



Multicity HIV seroprevalence in street youth, Ukraine

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Summary: We conducted the first systematic, community-based, multicity assessment outside the USA of HIV seroprevalence, risk factors and linkage into clinical services among 929 street youth. After city-wide mapping, we used time-location sampling and randomly selected 74 venues in Odesa, Kyiv and Donetsk, Ukraine. Rapid HIV testing with post-test counselling was offered to all eligible youths aged 15–24 years. Overall, 18.4% (95% confidence interval 16.2–20.2) were HIV positive and 85% had previously unknown status. Rates were identical by sex. Subgroups with highest rates included orphans (26%), youths with histories of exchanging sex (35%), sexually transmitted infections (STIs) (37%), injection drug use (IDU) (42%) and needle sharing (49%). Independent predictors, similar across age groups and city, included being orphaned, time on the street, history of anal sex, STIs, exchanging sex, any drug use, IDU and needle sharing. Two-thirds (68%) of HIV-positive youths were linked to services. This high-risk population has many immediate needs.

Keywords: HIV, Europe, epidemiology, high-risk screening

INTRODUCTION

Recent reports suggest that half of all new cases of HIV in the world occur in youths aged 15–24 year,^{1–3} and HIV is the second leading cause of death among youths aged 20–24 years.⁴ Multiple international donor organizations acknowledge young people are at increased risk of HIV/AIDS.² Although youths constitute 29% of the total population in developing countries,⁵ and are at high risk, many young people lack access to HIV prevention, testing and treatment services.^{1,2} Youths who are minors (aged <18 years) face additional challenges as they may lack legal authority to access HIV testing without parental consent and yet be unable to obtain such consent. This gap in access constitutes a breach of the widely endorsed universal access framework, which advocates that equal access to comprehensive HIV prevention, treatment, care and support should be available to all who need it.^{1,6}

Certain subpopulations of young people, such as street youth, are at even greater risk of HIV/AIDS.^{3,6} Street youth, or young people aged 15–24 years living part-time or full-time on the street, often have social risk factors such as abuse, neglect, abandonment and deficient familial support, which may lead to sexual and drug-use risk-taking behaviours.^{7–11} Risk of HIV infection among street youth is further increased if they inject drugs or exchange sex for money or goods.^{3,7}

Moreover, the very characteristics that increase vulnerability of street youth (e.g. living outside of parental care) also create barriers to HIV prevention, testing and care.^{1,2,8–11}

Although it is generally accepted that street youth possess an elevated risk of HIV, studies addressing HIV seroprevalence have primarily been based on convenience samples of shelter populations in single cities in the USA or Canada, which have found rates ranging from 0.3% to 11.5%.^{12–16} The three studies that attempt to avoid the biases of convenience sampling were conducted in single cities in Canada, the USA and Eastern Europe, and tended to report higher seroprevalences ranging from 2.8% to 37%.^{9,17,18} High HIV seroprevalences among street youth in single cities may reflect isolated geographic outbreaks; in contrast, a systematic, multicity, community-based study would shed light on whether high HIV rates among street youth are a generalized phenomenon. To date, the only multicity report was based on a convenience sample from a USA population of youths accessing shelters or medical clinics nearly two decades ago, and reported a seroprevalence of 2.3%.¹⁹ Thus, previous estimates of HIV seroprevalence among street youth may have been biased by sampling approaches.

Valid estimates of the size of the street youth population do not exist, but up to 100,000,000 worldwide have been cited.²⁰ The size of the street youth population in Ukraine, estimated at 40,000–300,000,³ rivals estimates for other populations most at risk for HIV infection, such as sex workers (110,000) and injection drug users (325,000).²¹ Although there is a sizeable street youth population, little is known about the HIV seroprevalence or risk factors of those in Ukraine, which has one of the fastest growing HIV epidemics in the world.^{2,8,9} As of 2007, 440,000 children and adults ≥ 15 years

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living in Ukraine were estimated to have HIV/AIDS.¹¹ Although in Ukraine, many HIV-infected persons in need of antiretroviral therapy receive it at no cost, the demand for services, including highly active antiretroviral therapy and social services (e.g. needle syringe exchange programmes and drug rehabilitation), exceeds availability.

3 In three geographically diverse Ukrainian cities with populations exceeding a million persons, we sought to systematically assess community-based HIV seroprevalence among street youth, identify risk factors for HIV infection, evaluate differences by age and assess feasibility of linking those found to be HIV-positive to clinical services.

