Original research

Undetectable equals untransmittable (U = U): awareness and associations with health outcomes among people living with HIV in 25 countries

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INTRODUCTION

Despite global targets to eliminate AIDS as a public health threat by 2030, about 14% (3.5 million) of the 25.4 million people living with HIV (PLHIV) on treatment are virally non-suppressed.1 2 The evidence-based campaign, “Undetectable equals Untransmittable” (U=U),1 3 4 is an empowering discussion that may help motivate and incentivise PLHIV to reach and maintain undetectability.2 The key message behind this informational campaign is that ‘for people who achieve and maintain viral suppression, there is effectively no risk of transmitting HIV to their HIV-negative sexual partners’.3

U=U is appealing in its simplicity, person-focus and potential downstream benefits in promoting prevention at all levels, including primary (preventing transmission to uninfected persons), secondary (ensuring regular viral load monitoring and health screenings among PLHIV) and tertiary (improving PLHIV’s quality of life). By focusing on being ‘undetectable’, an objectively measured health state, U=U provides PLHIV with an unambiguous health target that emphasises personal responsibility.14 ‘Untransmissibility’, the reward for ‘Undetectability’ may be particularly appealing for serodiscordant couples in a relationship or wishing to start a family. Besides encouraging antiretroviral therapy (ART) initiation and adherence among PLHIV, U=U could also recalibrate social norms among non-HIV populations, given that transmission risk is a major source of fear/stigma.9 12

The U=U message has been incorporated into numerous public health campaigns and clinical guidelines.1 13 Discussing U=U in clinical settings is vital because patients perceive information they hear directly from their healthcare providers (HCPs) as being more believable.14 The impact of HCP counselling has been well demonstrated in other areas of public health such as smoking cessation.15 Since clinicians are likely the first professionals to whom a newly diagnosed person will turn for advice about their new health circumstance, it is essential to evaluate the extent to which HCPs share information on U=U with their patients and whether this varies by risk groups for HIV transmission and by burden of disease.16-21

This study therefore examined: (1) Prevalence and disparities in self-report of having had a U=U discussion with HCPs. (2) Associations between exposure to U=U information and health-related perceptions and behaviours. We further examined...
whether the observed impact of exposure to U=U message was modified by the source of the information (HCP or non-HCP sources) as well as by PLHIV characteristics.

METHODS

Data source

Sample size
The 2019–2020 Positive Perspectives Study was fielded from 3 April 2019 to 31 January 2020 (n=2389, response rate=58.6%). It was a web-based, self-reported, cross-sectional survey of PLHIV in 25 countries: USA (n=400), South Africa (n=179), Russia (n=150), UK (n=123), Australia (n=120), Canada (n=120), France (n=120), Germany (n=120), Italy (n=120), Spain (n=120), Japan (n=75), Mexico (n=63), Portugal (n=60), Brazil (n=58), Switzerland (n=55), Taiwan (n=55), Netherlands (n=51), Argentina (n=50), Austria (n=50), Chile (n=50), China (n=50), Ireland (n=50), Belgium (n=50), Poland (n=50), and South Korea (n=50). Sampling was purposive and aimed at achieving adequate sample sizes within three prespecified strata: those diagnosed as HIV seropositive within the last 2 years, women and persons aged 50+ years, and those not informed of U=U by their HCP, but who nonetheless perceived comfort ‘with sharing (their) HIV status’. PLHIV further identified whom they had shared their HIV status with besides their primary HIV care providers. Participants were otherwise told the study was being conducted ‘on behalf of a pharmaceutical company’.

Survey recruitment/fielding

Participants were eligible for selection if they were aged ≥18 years, confirmed being HIV seropositive and were on ART. Of the 2389 participants, 1387 (58.1%) were recruited from support groups/charities for patients with HIV, 627 (26.2%) from existing panels of PLHIV; 204 (8.5%) from local operating company contacts; 108 (4.5%) from patient-to-patient referrals; and 63 (2.6%) from social media (online supplementary table 1). The survey was fielded in 20 languages.

The questionnaire, developed specifically for this primary data collection, comprised 60 questions designed to be completed in 25-30 min. It was developed, piloted and reviewed alongside an advisory panel that included PLHIV. The survey was sponsored by ViiV Healthcare and fielded independently by Ipsos Healthcare. To minimise bias in administering the survey, there was double blinding: ViiV Healthcare was not identified to participants as the study sponsor; likewise, participants’ identities were not revealed to ViiV Healthcare. Participants were however told the study was being conducted ‘on behalf of a pharmaceutical company’.

