AIDS PATIENT CARE and STDs
Volume 34, Number 5, 2020
© Mary Ann Liebert, Inc.
DOI: 10.1089/apc.2019.0300

Belief, Covariates, and Impact of the "Undetectable = Untransmittable" Message Among People Living with HIV in Australia

Ben Huntingdon, BLibStud (Hons),[1] John de Wit, MSc, PhD,[2,3]
Martin Duracinsky, MD, PhD,[4–6] and Ilona Juraskova, MPsych, PhD[1,7]

Downloaded by Universiteit Utrecht from www.liebertpub.com at 03/02/21. For personal use only.

Abstract

There is effectively no risk of transmission of HIV from an HIV-positive person with consistent undetectable viral load (UDVL) to an HIV-negative person during sex. This has been publicly disseminated by an international health campaign called ''undetectable = untransmittable'' (U = U). This study extends previous research by examining confidence in the U = U message and potential covariates of confidence in U = U, as well as by assessing the perceived personal risk and sexual outcomes in a sample of people living with HIV (PLWH) in Australia. Between October 2017 and June 2018, 139 adult PLWH were recruited through clinics or community-based strategies. They completed an online questionnaire assessing participant characteristics, general agreement with the U = U message, confidence in U = U as an effective HIV prevention strategy, perceived personal risk of onward transmission, and sexual outcomes. While the majority of participants (70.5%) agreed with the general U = U message, only 48.2% were confident in U = U as an effective HIV transmission prevention strategy across sexual situations. Lack of confidence in U = U was more pronounced in the community subsample, minority group participants, and lower educated participants. A minority of PLWH with self-reported UDVL thought they could pass on HIV and indicated poor sexual outcomes, including sexual inactivity, reduced frequency of sex, and reduced sexual satisfaction. General agreement with the U = U message among PLWH may mask lack of confidence in U = U. Community-based information and education tailored to culturally diverse groups and people with low health literacy are required to promote accurate perception of risk of transmission of HIV with consistent UDVL.

Keywords: HIV, undetectable viral load, agreement, confidence, sexual health

Introduction

Understanding of risk of transmission of HIV with undetectable viral load (UDVL) has developed over time. The Swiss Statement, based on observational evidence, stated that the risk of transmission among heterosexual couples, in which one partner had HIV with UDVL, was zero.[1] These observational data have been followed by the HPTN-052,[2] partner[3,4] and opposites attract[5] clinical trials, which have demonstrated that the risk of transmission of HIV from an HIV-positive person with consistent UDVL to an HIV-negative person during sexual intercourse, regardless of gender or sex, is negligible or ''effectively zero.'' Influential experts have described the risk of transmission with consistent UDVL as zero.[6]

In 2017, such evidence of negligible risk of transmission was simplified as part of a public health campaign as ''Undetectable = Untransmittable'' (U = U).[7] U = U has been endorsed by HIV experts,[8,9] and community health promotion organizations[10] and clinical guidelines[11] have embraced the dissemination of the U = U message, which has been heralded as an opportunity to promote the sexual wellbeing of

[1]Clinical Psychology Unit, School of Psychology, The University of Sydney, Sydney, Australia.
[2]Center for Social Research in Health, UNSW Sydney, Sydney, Australia.
[3]Department of Interdisciplinary Social Science, Utrecht University, Utrecht, The Netherlands.
[4]Hopital Hotel-Dieu, Unité de Recherche Clinique (URC-ECO), Paris, France.
[5]EA 7334, Patient-Centered Outcomes Research, Université Paris-Diderot, Sorbonne Paris Cité, Paris, France.
[6]Service de Médecine Interne et d'Immunologie Clinique, Hopital Bicetre, Kremlin-Bicetre, France.
[7]School of Psychology, Center for Medical Psychology and Evidence-based Decision-making (CeMPED), The University of Sydney, Sydney, Australia.

people living with HIV (PLWH).[7] Yet to our knowledge, no study, to date, has investigated the impact of the U = U message on sexual wellbeing outcomes of PLWH.

Before the public dissemination of the U = U message, a number of studies examined PLWH's beliefs in UDVL as an HIV transmission prevention method.[12–16] Increasing belief in UDVL as an HIV transmission prevention method over time has been evident. For example, Holt et al.[14] found the proportion of Australian gay and bisexual men with HIV who expressed belief in UDVL as an HIV transmission prevention method to have increased dramatically from 9.7% in 2013 to 46.2% in 2015. In the United States, Siegel and Meunier[17] collected data in New York City during 2016–2017 and found just over a third of men who have sex with men (MSM; 39.1%) believed a stable UDVL offered ''a lot of'' or ''complete'' prevention of HIV transmission. Furthermore, in another study in New York City with data collected in 2017, Rendina and Parsons[18] found that approximately two-thirds of HIV-positive men considered the U = U message to be somewhat or completely accurate. A recent follow-up study by Rendina et al.[19] with data collected mostly during 2018 found that 83.9% perceived U = U to be somewhat or completely accurate.