METHODS

From May to December 2008, a multisite HIV seroprevalence assessment among street youth was conducted in Odesa, Kyiv and Donetsk. In each city, the assessment included developing a sampling frame of street youth locations, randomly selecting sites, and administering HIV tests and interviews to all consenting eligible youth at selected sites (~300 participants per city).

Target population

Our target population was street and out-of-school youth residing in Odesa, Kyiv and Donetsk, who were aged 15–24 years. Eligibility criteria for minors aged 15–17 years stipulated that they be found at street venues without parents, and at least one of the following: live part- or full-time on the street, live out of family care, self-identify as 'street youth' or 'street kids,' or did not attend school everyday/almost everyday when school was last in session. Eligibility criteria for non-minor youths (≥ 18 years) included living part- or full-time on the street, or self-identifying as 'street youth' or 'street kids.' Exclusion criteria were previous participation in the assessment, inability to provide informed consent and staff suspicion that a street youth posed a potential threat.

Sampling methodology

We used an adaptation of time-location sampling, which provides systematic methods for accessing hidden high-risk populations²² to map public locations where street youth were thought to congregate (e.g. near fast-food restaurants, recreation areas, computer clubs and metro stops). In each city, local nongovernmental organizations (NGOs) and faith-based organizations serving street youth classified locations as definite (reported by \geq two organizations), presumptive (reported by one organization) or potential (not reported by any organization but thought to be a possible location). Outreach workers evaluated each presumptive and potential location to assess suitability for inclusion in the sampling frame. The final sampling frame consisted of definite locations and all presumptive and potential locations where \geq five street youth were seen during formative observation. Assessment sites were randomly selected by the senior study team and street youth present at those sites were universally invited to participate.

Assessments

The assessments began in each city within two weeks of mapping and were conducted sequentially from May to December 2008 by two teams staffed by nurses, social workers and outreach

workers who simultaneously visited each site via mobile vans equipped for HIV counselling and testing. Outreach workers systematically approached all youths observed at each site to evaluate their eligibility and coordinate enrollment. Trained social workers obtained informed consent from eligible youths before administering pre-test counselling and a structured interview.

A nurse performed rapid HIV testing using whole-blood samples drawn by finger stick using the Determine rapid HIV-1/2 test, which has 100% reported sensitivity and 99.6–100% specificity.^{23,24} After the nurse provided the rapid test results (~15 minutes), participants received post-test counselling, were given information on HIV prevention and services, and were offered small gifts such as food, juice or clothing items. All sexually active youths were also offered condoms. If time was insufficient to assess all eligible youths at a site in one visit, the teams returned as many times as necessary to offer universal participation to all eligible youths.

All youths with positive rapid HIV tests were offered active follow-up by the social worker to facilitate referrals to the City AIDS Center, which provides free services for HIV-infected individuals, including clinical evaluation, immunological and virological monitoring, antiretroviral treatment, care and support. Accessibility of HIV services for nonresidents varied by city. Coordination of referrals was provided by the same social worker who administered the interview.

Analysis

We estimated HIV seroprevalence and computed χ^2 tests to assess the associations between characteristics and testing HIV positive. We used logistic regression to estimate unadjusted and adjusted odds ratios (ORs and AORs), with 95% confidence intervals (CI), for all significant risk factors and gender. Due to multicollinearity among several risk factors, we used different base models when assessing the significance of demographic, social, sexual and substance-use characteristics in multivariable analyses. We also examined whether risk factors significantly associated with HIV infection varied by age, gender, city and lifetime injection drug use (IDU). We used SAS-callable SUDAAN software (Research Triangle Institute, Research Triangle Park, NC, USA) to account for intra-cluster homogeneity within sites and cities in all analyses.

Ethical reviews

This rapid assessment was conducted as an emergency response to a potential public health crisis among street youth in Ukraine. The protocol was reviewed for ethical concerns by the Centers for Disease Control and Prevention and deemed to be public health practice. An authority from the Ukrainian Ministry of Family, Youth, and Sports likewise reviewed and approved the protocol for ethical concerns. Provisions were taken to assure anonymity of youths and confidentiality of the data during enrollment, data collection, data storage and analysis. Local project staff collected no identifying information from HIV-positive youths, only nicknames or first names, which were used for linking participants into follow-up care, support and treatment.

RESULTS

In total, 91 street youth locations were mapped and 74 sites randomly selected. Of 1043 youths approached for participation,

961 (92%) met eligibility criteria and 929 (97%) participated. Approximately three-quarters of participants were men (76%) or were ≥ 18 years (675/929, 73%), but the age distribution varied by city, with Odesa having the largest percentage of minors (48%) and Kyiv having the smallest (17%; Table 1).