MEASURES

Exposure to U=U information

Conceptually, we classified participants into three categories based on exposure to U=U information: (a) Not heard of U=U; (b) Discussed U=U with their HCP; (c) Heard about U=U only from sources other than an HCP. Operationally, those who affirmed in the survey (‘agree’ or ‘strongly agree’) that ‘My provider has told me about “undetectable=untransmittable”’ were classified as (b) regardless of whether the discussion was patient-prompted or HCP initiated, and also regardless of whether PLHIV heard about U=U from other sources as well; those not informed of U=U by their HCP, but who nonetheless reported awareness that ‘My HIV medication prevents me from passing on HIV to others’ were classified as (c); all others who provided dissenting responses to the two survey questions above were classified as (a). The specific wording of the questions above are shown in online supplementary table 2. Respondents were also asked their perceived comfort discussing with HCPs their ‘concerns about the safety of others/preventing transmission’.

Self-rated health

Participants rated their sexual, physical, mental and overall health. Responses of ‘Very good’ or ‘Good’ (vs ‘Neither good nor poor’/‘Poor’/‘Very poor’) were classified as optimal.

Sharing of HIV status

Both components of social norms—descriptive (estimated prevalence) and injunctive (perceptions of acceptability)—can mediate the stigma experienced among PLHIV. For example, PLHIV might be unwilling to share their HIV status because they perceive very few other people within their social circle as living with HIV (descriptive norms), or because having HIV is judged by people within their social circle as being undesirable (injunctive norms).

We assessed whether exposure to U=U messages was associated with differential willingness to share HIV status with others. PLHIV were asked various questions to determine their perceived comfort ‘with sharing (their) HIV status’; if they had ‘ever hidden or disguised (their) HIV medication to avoid revealing (their) status’, and perceived comfort discussing with HCPs their ‘concerns about privacy and not disclosing (their) HIV status’. PLHIV further identified whom they had shared their HIV status with besides their primary HIV care providers.

Other variables

Suboptimal adherence was a report of at least one reason for missing ART for at least five times within the past month. Other assessed variables included age, gender, sexual orientation, location of PLHIV and of their primary HCP, commute time to HCR relationship status, and duration of disease. Several other aspects of engagement with HCPs were assessed, including sharing of health information, involvement in treatment decisions/care and communication.

Analyses

Percentages were compared with χ² tests. Associations between receipt of U=U message and health outcomes were measured using logistic regression. The outcomes analysed were self-reported viral suppression, suboptimal adherence, self-rated health, and privacy-related perceptions and behaviours. Separate logistic regression analyses were conducted for each outcome, adjusting for gender, age, sexual orientation, geographical region, duration of disease, domicile (metropolitan or non-metropolitan), education and ethnicity. Confounding variables were identified statistically (independently associated with exposure and outcomes) as well as with directed acyclic graphs. To assess for effect modification by PLHIV characteristics (≥10% difference in effect measure), analyses were further stratified by age (<50 or ≥50 years) and gender (men or women). All statistical procedures were performed with R V3.6.1.

RESULTS

Mean age was 41.2 (SD=12.2) years. Overall, 29.1% self-identified as women, 70.7% were aged <50 years and 73.5% had >high school. Among those diagnosed with HIV prior to 2017, 60.1% (1106/1841) currently prioritised preventing transmission to a sexual partner, and 20.4% (376/1841) currently prioritised having children. Black participants made up 13.6% (275/2014) of all respondents with information on ethnicity,
Table 1  Attitudes and perceptions towards preventing HIV transmission and the percentage that reported ever discussing U=U with their healthcare provider among people living with HIV in 25 countries, Positive Perspectives Study, 2019

