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Assessing the effectiveness of HIV/STI risk communication displays among Melbourne Sexual Health Centre attendees: a cross-sectional, observational and vignette-based study

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ABSTRACT

Introduction Increasing rates of sexually transmitted infections (STIs) over the past decade underscore the need for early testing and treatment. Communicating HIV/STI risk effectively can promote individuals' intention to test, which is critical for the prevention and control of HIV/STIs. We aimed to determine which visual displays of risk would be the most likely to increase testing or use of prevention strategies.

Methods A vignette-based cross-sectional survey was conducted with 662 clients (a median age of 30 years (IQR: 25–36), 418 male, 203 female, 41 other genders) at a sexual health clinic in Melbourne, Australia, between February and June 2023. Participants viewed five distinct hypothetical formats, presented in a randomised order, designed to display the same level of high risk for HIV/STIs: icon array, colour-coded risk metre, colour-coded risk bar, detailed text report and guideline recommendation. They reported their perceived risk, concern and intent to test for each risk display. Associations between the format of the risk display and the intention to test for HIV/STI were analysed using logistic regression.

Results About 378 (57%) of participants expressed that the risk metre was the easiest to understand. The risk metre (adjusted OR (AOR)=2.44, 95% CI=1.49 to 4.01) and risk bar (AOR=2.08, CI=1.33 to 3.27) showed the greatest likelihood of testing compared with the detailed text format. The icon array was less impactful (AOR=0.73, CI=0.57 to 0.94). The risk metre also elicited the most concern but was the most preferred and understood. High-risk perception and concern levels were strongly associated with their intention to have an HIV/STI test.

Conclusions Displaying risk differently affects an individual's perceived risk of an HIV/STI and influences their intention to test.

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Existing literature has demonstrated the effectiveness of government recommendations in promoting informed health decisions for cancer screening. Visual risk communication formats like icon arrays, risk metres and risk bars have shown promise for risk communication in broader health contexts. However, limited research exists on risk communication displays tailored to HIV/sexually transmitted infection (STI) testing.

WHAT THIS STUDY ADDS

⇒ Our study is the first to examine the effectiveness of various risk display formats, like risk metres and risk bars, specifically for HIV/STI testing intentions. We found that the colour-coded risk metre was most effective in influencing participants' intention to get tested, likely due to its ease of understanding and potential familiarity from its resemblance to other risk displays, such as bushfire warnings in Australia. Our study also indicates that a one-size-fits-all approach may not work; the text report was the second most preferred option for specific groups, suggesting the need for multiple formats to meet diverse needs.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ Our findings can inform the development of risk communication strategies, particularly web-based tools, that leverage optimal formats to convey HIV/STI risk and empower testing decisions effectively. Healthcare providers and policymakers should consider adopting multiple, visually engaging risk display formats that can be easily understood to encourage testing, especially among high-risk groups. Additionally, the study identifies areas for future research, such as the psychological impact of these risk displays and how personal health literacy might influence their effectiveness.

INTRODUCTION

HIV and sexually transmitted infections (STIs) present a formidable global health concern. Approximately 38 million individuals worldwide live with HIV, with 376 million new cases of curable STIs emerging each year.[1] Australia mirrors this global trend, with STI incidence increasing over the last decade.[2–4] The cornerstone of HIV/STI transmission mitigation lies in early detection and timely treatment.[5] Yet, many remain unaware of their risk or avoid

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testing due to the stigma attached to STIs or the absence of symptoms.[6–8]

The Melbourne Sexual Health Centre (MSHC) is addressing this challenge by developing a website that features a web-based tool using machine learning algorithms to predict the risk of HIV/STIs, allowing individuals, including those without symptoms, to assess their risk.[9 10] The primary aim of this web tool is to support early diagnosis and prompt treatment. To enhance HIV/STI testing, the risk should be presented in the most meaningful manner without causing undue distress. Effective risk communication can influence how individuals perceive their risk, thereby impacting their decision to seek testing and treatment.[11]

