processes, such as in vitro fertilization,[40] hypertension,[41] diabetes,[19,42] influenza vaccination,[21,43]

Table 1: Baseline characteristics of all participants and those available for primary analysis

Characteristic	Primary Analysis*				All Allocated Participants*			
	PCHMS ($n=150$)		Waitlist ($n=225$)		PCHMS ($n=265$)		Waitlist ($n=283$)	
Age (years)	21.8	(2.9)	21.3	(2.8)	21.6	(2.8)	21.3	(2.8)
Sex (female)	87	(58.0%)	132	(58.7%)	151	(57.0%)	158	(55.8%)
University student	145	(96.7%)	221	(98.2%)	259	(97.7%)	279	(98.6%)
Medicine faculty[a]	49	(32.7%)	68	(30.2%)	79	(29.8%)	77	(27.2%)
Patient at the University Health Service	66	(44.0%)	77	(34.2%)	106	(40.0%)	91	(32.2%)
Recent[b] visit with healthcare professional(s)	111	(74.0%)	175	(77.8%)	199	(75.1%)	214	(75.6%)
History of sexual activity[c]	110	(73.3%)	156	(69.3%)	190	(71.7%)	198	(70.0%)
Number of recent[b] sexual partners								
None	53	(35.3%)	92	(40.9%)	104	(39.2%)	112	(39.6%)
One	77	(51.3%)	103	(45.8%)	131	(49.4%)	129	(45.6%)
Two or three	13	(8.7%)	24	(10.7%)	20	(7.5%)	31	(11.0%)
Four or more	7	(4.7%)	6	(2.7%)	10	(3.8%)	11	(3.9%)
History of sex[c] without condoms	80	(53.3%)	121	(53.8%)	133	(50.2%)	147	(51.9%)
Previous STI test	60	(40.0%)	71	(31.6%)	90	(34.0%)	84	(29.7%)
Previous STI infection	10	(6.7%)	10	(4.4%)	13	(4.9%)	10	(3.5%)

STI = sexually transmitted infection; PCHMS = personally controlled health management system.
* Data are number (%) or mean (SD)
[a] Staff and students in a Faculty or School of Medicine
[b] In the previous 6 months
[c] Sex defined as oral sex or penetrative vaginal/anal intercourse

medication accuracy,[44] breast cancer management,[45] physical and emotional well-being,[22] and asthma.[28] To date, there remains a lack of literature on how (or whether) patients and consumers would use these systems to engage with health services when they may not have experienced concerns or symptoms yet.

Our findings provide preliminary evidence to support the hypothesis that such enhanced online PCHMS interventions can be effective in inducing a change in the sexual health-seeking behaviors of young people. This is in agreement with the findings of a systematic review of Australian interventions intending to combat STIs, which found RCTs of other internet delivered interventions to be significantly associated with increased sexual health-seeking behaviors.[46] Additionally, the outcome provides further evidence to support the use of a PCHMS as an intervention to increase the uptake of primary preventative healthcare activities, such as screening, among health consumers.

Explanation of Intervention Effect

An important barrier to STI screening is the embarrassment and reluctance that many young people experience in regards to discussing sexual health[15,38]; online interventions help to address this through the anonymity and privacy afforded by the Internet medium. Many young Australians regularly use the internet to find sexual health-related information[47] and have expressed acceptance toward novel sexual health interventions, provided that they are accessible and trustworthy.[48–50] Accordingly, the *Healthy.me* PCHMS and its sexual health content execute a multifaceted, theory-based approach in an attempt to bring about a health behavioral change where participants can remain anonymous.

The sexual health 'journey' is based on the Health Belief Model and incorporates its constructs of perceived susceptibility, severity, barriers, benefits, and self-efficacy.[23] These constructs are incorporated into three stages of the sexual health 'journey'. The first and second stages aim to increase the participants' perceived susceptibility to, and severity of, STIs, through increasing their STI-related knowledge and understanding of infection prevalence, risk factors, and indications/recommendations for screening. The third stage attempts to directly address many of the perceived barriers to STI screening, including those regarding costs, test procedures, where to get tested, and fears of testing outcomes and interacting with clinical staff; thereby enhancing self-efficacy.[15] The perceived benefits of STI testing, and its presentation as a positive social norm, are appropriately incorporated and reinforced in all three stages. A review of online interventions found that those built upon a theoretical framework demonstrated greater efficacy,[24] supporting the suggested effectiveness of the *Healthy.me* journey model.