| Characteristics | Categories                  | N, %          | Comfortable discussing HIV transmission with HCP, % | Ever discussed U=U with HCP, % | Aware that HIV medications prevent HIV transmission, % | Either discussed U=U with HCP or reported awareness that HIV medications prevent transmission, % |
|-----------------|-----------------------------|---------------|---------------------------------------------------|--------------------------------|---------------------------------------------------|------------------------------------------------------------------------------------------------|
| Total           | Overall                     | 2389 (100.0)  | 59.8                                              | 66.5                           | 74.2                                              | 87.6                                                                                            |
| Age, years      | <50                         | 1690 (70.7)   | 55.5                                              | 65.5                           | 74.0                                              | 87.0                                                                                            |
|                 | 50+                         | 699 (29.3)    | 70.1                                              | 68.8                           | 74.7                                              | 89.0                                                                                            |
| Gender          | Men                         | 1623 (67.9)   | 61.5                                              | 66.6                           | 76.8                                              | 88.4                                                                                            |
|                 | Women                       | 696 (29.1)    | 58.0                                              | 64.7                           | 67.8                                              | 85.1                                                                                            |
|                 | Other                       | 70 (2.9)      | 37.1                                              | 81.4                           | 78.6                                              | 95.7                                                                                            |
| Gender/sexual orientation | Men who have sex with men | 1018 (42.6)   | 70.3                                              | 70.5                           | 83.2                                              | 92.7                                                                                            |
|                 | Men who have sex with women | 479 (20.1)    | 42.8                                              | 57.6                           | 63.0                                              | 78.7                                                                                            |
|                 | Women who have sex with men | 481 (20.1)    | 59.3                                              | 64.2                           | 69.9                                              | 85.7                                                                                            |
|                 | Women who have sex with women | 62 (2.6)      | 45.2                                              | 61.3                           | 54.8                                              | 74.2                                                                                            |
|                 | Other/indeterminate         | 349 (14.6)    | 55.6                                              | 70.8                           | 72.8                                              | 90.0                                                                                            |
| Overall health  | Suboptimal                  | 1012 (42.4)   | 50.5                                              | 61.4                           | 69.1                                              | 83.8                                                                                            |
|                 | Optimal                     | 1377 (57.6)   | 66.6                                              | 70.2                           | 78.0                                              | 90.4                                                                                            |
| Physical health | Suboptimal                  | 953 (39.9)    | 50.2                                              | 59.8                           | 67.1                                              | 83.0                                                                                            |
|                 | Optimal                     | 1436 (60.1)   | 66.2                                              | 70.9                           | 79.0                                              | 90.7                                                                                            |
| Mental health   | Suboptimal                  | 1013 (42.4)   | 50.9                                              | 58.8                           | 68.3                                              | 81.9                                                                                            |
|                 | Optimal                     | 1376 (57.6)   | 66.3                                              | 72.1                           | 78.6                                              | 91.8                                                                                            |
| Sexual health   | Suboptimal                  | 1227 (51.4)   | 55.7                                              | 63.0                           | 70.9                                              | 85.8                                                                                            |
|                 | Optimal                     | 1162 (48.6)   | 64.1                                              | 70.1                           | 77.7                                              | 89.5                                                                                            |
| Geographical Region* | Northern America              | 520 (21.8)   | 53.8                                              | 67.3                           | 64.2                                              | 84.8                                                                                            |
|                 | Europe                      | 1119 (46.8)   | 61.1                                              | 68.4                           | 78.8                                              | 90.5                                                                                            |
|                 | Latin America               | 221 (9.3)    | 59.7                                              | 60.6                           | 71.9                                              | 84.6                                                                                            |
|                 | Asia                        | 230 (9.6)    | 50.4                                              | 51.3                           | 64.3                                              | 78.7                                                                                            |
|                 | Australia                   | 120 (5.0)    | 81.7                                              | 80.0                           | 90.8                                              | 97.5                                                                                            |
|                 | South Africa                | 179 (7.5)    | 65.9                                              | 69.8                           | 78.8                                              | 86.0                                                                                            |
| Housing status  | Own                         | 722 (30.2)    | 61.1                                              | 65.7                           | 73.1                                              | 88.4                                                                                            |
|                 | Rent                        | 916 (38.3)    | 63.3                                              | 68.1                           | 77.5                                              | 89.2                                                                                            |
|                 | Other                       | 751 (31.4)    | 54.2                                              | 65.2                           | 71.2                                              | 85.0                                                                                            |
| HCP location    | Metropolitan                | 1583 (66.3)   | 64.8                                              | 69.0                           | 79.7                                              | 90.9                                                                                            |
|                 | Non-metropolitan            | 806 (33.7)    | 49.9                                              | 61.5                           | 63.4                                              | 81.1                                                                                            |
| PLHIV location  | Metropolitan                | 1335 (55.9)   | 63.4                                              | 67.9                           | 80.0                                              | 90.7                                                                                            |
|                 | Non-metropolitan            | 1054 (44.1)   | 55.1                                              | 64.6                           | 66.9                                              | 83.7                                                                                            |
| Commute to HCP  | <30min                      | 869 (36.4)    | 65.5                                              | 71.9                           | 78.3                                              | 91.4                                                                                            |
|                 | 30–59min                    | 1027 (43.0)   | 58.1                                              | 65.5                           | 71.0                                              | 85.0                                                                                            |
|                 | 60+ min/unknown             | 493 (20.6)    | 53.1                                              | 58.8                           | 73.8                                              | 86.4                                                                                            |
| Employment status | Employed                   | 1653 (69.2)   | 60.0                                              | 65.8                           | 73.7                                              | 87.6                                                                                            |
|                 | Non-employed                | 736 (30.8)    | 59.4                                              | 68.1                           | 75.3                                              | 87.6                                                                                            |
| Education       | ≤High school                | 532 (22.3)    | 59.0                                              | 72.6                           | 72.0                                              | 88.5                                                                                            |
|                 | >High school                | 1756 (73.5)   | 61.4                                              | 63.7                           | 74.7                                              | 87.0                                                                                            |
|                 | Refused to answer           | 101 (4.2)     | 35.6                                              | 83.2                           | 78.2                                              | 93.1                                                                                            |
| Ethnicity       | White                       | 1393 (58.3)   | 61.7                                              | 67.1                           | 74.3                                              | 88.4                                                                                            |
|                 | Black                       | 275 (11.5)    | 60.0                                              | 69.8                           | 70.9                                              | 84.0                                                                                            |
|                 | Other                       | 346 (14.5)    | 59.0                                              | 63.9                           | 74.0                                              | 86.7                                                                                            |
|                 | Unknown/missing             | 375 (15.7)    | 53.3                                              | 64.0                           | 76.5                                              | 88.3                                                                                            |
| Preventing HIV transmission was a treatment goal when starting treatment | No                      | 1216 (50.9)   | 57.6                                              | 61.8                           | 69.4                                              | 84.7                                                                                            |
|                 | Yes                        | 1173 (49.1)   | 62.1                                              | 71.3                           | 79.2                                              | 90.6                                                                                            |
| Self-reported viral load | Not suppressed/unknown     | 619 (25.9)    | 48.5                                              | 59.6                           | 54.3                                              | 79.2                                                                                            |
|                 | Suppressed                  | 1770 (74.1)   | 63.7                                              | 68.9                           | 81.2                                              | 90.6                                                                                            |
| HIV diagnosis year | 2017–2019            | 548 (22.9)    | 55.5                                              | 67.3                           | 67.9                                              | 88.5                                                                                            |
|                 | 2010–2016                   | 913 (38.2)    | 54.2                                              | 66.2                           | 73.1                                              | 85.0                                                                                            |
|                 | Pre-2010                    | 928 (38.8)    | 67.8                                              | 66.3                           | 79.1                                              | 89.7                                                                                            |