Evidence suggests that absolute risk communication, as opposed to relative risk, provides clearer, comprehensive information without exaggerating benefits or harms.[11–17] Previous studies have shown that icon arrays can effectively communicate medical risks to various patient groups, including individuals with lower numeracy skills.[12 13 16 17] Moreover, other forms of infographics, such as risk metres and bars, have also shown promise in presenting complex data clearly and understandably, which can help people make informed decisions about their health.[18 19] In cancer research, several studies have found government recommendations to be more impactful than other risk communication formats.[12 20 21]

While considerable research has been conducted on risk communication in other healthcare areas, there is a lack of research on effective communication of HIV/STI risk. Given the sensitive nature of the topic, it is essential to explore how different risk communication displays impact the intention to have HIV/STI testing. Therefore, we aimed to investigate the effectiveness of various risk communication displays—including an icon array, colour-coded risk metre, colour-coded risk bar, detailed text risk report and guideline recommendations—in promoting HIV/STI testing. Our findings aim to enhance the public-facing MySTIRisk tool's effectiveness, potentially increasing HIV/STI testing uptake, reducing transmission rates and bolstering public health outcomes.

METHODS

Study population

This was a cross-sectional vignette-based study. We sent short message service (SMS) to eligible clients who had visited the MSHC between February and June 2023 and who had previously consented to receiving SMS.

Data collection

To be eligible, individuals had to have had a sexual partner in the last 3 months before their visit to MSHC and have agreed to receive SMS from MSHC. We identified eligible participants through daily queries of data collected using computer-assisted self-interviewing interviews (CASIs) completed on arrival at the MSHC. Eligible participants were then contacted via direct SMS messaging on the day after their visit.

We aimed to enrol 200 participants in each of the three groups, each representing about one-third of clients at MSHC. This target was set to ensure a sufficient sample to assess the preferences for risk display formats, based on practical considerations such as expected response rates and resource availability. The calculation of 582 total participants was influenced by an anticipated frequency of 30%, an absolute precision of 5% and a design effect of 1.8. The three groups were gay, bisexual and other men who have sex with men (GBMSM); heterosexual men; and women groups. Additionally, we included trans and gender-diverse participants in the study to ensure a more comprehensive and inclusive representation, although we did not set a minimum target for this group. The questionnaire allowed participants to select their gender identity and sexual orientation in the survey, which may have differed from the initial categories based on CASI.

Procedures

We developed five different risk communication displays for a hypothetical high risk of HIV/STIs (figure 1A–E). The display formats included: a detailed text risk report (figure 1A) showing absolute risk information for HIV, syphilis, gonorrhoea and chlamydia; the colour-coded risk metre (figure 1B), showing general STI risk; the colour-coded risk bar (figure 1C), showing general STI risk; the guideline recommendations (figure 1D), showing general STI risk; and the icon array (figure 1E), demonstrating both the current and the future risk of chlamydia in a year. Participants were asked to envision the risk reports as their own. The risk level for a high-risk asymptomatic individual was consistently displayed across all formats, presented in a randomised order. The icon array specifically focused on chlamydia risk rather than general STI risk because icon arrays require data on a specific condition to construct the visual representation. The detailed text report provided numerical risk estimates for multiple STIs to give participants detailed risk information. The other formats presented a summarised view of general STI risk rather than infection-specific risks (figure 1).

Participants were asked identical questions for each risk display option to gauge their understanding, including whether they perceived themselves as at risk upon seeing the displayed risk. Additionally, participants were queried about their intention to have HIV/STI testing, and how concerned they would be upon seeing the displayed risk. Additionally, participants were invited to express their preference for the risk display option they found easiest to understand and the one they would favour for an HIV/STI risk assessment website (see figure 1).

Before initiating the study, we conducted five individual pilot interviews, including three men and two women, with consenting English-speaking clients who visited MSHC over the age of 18 years. We reviewed the survey questionnaire with these five participants to ensure the clarity of survey questions and comprehensibility of the scenarios presented. Following the completion of pilot interviews, minor modifications were made to the questionnaire, including clarifying the language used in the instructions.

