

# Condomless Sex Among Virally Suppressed Women With HIV With Regular HIV-Serodiscordant Sexual Partners in the Era of Treatment as Prevention

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**Background:** Sexual HIV transmission does not occur with sustained undetectable viral load (VL) on antiretroviral therapy (ART). Awareness of ART prevention benefits and its influence on condom use among women with HIV (WWH) remain unexplored. We estimated prevalence and correlates of condomless sex with regular HIV-serodiscordant partners among WWH with undetectable VL on ART.

**Methods:** We used baseline questionnaire data from the community-based longitudinal Canadian HIV Women's Sexual and Reproductive Health Cohort Study (CHIWOS). We included WWH self-reporting vaginal/anal sex with  $\geq 1$  HIV-negative/unknown status regular partner within 6 months, and undetectable VL ( $< 50$  copies/mL) on ART. We excluded participants exclusively reporting female partners or missing condom-use data. Condomless sex was defined as  $< 100\%$  condom use within 6 months. The primary explanatory variable was awareness of ART prevention benefits. Logistic regression identified factors independently associated with condomless sex.

**Results:** Of 271 participants (19% of the CHIWOS cohort), median age was 41 (interquartile range: 34–47), 51% were in a relationship, 55% reported condomless sex, and 75% were aware of ART prevention benefits. Among women aware, 63% reported condomless sex compared with 32% of women not aware ( $P < 0.001$ ). Factors independently associated with condomless sex included being aware of ART prevention benefits (adjusted odds ratio: 4.08; 95% confidence interval: 2.04 to 8.16), white ethnicity,  $\geq$ high-school education, residing in British Columbia, and being in a relationship.

**Conclusions:** Virally suppressed women aware of ART prevention benefits had 4-fold greater odds of condomless sex. Advancing safer sex discussions beyond condoms is critical to support women in regular serodiscordant partnerships to realize options for safe and satisfying sexuality in the Treatment-as-Prevention era.

**Key Words:** HIV, women, condomless sex, antiretroviral therapy, Canada, CHIWOS

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S.P., A.C., and A.K. conceived the idea for this analysis. A.K., A.d.P., and M.L. contributed to design and acquisition of data. Data preparation and statistical analysis were conducted by E.D. Data interpretation was performed by S.P., E.D., and A.K. S.P. drafted the initial manuscript under the supervision of A.K., and all authors contributed to the final version. All authors have critically reviewed and approved the final manuscript, gave approval for publication and act as guarantors of the work.

The CHIWOS Research Team members are listed in Appendix 1.

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who engage in condomless sex to conceive<sup>8,9</sup> or for enhanced sexual pleasure and intimacy.<sup>4,10</sup>

In 2008, the Swiss Federal AIDS Commission released a statement declaring that people with HIV with no concurrent sexually transmitted infections (STIs), who adhered to ART for 6 months and achieved an undetectable HIV viral load (VL) (<40 copies/mL) posed no risk of transmitting HIV to a serodiscordant sexual partner.<sup>11</sup> This statement was met with substantial debate, with concerns raised regarding its potential impact on sexual behaviors of people with HIV and risks of increased HIV incidence.<sup>12,13</sup> However, with the release of landmark findings from the HPTN 052 randomized controlled trial,<sup>14</sup> and findings from the PARTNER<sup>15,16</sup> and Opposites Attract studies,<sup>17</sup> evidence in support of the Swiss Statement is undeniable,<sup>14,15,17–19</sup> furthering a global movement toward adopting Treatment-as-Prevention (TasP) initiatives.<sup>20,21</sup>

With growing consensus that the risk of sexual HIV transmission to sexual partners is zero in the presence of an undetectable VL through ART use,<sup>14,16</sup> an undetectable VL constitutes a highly effective form of safer sex within HIV-serodiscordant partnerships.<sup>22–24</sup> Fundamentally, TasP offers a promise in redefining sexual relationships for people with HIV, shifting the focus toward supporting ART uptake and adherence rather than risk-based sexual behavior discourses, both within scientific<sup>4</sup> and advocacy communities.<sup>25</sup> Consequently, awareness of the HIV prevention benefits of ART may influence sexual decision making among people with HIV.<sup>26–32</sup> Although previous work has identified no association between condomless sex and ART use<sup>26,33–35</sup> or ART-related viral suppression,<sup>26,36–38</sup> some studies have suggested that people with HIV who are aware of HIV prevention benefits of ART are embracing and translating this science to inform decisions related to condomless sex with an undetectable VL.<sup>26,29,32</sup>