While evidence is accumulating regarding the views of MSM regarding the U = U message in general, extant studies have not assessed the confidence in U = U as an HIV prevention method to be used in specific sexual situations, nor the impact of U = U on the sexual wellbeing of PLWH. We posit that for U = U information to have a positive impact on the sexual wellbeing of PLWH, individuals need not only to agree with the U = U statement in general, but also need to have confidence in using U = U as an HIV transmission prevention method in specific sexual situations. Furthermore, agreement with the U = U message and confidence in U = U as an effective HIV prevention strategy in specific sexual situations is likely to differ among PLWH. It is hence critical to investigate participant characteristics associated with belief in U = U, to inform tailored interventions to promote understanding and confidence in U = U.

The aim of this study was to investigate general agreement with U = U as well as confidence in U = U as an effective HIV prevention strategy in specific sexual situations. We also examine potential covariates of confidence in U = U, and assess the extent to which PLWH with UDVL currently perceive a personal risk of HIV transmission and experience poor sexual outcomes.

Methods

Participants

Between October 2017 and June 2018, 139 PLWH living in Australia completed an online questionnaire as part of a larger international study.[20,21] Inclusion criteria were 18 years or older, living with HIV in Australia at the time of research, and sufficient language proficiency to complete the questionnaire in English.

Procedure

Participants were recruited through HIV clinics (clinic sample) and through direct e-mail invitations from community and online groups (community sample). The clinic sample was recruited through health professionals at three Australian HIV treatment centers, who invited PLWH to participate in the current study. Potential participants provided written permission to be contacted by the lead author, who provided detailed study information and obtained informed consent. The community sample was recruited through HIV community groups who advertised the study among their HIV-positive membership. In addition, Australians with HIV who had preregistered with a third-party research service to take part in online surveys were sent an invitation e-mail containing a web link to the online questionnaire.

The first section of the questionnaire included a participant information sheet and consent form, whereby participants provided their consent before proceeding to complete the questionnaire. Participants were reimbursed for their time with a AUD$20 gift card. The South Eastern Sydney Local Health District Human Research Ethics Committee granted approval before data collection [15/056 (HREC/15/POWH/1571)].

Measures

Participant characteristics included items assessing participants' sociodemographic characteristics, notably age, gender identity, sexual orientation, cultural background, educational attainment, employment status, and place of recruitment. We also assessed HIV-specific clinical parameters (e.g., time since commencing HIV treatment, viral load), and physical and mental health comorbidities. Furthermore, general health was assessed using the 12-item Short Form Health Survey (version 2) SF-12v2, which is widely used to capture general self-reported health outcomes.[22,23] Physical and mental health summary scores were calculated, as well as scores for the subscales of the SF-12v2 as per the scoring manual.[23]

General agreement with the U = U message was assessed with a single item: ''Thinking about HIV TREATMENTS, how much do you agree or disagree with the following statement: a person with undetectable viral load cannot pass on HIV.'' Participants answered on a 5-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree). This question was replicated from a previous study on HIV treatment beliefs.[13]

Confidence in reduced risk of HIV transmission with UDVL was assessed by asking participants to rate the risk of HIV transmission in the six specific sexual situations, each involving an HIV-positive person with UDVL and an HIV-negative person:

1. HIV-positive person giving oral sex to HIV-negative person;
2. HIV-positive person receiving oral sex from HIV-negative person;
3. HIV-positive woman having vaginal sex with HIV-negative man;
4. HIV-positive man having vaginal sex with an HIV-negative woman;
5. HIV-positive man giving anal sex to an HIV-negative man; and
6. HIV-positive man receiving anal sex from HIV-negative man.

For each of these scenarios, participants were asked to respond to the question ''What is the risk that HIV will be

Downloaded by Universiteit Utrecht from www.liebertpub.com at 03/02/21. For personal use only.

Downloaded by Universiteit Utrecht from www.liebertpub.com at 03/02/21. For personal use only.

passed on?,'' with answers given on a 6-point scale, ranging from 1 (not possible) to 6 (certain). These items were based on information about risk of transmission in a consensus statement of the Australasian Society for HIV and Sexual Health Medicine.[24] The wording of the items and the design of the graphics to assist comprehension were purposively designed by the authors, with drafts reviewed for meaning and comprehension by four HIV experts and five PLWH (Supplementary Table S1 for these risk perception questions and accompanying graphics).