The survey was administered via the Qualtrics online survey platform[22] and was intentionally designed to be concise, with a target completion time of no more than 10 min.

Statistical analysis

In addition to the descriptive analysis, we employed univariable and multivariable logistic regression to explore associations between risk display formats and the intention to have HIV/STI testing after reviewing the corresponding risk reports. In our multivariable logistic regression analyses, explanatory variables included risk display formats, specific participant groups, age, gender, country of birth, educational attainment, previous HIV/STI testing, risk perception and concern level. Due to the limited set of variables collected in the survey and the study's exploratory nature, all available variables were included in the multivariable logistic regression model. No variable selection criteria were applied. The variables included were relevant to the research question and aimed to capture a comprehensive view of

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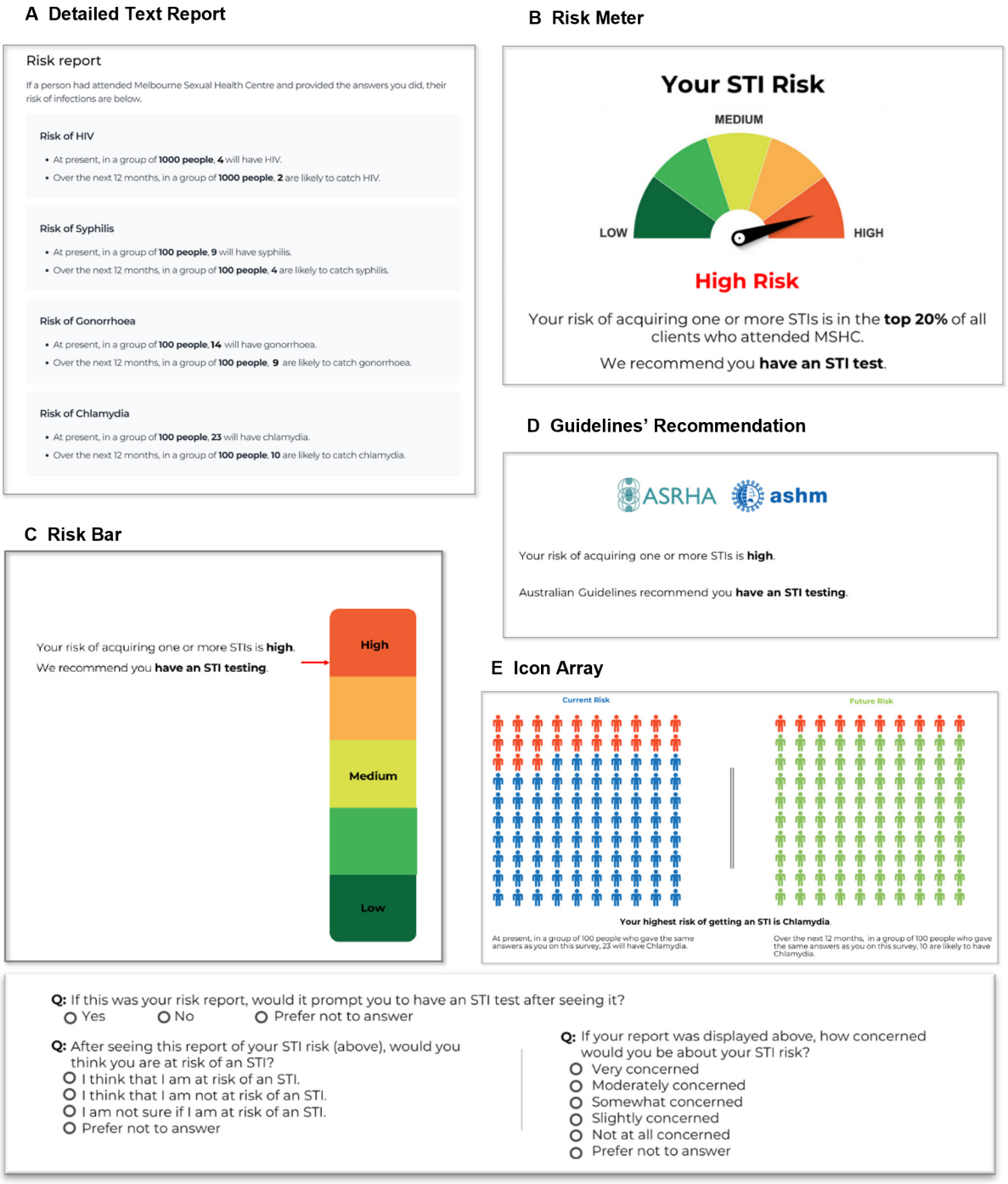