In Canada and elsewhere, awareness of the HIV prevention benefits of ART is advancing among people with HIV, with community groups and activists leading the promotion of this science through “Undetectable = Untransmittable” campaigns.<sup>39,40</sup> Few quantitative studies have focused specifically on awareness of the HIV prevention benefits of ART to prevent sexual HIV transmission and its influence on condom-use practices among women with HIV (WWH).<sup>31,32</sup> This question remains unexplored in Canada, a setting where TasP has been heavily promoted in some provinces.<sup>41</sup>

Within a community-based cohort study by, with, and for WWH across Canada, we measured the prevalence and correlates of condomless sex with serodiscordant regular sexual partners among women with an undetectable VL on ART. Specifically, we assessed the association between condomless sex and awareness of HIV prevention benefits of ART, to infer whether WWH in Canada are using ART as a safer sex option to minimize HIV transmission to HIV-serodiscordant regular partners. This work adopts a feminist lens in alignment with a critical field of scholarship that explores the potential for TasP to promote sex-positive approaches and support the sexual rights of WWH.<sup>2,4</sup>

## METHODS

### Data Source

We used cross-sectional baseline questionnaire data from the Canadian HIV Women’s Sexual and Reproductive Health Cohort Study (CHIWOS, [www.chiwos.ca](http://www.chiwos.ca)), a community-based study enrolling WWH, described in detail elsewhere.<sup>42,43</sup> CHIWOS was established to assess barriers to and facilitators of accessing women-centered HIV care for women across Canada, and to explore the mental, sexual, and reproductive health benefits of this health care approach. CHIWOS has enrolled 1424 women from British Columbia (BC), Ontario, and Quebec, the provinces comprising most (81%) WWH nationally.<sup>44</sup>

CHIWOS is grounded in the principles of Critical Feminist theory<sup>45</sup> and Community-Based Research (CBR). CHIWOS involves WWH and allied clinicians, researchers, and community partners as core partners throughout the research. Peer Research Associates (PRAs, WWH trained in research skills) contributed to questionnaire development, led participant outreach and recruitment, and administered questionnaires.

Recruitment was conducted between August 27, 2013, and May 1, 2015. Women were eligible for inclusion if they were aged 16 years and older, self-identified as a woman with HIV and resided in 1 of the 3 study provinces. Recruitment was conducted in regional community and clinic settings, through peer outreach and word of mouth.<sup>46</sup> Particular efforts were made to recruit populations disproportionately affected by HIV or underserved by research or health services, including transwomen, lesbian/bisexual/queer women, Indigenous women, and black women.

At baseline, participants completed a PRA-administered survey of approximately 90 minutes, with questions assessing reproductive, sexual, mental, and women’s health outcomes, and use of HIV/AIDS services. The survey was administered by PRAs online in English or French using FluidSurveys software.

Ethical approval was granted by the Research Ethics Boards of Simon Fraser University, University of British Columbia/Providence Health, Women’s College Hospital, and McGill University Health Centre. Participants provided voluntary informed consent and were provided with \$50 honoraria.

### Inclusion Criteria

We included women self-reporting vaginal/anal sex in the past 6 months with at least 1 HIV-negative/unknown HIV status regular sexual partner (defined in the survey as an intimate noncommercial sexual partner with whom women had multiple sexual encounters, for a “long period of time”, and who they did not exchange drugs, money, etc., as defined by the participant). We also restricted inclusion to women self-reporting an undetectable HIV plasma VL (<50 copies/mL) on ART at interview. A validity study showed self-reported VL to be strongly predictive of laboratory-confirmed (true) VL in CHIWOS.<sup>47</sup> We excluded participants exclusively reporting female sexual partners in the preceding 6

months or missing condom-use data. These criteria were applied to obtain a sample of women who would be positioned to benefit from the use of ART as an HIV prevention strategy during sex with regular serodiscordant male partners.