We calculated an overall score reflecting confidence in U = U as an HIV transmission prevention method by combining scores across the six specific sexual situations. Participants who responded that there was some level of risk of transmission of HIV in one or more of the specific situations (i.e., they responded ''possible and the risk is low,'' ''possible and the risk is medium,'' ''possible and the risk is high'' or ''certain'') were categorized as lacking full confidence in U = U (scored as 1). Conversely, participants who answered that the risk of HIV transmission with UDVL in all six specific sexual situations was ''impossible'' or ''almost impossible'' were considered fully confident in U = U (scored as 0). It was considered that the response ''impossible'' is equivalent to absolutely zero risk, and ''almost impossible'' is equivalent to effectively zero, and that both of these zero responses are consistent with the U = U message.

Impact of perception of risk of transmission with UDVL on sexual life was assessed by asking participants with self-reported UDVL to indicate their perception of their personal risk of transmitting HIV. They were asked to rate this risk on a 6-point scale, ranging from 1 (not possible) to 6 (certain). Participants with self-reported UDVL were also asked about the potential impact of concern with the risk of transmitting HIV on four aspects of their recent sexual behavior; namely, not having sex at all, having less sex, being less satisfied with sex, and being preoccupied while having sex. For each item, participants indicated their responses using a 5-point scale ranging from 1 (strongly disagree) to 5 (strongly agree).

Data analyses

Analyses were conducted using SPSS version 22.[25] Descriptive statistics were calculated to characterize the sample and describe outcome data. A logistic regression model was used to examine factors associated with a lack of full confidence in U = U as an HIV transmission prevention method. Independent variables of interest included in the logistic regression model were age, gender, education, minority cultural background, SF-12v2 mental health score, SF-12v2 physical health score, and recruitment strategy. These variables were selected based on past research.[13,18] Age, mental health, and physical health variables were included as continuous variables. Education was included as an ordinal variable (higher scores indicate higher educational attainment). Minority cultural background (recoded as majority or minority status) and recruitment strategy were included as binary variables.

Tests of the assumptions of logistic regression[26] found that assumptions regarding sufficient events per independent variable, conformity of linear gradient for continuous variables, collinearity, and goodness of fit were satisfied. Independent variables were entered into the multivariate model if they were found to be significant at $p < 0.05$ in preceding simple linear regression analyses. Variables were entered into the final model simultaneously.

Results

Of the 139 participants, 100 were recruited through clinics, and 39 through the community organizations and preregistration for research participation (Table 1). An additional

Table 1. Participant Characteristics ($N = 139$)

	Mean (SD) or n *(%)*
Age	45.8 (13.3)
Gender	
Male	109 (78.4)
Female	30 (21.6)
Trans	2 (1.4)
Sexual orientation	
Homosexual	94 (67.6)
Bisexual	7 (5)
Heterosexual	34 (24.5)
Identify with none of these	4 (2.9)
Cultural background	
Anglo-Saxon/Celtic or European	103 (74.1)
Aboriginal Australian or Torres Strait Islander	10 (7.2)
Asian	9 (6.5)
Hispanic	6 (4.3)
African	4 (2.9)
Other	7 (5)
Highest education	
Primary	2 (1.4)
Secondary	27 (19.4)
Tertiary certificate or diploma	58 (41.7)
Tertiary degree or post graduate degree	52 (37.4)
Employment	
Employed	81 (58.3)
Student	9 (6.5)
Home duties	4 (2.9)
Retired	21 (15.1)
Unemployed	24 (17.3)
Recruitment strategy	
Clinic	100 (71.9)
Community	39 (28.1)
Years since HIV diagnosis	13.6 (9.6)
Years since commencing antiretroviral treatment	10.5 (7.7)
Self-reported undetectable viral load	112 (84.8)
Probable depression	72 (51.8)
Probable anxiety	80 (57.8)
Quality-of-life (SF-12v2) summary scores	
Physical health	49.2 (11.6)
Mental health	37.7 (12.8)
Quality-of-life (SF-12v2) subscale scores	
Physical functioning	71.4 (33.7)
Physical role functioning	65.9 (31.6)
Bodily pain	76.3 (27.6)
General health	61.5 (30.4)
Vitality	46.4 (27.7)
Social functioning	53.4 (31.9)
Emotional role functioning	57.5 (30.9)
Mental functioning	52.2 (23.5)