* Geographical regions were: Northern America (U.S. and Canada); Europe (Austria, Belgium, France, Germany, Italy, the Netherlands, Poland, Portugal, Ireland, Russia, Spain, Switzerland, and the UK); Latin America (Argentina, Brazil, Chile, and Mexico), and Asia (China, Japan, South Korea, and Taiwan); South Africa and Australia were analyzed separately.

HCP, healthcare provider; PLHIV, people living with HIV; U=U, undetectable equals untransmittable.
Other characteristics are in table 1.

Percentage of PLHIV reporting past U=U discussions with HCPs

Overall, 66.5% (1588/2389) reported ever discussing U=U with their HCP (table 1). PLHIV who considered prevention of HIV transmission to a partner as an important treatment goal when they started ART reported significantly higher prevalence than those less concerned at ART initiation (71.3% [836/1173] vs 61.8% [752/1216], p<0.001). Notably, there was no significant difference in discussing U=U with HCPs by either year of HIV diagnosis (p=0.886) or age (p=0.119).

Subgroups reporting high percentages for having discussed U=U with their HCP included people of black origins (69.8%, 192/275), those identifying as transgender (77.1%, 27/35), with casual sex partners (75.3%, 253/336), reporting viral suppression (68.9%, 1219/1770) and with ≤ high school (72.6%, 386/532) (table 1, figure 1). Prevalence by gender was 66.6% (1081/1623) for men, 64.7% (450/696) for women and 81.4% (57/70) for self-reported ‘Other’ gender (p=0.018). Striking differences were observed when separating estimates for men who have sex with men (70.5%, 718/1018) versus men who have sex with women (57.6%, 276/479) (p<0.001). Place-based differences were also noted; prevalence was highest among those whose HCP practised in a metropolitan area (69.0%, 1092/1583) and whose commute

### Table 1: Characteristics of people living with HIV who reported being told by their healthcare provider of ‘Undetectable=Untransmittable’, by selected characteristics, Positive Perspectives Study, 2019 (n=2389).