Figure 1 Hypothetical risk display formats: (A) detailed text report; (B) risk metre; (C), risk bar; (D) guidelines' recommendation; (E) icon array. ASHM, Australasian Society for HIV, Viral Hepatitis and Sexual Health Medicine; ASRHA, Australasian Sexual and Reproductive Health Alliance; MSHC, Melbourne Sexual Health Centre; STI, sexually transmitted infection.

factors potentially influencing the intention to test for HIV/STIs. We accounted for clustering due to multiple data points from each participant by adjusting with robust SEs.

We observed only minimal missing data in survey responses. We employed a complete case approach for the logistic regression analyses, where only rows with complete information for all variables were included in the model. This choice assumed that the missing data were missing completely at random, and their exclusion would not introduce bias into our findings.

Data collection and processing were managed via the Qualtrics server, with subsequent analysis conducted using STATA V.17.[23]

RESULTS

Demographic characteristics of study participants

From February to June 2023, we recruited 662 participants who visited MSHC out of 4708 individuals who had consented to receiving an SMS, resulting in a 14% response rate among those to whom survey links were sent. Most participants were aged between 25 and 34 years (48%, n=315), with male being predominant in terms of sex assigned at birth (67%, n=445). The cohort was notably educated, most having an undergraduate degree or higher. Over half of the participants (51%, n=339) self-identified as Australian

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Table 1 Summary of participant characteristics (n=662)

	Participants n (%)
Age (years)	
18–24	142 (21)
25–34	315 (48)
35–44	133 (20)
45–55	39 (6)
55 and above	33 (5)
Sex assigned at birth	
Male	445 (67)
Female	215 (32)
Don't know	2 (0)
Current gender identity	
Male	418 (63)
Female	203 (31)
Non-binary/gender fluid	34 (5)
Different identity	7 (1)
Sexual orientation	
Lesbian/gay/homosexual	183 (28)
Bisexual	73 (11)
Straight/heterosexual	337 (51)
Queer	50 (8)
Different identity	17 (3)
Prefer not to say	2 (0)
Country of origin	
Australia	339 (51)
Other countries	322 (49)
Missing	1 (0)
Education	
Primary school	4 (1)
Secondary school	153 (23)
Undergraduate degree	267 (40)
Postgraduate degree	222 (34)
Missing	16 (2)
Previously tested for STI	
Yes	588 (89)
No	8 (1)
Missing	6 (1)
Participant groups	
GBMSM	213 (32)
Heterosexual men	202 (31)
Women	201 (30)
Trans and gender diverse	45 (7)

GBMSM, gay, bisexual and other men who have sex with men; STI, sexually transmitted infection.

nationals. Compared with individuals to whom the SMS was sent, the survey respondents showed similar distributions in both age (medians 30 vs 29 years) and country of birth (51% vs 46% Australian nationals). A significant proportion reported a history of STI testing (89%, n=588) (see table 1).

Participant understanding and preference for risk communication formats

Among all participants, 57% (n=378) found the risk metre the easiest to understand and was the most preferred option (44%, n=292). Conversely, the icon array was considered the least easy to understand (5%, n=31). The risk metre was also the most preferred option (44%, n=292), and the icon array was the least preferred option (8%, n=56) (see figure 2A,B).