## Measures

### Primary Outcome

The primary outcome variable was condomless sex, defined as self-reporting <100% male or female condom use during vaginal/anal penetrative intercourse with at least 1 regular male partner within 6 months before the baseline interview.

### Explanatory Variables

Explanatory variables were selected after a priori literature review.<sup>26–38</sup> The primary explanatory variable was awareness of HIV prevention benefits of ART. Participants were asked, “How do you think taking ARVs changes your risk of transmitting HIV?” A 5-point Likert scale was used for response options with participant responses dichotomized as follows “Makes the risk of transmission a lot lower” vs. “Makes the risk of transmission a little lower/makes no difference/makes the risk of transmission a little/a lot higher/don’t know”. Participants responding “Makes the risk of transmission a lot lower” were classified as being aware of HIV prevention benefits of ART, to accurately reflect current scientific evidence that the risk of sexual HIV transmission with an undetectable VL on ART approaches zero.<sup>14,16,48</sup> We also conducted a sensitivity analysis investigating a less conservative definition of awareness of HIV prevention benefits of ART, collapsing “a lot lower” and “a little lower” vs. all other responses to observe whether this affected the associations observed.

We assessed additional covariates of condomless sex, including sociodemographic variables [age at interview (per year increase), race/ethnicity (white vs. Indigenous vs. African/Caribbean/black vs. other and multiple ethnicities), born in Canada (yes vs. no), personal annual income (<\$20,000 vs. ≥\$20,000), formal education (<high school vs. ≥high school), history of incarceration (yes vs. no), history of injection drug use (yes vs. no), and sex work in past 6 months (exchanged sex for money, drugs, clothing, and possessions) (yes vs. no)]; clinical variables [years living with HIV, whether a health care provider had discussed the impact of VL on HIV transmission risk (yes vs. no)]; sexuality and relationship variables {satisfaction with current sex life [completely/very/reasonably satisfactory vs. not very/not at all satisfactory], number of sex partners within past 6 months, type of sexual partners in past 6 months [regular exclusively vs. regular and casual partners], length of relationship with regular sexual partners [years], in a relationship at interview [yes (married/common law/living-apart relationship) vs. no (single/separated/widowed/divorced)]}; reproductive health variables [previous pregnancy (yes vs. no), future pregnancy intentions (yes vs. no)]; HIV-related stigma variables (fear of HIV status disclosure in the month before interview) (yes vs.

no), HIV-related stigma (measured using the 10-item HIV Stigma Scale, with scores ≥median recorded as “high” HIV-related stigma vs. “low”<sup>49,50</sup>); and current sexual (yes vs. no) and physical (yes vs. no) violence.

Imputation methods were used to recode data for 5 participants who preferred not to report their partner’s HIV status to preserve statistical power and avoid biases associated with excluding these participants from the model. These participants were recorded as reporting HIV status unknown/serodiscordant partners. Where data related to other covariates were missing during the model selection process, participants affected were excluded from the final model.

### Statistical Analysis

We calculated the proportion of participants who self-reported condomless sex in the 6 months before interview. Sociodemographic, behavioral, clinical, and sexual and reproductive characteristics were compared between participants reporting condomless sex versus those who did not, using Pearson  $\chi^2$  test for categorical variables (Fisher exact test for small cell counts) and the Wilcoxon rank-sum test for continuous variables.

Multivariable logistic regression identified covariates independently associated with condomless sex. Candidates for model inclusion were variables having  $P < 0.2$  in the bivariable analysis or variables considered a priori to influence likelihood of condomless sex after literature review. Model selection was determined by minimizing the Akaike information criterion and maintaining type III  $P$  values.  $P$  values were 2-sided and considered significant at  $P < 0.05$ . All analyses were conducted using SAS 9.4 software (SAS Institute Inc., Cary, NC).

## RESULTS

Of the 1424 women enrolled in CHIWOS, we excluded 773 women self-reporting no consensual sex (including oral sex) in the 6 months before interview, 70 women self-reporting no anal/vaginal sex, 182 women self-reporting all HIV concordant regular partners, and 15 women self-reporting female partners exclusively. Finally, we excluded 13 women for whom condom-use data were missing, and 100 women who did not have an undetectable HIV VL (>50 copies/mL) on ART, yielding an analytic sample of 271 participants.