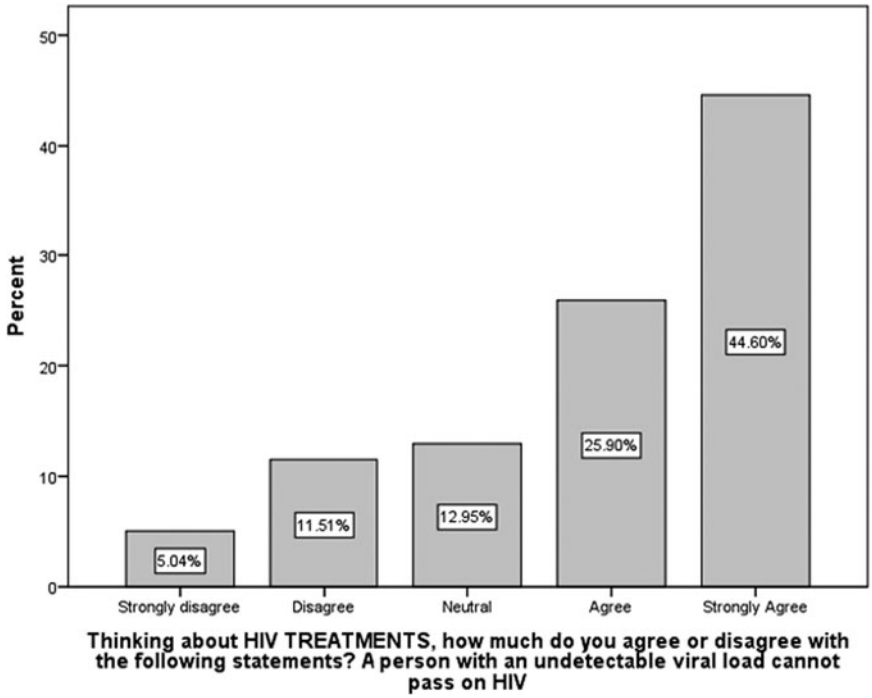

FIG. 1. Percentage of sample who agreed with general U = U statement. U = U, ''undetectable = untransmittable.''

61 potential clinic participants who initially verbally agreed to complete the study did not complete the questionnaire either because they did not begin the questionnaire or partially completed the questionnaire (clinic recruitment response rate 62.1%). As community-based recruitment pathways used opt-in recruitment, the response rate for this subsample could not be calculated.

Participant characteristics are shown in Table 1. Average age was 45.8 years (SD = 13.3), 78.4% of the sample identified as male, and 25.9% identified with a minority cultural background. Regarding mean quality-of-life scores, the current sample scored above average (indicating better health than a general population sample) on the physical functioning, physical role functioning, bodily pain, and general health subscales, and approximately average on the social functioning, emotional role functioning, and mental functioning subscales of the SF-12v2. The vitality subscale mean score was below average.

Agreement with the U = U message

The majority of participants (70.5%) agreed (i.e., answered ''agree'' or ''strongly agree'') with the statement that ''a person with undetectable viral load cannot pass on HIV.'' However, over a quarter (29.5%) were neutral/unsure or disagreed with the statement (Fig. 1).

Confidence in negligible risk of HIV transmission with UDVL

The proportion of participants choosing each of the perceived risk options for each of the six specific sexual situations is shown in Table 2. The response options ''not possible'' and ''highly unlikely/almost impossible'' are considered consistent with the U = U message. Proportions of participants who responded consistently with the U = U message varied for the specific sexual situations varied, ranging from 51.8% agreement with U = U in the specific

Table 2. Perception of Risk of Transmission with Undetectable Viral Load in Six Sexual Practice Scenarios

	No. of participant answers for each risk category n *(%)*					
Sexual practice scenario	*Not possible*	*Highly, unlikely almost impossible*	*Possible, low risk*	*Possible, medium risk*	*Possible, high risk*	*Certain*
Giving oral sex	64 (46)	29 (20.9)	23 (16.5)	16 (11.5)	6 (4.3)	1 (0.7)
Receiving oral sex	56 (40.3)	38 (27.3)	21 (15.1)	15 (10.8)	9 (6.5)	0 (0)
HIV-positive woman receiving vaginal sex with HIV-negative man	45 (32.4)	37 (26.6)	23 (16.5)	15 (10.8)	17 (12.2)	2 (1.4)
HIV-positive man having vaginal sex with HIV-negative woman	34 (24.5)	41 (29.5)	20 (14.4)	16 (11.5)	27 (19.4)	1 (0.7)
HIV-positive man topping	31 (22.3)	41 (29.5)	25 (18)	12 (8.6)	27 (19.4)	3 (2.2)
HIV-positive man bottoming	39 (28.1)	43 (30.9)	20 (14.4)	19 (13.7)	17 (12.2)	1 (0.7)

Responses ''not possible'' and ''highly unlikely almost impossible'' are considered consistent with U = U.
U = U, ''undetectable = untransmittable.''