| Characteristic                  | Percentage (%) |
|--------------------------------|----------------|
| **Overall**                     | 66.5           |
| **Education**                   |                |
| Less than high/secondary school | 69.8           |
| High school/secondary school    | 73.2           |
| Vocational qualifications       | 64.7           |
| University/College degree       | 63.4           |
| Post-graduate/Masters/Doctorate | 61.9           |
| Other                          | 66.7           |
| Prefer not to answer            | 83.2           |
| **Geographic Region**           |                |
| Northern America                | 67.3           |
| Europe                          | 68.4           |
| Latin America                   | 51.3           |
| Asia                            | 80.0           |
| Australia                       | 69.8           |
| South Africa                    |                |
| **Housing Type**                |                |
| Live in a home that I own       | 67.7           |
| Live in a home that I rent      | 68.1           |
| Shelter or similar housing     | 53.8           |
| Staying with family             | 61.3           |
| Staying with friends            | 68.2           |
| Other                           | 58.5           |
| Prefer not to answer            | 81.4           |
| **Gender Status**               |                |
| Men (1823)                      | 66.6           |
| Women (696)                     | 64.7           |
| Other (70)                      | 81.4           |
| **Gender Identity**             |                |
| Cis-gender (2315)               | 66.0           |
| Transgender (36)                | 77.1           |
| Prefer not to say               | 84.6           |
| **Sexuality**                   |                |
| Men who have sex with men (1018)| 57.6           |
| Men who have sex with women (479)| 70.5           |
| Women who have sex with women (481)| 64.2           |
| Women who have sex with women (62) | 61.3           |
| Unknown/other (349)             | 70.8           |
| **Relationship Status**         |                |
| No relationship (178)           | 68.5           |
| Serious relationship (329)      | 64.4           |
| Casual sex partners (336)       | 65.9           |
| Multiple partners (1244)        | 75.3           |
| Indeterminate (302)             | 59.9           |
| **Viral Load**                  |                |
| Not suppressed/unknown (619)    | 59.6           |
| Suppressed (1770)               | 68.9           |
to their HCP was <30 min (71.9%, 625/869). Country-specific prevalence ranged from Switzerland (87.3%, 48/55) to South Korea (38.0%, 19/50) (online supplementary figure 1).

Discussions with HCPs about U=U were correlated with other indicators of HCP engagement. Compared with those not reporting any U=U discussions with their HCP, those reporting a past discussion also reported significantly higher estimates for the following indicators: ‘I am given enough information to be involved in making choices about my HIV treatment’ (72.0% [1144/1588] vs 43.8% [351/801]), ‘My provider seeks my views about treatment before prescribing’ (72.4% [1150/1588] vs 43.7% [350/801]), ‘My provider asks me if I have any concerns about the HIV medication I am currently taking’ (74.5% [1183/1588] vs 46.6% [373/801]), ‘My provider tells me about new HIV treatment options that become available’ (69.3% [1101/1588] vs 39.0% [312/801]) and ‘I feel I understand enough about my HIV treatment’ (79.0% [1254/1588] vs 56.8% [455/801]) (all p<0.001).

Differences in health outcomes with HCP versus non-HCP U=U exposure

Stronger associations with health outcomes were noted when PLHIV discussed U=U with their HCP, than when exposed from non-HCP sources (tables 2 and 3). Prevalence of various health-related outcomes was as follows among the three categories of PLHIV reporting being unaware of U=U, being made aware of U=U from non-HCP sources and being engaged in a past U=U discussion with their HCP, respectively: self-reported viral suppression (56.4% [167/296], 76.0% [384/505] and 76.8% [1144/1588]), optimal overall health (57.6% [146/296], 55.0% [278/505] and 60.9% [1150/1588]), optimal mental health (57.6% [146/296], 53.7% [278/505] and 62.5% [1150/1588]), optimal physical health (60.1% [171/296], 56.2% [282/505] and 64.1% [1150/1588]), optimal sexual health (48.6% [141/296], 44.6% [220/505] and 51.3% [1150/1588]), comfortable sharing HIV status (29.8% [89/296], 26.5% [133/505] and 32.7% [484/1588]), and would be anxious or stressed if others were to see their HIV medication (45.8% [137/296], 50.3% [253/505] and 43.3% [668/1588]).

Table 2 Bivariate analyses of prevalence of health outcomes by source of information about U=U, Positive Perspectives Study, 2019 (n=2389)