The median age of women was 41 [interquartile range (IQR): 34–47] and the median years living with HIV was 11 (IQR: 6–18) (Table 1). Overall, 34% of participants were resident in BC, 35% in Ontario, and 31% in Quebec. In terms of ethnicity, 16% women reported Indigenous ancestry, 32% were African, Caribbean, or black, and 48% were white. Overall, 80% of participants reported regular sexual partnerships exclusively within 6 months before the interview, with no casual sexual partners. The median duration of regular sexual partnerships was 3 years (IQR: 1–8). At the time of interview, 51% of women reported being in a relationship and 84% of women were satisfied with their sex lives. The median

**TABLE 1.** Characteristics of 271 WWH With Undetectable VL on ART and Reporting Serodiscordant Sexual Partners, Stratified by Condomless Sex in the 6 Months Before Interview

Variable	Median (IQR) or n (%)	Total	Condomless Sex (n = 149)		No Condomless Sex (n = 122)		P
			Median (IQR) or n (%)		Median (IQR) or n (%)		
Aware of HIV prevention benefits of ART		271					<0.001
Yes	203 (75)		127 (85)		76 (62)		
No	68 (25)		22 (15)		46 (38)		
Discussed with health care provider impact of VL on HIV transmission risk		271					0.239
Yes	224 (83)		126 (85)		98 (80)		
No	45 (17)		21 (14)		24 (20)		
Do not know	2 (1)		2 (1)		0		
Age at interview, yrs	41 (34, 47)	271	40 (34, 47)		41 (34, 46)		0.958
Province of interview		271					0.002
British Columbia	92 (34)		64 (43)		28 (23)		
Ontario	95 (35)		47 (32)		48 (39)		
Quebec	84 (31)		38 (26)		46 (38)		
Ethnicity		271					0.008
White	129 (48)		83 (56)		46 (38)		
Indigenous	44 (16)		25 (17)		19 (16)		
African, Caribbean, and black	86 (32)		35 (23)		51 (42)		
Other ethnicities	12 (4)		6 (4)		6 (5)		
Born in Canada		271					0.002
Yes	169 (62)		105 (70)		64 (52)		
No	102 (38)		44 (30)		58 (48)		
Education							0.090
<High school	40 (15)		17 (11)		23 (19)		
≥High school	230 (85)		131 (88)		99 (81)		
Do not know/prefer not to answer	1 (0)		1 (14)		0		
Personal annual income							0.040
<\$20,000	182 (67)		92 (62)		90 (74)		
≥\$20,000	81 (30)		52 (35)		29 (24)		
Do not know/prefer not to answer	8 (3)		5 (3)		3 (2)		
Ever incarcerated		271					0.193
Yes	98 (36)		59 (40)		39 (32)		
No	173 (64)		90 (60)		83 (68)		
History of injection drug use		271					0.047
Yes	88 (32)		56 (38)		32 (26)		
No	183 (68)		93 (62)		90 (74)		
Years living with HIV	11 (6, 18)	262	11 (6, 18)		12 (6, 18)		0.781
In a relationship		271					0.026
Yes	138 (51)		85 (57)		53 (43)		
No	133 (49)		64 (43)		69 (57)		
Duration of regular sexual partnership, yrs	3 (1, 8)	264	3 (1, 8)		3 (1, 8)		0.816
No. of recent sex partners		265					0.620
1	209 (77)		116 (78)		93 (76)		
>1	56 (21)		29 (19)		27 (22)		
Do not know/prefer not to answer	6 (2)		4 (3)		2 (2)		
Type of recent sex partner(s)		271					0.584
Regular partners exclusively	217 (80)		120 (81)		97 (80)		
Regular and casual partners	47 (17)		24 (16)		23 (19)		
Unknown	7 (3)		5 (3)		2 (2)		
HIV status of sexual partners		271					1.000
All serodiscordant	269 (99)		148 (99)		121 (99)		
Mix of seroconcordant/discordant	2 (1)		1 (1)		1 (1)		

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**TABLE 1.** (Continued) Characteristics of 271 WWH With Undetectable VL on ART and Reporting Serodiscordant Sexual Partners, Stratified by Condomless Sex in the 6 Months Before Interview