Downloaded by Universiteit Utrecht from www.liebertpub.com at 03/02/21. For personal use only.

Table 3. Factors Associated with Lack of Full Confidence in U = U (N = 139)

Factor	*Unadjusted odds ratio (95% CI)*	p	*Adjusted odds ratio (95% CI)*	p
Age	0.984 (0.96–1.01)	0.216		
Gender	0.55 (0.24–1.26)	0.156		
Education	**0.52 (0.33–0.83)**	**0.006**	**0.47 (0.27–0.83)**	**0.008**
Minority cultural background	**3.22 (1.41–7.36)**	**0.006**	**3.87 (1.44–10.40)**	**0.007**
Recruitment strategy	**8.60 (3.30–22.43)**	**0.000011**	**7.77 (2.78–21.74)**	**0.000094**
SF-12 physical health score	**0.95 (0.92–0.98)**	**0.003**	1.03 (1.00–1.07)	0.055
SF-12 mental health score	0.99 (0.96–1.01)	0.313		

Values in bold are statistically significant at $p < 0.01$.

situation of an HIV-positive man giving anal sex (scenario 5) to 66.9% and 67.6% agreement in the specific situation of giving and receiving oral sex, respectively (scenarios 1 and 2).

Factors associated with confidence in negligible risk of HIV transmission with UDVL

Around half of participants (51.8%) were categorized as lacking full confidence in U = U as an effective HIV transmission prevention strategy. In simple regression analyses, this lack of confidence was significantly associated with lower education, minority cultural identity, community recruitment strategy, and lower SF-12v2 physical health summary score (Table 3). Age, gender, and SF-12 mental health summary score were not found to be significantly associated with simple regression analyses. The multivariate model (Table 3) showed that lack of confidence in U = U was associated with lower educational attainment (AOR = 0.47, 95% CI: 0.27–0.83, $p = 0.008$; odds of being in the ''lack of confidence in U = U'' group decreased by 0.47 for each one unit increase in level of educational attainment), identifying with a minority cultural background (AOR = 3.97, 95% CI: 1.44–10.40, $p = 0.007$), and having been recruited using community strategies (AOR = 7.77, 95% CI: 2.78–21.74, $p = 0.000094$). The association with physical health became nonsignificant in the multivariate model (AOR = 1.03, 95% CI: 1.00–1.07, $p = 0.055$).

Perceived personal risk and sexual outcomes among PLWH with UDVL

Of participants who self-reported UDVL ($n = 112$), the majority (73.2%) responded that their personal risk of transmitting HIV was effectively zero (i.e., answering ''not possible'' or ''highly unlikely, almost impossible''). Around a quarter (25.9%) of participants with UDVL responded that there was some level of risk of passing on HIV during sex.

Of the 112 participants who self-reported UDVL, 21% responded (i.e., answering ''agree'' or ''strongly agree'') that they refrained from any sexual activity due to their perceived risk of transmitting HIV, and over a third (35%) reported they had less sex than they would have otherwise (see Table 4). Around a quarter of participants with self-reported UDVL (26%) reported being less satisfied with sex because of the perceived risk of transmitting HIV, and 21% reported being preoccupied by risk of HIV transmission while having sex.

Discussion

This study examined agreement with U = U as well as confidence in U = U and associated factors among a sample of PLWH recruited from clinics and communities in Australia. Close to two thirds of participants (70.5%) reported believing the U = U message that a person with UDVL cannot pass on HIV. This compares favorably with the findings of a previous Australian study by Holt et al.,[14] who found that 9.7% and 46.2% of their HIV-positive gay and bisexual sample agreed with this statement in 2013 and 2015, respectively. Our findings, obtained in 2017–2018, hence suggested a continuing trend of increasing belief in the U = U message in Australia, which coincides with the broad dissemination of the U = U message as part of a community campaign.[10] Studies from New York City, which found 39.1% agreement with U = U among PLWH in 2016–2017,[17] 66.7% agreement in 2017[18] and 83.9% agreement in 2018[19] suggest a similar increase in belief in U = U in other high-income countries.