| Domain | Characteristic | Overall (n=2389) | Completely unaware of U=U (n=296) | Aware of U=U from non-HCP sources (n=505) | Informed by HCP of U=U (n=1588) | P value |
|--------|----------------|-----------------|----------------------------------|------------------------------------------|---------------------------------|---------|
| Health indicators | Viral suppression | 74.1 | 56.4 | 76.0 | 76.8 <0.001 |
| | Optimal overall health | 57.6 | 44.6 | 55.0 | 60.9 <0.001 |
| | Optimal mental health | 57.6 | 38.2 | 53.7 | 62.5 <0.001 |
| | Optimal physical health | 60.1 | 45.3 | 56.2 | 64.1 <0.001 |
| | Optimal sexual health | 48.6 | 41.2 | 44.6 | 51.3 0.001 |
| Attitudes and behaviours towards sharing HIV status | Comfortable sharing HIV status | 29.8 | 19.6 | 26.5 | 32.7 <0.001 |
| | Would be anxious or stressed if others were to see their HIV medication | 45.8 | 51.0 | 50.3 | 43.3 0.004 |
| | Ever hid or disguised their HIV medication within the past 6 months | 57.9 | 67.2 | 61.4 | 55.0 <0.001 |
| | Comfortable discussing ART-related privacy concerns with HCP | 52.0 | 34.8 | 45.5 | 57.2 <0.001 |
| | Comfortable discussing with HCP concerns about the safety of others/preventing transmission | 59.8 | 36.1 | 55.2 | 65.6 <0.001 |
| | Have always shared HIV status | 6.8 | 2.7 | 5.5 | 8.0 0.002 |
| | Missed ART dose for 5+ times in past month because of privacy concerns | 4.3 | 8.8 | 5.5 | 3.0 <0.001 |
| People shared HIV status with | Shared HIV status with nobody besides primary HIV care provider | 12.6 | 20.9 | 11.7 | 11.4 <0.001 |
| | 'Most of the people in my life' | 29.1 | 20.1 | 31.6 | 29.9 0.002 |
| | Close friends | 71.1 | 56.4 | 73.9 | 72.9 <0.001 |
| | Parents, siblings and children | 68.1 | 60.2 | 67.4 | 69.8 0.006 |
| | Co-workers | 33.9 | 27.5 | 39.0 | 33.4 0.007 |
| | Wider family/circle of friends | 46.7 | 34.8 | 46.3 | 48.9 0.001 |
| | Current family doctor not providing HIV care | 68.0 | 55.5 | 67.0 | 70.6 <0.001 |
| | Sexual partners | 61.1 | 50.9 | 62.0 | 62.5 0.005 |
| | Other HCPs not providing HIV care | 60.5 | 48.4 | 62.8 | 62.0 <0.001 |
| | Partner/spouse/significant other | 75.8 | 69.3 | 75.8 | 77.2 0.025 |
| Reason for not sharing HIV status | They would see or treat me different | 58.6 | 47.6 | 62.0 | 59.6 0.0001 |
| | They might then disclose my HIV status to others | 51.8 | 48.3 | 54.7 | 51.6 0.210 |
| | I might be excluded from activities | 38.1 | 40.2 | 39.2 | 37.4 0.565 |
| | Being denied access to healthcare services | 18.1 | 18.2 | 24.0 | 16.2 <0.001 |
| | Being denied access to financial benefits | 17.7 | 20.3 | 17.8 | 17.1 0.427 |
| | Might affect my friendships | 45.8 | 43.9 | 47.7 | 45.6 0.549 |
| | I might lose my job | 33.9 | 34.5 | 37.6 | 32.6 0.115 |
| | Might affect my romantic or sexual relationships | 37.3 | 27.0 | 39.2 | 38.7 0.001 |
| | My physical safety/potential violence | 20.1 | 22.6 | 22.8 | 18.7 0.068 |
| | Criminal prosecution | 10.1 | 10.5 | 10.5 | 9.9 0.899 |

The p-values shown are derived from global tests (Chi-square statistics) assessing whether at least two groups are significantly different.

ART, antiretroviral therapy; HCP, healthcare provider; U=U, undetectable equals untransmittable.
Table 3  Binary logistic regression analyses for the relationship between awareness of U=U and health outcomes among the entire study population, Positive Perspectives Study, 2019 (n=2389)