Variable	Median (IQR) or n (%)	Total	Condomless Sex (n = 149)		No Condomless Sex (n = 122)		P
			Median (IQR) or n (%)		Median (IQR) or n (%)		
Previous pregnancy		271					0.354
Yes	218 (80)		122 (82)		96 (79)		
No	48 (18)		23 (15)		25 (20)		
Unknown	5 (2)		4 (3)		1 (1)		
Intend to become pregnant		271					0.886
Yes	70 (26)		39 (26)		31 (25)		
No/unknown	201 (74)		110 (74)		91 (75)		
Sexual satisfaction		271					0.297
Satisfied	227 (84)		128 (86)		99 (81)		
Not satisfied	40 (15)		19 (13)		21 (17)		
Prefer not to answer	4 (1)		2 (1)		2 (2)		
Current sex work		271					0.721
Yes	17 (6)		10 (7)		7 (6)		
No	252 (93)		137 (92)		115 (94)		
Unknown	2 (1)		2 (1)		0 (1)		
Afraid to disclose HIV status to others		271					0.913
Yes	203 (75)		112 (75)		91 (75)		
No/unsure	68 (25)		37 (25)		31 (25)		
Current physical violence		260					0.880
Yes	18 (7)		10 (7)		8 (7)		
No	242 (89)		130 (87)		112 (92)		
Unknown	11 (4)		9 (6)		2 (2)		
Current sexual violence		260					1.000
Yes	8 (3)		4 (3)		4 (3)		
No	252 (93)		136 (91)		116 (95)		
Unknown	11 (4)		9 (6)		2 (2)		
HIV-related stigma		268					0.785
Low HIV-related stigma	142 (53)		79 (54)		63 (52)		
High HIV-related stigma	126 (47)		68 (46)		58 (48)		

HIV-related stigma score in the sample was 57.5 (IQR: 41.3–67.5), with 47% of women reporting high HIV-related stigma.

(AOR: 0.26; 95% CI: 0.12 to 0.59) compared with BC were negatively associated with condomless sex.

### Condomless Sex and Awareness of HIV Prevention Benefits of ART

Condomless sex was reported by 149 (55%) participants in the 6 months before the interview (Table 1). Although all participants were on ART and self-reported an undetectable VL, 203 (75%) women were aware of the HIV prevention benefits of ART and 224 (83%) had discussed the impact of VL on HIV transmission risk with their provider. Of women aware of ART prevention benefits, 63% reported condomless sex, compared with 32% of women not aware ( $P < 0.001$ ).

In logistic regression, factors positively associated with condomless sex included awareness of the HIV prevention benefits of ART [adjusted odds ratio (AOR): 4.08; 95% confidence interval (CI): 2.04 to 8.16],  $\geq$ high-school education (AOR: 2.36; 95% CI: 1.01 to 5.53), and being in a relationship (AOR: 1.78; 95% CI: 1.02 to 3.11) (Table 2). African, Caribbean, or black compared with white race/ethnicity (AOR: 0.36; 95% CI: 0.18 to 0.74), and residence in Ontario (AOR: 0.40; 95% CI: 0.19 to 0.83) or Quebec

### Sensitivity Analysis

When we expanded the definition of awareness of HIV prevention benefits of ART to also include participants reporting the belief that ART “makes the risk of transmission a little lower”, 236 (87%) participants were aware of HIV prevention benefits of ART. When this alternative definition was applied in the logistic regression analysis, awareness of HIV prevention benefits of ART remained positively associated with condomless sex (AOR: 7.46; 95% CI: 2.88 to 19.37) (Table 3), with a stronger effect estimate.

### DISCUSSION

In a Canadian community-based cohort of WWH, we observed that awareness of the HIV prevention benefits of ART was associated with a 4-fold increased odds of condomless sex among women with an undetectable VL on ART and regular HIV-serodiscordant sexual partners. We also found independent associations between condomless sex

**TABLE 2.** Logistic Regression of Factors Associated With Condomless Sex Among WWH With Undetectable VL on ART and Regular HIV-Serodiscordant Sexual Partners (n = 254)