Findings regarding perceived risk of transmission with UDVL in six specific sexual situations signal lack of confidence among some PLWH about U = U as an effective HIV prevention strategy. Across the sexual situations, between

Table 4. Self-Reported Impact of Risk of Transmission on Sexual Life and Behavior Among People with Undetectable Viral Load (N = 112)

	No. of participants in each agreement response n *(%)*					
Impact on sex life	*Strongly disagree*	*Disagree*	*Neutral*	*Agree*	*Strongly agree*	*Not applicable*
…I did not have sex at all	42 (37.5)	21 (18.8)	9 (8)	9 (8)	12 (10.7)	19 (17)
…I had less sex	36 (32.1)	14 (12.5)	7 (6.3)	12 (12.5)	21 (18.8)	20 (17.9)
…I was less satisfied with sex	36 (32.1)	14 (12.5)	17 (15.2)	15 (13.4)	11 (9.8)	19 (17)
…I was preoccupied while having sex	32 (28.6)	19 (17)	14 (12.5)	14 (12.5)	7 (6.3)	26 (23.2)

Question asked ''Thinking about YOUR sex life during the past four weeks, choose one box that shows how much you agree with each statement. Because of the risk of passing on HIV…

Downloaded by Universiteit Utrecht from www.liebertpub.com at 03/02/21. For personal use only.

around 3 in 10 and 4 in 10 participants were not confident that UDVL eliminated the risk of HIV transmission, and overall just over half of participants were categorized as lacking full confidence in the U = U message across sexual situations. The proportions of participants considering that risk of transmission with UDVL was still possible for specific sexual practices, paralleled the known relative transmission risk of these practices when viral load was detectable.[27] This suggests that some PLWH fail to agree that UDVL effectively eliminates the risk of HIV transmission during sexual behaviors associated with a great likelihood of HIV transmission.

The adjusted logistic regression model indicated that, in comparison to PLWH who felt confident in U = U, the half of participants (51.8%) who lacked full confidence in U = U were significantly more likely to have been recruited using community sources (rather than from clinic sources), to identify with a minority cultural background, and to have lower educational attainment. While we did not assess to what extent participants were informed about U = U and how they received this information, those recruited through a health professional specializing in HIV may be more likely to have received specific information, including from that health professional, about U = U and the risk of transmission of HIV with UDVL. This would have contributed to their understanding and confidence in U = U. Indeed, the Australasian Society of HIV and Sexual Health Medicine has released guidelines for HIV professionals on how to discuss U = U with PLWH.[11] This difference highlights the importance of ensuring appropriate information, education, and communication about U = U in a range of settings, including community settings, to maximize accurate understanding of U = U among PLWH.

The lower confidence in U = U among PLWH who identify with a minority cultural background or have lower educational attainment may reflect particular barriers in accessing as well as understanding information. There is likely a need for the development of information, education, and communication about U = U that is appropriate and suited for people of different cultural and educational backgrounds who differ in levels of health literacy. It is particularly important that information on U = U is not only accurate but is also understandable to people with lower levels of (health) literacy, similar to other information on health issues.[28] An intervention has been developed, which tailors health information delivered through social medical platforms to an individual's stage along the HIV care continuum.[29] This intervention has been demonstrated to increase engagement in HIV care and HIV medication adherence.[30] Such an intervention could be expanded and adapted to deliver information tailored to the (health) literacy needs of the individual.

Findings regarding the perceived personal risk of onward HIV transmission and sexual outcomes of PLWH with self-reported UDVL suggest substantial remaining HIV transmission concerns and concomitant adverse impacts on the sexual wellbeing of some PLWH. This study provides quantitative data to support findings from a recent qualitative analysis, which found that accurate knowledge of risk of transmission of HIV, including with UDVL, promotes sexual adjustment to HIV.[31] Satisfying sexual and intimate relationships are important contributors to happiness and wellbeing.[32] In the current biomedical era, there is no scientific reason for fear of transmission of HIV among PLWH with consistent viral suppression to be causing sexual inactivity, reduced frequency, and reduced satisfaction. Our findings indicate the need for interventions to assist PLWH in overcoming undue fear of transmission of HIV, including accurate information on U = U provided by trusted professionals.

This study extends previous research by not only assessing agreement with the U = U message, but also by investigating confidence in U = U as an effective HIV transmission prevention strategy. Moreover, this study also highlights remaining personal concern among PLWH with UDVL about the risk of onward HIV transmission and adverse sexual outcomes, notably sexual inactivity, reduced frequency of sex, and reduced sexual satisfaction. The study also has several limitations that need to be considered in drawing conclusions. While we recruited a diverse sample of PLWH from treatment centers and the community sources, participation was based on self-inclusion and the sample is not representative of the population of PLWH in Australia. Also, findings may be specific to the Australian context and not generalizable to other settings. Furthermore, we purposively developed the items for this study, and their validity remains to be assessed, in particular of the items assessing risk of HIV transmission in specific sexual situations. Given the need to present extensive information, it may be that PLWH had difficulty understanding the risk perception items. This could partially explain the finding that those with higher education were more likely to be more confident in U = U. Also, while there was no option for participants to indicate that they did not know what UDVL was, we believe that most PLWH would be familiar with and understand this concept, which is typically addressed by their HIV care provider.