Overall, we found high rates of social, sexual and substance-use risk factors for HIV. Many minor and non-minor street youth lacked city legal residence registration. The majority of youths had no place to live or had spent several nights per week outside of their residences for the past few months and had been spending time on the street >3 years. Many had evidence of prior familial dysfunction, as they lived with someone during childhood who was a problem drinker, alcoholic or was incarcerated. Nearly half were orphans and over two-thirds did not have an adult they could turn to for help. Most reported sexual activity initiation, many had unprotected sex (47%) and nearly one-third had ≥ 6 sexual partners in the past year. The majority had used drugs with one-third reporting IDU and nearly one-quarter sharing

needles. In comparison with non-minors, minors (aged 15–17 years) had significantly higher rates of social risks, such as living alone or with friends and having previously lived in a shelter or orphanage. Conversely, youths aged 18–24 years had significantly higher rates of many sexual and substance-use characteristics (Table 1).

In our study population ($n = 929$), overall HIV seroprevalence was 18.4% (95% CI: 16.2–20.2) with significant variation among many subgroups reflecting street youth's life histories of victimization and marginalization (Table 2). Overall, subgroups with the highest HIV infection rates ($>25\%$) included youths living in Odesa, orphans, youths who lived with someone during childhood who used illegal drugs or was incarcerated, and youths with lifetime histories of exchanging sex for money or goods, sexually transmitted infections (STIs), any drug use, IDU, or needle sharing, those who reported getting drunk ≥ 10 days in the past month, and those who did not know that people can get HIV by sharing needles with those who were HIV infected. Among

Table 1 Characteristics of street youth, stratified by age, Ukraine 2008

| Characteristics | Categories | 15–17 (N = 254) n (%) | 18–24 (N = 675) n (%) | P* | Total (N = 929) n (%) |
|---------------------------------|---|--------------------------|--------------------------|---------|--------------------------|
| Demographic | | | | | |
| Gender | Male | 190 (74.8) | 516 (76.4) | 0.60 | 706 (76.0) |
| | Female | 64 (25.2) | 159 (23.6) | | 223 (24.0) |
| City | Odesa | 123 (48.4) | 188 (27.9) | <0.0001 | 311 (33.5) |
| | Kyiv | 44 (17.3) | 267 (39.6) | | 311 (33.5) |
| | Donetsk | 87 (34.3) | 220 (32.6) | | 307 (33.1) |
| Social risk factors | | | | | |
| | Not registered as city resident | 120 (47.2) | 255 (37.8) | <0.01 | 375 (40.4) |
| | Completed ≤ 9 grades of education | 210 (82.7) | 375 (55.6) | <0.0001 | 585 (63.0) |
| | Does not work for pay [†] | 156 (61.4) | 249 (36.9) | <0.0001 | 405 (43.6) |
| | Orphan | 113 (44.5) | 291 (43.1) | 0.71 | 404 (43.5) |
| | Currently living alone/with friends | 125 (49.2) | 246 (36.4) | <0.001 | 371 (39.9) |
| | No adult to turn to for help | 160 (63.0) | 471 (69.8) | <0.05 | 631 (67.9) |
| | Ever lived in a shelter or orphanage | 128 (50.4) | 196 (29.0) | <0.0001 | 324 (34.9) |
| | No place to live or spending ≥ 2 nights/week for past few months outside residence | 175 (68.9) | 468 (69.3) | 0.90 | 643 (69.2) |
| | Time on streets >3 years | 103 (40.6) | 450 (66.7) | <0.0001 | 553 (59.5) |
| | Lived with someone during childhood who was a problem drinker or alcoholic [‡] | 162 (63.8) | 393 (58.2) | 0.12 | 555 (59.7) |
| | Lived with someone during childhood who used illegal drugs [‡] | 49 (19.3) | 121 (17.9) | 0.63 | 170 (18.3) |
| | Lived with someone during childhood who attempted suicide [‡] | 32 (12.6) | 115 (17.0) | 0.10 | 147 (15.8) |
| | Lived with someone during childhood who was incarcerated [‡] | 111 (43.7) | 271 (40.2) | 0.33 | 382 (41.1) |
| Sexual risk factors | | | | | |
| | Ever had sex | 190 (75.1) | 662 (98.2) | <0.0001 | 852 (91.9) |
| | Lifetime anal sex | 22 (8.7) | 206 (30.5) | <0.0001 | 228 (24.5) |
| | Past year ≥ 6 opposite sex partners | 51 (20.2) | 215 (32.0) | <0.001 | 266 (28.7) |
| | Last sex unprotected | 70 (27.8) | 368 (54.6) | <0.0001 | 438 (47.3) |
| | Lifetime sex exchange [§] | 13 (5.1) | 30 (4.5) | 0.66 | 43 (4.6) |
| | Lifetime STI diagnosis | 16 (6.3) | 95 (14.1) | <0.01 | 111 (12.0) |
| | Lifetime sexual victimization** | 18 (7.1) | 65 (9.6) | 0.23 | 83 (9.0) |
| Substance use behaviours | | | | | |
| | Lifetime use of any drug | 176 (69.3) | 504 (74.7) | 0.10 | 680 (73.2) |
| | Lifetime injection drug use | 54 (21.3) | 259 (38.4) | <0.0001 | 313 (33.7) |
| | Lifetime needle sharing | 36 (14.2) | 170 (25.2) | <0.001 | 206 (22.2) |
| | Got drunk ≥ 10 days in past month | 12 (4.7) | 88 (13.0) | <0.001 | 100 (10.8) |
| HIV knowledge | | | | | |
| | Does not know that people can get HIV infection or AIDS by sharing needles | 14 (5.5) | 45 (6.7) | 0.52 | 59 (6.4) |
| | Does not know that people can protect themselves from HIV infection or AIDS by using a condom | 67 (26.4) | 169 (25.0) | 0.68 | 236 (25.4) |
| | Does not know that a healthy-looking person can be infected with HIV | 59 (23.2) | 119 (17.6) | 0.05 | 178 (19.2) |