Variable	Unadjusted OR (95% CI)	AOR (95% CI)
Aware of HIV Prevention benefits of ART		
No	1.00	1.00
Yes	3.70 (2.03, 6.75)	4.08 (2.04, 8.16)
Age (per year increase)	1.00 (0.98, 1.03)	1.03 (0.99, 1.06)
Province of interview		
British Columbia	1.00	1.00
Ontario	0.43 (0.23, 0.80)	0.40 (0.19, 0.83)
Quebec	0.36 (0.19, 0.68)	0.26 (0.12, 0.59)
Ethnicity		
White	1.00	1.00
Indigenous	0.72 (0.36, 1.46)	0.62 (0.26, 1.48)
African, Caribbean, and black	0.34 (0.19, 0.60)	0.36 (0.18, 0.74)
Other ethnicities	0.46 (0.13, 1.59)	0.53 (0.13, 2.17)
Born in Canada		
Yes	1.00	—
No	0.41 (0.25, 0.69)	
Education		
<High school	1.00	1.00
≥High school	1.78 (0.89, 3.57)	2.36 (1.01, 5.53)
Personal annual income		
<\$20,000	1.00	1.00
≥\$20,000	1.79 (1.03, 3.09)	1.65 (0.86, 3.15)
Ever incarcerated		
No	1.00	—
Yes	1.49 (0.89, 2.48)	
History of injection drug use		
No	1.00	—
Yes	1.76 (1.03, 3.00)	
In a relationship		
No	1.00	1.00
Yes	1.80 (1.10, 2.96)	1.78 (1.02, 3.11)
No. of recent sex partners		
1	1.00	—
>1	0.81 (0.44, 1.47)	
Intend to become pregnant		
No/unknown	1.00	1.00
Yes	1.10 (0.63, 1.93)	0.73 (0.50, 1.08)

Seventeen participants with missing data not included in model.

**TABLE 3.** Sensitivity Analysis: Logistic Regression of Factors Associated With Condomless Sex, Using Alternative Definition of Awareness of HIV Prevention Benefits of ART (Believe that ART Makes HIV Transmission Risk “a Lot Lower” or “a Little Lower” Vs. All Other Responses) (n = 258)

Variable	Unadjusted OR (95% CI)	AOR (95% CI)
Aware of HIV prevention benefits of ART		
No	1.00	1.00
Yes	5.91 (2.48, 14.11)	7.46 (2.88, 19.37)
Age	1 (0.98, 1.03)	1.03 (0.99, 1.06)
Province interview conducted		
British Columbia	1.00	1.00
Ontario	0.43 (0.23, 0.80)	0.41 (0.21, 0.84)
Quebec	0.36 (0.19, 0.68)	0.33 (0.16, 0.68)
Ethnicity		
White	1.00	Not selected
Aboriginal	0.72 (0.36, 1.46)	
African, Caribbean, and black	0.34 (0.19, 0.60)	
Other ethnicities	0.46 (0.13, 1.59)	
Born in Canada		
Yes	1.00	1.00
No	0.41 (0.25, 0.69)	0.40 (0.22, 0.74)
Education		
≥High school	1.00	1.00
<High school	0.56 (0.28, 1.13)	0.41 (0.18, 0.94)
Personal income		
<\$20,000	1.00	1.00
≥\$20,000	1.79 (1.03, 3.09)	1.68 (0.89, 3.20)
Ever incarcerated		
No	1.00	—
Yes	1.49 (0.89, 2.48)	
History of injection drug use		
No	1.00	—
Yes	1.76 (1.03, 3.00)	
In a relationship		
Yes	1.00	1.00
No	0.55 (0.34, 0.91)	0.54 (0.31, 0.95)
No. of recent sex partners		
1	1.00	—
>1	0.81 (0.44, 1.47)	
Intend to become pregnant in future		
No/Unknown	1.00	1.00
Yes	1.05 (0.61, 1.82)	1.65 (0.84, 3.24)
Previous pregnancies		
No/unknown	1.00	1.00
Yes	1.10 (0.63, 1.93)	1.73 (0.83, 3.61)

Thirteen participants with missing data not included in model.

and ethnicity, education, province of interview, and relationship status. These findings suggest that some WWH are embracing and translating the evidence behind TasP to inform their own sexual decision making.