Agreement with the U = U message appears to have steadily increased over time among PLWH in Australia. Yet, the relatively high levels of general agreement may mask an underlying lack of confidence in U = U as an HIV transmission prevention strategy among some PLWH, as evident in their evaluation of the risk of transmission in specific sexual situations, the perceived personal risk of onward HIV transmission, and experienced adverse sexual outcomes. In the current study, lack of confidence in U = U was particularly pronounced among PLWH recruited through community sources, from minority cultural backgrounds, and with lower levels of educational attainment. In addition to more widely promoting the general U = U message, there is a need for informational resources to strengthen accurate understanding and confidence in U = U among PLWH with lower levels of (health) literacy, as well as other (psychosocial) interventions that contribute to improving the sexual life of PLWH.

Acknowledgments

The authors thank all the participants, as well as the staff at the following centers: The Albion Center, Sydney (Dr. Kim Begley, Ruth Hennessy, Shiraze Bulsara, Dr. Tracey Mills, Damien Rivkin, Benjamin Andrew, Katherine Coote, Dion Alperstein, A/Prof. Derek Chan), Sydney Sexual Health Center (Lisa MacCann, Brendan Crozier, Ron Tripp), and The Interchange Practice (now Hobart Place Practice; Dr. Clara Tuck Meng Soo). The authors thank Dr. Daniel Costa for assistance with analyses.

Downloaded by Universiteit Utrecht from www.liebertpub.com at 03/02/21. For personal use only.

Author Disclosure Statement

The authors declare that they have no competing interests.

Funding Information

This study was supported by funding from The French National Agency for HIV/AIDS Research (ANRS), which was used to conduct this research as part of a larger international study.