* χ^2 test comparing the distribution of characteristics of youth aged 15–17 years with the characteristics of youth aged 18–24 years

[†]Excluding sex work and selling drugs

[‡]Before the age of 15 years

[§]Defined as exchanging sex for drugs, money, food, clothes, shelter or other goods

**Based on question 'Have you ever been forced to have sex?'

Table 2 Prevalence of HIV among street youth, overall and by characteristics, stratified by age (Ukraine, 2008)

| | % HIV positive | | |
|---|------------------|------------------|------------------|
| | 15–17 n/n (%) | 18–24 n/n (%) | Total n/n (%) |
| Overall HIV seroprevalence | 28/254 (11.0) | 143/675 (21.2) | 171/929 (18.4) |
| Demographic characteristics | | | |
| Gender | | | |
| Male | 22/190 (11.6) | 108/516 (20.9) | 130/706 (18.4) |
| Female | 6/64 (9.4) | 35/159 (22.0) | 41/223 (18.4) |
| City | | | |
| Odesa | 21/123 (17.1) | 62/188 (33.0) | 83/311 (26.7) |
| Kyiv | 5/44 (11.4) | 53/267 (19.9) | 58/311 (18.7) |
| Donetsk | 2/87 (2.3)* | 28/220 (12.7)* | 30/307 (9.8)* |
| Social risk factors | | | |
| Registered as city resident | | | |
| No | 20/120 (16.7) | 60/255 (23.5) | 80/375 (21.3) |
| Yes | 8/134 (6.0)* | 83/420 (19.8) | 91/554 (16.4) |
| Education | | | |
| Completed ≤ 9 grades | 25/210 (11.9) | 98/375 (26.1) | 123/585 (21.0) |
| Completed 10–12 grades | 3/44 (6.8) | 45/300 (15.0)* | 48/344 (14.0)* |
| Work for pay† | | | |
| No | 21/156 (13.5) | 78/249 (31.3) | 99/405 (24.4) |
| Yes (regularly or sporadically) | 7/98 (7.1) | 65/426 (15.3)* | 72/524 (13.7)* |
| Orphan | | | |
| No | 9/141 (6.4) | 59/384 (15.4) | 68/525 (13.0) |
| Yes | 19/113 (16.8)* | 84/291 (28.9)* | 103/404 (25.5)* |
| Currently living alone/with friends | | | |
| No | 7/129 (5.4) | 81/429 (18.9) | 88/558 (15.8) |
| Yes | 21/125 (16.8)* | 62/246 (25.2) | 83/371 (22.4)* |
| Had an adult to turn to for help | | | |
| No | 18/160 (11.3) | 100/471 (21.2) | 118/631 (18.7) |
| Yes | 10/94 (10.6) | 43/204 (21.1) | 53/298 (17.8) |
| Ever lived in a shelter or orphanage | | | |
| No | 6/126 (4.8) | 79/479 (16.5) | 85/605 (14.0) |
| Yes | 22/128 (17.2)* | 64/196 (32.7)* | 86/324 (26.5)* |
| No place to live or spending ≥2 nights/week for past few months outside residence | | | |
| No | 2/79 (2.5) | 29/207 (14.0) | 31/286 (10.8) |
| Yes | 26/175 (14.9)* | 114/468 (24.4)* | 140/643 (21.8)* |
| Time on streets | | | |
| ≤ 3 years | 9/151 (6.0) | 34/225 (15.1) | 43/376 (11.4) |
| > 3 years | 19/103 (18.4)* | 109/450 (24.2)* | 128/553 (23.1)* |
| Lived with someone during childhood who was a problem drinker or alcoholic‡ | | | |
| No | 4/92 (4.4) | 56/282 (19.9) | 60/374 (16.0) |
| Yes | 24/162 (14.8)* | 87/393 (22.1) | 111/555 (20.0) |
| Lived with someone during childhood who used illegal drugs‡ | | | |
| No | 20/205 (9.8) | 103/554 (18.6) | 123/759 (16.2) |