Among this cohort of virally suppressed women, condomless sex was reported by 55% of women overall and by 63% of women who were aware of the HIV prevention benefits of ART. The relationship between awareness of HIV prevention benefits of ART and condomless sex persisted in the adjusted logistic regression analysis. Our findings support the hypothesis that awareness of HIV prevention benefits of ART influences

condom-use practices and suggest that some women with an undetectable VL on ART are embracing the HIV prevention benefits of ART as a safer sex option to avert HIV transmission to HIV-serodiscordant regular partners, consistent with qualitative reports from women and couples themselves.<sup>4,25</sup>

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Our findings align with previous work in this field. Analyses using data collected in earlier treatment eras (before 2004) within the Women's Interagency HIV Study revealed a positive association between awareness of HIV prevention benefits of ART and condomless sex.<sup>31,32</sup> This association has similarly been reported by empirical analyses in the modern TasP era.<sup>29,30</sup> Notably, the Swiss Cohort Study evaluated sexual behaviors before and after the release of the Swiss Consensus Statement in 2008<sup>11</sup> and found that participants interviewed after the release of the statement were more likely to report condomless sex; an association that was stronger among those with VL suppression.<sup>27</sup> Furthermore, an accelerated increase in the prevalence of condomless sex was observed among Swiss Cohort Study participants in stable partnerships in the years after the release of the Swiss Consensus Statement (between 2008 and 2013).<sup>28</sup> Although our study is cross-sectional, it adds to the evidence base that viral suppression with ART is increasingly being accurately viewed as an HIV prevention and safer sex strategy for WWH, particularly as evidence in support of TasP become more widely acknowledged.

In our analysis, partnered relationship status at interview was independently associated with condomless sex, consistent with previous work in local and international settings,<sup>27,28,36,51,52</sup> likely reflecting a mutual decision between partners in a disclosed relationship to engage in condomless sex. Women educated beyond high school and reporting white ethnicity had greater odds of reporting condomless sex. This finding may be attributed to greater treatment optimism among women with higher socioeconomic backgrounds. Previous work supports this hypothesis, observing that people with HIV who are from marginalized socioeconomic groups or who are isolated from HIV services are less likely to be aware of HIV prevention benefits of ART.<sup>30,53,54</sup> Residence in BC compared with Ontario or Quebec was also an independent correlate of condomless sex among women in this cohort, likely reflecting the localized, province-wide expansion of TasP in BC.<sup>55</sup>

Although all women in our analytic sample reported an undetectable VL on ART, one-quarter of participants were not fully aware of the accompanying HIV prevention benefits. Moreover, 17% of women had never discussed TasP with their health care provider. These echo findings from an analysis in the Italian *Donne con Infezione Da HIV* (DIDI) study, observing no association between condomless sex and undetectable VL on ART among WWH in serodiscordant partnerships, suggesting either low awareness or application of the HIV prevention benefits of ART.<sup>36</sup> These findings stress the need to convey the HIV prevention benefits of ART to all women, to promote access to the full array of safer sex options to make informed sexual decisions in the TasP era.

Although our analysis supports the hypothesis that awareness of the HIV prevention benefits of ART influences condom-use practices, condomless sex was not consistently reported among women who were aware of HIV prevention benefits of ART. Besides concerns related to HIV transmission, complex relationship priorities, gender dynamics, fears of disclosure, and stigma also shape sexual behavior, in addition to considerations around pregnancy and STI pre-

vention.<sup>9,56,57</sup> In a climate of growing HIV criminalization, WWH may also use condoms to protect themselves against potential charges for HIV nondisclosure to sexual partners. In Canada, people with HIV are legally obligated to disclose their HIV status to sexual partners before sex that represents a realistic possibility of HIV transmission.<sup>58,59</sup> The legal obligation to disclose is avoided only during condom-protected vaginal sex in the context of a low VL (<1500 copies/mL).<sup>59</sup>