In terms of specific participant groups, all shared similar patterns, with the risk metre being rated as the easiest to understand (p=0.85) and the most preferred option (p=0.10). However, for heterosexual male and trans and gender-diverse participants, the detailed text report was the second most preferred option. For GBMSM and women, the risk bar was the second most preferred option.

Level of concern expressed by the participants

The risk metre and risk bar formats generated a higher level of concern, with 61% (n=404) and 55% (n=363) of participants, respectively, reporting a high concern. In contrast, the text report and icon array formats were associated with lower concern levels, with 37% (n=248) and 36% (n=235) of participants, respectively, reporting low concern. The guideline recommendation format produced a moderate level of concern among the majority of participants, with 47% (n=311) (see figure 2).

Multivariable logistic regression analysis of STI risk display formats and the intention to test for HIV/STI

Table 2 shows the crude and adjusted ORs (AORs) for the intention to test for HIV/STIs. Overall, the risk metre and risk bar were significantly associated with an increased intention to test for HIV/STIs compared with the text display format after adjusting for variables described in table 2. The risk metre showed a significantly higher intention to have HIV/STI testing (AOR=2.44, 95% CI=1.49 to 4.01, p<0.001). The risk bar also showed a statistically significant association with a higher intent to have HIV/STI testing (AOR=2.08, 1.33 to 3.27, p=0.001). In contrast, the guideline recommendations did not show a statistically significant association (p=0.36) and the icon array was associated with a decreased intent to test (AOR=0.73, 0.57 to 0.94, p=0.02) (see table 2).

No statistically significant associations were found between specific participant groups (GBMSM, heterosexual men, women and gender-diverse people) and the intention to have HIV/STI testing (p>0.35). Similarly, age, sex, country of origin, education level and previous STI testing did not show significant associations with intent to have HIV/STI testing.

Risk perception and level of concern were strongly associated with participants' intention to test for HIV/STI. Participants who perceived themselves as at risk of an STI had more intention to have HIV/STI testing than those who perceived themselves as not at risk (AOR=13.14, 7.77 to 22.22). Similarly, participants with a high level of concern had significantly higher odds of testing compared with those with low concern (AOR=4.79, 1.93 to 11.87).

DISCUSSION

Our study found that the risk metre and risk bar formats were associated with higher intention to test for HIV/STIs. Conversely, the icon array format was associated with lower intention to test for HIV/STIs. Additionally, there was a clear association between the level of concern created by the different risk displays and the intention to test. The risk metre stood out as both the easiest to understand and the most preferred format by all participant groups. While other studies have assessed the effectiveness of risk display formats for other conditions, such as colorectal cancer,[12] we were unable to find any studies that had assessed different risk displays for HIV/STIs. Our findings offer valuable