| Yes | 8/49 (16.3) | 40/121 (33.1)* | 48/170 (28.2)* |
| Lived with household member during childhood who attempted suicide‡ | | | |
| No | 21/222 (9.5) | 117/560 (20.9) | 138/782 (17.6) |
| Yes | 7/32 (21.9)* | 26/115 (22.6) | 33/147 (22.4) |
| Lived with someone during childhood who was incarcerated‡ | | | |
| No | 10/143 (7.0) | 65/404 (16.1) | 75/547 (13.7) |
| Yes | 18/111 (16.2)* | 78/271 (28.8)* | 96/382 (25.1)* |
| Sexual risk factors | | | |
| Ever had sex | | | |
| No | 11/63 (17.5) | 0/12 (0.0) | 11/75 (14.7) |
| Yes | 16/190 (8.4)* | 142/662 (21.5) | 158/852 (18.5) |
| Lifetime anal sex | | | |
| No | 27/232 (11.6) | 90/469 (19.2) | 117/701 (16.7) |
| Yes | 1/22 (4.5) | 53/206 (25.7) | 54/228 (23.7)* |
| Past year ≥ 6 opposite sex partners | | | |
| No | 22/202 (10.9) | 91/458 (19.9) | 113/660 (17.1) |
| Yes | 5/51 (9.8) | 51/215 (23.7) | 56/266 (21.1) |
| Last sex unprotected | | | |
| No or never had sex | 17/182 (9.3) | 56/306 (18.3) | 73/488 (15.0) |
| Yes | 10/70 (14.3) | 86/368 (23.4) | 96/438 (21.9)* |
| Lifetime sex exchange§ | | | |
| No | 26/240 (10.8) | 128/644 (19.9) | 154/884 (17.4) |
| Yes | 1/13 (7.7) | 14/30 (46.7)* | 15/43 (34.9)* |
| Lifetime STI diagnosis | | | |
| No | 24/238 (10.1) | 106/580 (18.3) | 130/818 (15.9) |
| Yes | 4/16 (25.0) | 37/95 (38.9)* | 41/111 (36.9)* |

(Continued)

Table 2 Continued

| | % HIV positive | | |
|---|------------------|------------------|------------------|
| | 15–17 n/n (%) | 18–24 n/n (%) | Total n/n (%) |
| Lifetime sexual victimization** | | | |
| No | 25/235 (10.6) | 122/609 (20.0) | 147/844 (17.4)* |
| Yes | 2/18 (11.1) | 20/65 (30.8)* | 22/83 (26.5) |
| Substance use behaviours | | | |
| Lifetime use of any drug | | | |
| No | 0/78 (0.0) | 12/171 (7.0) | 12/249 (4.8) |
| Yes | 28/176 (15.9)* | 131/504 (26.0)* | 159/680 (23.4)* |
| Lifetime injection drug use | | | |
| No | 10/200 (5.0) | 30/416 (7.2) | 40/616 (6.5) |
| Yes | 18/54 (33.3)* | 113/259 (43.6)* | 131/313 (41.9)* |
| Lifetime needle sharing | | | |
| No | 16/218 (7.3) | 55/505 (10.9) | 71/723 (9.8) |
| Yes | 12/36 (33.3)* | 88/170 (51.8)* | 100/206 (48.5)* |
| Got drunk ≥ 10 days in past month | | | |
| No | 27/242 (11.2) | 118/587 (20.1) | 145/829 (17.5) |
| Yes | 1/12 (8.3) | 25/88 (28.4) | 26/100 (26.0)* |
| HIV knowledge | | | |
| Knows that people can get HIV infection or AIDS by sharing needles | | | |
| No | 2/14 (14.3) | 15/45 (33.3) | 17/59 (28.8) |
| Yes | 26/240 (10.8) | 128/630 (20.3)* | 154/870 (17.7)* |
| Knows that people can protect themselves from HIV infection or AIDS by using a condom | | | |
| No | 8/67 (11.9) | 42/169 (24.9) | 50/236 (21.2) |
| Yes | 20/187 (10.7) | 101/506 (20.0) | 121/693 (17.5) |
| Knows that a healthy-looking person can be infected with HIV | | | |
| No | 11/59 (18.6) | 20/119 (16.8) | 31/178 (17.4) |
| Yes | 17/195 (8.7)* | 123/556 (22.1) | 140/751 (18.6) |