Previous work suggests that people with HIV remain apprehensive about the HIV prevention benefits of ART.<sup>56</sup> Women may be aware of the HIV prevention benefits of ART but be reluctant and fearful of foregoing condoms, given the decades-long discourse of risk, contamination, fear, and stigma, in addition to the virtually exclusive promotion of male condom use for HIV prevention. Although HIV prevention benefits of ART are clear on a population health level, it can be challenging to translate this messaging into individual-level clinical counseling. For instance, earlier research reported that genital HIV RNA viral shedding may occur among individuals who have an undetectable plasma HIV VL,<sup>60–62</sup> raising the possibility of onward HIV transmission. Furthermore, previous work has suggested that coinfection with an STI may compromise the prevention benefits conveyed by an undetectable HIV VL on ART.<sup>61,63</sup> However, more recent studies in the modern ART era have shown that HIV viral suppression is maintained despite coinfection with STIs.<sup>13,15,64</sup> Incorporation of this new evidence into sexual health messaging is slow and both providers and, understandably, some WWH remain apprehensive. Additional efforts are required to support WWH navigating sexual decision making within an environment still largely framed by an antiquated risk discourse, rather than reflecting established scientific evidence of sexual HIV transmission in the context of viral suppression on ART.

Although our findings suggest that some WWH are aware of condomless sex with an undetectable VL on ART as an effective strategy to prevent HIV transmission to serodiscordant sexual partners, supporting comprehensive protection should also offer regular STI/HIV testing for partners and couples, and expanded female-controlled contraception options to minimize the risk of unintended pregnancy.<sup>65</sup> This is particularly relevant given that previous work has suggested that WWH in Canada primarily rely on the male condom for contraception.<sup>42</sup>

## Limitations

We did not capture STI acquisition within the CHIWOS baseline questionnaire, as such the impact of STIs on condom-use practices or awareness of HIV prevention benefits of ART could not be assessed. The condom-use variable used in this analysis is self-reported, and may be subject to social desirability bias, which may underestimate the prevalence of condomless sex.

Although CHIWOS represents the largest cohort of WWH in Canada, findings generated from this analysis may not be generalizable to women in other Canadian provinces or international settings. Five participants preferred not to

disclose their partner's HIV status and were recorded as reporting HIV status unknown/serodiscordant partners, which may have introduced information bias into our analysis. However, when we repeated the logistic regression after excluding these participants, the results remained unchanged (results not shown).

We restricted inclusion to women with regular HIV-serodiscordant sexual partners, as we did not ask about the HIV status of casual partners nor condom-use practices within casual relationships in the CHIWOS questionnaire. Considerations and recommendations for practicing condomless sex in the context of an undetectable VL on ART may be different for women engaging in casual sexual encounters with non-regular partners. Although women in casual relationships may also translate their awareness of ART prevention benefits to inform condom-use practices, these data were not collected within CHIWOS. Finally, as we limited this analysis to women with an undetectable VL, we were unable to evaluate the impact of TasP messaging on condom-use practices of WWH with a detectable VL on ART.

It is important to acknowledge the high prevalence of sexual inactivity in this cohort. We excluded 773 women self-reporting no recent consensual sex from this analysis. Although the perspectives of sexually inactive WWH were not captured within this analysis, previous work has shown that many complex reasons drive sexual inactivity among WWH.<sup>66</sup> Among CHIWOS participants, fear of transmitting HIV to sexual partners has been identified as a key factor driving intentional sexual abstinence.<sup>66</sup> Although previous work has shown that awareness of HIV prevention benefits of ART is not a significant correlate of sexual inactivity in the CHIWOS cohort, women who have engaged in discussions around the prevention benefits of ART with their health care provider have been shown to demonstrate lower odds of sexual inactivity.<sup>42</sup> Our analysis adds to this body of work revealing how the awareness of the HIV prevention benefits of ART expands HIV prevention options and may influence sexual decision making of sexually active WWH with serodiscordant male partners in the TasP era.

### CONCLUSIONS

Within a sample of Canadian WWH with an undetectable VL on ART and reporting regular HIV-serodiscordant sexual partners, most were aware of the HIV prevention benefits of ART. We also observed an association between awareness of HIV prevention benefits of ART and condomless sex. Our findings support that an undetectable VL on ART may be accurately viewed as a safer sex option to minimize HIV transmission risk to HIV-serodiscordant regular male partners among WWH. However, awareness of the HIV prevention benefits of ART is not universal, and decisions related to safer sex strategies remain complex. This work highlights the critical need to advance safer sex discussions beyond condom use to better support WWH to make informed sexual decisions, and fully realize options for healthy, safe, pleasurable, and satisfying sexuality in the TasP era.<sup>23</sup>

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