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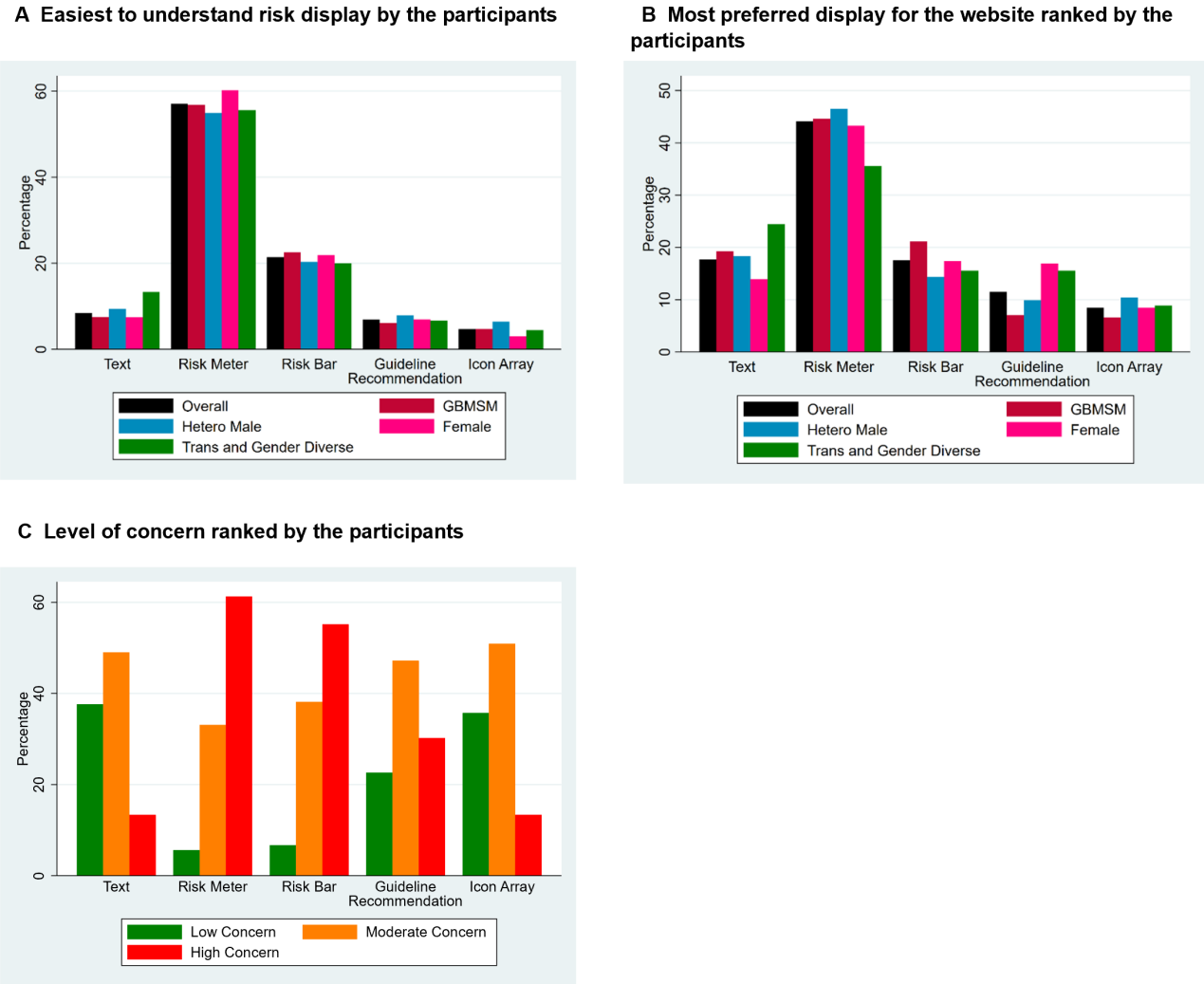

Figure 2 Participant rankings of risk display formats: (A) ease of understanding, (B) preference for the website and the (C) level of concern. GBMSM, gay, bisexual and other men who have sex with men.

insights into how different risk display formats may influence an individual's intention to test for HIV/STIs.

We found that the colour-coded risk metre and risk bar showed a greater association with the intent to test for HIV/STIs, and that the risk metre was the most preferred display for HIV/STI risk among the participants. The risk metre format closely resembles colour-coded warning systems commonly used in Australia for bushfire alerts, particularly using red or similar colours to indicate high risk. As these bushfire warning signs are ubiquitous in Australia, this familiar format may have primed participants to interpret high-risk levels more easily than other risk display formats. Priming, where exposure to comparable previous constructs influences responses, is well documented in previous studies.[24 25] Additionally, our findings align with existing literature, indicating that visual displays can communicate risks more effectively than numerical approaches, by focusing attention through bold colours or shapes.[13 18 26]

We found a strong association between perceived risk and the intent to have HIV/STI testing. This finding aligns with the principles of the Health Belief Model, which postulates that perceived susceptibility to and severity of a health threat can encourage individuals to engage in preventive actions.[27 28] It is also possible that the greater ease of understanding from the risk metre and risk bar formats contributed to the greater intent to test, particularly as the intent to test was correlated with the highest reported ease of understanding among the displays. We did not formally measure anxiety levels and other emotional impacts using validated scales in our vignette study design, and future studies may wish to do this to ensure no undue harm occurs. It is interesting, however, that even though we could not measure anxiety levels from the metre display, participants preferred this display, which they reported as the easiest to understand. These findings highlight the importance of appropriate information resources listed on the website when displaying an HIV/STI risk. Individuals concerned about their risk may wish to access further information about HIV/STIs and where they can access testing, support or counselling.