STI = sexually transmitted infection

*Statistically different at $P < 0.05$ based on χ^2 test comparing the distribution of HIV by youth characteristics, conducted separately for youth aged 15–17 years, youth aged 18–24 years and the total sample of youth

†Excluding sex work and selling drugs

‡Before the age of 15 years

§Defined as exchanging sex for drugs, money, food, clothes, shelter or other goods

**Based on question: 'Have you ever been forced to have sex?'

HIV-positive youth, 85% reported no previous HIV diagnosis (data not shown).

Street youth aged 18–24 years ($n = 675$) had higher rates of HIV infection (143/675, 21.2%) than minors (28/254, 11.0%), but risk factors for HIV infection among minors and non-minors were similar (Table 2). Minors with HIV seroprevalence rates exceeding 15% and non-minors with HIV seroprevalence >20% included those who lived in Odesa, were not registered city residents, were orphans, lived alone or with friends, had lived in orphanages or shelters, had no place to live or spent ≥2 nights/week outside of their residences, spent time on the street for >3 years, or lived with someone during childhood who was a problem drinker or alcoholic, used illegal drugs, attempted suicide, or was incarcerated. In addition, history of STIs, drug use, IDU and needle sharing were associated with very high rates of HIV for minors and non-minors alike. Non-minors with significantly increased HIV risk also included those who did not work, had lifetime histories of exchanging sex for money or goods, sexual victimization, and those who did not know that HIV can be transmitted through needle sharing. One year after the assessment, 116/171 (68%) street youth testing positive were linked to services and 79/171 (46%) had registered at the local City AIDS Centers where they received confirmatory testing as well as other HIV-related services.

Nearly all characteristics associated with HIV in crude analyses remained statistically significant after adjustment for covariates (Table 3). Characteristics independently associated

with increased odds of HIV infection in multivariable analyses included female gender (AOR = 1.6); 18–24 years (AOR = 2.1); living in Odesa (AOR = 2.3); not working (AOR = 2.2); being orphaned (AOR = 1.7); having no place to live or spending ≥2 nights/week outside of residence (AOR = 1.9); spending >3 years on the street (AOR = 2.0); and lifetime histories of anal sex (AOR = 1.8), exchanging sex for money or goods (AOR = 4.8), STIs (AOR = 2.8), any drug use (AOR = 5.0), IDU (AOR = 9.0) and needle sharing (AOR = 6.8).

We found important and statistically significant effect modification ($P < 0.05$) by gender and IDU, but not by age or city. For example, the independent influence of unprotected sex on HIV infection was stronger among never injectors (AOR = 1.8) as compared with ever injectors (AOR = 1.2), although statistically significant in both strata (Table 4). Similarly, the influence of past STI diagnosis was stronger among youths who had never injected (AOR = 5.4) compared with those who had ever injected drugs (AOR = 1.6). The increased odds of HIV infection associated with not working was only statistically significant among men (AOR = 3.2, CI: 2.5–4.0) and youths who had ever injected drugs (AOR = 3.6, CI: 2.8–4.8), but not among women or youths who never injected drugs (data not shown). Conversely, we found that living with someone during childhood who used illegal drugs was associated with increased odds of HIV infection only among women (AOR = 5.3, CI: 3.4–8.1) and never injectors (AOR = 3.4, CI: 2.3–4.9) (data not shown).