| Outcomes                          | Categories of predictor variable | Crude analyses OR (95%CI) | P value | Adjusted analyses* OR (95%CI) | P value |
|-----------------------------------|---------------------------------|---------------------------|---------|-------------------------------|---------|
| Self-reported viral suppression   | Completely unaware of U=U       | 1.00 (referent)           | <0.001  | 1.00 (referent)               | <0.001  |
|                                   | Aware from non-HCP sources     | 2.45 (1.80 to 3.33)       | <0.001  | 2.10 (1.45 to 3.02)           | <0.001  |
|                                   | Informed by HCP                | 2.55 (1.97 to 3.30)       | <0.001  | 2.34 (1.72 to 3.20)           | <0.001  |
| Suboptimal adherence              | Completely unaware of U=U       | 1.00 (referent)           | <0.001  | 1.00 (referent)               | <0.001  |
|                                   | Aware from non-HCP sources     | 0.74 (0.54 to 0.99)       | 0.049   | 0.94 (0.68 to 1.30)           | 0.699   |
|                                   | Informed by HCP                | 0.46 (0.35 to 0.60)       | <0.001  | 0.59 (0.44 to 0.78)           | <0.001  |
| Optimal overall health            | Completely unaware of U=U       | 1.00 (referent)           | <0.001  | 1.00 (referent)               | <0.001  |
|                                   | Aware from non-HCP sources     | 1.52 (1.14 to 2.03)       | 0.004   | 1.51 (1.12 to 2.03)           | 0.007   |
|                                   | Informed by HCP                | 1.93 (1.51 to 2.49)       | <0.001  | 1.94 (1.49 to 2.51)           | <0.001  |
| Optimal mental health             | Completely unaware of U=U       | 1.00 (referent)           | <0.001  | 1.00 (referent)               | <0.001  |
|                                   | Aware from non-HCP sources     | 1.88 (1.40 to 2.51)       | <0.001  | 1.79 (1.32 to 2.43)           | <0.001  |
|                                   | Informed by HCP                | 2.70 (2.09 to 3.48)       | <0.001  | 2.50 (1.91 to 3.26)           | <0.001  |
| Optimal physical health           | Completely unaware of U=U       | 1.00 (referent)           | <0.001  | 1.00 (referent)               | <0.001  |
|                                   | Aware from non-HCP sources     | 1.55 (1.16 to 2.07)       | 0.003   | 1.44 (1.07 to 1.94)           | 0.018   |
|                                   | Informed by HCP                | 2.16 (1.68 to 2.77)       | <0.001  | 1.95 (1.50 to 2.54)           | <0.001  |
| Optimal sexual health             | Completely unaware of U=U       | 1.00 (referent)           | <0.001  | 1.00 (referent)               | <0.001  |
|                                   | Aware from non-HCP sources     | 1.15 (0.86 to 1.53)       | 0.358   | 1.13 (0.83 to 1.53)           | 0.441   |
|                                   | Informed by HCP                | 1.50 (1.17 to 1.93)       | <0.001  | 1.48 (1.14 to 1.92)           | 0.004   |
| Comfortable sharing HIV status    | Completely unaware of U=U       | 1.00 (referent)           | <0.001  | 1.00 (referent)               | <0.001  |
|                                   | Aware from non-HCP sources     | 1.48 (1.05 to 2.10)       | 0.027   | 1.58 (1.10 to 2.26)           | 0.013   |
|                                   | Informed by HCP                | 1.99 (1.47 to 2.70)       | <0.001  | 2.15 (1.57 to 2.95)           | <0.001  |
| Always share HIV status           | Completely unaware of U=U       | 1.00 (referent)           | <0.001  | 1.00 (referent)               | <0.001  |
|                                   | Aware from non-HCP sources     | 2.11 (0.95 to 4.70)       | 0.067   | 2.10 (0.93 to 4.77)           | 0.075   |
|                                   | Informed by HCP                | 3.13 (1.51 to 6.46)       | 0.002   | 2.99 (1.42 to 6.28)           | 0.004   |
| Shared HIV status with others besides HIV care provider | Completely unaware of U=U       | 1.00 (referent)           | <0.001  | 1.00 (referent)               | <0.001  |
|                                   | Aware from non-HCP sources     | 2.00 (1.36 to 2.96)       | <0.001  | 1.67 (1.11 to 2.52)           | 0.014   |
|                                   | Informed by HCP                | 2.06 (1.50 to 2.84)       | <0.001  | 1.74 (1.24 to 2.45)           | 0.001   |
| Ever disguised/hid HIV medicines in past 6 months | Completely unaware of U=U       | 1.00 (referent)           | <0.001  | 1.00 (referent)               | <0.001  |
|                                   | Aware from non-HCP sources     | 0.77 (0.57 to 1.05)       | 0.098   | 0.87 (0.63 to 1.21)           | 0.417   |
|                                   | Informed by HCP                | 0.60 (0.46 to 0.78)       | <0.001  | 0.65 (0.49 to 0.86)           | 0.003   |
| Comfortable discussing privacy issues with HCP | Completely unaware of U=U       | 1.00 (referent)           | <0.001  | 1.00 (referent)               | <0.001  |
|                                   | Aware from non-HCP sources     | 1.57 (1.17 to 2.11)       | 0.003   | 1.41 (1.04 to 1.91)           | 0.029   |
|                                   | Informed by HCP                | 2.51 (1.94 to 3.25)       | <0.001  | 2.50 (1.91 to 3.28)           | <0.001  |
| Comfortable discussing concerns about transmission with HCP | Completely unaware of U=U       | 1.00 (referent)           | <0.001  | 1.00 (referent)               | <0.001  |
|                                   | Aware from non-HCP sources     | 2.18 (1.62 to 2.93)       | <0.001  | 1.93 (1.42 to 2.62)           | <0.001  |
|                                   | Informed by HCP                | 3.37 (2.60 to 4.37)       | <0.001  | 3.27 (2.49 to 4.29)           | <0.001  |
| Missed ART for ≥5 times in past month because of privacy concerns | Completely unaware of U=U       | 1.00 (referent)           | <0.001  | 1.00 (referent)               | <0.001  |
|                                   | Aware from non-HCP sources     | 0.61 (0.35 to 1.06)       | 0.080   | 0.83 (0.47 to 1.48)           | 0.533   |
|                                   | Informed by HCP                | 0.32 (0.20 to 0.53)       | <0.001  | 0.41 (0.25 to 0.69)           | 0.001   |

*Adjusted for ethnicity, region, age, sexual orientation, diagnosis year, domicile and education.