Although our findings align with some existing research, they diverge notably regarding the impact of government guidelines.[12 21] For instance, Kim *et al* found that patients in a Melbourne general practice were more inclined to opt for colorectal cancer screening when presented with the Australian government's screening guidelines.[12] This contrasts with our study, where guidelines did not associate with higher intent for HIV/STI testing. Instead, our results indicated that visually compelling risk displays, such as the risk metre and risk bar

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Table 2 Predictors of HIV/STI testing intention based on univariable and multivariable logistic regression analyses

Predictor	Crude OR	P value	AOR	P value
Format				
Text display	Ref		Ref	
Risk metre	13.71 (9.35 to 20.11)	<0.001	2.44 (1.49 to 4.01)	<0.001
Risk bar	10.4 (7.35 to 14.71)	<0.001	2.08 (1.33 to 3.27)	0.001
Guideline recommendation	2.36 (1.90 to 2.94)	<0.001	1.16 (0.85 to 1.59)	0.36
Icon array	0.95 (0.81 to 1.12)	0.54	0.73 (0.57 to 0.94)	0.02
Participant groups				
Heterosexual men	Ref		Ref	
GBMSM	0.91 (0.70 to 1.18)	0.47	0.87 (0.56 to 1.35)	0.54
Women	0.88 (0.68 to 1.15)	0.34	1.71 (0.56 to 5.21)	0.35
Trans and gender diverse	0.74 (0.52 to 1.07)	0.11	0.93 (0.39 to 2.25)	0.88
Age	1.01 (0.99 to 1.02)	0.32	1.00 (0.98 to 1.02)	0.97
Sex assigned at birth				
Male	Ref		Ref	
Female	0.92 (0.74 to 1.14)	0.43	0.50 (0.18 to 1.39)	0.19
Country of origin				
Australia	Ref		Ref	
Other countries	1.08 (0.88 to 1.32)	0.70	1.06 (0.76 to 1.50)	0.72
Education				
Primary school	Ref		Ref	
Secondary school	0.62 (0.17 to 2.26)	0.47	4.75 (0.42 to 53.24)	0.21
Undergraduate degree	0.61 (0.17 to 2.22)	0.46	4.38 (0.39 to 48.66)	0.23
Postgraduate degree	0.59 (0.16 to 2.13)	0.42	3.73 (0.34 to 41.04)	0.28
Previously tested for STI				
Yes	Ref		Ref	
No	1.05 (0.75 to 1.46)	0.77	0.88 (0.51 to 1.52)	0.64
Risk perception				
I think that I am not at risk of an STI	Ref		Ref	
I think that I am at risk of an STI	42.76 (28.88 to 63.31)	<0.001	13.14 (7.77 to 22.22)	<0.001
I am not sure if I am at risk of an STI	2.09 (1.45 to 3.00)	<0.001	1.95 (1.26 to 3.04)	0.003
Level of concern				
Moderate				
Low	0.06 (0.05 to 0.08)	<0.001	0.11 (0.08 to 0.16)	<0.001
High	13.7 (5.78 to 32.45)	<0.001	4.79 (1.93 to 11.87)	0.001

AOR, adjusted OR; GBMSM, gay, bisexual and other men who have sex with men; STI, sexually transmitted infection.

formats, had a stronger impact on the intention to test. This might be because HIV/STI testing has higher stigma and disclosure fears, unlike cancer screening. Our younger sample demographic may also contribute, considering declining trust in government recommendations among younger generations.[29] Furthermore, other studies have shown that authoritative recommendations, even from globally recognised entities like the WHO, are not universally accepted, such as in the context of seeking information on pre-exposure prophylaxis.[30] While government recommendations seem reliable, their effectiveness can vary depending on context. For HIV/STI testing, visual risk displays may prompt more immediate action than guidelines.