Table 3 Odds ratios for testing HIV positive, street youth (Ukraine, 2008)

| | Total (n = 929) | |
|---|------------------------|----------------------|
| | HIV positive | |
| | Unadjusted OR (95% CI) | Adjusted OR (95% CI) |
| Demographic characteristics* | | |
| Gender | | |
| Female | 1.0 (0.8, 1.3) | 1.6 (1.2, 2.1) |
| Age | | |
| 18–24 years | 2.2 (1.9, 2.5) | 2.1 (1.5, 3.0) |
| City | | |
| Odesa | 3.4 (2.7, 4.2) | 2.3 (1.9, 2.9) |
| Kyiv | 2.2 (1.5, 3.0) | 0.5 (0.3, 0.8) |
| Donetsk | Referent | Referent |
| Social risk factors[†] | | |
| Completed ≤9 grades of education | 1.6 (1.3, 2.1) | 1.7 (1.2, 2.4) |
| Does not work for pay [‡] | 2.0 (1.7, 2.5) | 2.2 (1.8, 2.7) |
| Orphan | 2.3 (1.8, 2.8) | 1.7 (1.4, 2.1) |
| Currently living alone/with friends | 1.5 (1.3, 1.8) | 1.3 (1.1, 1.6) |
| Ever lived in a shelter or orphanage | 2.2 (1.9, 2.6) | 1.9 (1.5, 2.4) |
| No place to live or spending ≥2 nights/week for past few months outside residence | 2.3 (1.9, 2.8) | 1.9 (1.5, 2.3) |
| Time on streets >3 years | 2.3 (1.9, 2.9) | 2.0 (1.6, 2.4) |
| Lived with someone during childhood who used illegal drugs [§] | 2.0 (1.7, 2.4) | 1.3 (1.0, 1.7) |
| Lived with someone during childhood who was incarcerated [§] | 2.1 (1.8, 2.5) | 1.6 (1.3, 2.1) |
| Sexual risk factors** | | |
| Lifetime anal sex | 1.6 (1.3, 1.9) | 1.8 (1.4, 2.4) |
| Last sex unprotected | 1.6 (1.4, 1.8) | 1.4 (1.2, 1.6) |
| Lifetime sex exchange ^{††} | 2.5 (1.7, 3.7) | 4.8 (2.8, 8.2) |
| Lifetime STI diagnosis | 3.1 (2.6, 3.7) | 2.8 (2.1, 3.6) |
| Lifetime sexual victimization ^{‡‡} | 1.7 (1.4, 2.2) | 1.4 (1.0, 2.0) |
| Substance use behaviours^{§§} | | |
| Lifetime use of any drug | 6.0 (4.7, 7.7) | 5.0 (3.8, 6.6) |
| Lifetime injection drug use | 10.4 (8.4, 12.8) | 9.0 (6.8, 11.9) |
| Lifetime needle sharing | 8.7 (7.5, 10.0) | 6.8 (5.7, 8.2) |
| Got drunk ≥10 days in past month | 1.7 (1.2, 2.3) | 1.5 (1.0, 2.1) |
| HIV knowledge^{§§} | | |
| Does not know that people can get HIV infection or AIDS by sharing needles | 1.9 (1.5, 2.4) | 1.2 (0.9, 1.7) |

OR = odds ratios; STI = sexually transmitted infection

*Adjusted for gender (for age), age (continuous, for gender), education, work for pay, orphan status, spending nights outside of residence ≥2 nights/week for past few months/no place to live, lifetime STI diagnosis, lifetime injection drug use and city (for gender)

[†]Adjusted for gender, age (continuous), lifetime STI diagnosis, lifetime injection drug use and city[‡]Excluding sex work and selling drugs[§]Before the age of 15 years

**Adjusted for gender, age (continuous), education, work for pay, orphan status, spending nights outside of residence ≥2 nights/week for past few months/no place to live, lifetime injection drug use and city

^{††}Defined as exchanging sex for drugs, money, food, clothes, shelter or other goods^{‡‡}Based on question: 'Have you ever been forced to have sex?'^{§§}Adjusted for gender, age (continuous), education, work for pay, orphan status, spending nights outside of residence ≥2 nights/week for past few months/no place to live, lifetime STI diagnosis and city

DISCUSSION

Findings from this report, the first systematic, multicity community-based assessment of HIV seroprevalence among street youth outside the USA indicated that overall, nearly one in five Ukrainian street youth were HIV-infected. HIV rates in many subgroups exceeded 10–30 times the Ukrainian national HIV seroprevalence rate of 1.5% for young people aged 15–24 years.¹⁰ Demographic and social risk factors (e.g. being an orphan, living with someone who used illegal drugs or was incarcerated) were associated with 10-fold or greater