Table 2: Analyses of secondary outcomes by study group

Analysis		Number (%)		Risk difference (95% CI)	Relative risk (95% CI)	*P*-value
Secondary Outcomes	Visiting a healthcare professional for any sexual health related concerns	PCHMS ($n = 150$)	Waitlist ($n = 225$)			
		46 (30.7)	42 (18.7)	12.0% (3.2–21.0)	1.6 (1.1–2.4)	.007
	Intentions to get tested	PCHMS ($n = 149$)	Waitlist ($n = 225$)			
	Certainly not	28 (18.8)	53 (23.6)	−4.8% (−12.9 to 3.9)	0.8 (0.5–1.2)	.009
	Probably not	61 (40.9)	107 (47.6)	−6.6% (−16.6 to 3.7)	0.9 (0.7–1.1)	
	Don't know	28 (18.8)	37 (16.4)	2.4% (−5.3 to 10.6)	1.1 (0.7–1.8)	
	Probably yes	18 (12.1)	19 (8.4)	3.6% (−2.5 to 10.5)	1.4 (0.8–2.6)	
	Certainly yes	14 (9.4)	9 (4.0)	5.4% (0.0–11.5)	2.3 (1.0–5.3)	
	Attitude (Is STI testing relevant to you?)	PCHMS ($n = 147$)	Waitlist ($n = 224$)			
	Totally disagree	56 (38.1)	111 (49.6)	−11.5% (−21.4 to −1.1)	0.8 (0.6–1.0)	.025
	Somewhat disagree	30 (20.4)	43 (19.2)	1.2% (−6.8 to 9.8)	1.1 (0.7–1.6)	
	Neutral	27 (18.4)	29 (12.9)	5.4% (−2.0 to 12.4)	1.4 (0.9–2.3)	
	Somewhat agree	20 (13.6)	30 (13.4)	0.2% (−6.7 to 7.8)	1.0 (0.6–1.7)	
	Totally agree	14 (9.5)	11 (4.9)	4.6% (−0.6 to 10.8)	1.9 (0.9–4.2)	

PCHMS = personally controlled health management system; CI = confidence interval.

Evidence also suggests that education alone is insufficient in promoting a behavioral change.[51] Interventions which present informational cues in an interactive and immediately actionable way have previously demonstrated efficacy in promoting changes in some sexual health behaviors and intentions.[52] The *Healthy.me* PCHMS achieves this through the inclusion of features such as the polls, 'Book Now' button, and prompts to visit the forum where questions can be posed to a GP or other participants. These features assist the informational cues in overcoming barriers related to embarrassment, stigma, and access by taking communication platforms that young people are comfortable using[53] and applying them with the intention of *normalizing* STI testing and broaching channels of communication with healthcare providers. A recent study that investigated the use of practitioner contact via email found it to be positively correlated with increased reported STI screening, supporting the importance of the practitioner contact element of this intervention.[30]

Limitations of Study Design and Interpretation

Notable limitations of this study include (i) participant attrition rate, (ii) the use of self-reported data, and (iii) the generalizability of the results.

i. Participant attrition

Like many similar studies conducted online,[54] a large proportion of the participants in the present study did not complete the follow-up survey, resulting in moderate to high rates of attrition in the intervention (60%) and control groups (40%). High attrition rates are common in eHealth intervention studies. For example, two large studies of internet-based weight loss interventions suffered attrition rates of 52% and 89%,[55,56] an online HIV prevention intervention study suffered attrition of 85%,[57] and a recent systematic review revealed that completion of protocol rates for depression sites ranged from 43% to 99%.[58]

ii. Self-reported data

The use of self-reported data is another limitation, as the accuracy of the information could not be verified. The use of self-reported data is ubiquitous in this type of sexual health research and its validity is often questioned due to the risk of social desirability bias.[59] However, evidence exists to support the validity of some self-reported sexual health characteristics. For example, in adolescents self-reported condom use with the last two partners has shown to be associated with the absence of an STI.[60] In the present study, to reduce the risk of participants misinterpreting a question, we carefully defined our terms and refined and piloted our wording. Furthermore, participants did not need to provide any personally identifying information, apart from an email address, when completing the surveys, and they were assured that their responses would remain anonymous and de-identified. Evidence suggests that these strategies may support more complete and accurate self-reporting of sexual health-related data.[61]

iii. Generalizability of results

While the eligibility criteria were non-restrictive and designed to include a representative sample of young people, participants were recruited from a university setting. Such participants have higher levels of sexual health knowledge and STI testing,[15] and may be more willing

to engage with novel interventions. However, recent survey evidence suggests that young people with a university education do not exhibit lower risk factors for STIs than the general population.[15]

The generalizability of these results may also be limited by the high proportion of participants who were affiliated with a university medical faculty (32.7% and 30.2% of intervention and control groups respectively). Such participants may have been more receptive to novel interventions targeting sexual health.

CONCLUSIONS

This study provides evidence that access to a web-based personally controlled health management system (PCHMS) intervention increases the reported uptake of STI screening, and the utilisation of health services for sexual health-related concerns, in a group of Australian university students. Future research should apply a PCHMS intervention to a more demographically diverse population of young people, and attempt to maximise the intervention effect size and minimise limitations through enhancing the intervention's engagement potential.

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COMPETING INTERESTS

AL is a co-inventor of the *Healthy.me* platform and could benefit from its commercialization.

CONTRIBUTORS

Study conceptualization: NM, AL. Study design: NM, JR, RG, AH, AL. Journey design: NM, JR, RG, AL. Data collection: NM. Data analysis: NM, AH. First draft: NM. Draft revision and approval: NM, JR, RG, AH, AL.

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SUPPLEMENTARY MATERIAL

Supplementary material is available online at http://jamia.oxfordjournals.org/.

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