Supplementary Material

Supplementary Table S1

References

1. Vernazza P, Hirschel B, Bernasconi E, Flepp M. HIV positive individuals not suffering from any other STD and adhering to an effective antiretroviral treatment do not transmit HIV sexually. [Les personnes séropositives ne souffrant d'aucune autre MST et suivant un traitment antirétroviral efficace ne transmettent pas le VIH par voie sexuelle]. Bulletin des Médecins Suisses 2008;89:5.
2. Cohen MS, Chen YQ, McCauley M, et al. Prevention of HIV-1 infection with early antiretroviral therapy. N Engl J Med 2011;365:493–505.
3. Rodger AJ, Cambiano V, Bruun T, et al. Risk of HIV transmission through condomless sex in MSM couples with suppressive ART: The PARTNER2 Study extended results in gay men. In 22nd International AIDS Conference, Amsterdam, The Netherlands, 2018; 163.
4. Rodger AJ, Cambiano V, Bruun T, et al. Sexual activity without condoms and risk of HIV transmission in serodifferent couples when the HIV-positive partner is using suppressive antiretroviral therapy. J Am Med Assoc 2016; 316:171–181.
5. Bavinton BR, Pinto AN, Phanuphak N, et al. Viral suppression and HIV transmission in serodiscordant male couples: An international, prospective, observational, cohort study. Lancet HIV 2018;5:e438–e447.
6. Eisinger RW, Dieffenbach CW, Fauci AS. HIV viral load and transmissibility of HIV infection: Undetectable equals untransmittable. J Am Med Assoc 2019;321:451–452.
7. Prevention Access Campaign. Prevention access campaign: Why is U = U important? 2017. Available at: https://www.preventionaccess.org/about (Last accessed October 16, 2019).
8. WHO. Viral suppression for HIV treatment success and prevention of sexual transmission of HIV. Geneva, Switzerland: World Health Organization; 2018.
9. ASHM. Undetectable = Untransmissable (U = U): Position statement. Sydney, NSW, Australia: Australasian Society for HIV, Viral Hepatitis and Sexual Health Medicine; 2017.
10. ACON. Ending HIV: About Undetectable and HIV. Surry Hills, NSW, Australia: AIDS Council of NSW; 2019.
11. ASHM. A guide for clinicians to discuss U = U undetectable = untransmittable. Sydney, NSW, Australia: Australasian Society for HIV, Viral Hepatitis and Sexual Health Medicine; 2018.
12. Bavinton BR, Holt M, Grulich AE, Brown G, Zablotska IB, Prestage GP. Willingness to act upon beliefs about 'Treatment as Prevention'among Australian gay and bisexual men. PLoS One 2016;11:e0145847.
13. Holt M, Lea T, Murphy DA, et al. Australian gay and bisexual men's attitudes to HIV treatment as prevention in repeated, national surveys, 2011–2013. PLoS One 2014;9: e112349.
14. Holt M, Lea T, Schmidt H-M, et al. Increasing belief in the effectiveness of HIV treatment as prevention: Results of repeated, national surveys of Australian gay and bisexual men, 2013–2015. AIDS Behav 2016;20:1564–1571.
15. Card KG, Armstrong HL, Lachowsky NJ, et al. Belief in treatment as prevention and its relationship to HIV status and behavioral risk. J Acquir Immune Defic Syndr 2018;77: 8–16.
16. Carter A, Lachowsky N, Rich A, et al. Gay and bisexual men's awareness and knowledge of treatment as prevention: Findings from the Momentum Health Study in Vancouver, Canada. J Int AIDS Soc 2015;18:20039.
17. Siegel K, Meunier É. Awareness and perceived effectiveness of HIV treatment as prevention among men who have sex with men in New York City. AIDS Behav 2019;23: 1974–1983.
18. Rendina HJ, Parsons JT. Factors associated with perceived accuracy of the Undetectable = Untransmittable slogan among men who have sex with men: Implications for messaging scale-up and implementation. J Int AIDS Soc 2018;21:e25055.
19. Rendina HJ, Cienfuegos-Szalay J, Talan A, Jones SS, Jimenez RH. Growing acceptability of Undetectable = Untransmittable but widespread misunderstanding of transmission risk: Findings from a very large sample of sexual minority men in the United States. J Acquir Immune Defic Syndr 2020;83:215–222.
20. Dara AF, Préau M, Castro D, et al. The conceptual framework of quality of sexual life in HIV and HCV. Value Health 2015;18:A592.
21. Da Silva M, Dara AF, Préau M, et al. Quality of sexual life of HIV and/or HCV patients: Qualitative study with semi-structured interviews. In: XVI Congress of the French AIDS Society, France, 2015.
22. Ware JE, Kosinski M, Keller SD. A 12-Item short-form health survey: Construction of scales and preliminary tests of reliability and validity. Med Care 1996;34:220–233.
23. Ware JE, Kosinski M, Turner-Bowker DM, Gandek B. How to Score Version 2 of the SF-12® Health Survey (with a Supplement Documenting Version 1). Lincoln, RI: QualityMetric Incorporated; 2002.
24. Boyd M, Cooper D, Crock EA, et al. Sexual transmission of HIV and the law: An Australian medical consensus statement. Med J Aust 2016;205:409–412.
25. IBM. IBM SPSS Statistics for Windows, 22 ed. Armonk, NY: IBM Corp; 2013.
26. Ottenbacher KJ, Ottenbacher HR, Tooth L, Ostir GV. A review of two journals found that articles using multivariable logistic regression frequently did not report commonly recommended assumptions. J Clin Epidemiol 2004; 57:1147–1152.
27. McAllister J. Literature review for the national guidelines for post-exposure prophylaxis after non-occupational and occupational exposure to HIV (revised). 2016. Available at: www.ashm.org.au/pep-guidelines (Last accessed November 2, 2019).
28. Mastroianni F, Chen Y-C, Vellar L, et al. Implementation of an organisation-wide health literacy approach to improve

Downloaded by Universiteit Utrecht from www.liebertpub.com at 03/02/21. For personal use only.

the understandability and actionability of patient information and education materials: A pre-post effectiveness study. Patient Educ Couns 2019;102:1656–1661.
29. Tanner AE, Mann L, Song E, et al. weCARE: A social media–based intervention designed to increase HIV care linkage, retention, and health outcomes for racially and ethnically diverse young MSM. AIDS Educ Prev 2016;28: 216–230.
30. Tanner AE, Song EY, Mann-Jackson L, et al. Preliminary impact of the weCare social media intervention to support health for young men who have sex with men and transgender women with HIV. AIDS Patient Care STDs 2018; 32:450–458.
31. Huntingdon B, Sharpe L, de Wit J, Duracinsky M, Juraskova I. A new grounded theory model of sexual adjustment to HIV: Facilitators of sexual adjustment and recommendations for clinical practice. BMC Infect Dis 2020 20(Article 31).
32. Holt-Lunstad J, Smith TB, Layton JB. Social relationships and mortality risk: A meta-analytic review. PLoS Med 2010;7:e1000316.

Address correspondence to:
Ben Huntingdon, BLibStud (Hons)
School of Psychology
University of Sydney
C/O A/Prof Ilona Juraskova, MPsych, PhD
Brennan MacCallum Building (A18)
Sydney 2006
Australia

E-mail: bhun1003@uni.sydney.edu.au

Downloaded by Universiteit Utrecht from www.liebertpub.com at 03/02/21. For personal use only.