Table 4 Prevalence of HIV among street youth, stratified by lifetime injection drug use (Ukraine, 2008)

| | Ever inject (n 5 313) | | Never inject (n 5 616) | |
|--|-----------------------|----------------|------------------------|----------------|
| | HIV positive | | HIV positive | |
| | n/n (%) | AOR (95% CI) | n/n (%) | AOR (95% CI) |
| TOTAL | | | | |
| Sexual risk factors[†] | | | | |
| Last sex unprotected | | | | |
| No or never | 58/141 (41.1) | Referent | 15/347 (4.3) | |
| Referent had sex | | | | |
| Yes | 71/170 (41.8) | 1.2 (1.0, 1.4) | 25/268 (9.3) | 1.8 (1.3, 2.5) |
| Lifetime STI diagnosis | | | | |
| No | 104/261 (39.8) | Referent | 26/557 (4.7) | |
| Referent Yes | 27/52 (51.9) | 1.6 (1.2, 2.2) | 14/59 (23.7) | 5.4 (3.9, 7.4) |
| STI ^{1/4} sexually transmitted infection; AOR ^{1/4} adjusted odds ratio | | | | |
| *Adjusted for gender, age (continuous), education, work for pay, orphan status, spending nights outside of residence ≥2 nights/week for past few | | | | |

increases in HIV rates, and sexual and substance-use risk factors (e.g. exchanging sex for money or goods, STIs, IDU or needle sharing) were associated with 20- to 30-fold increases. We found that independent risk factors for HIV infection were similar for both minors and non-minors and were not influenced by city. Although the influence of sexual risk factors on HIV infection was strongest among never injectors, these factors were also significant for those who had used injection drugs.

This analysis extends previous reports addressing street youth by providing more valid estimates regarding the magnitude of the HIV epidemic among marginalized minors and street youth and by identifying a broader array of social determinants of HIV infection in this population.^{3,7,9,16,25–30} The high HIV seroprevalence rates and consistency of risk factors observed in these geographically diverse cities suggest the presence of an advanced epidemic among street youth in Ukraine and may raise the possibility of generalizability to street youth populations in other countries. The low levels of HIV prevention resources targeted to street youth worldwide relative to other most-at-risk groups³¹ suggest that this is a largely under-served population, in spite of their potential contribution to propagating the HIV epidemic. Lack of access to HIV prevention, testing, treatment and care for street youth in general and for minors specifically is a global concern.^{32,33} Providing confidential HIV prevention, testing, follow-up and care for this mobile and difficult-to-reach population is challenging, particularly for minor street youth whose social histories often pose situational and legal barriers. In this study, most minors lacked residence documents and had no one to turn to for help; nearly half were orphaned. These same factors concomitantly limit youths' access to HIV testing and may lead to behaviours that increase their risk of contracting HIV.²⁷ Although the present study provided HIV testing in community settings as recommended by leading experts on street youth populations and evidence-based interventions.^{5,34}

team's intensive efforts to encourage youths with positive rapid HIV tests to access services at the City AIDS Centers, two-thirds of these youth accessed follow-up care. With access to treatment, HIV becomes a chronic disease, whereas without treatment, many HIV-positive street youth will die within 5–10 years. At the conclusion of this assessment, results were shared with a broad range of collaborating partners, including the Ukrainian Ministry of Health and Ministry of Family, Youth, and Sports, as well as United Nations Children's Fund (UNICEF)/Ukraine and NGOs. These partners then developed broad and multifaceted recommendations for strengthening HIV prevention among street youth populations. Political and health-care delivery system barriers for street youth must be tackled if universal access to comprehensive HIV prevention, testing, care and support is to become a reality.^{1,5,6,35}

LIMITATIONS

Study limitations include the inability to establish causation, possible bias due to self-reported data and incomplete confirmatory testing. Due to the cross-sectional design of this assessment, we could not determine temporality of risk factors and HIV status. While the possibility of social desirability bias cannot be excluded, any misclassification due to underreporting of sensitive sexual and substance-use behaviours would not be expected to vary by HIV status but could lead to underestimation of odds ratios. Finally, although it was not possible to confirm all positive rapid tests, a single test is considered sufficient for surveillance testing in populations with an HIV prevalence >10%.³⁶

CONCLUSIONS

From this study, it can be concluded that the Ukrainian street youth population has a high prevalence of HIV and many immediate needs. Given many street youth with positive rapid tests did not pursue clinic-based confirmation, and confirmatory testing was a prerequisite for treatment, consideration should be given to confirmation of rapid HIV tests with other rapid tests, a practice increasingly endorsed for non-clinical and high seroprevalence settings. HIV testing should be just one of several critical components of comprehensive care needed by this population, including HIV prevention education, treatment, contraception, drug rehabilitation, harm reduction, housing, vocational training and relevant social support services.

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