Our results showed that a detailed text report was the second most preferred option behind the risk metre for specific groups. This could indicate individuals wanted a comprehensive breakdown of numerical absolute risk values and explanatory details contained in the text report. We did not test combinations of reports, specifically the detailed reports together with a summary risk display. Providing graphical overviews like the risk metre, together with detailed numerical risk statistics, may effectively deliver comprehensive risk information meeting diverse needs.

To our knowledge, our study was the first to specifically focus on diverse sexual orientations and gender identities, considering disproportionate HIV/STI rates among certain groups. Our rigorous methodology presented vignettes and formats randomly, minimising bias and enhancing validity. Overall, we addressed critical gaps in the literature by conducting novel research on risk communication among a broad, diverse sample, making it highly relevant to HIV/STI prevention.

Our study has several limitations. First, our response rate was relatively low, especially among heterosexual males, though respondents showed a similar distribution of age and country of birth to those to whom SMS was sent. Although the SMS method has higher engagement than other methods[31], online surveys have lower response rates than other methods.[32] Although it could have led to a biased sample, we aimed for equal recruitment across specific population groups to ensure a balanced representation of those groups. Second, our sample was composed of sexual health centre's clients who might already have an understanding of their risk or prior testing experience, so their perceptions may not reflect the wider population. Moreover, while we aimed for recruitment across sexual

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and gender identities, our approach did not include individuals who lack access to testing services missing potentially high-risk or underserved populations. This limitation highlights the need for future research to broaden study parameters to include more diverse populations, encompassing different risk strata for HIV/STI. Third, unlike other formats, the icon array focused specifically on chlamydia because displaying a numerical risk for four infections in one display is impossible. This may have contributed to the weaker association between icon arrays and testing intent. Fourth, while both the risk metre and bar displayed hypothetical high-risk scenarios, the precise risk level shown differed slightly between formats. For the risk metre, the high-risk indicator was positioned in the middle of the red zone, while in the risk bar, it was positioned in the lower part of the red zone. This inconsistency could have influenced the participants' perception and interpretation of high risk. Fifth, our main reason for undertaking the study was to determine the effectiveness of the different formats for displaying risk using a vignette-based hypothetical scenario. This may have influenced participants to overstate their intention to get tested[20], potentially resulting in an overestimation of their intention to test in real-world settings. Finally, we did not co-design the risk displays with input from patients or community members, although they were based on existing literature. We acknowledge it as a limitation, as input from patients and community members can help maximise the accessibility, understandability and acceptability of risk communication tools.

Future research should explore which factors might influence the optimal risk format, including personal health or digital literacy levels. This could involve exploring tailored approaches that customise risk displays based on individual characteristics to enhance understanding of HIV/STI risk. Additionally, designing resources, such as educational materials or counselling services, could support risk communication strategies and empower individuals to make informed decisions about their sexual health. Establishing ongoing monitoring and evaluation mechanisms to assess the psychological impact of different risk communication formats would also be beneficial. By striking a balance between effectively conveying risk information and addressing individuals' concerns, healthcare providers can optimise the effectiveness of risk communication strategies and promote informed decision-making and appropriate testing for HIV/STIs.

CONCLUSION

Our study highlights the importance of the risk metre and risk bar formats in encouraging individuals' intention to test for HIV/STIs. These findings have significant implications for the development and optimisation of the MySTIRisk tool, a public-facing web application for assessing HIV/STI risk.[9 10] Adopting client-centred risk communication approaches not only aids individuals in making informed testing decisions but also furthers the goals of HIV/STI prevention and control.

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Patient consent for publication Obtained.

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