ART, antiretroviral therapy; HCP, healthcare provider; U=U, undetectable equals untransmittable.
within adjusted analyses. 

The observed strength of association between exposure to the U=U message and health outcomes varied by age and gender. For example, compared with those unaware of U=U, discussing U=U with their HCP was associated with over five times higher odds of sharing their HIV status with family, friends or co-workers; conversely, <50-year-old women were least likely to share their HIV status among their social contacts (online supplementary figure 2). 

DISCUSSION

Overall, 66.5% of PLHIV in our study had discussed U=U with their HCP. We saw no significant difference between PLHIV diagnosed prior to 2017 vs 2017 or later in being told of U=U by their HCP.24 Indeed, almost a decade before the launch of the U=U campaign, the Swiss Federal Commission for HIV/AIDS first endorsed a similar message of undetectable equals uninfectious in 2008.25 26 The global U=U campaign has however allowed for universal endorsement of this message. A possible explanation for the non-significant finding by time of diagnosis is that patient education about U=U may be occurring at multiple periods throughout the course of treatment other than just at time of diagnosis, thus explaining the similar rates of ever receiving U=U information from an HCP regardless of when diagnosed. We also observed that people of lower educational status were more likely to report receiving information on U=U from their HCP, possibly reflecting lack of other sources. Proactively discussing U=U at different points, including at the time of diagnosis, initiating ART and during routine follow-up consultations can empower PLHIV.27 Even brief counselling of 2–3 min has been shown to be effective with other behavioural interventions such as smoking cessation counselling.28

Information provided by HCPs may be deemed more credible than other media which may explain our observation of stronger effect sizes among those who were engaged by their HCP. We also observed that people of lower educational status were more likely to report receiving information on U=U from their HCP, possibly reflecting lack of other sources. Proactively discussing U=U at different points, including at the time of diagnosis, initiating ART and during routine follow-up consultations can empower PLHIV.27 Even brief counselling of 2–3 min has been shown to be effective with other behavioural interventions such as smoking cessation counselling.28

Strengths and limitations

The strengths of this study include the use of a standardised protocol in 25 countries and a large sample size which increases precision of estimates. Nonetheless, limitations exist. The non-probabilistic sampling and web-based survey administration may limit generalisability while the self-reported measures may be subject to misreporting and other measurement errors. For example, there could be underestimation of the percentage informed about U=U in clinical settings because of poor recall, or if PLHIV were informed by someone other than their primary HIV care provider. We could not explore non-HCP sources of U=U information in great detail because of limited information. Misclassification of U=U exposure status could also arise from dichotomisation of the Likert-type scale, but the effect of this misclassification is likely to be conservatively towards the null (ie, individuals with some exposure classified as being non-exposed). Finally, only associations can be drawn because of the cross-sectional design.

Education

In the US, other than their primary HIV care provider. We could not explore non-HCP sources of U=U information in great detail because of limited information. Misclassification of U=U exposure status could also arise from dichotomisation of the Likert-type scale, but the effect of this misclassification is likely to be conservatively towards the null (ie, individuals with some exposure classified as being non-exposed). Finally, only associations can be drawn because of the cross-sectional design.
Key messages

► A third of people living with HIV (PLHIV) in this international study reported not having had discussions with their healthcare provider (HCP) about ‘Undetectable equals Untransmittable’ (‘U=U’).

► PLHIV who reported discussing with their HCP about U=U had more favourable health outcomes than those not informed of U=U; for example, they had 41% lower odds of reporting suboptimal adherence and 48% higher odds of optimal sexual health.

► While U=U-related information accessed from non-HCP sources was beneficial as well, the observed associations were attenuated relative to those seen with actually discussing U=U with HCPs.

► U=U discussions between HCPs and patients should be considered in standard of care guidelines to help improve health-related outcomes of PLHIV and benefit public health.

CONCLUSIONS

Overall, only 66.5% of all PLHIV reported having discussed U=U with their HCP and disparities by region and other characteristics were observed. Discussing U=U with an HCP was significantly associated with favourable health outcomes, including greater adherence, better viral control, optimal health (including sexual health), greater willingness to share HIV status with others, and increased comfort discussing with HCP concerns about HIV transmission and privacy. Increased dissemination of the U=U message in clinical settings can benefit public health.

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