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HIV and sexual health needs of young key populations in Papua New Guinea: results of biobehavioural surveys (2016–2017)

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Abstract

Papua New Guinea lacks data characterising the sexual health needs of younger key populations (KP): female sex workers (FSW) and commercially and sexually exploited girls (CSE), men who have sex with men (MSM), and transgender women (TGW). Biobehavioural surveys among KP were conducted in three cities. We conducted unweighted and weighted analysis for sample and population proportions, respectively. Variables associated with younger versus older age (15–24 versus ≥25 years) were included in the multivariable analysis. Younger FSW/CSEG had greater odds of having both *Neisseria gonorrhoea* and *Chlamydia trachomatis* (aOR:3.2, 95%CI 2.0–5.0), or having either infection (aOR:2.2, 95%CI 1.2–4.1) than older peers. They also had lower odds of having tested for HIV (aOR: 0.6, 95% CI 0.4–0.8). Younger MSM/TGW had greater odds of paying for sex in the <6 months (aOR:2.2, 95%CI: 1.5–3.1) and of having been paid for sex

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Author contributions statement

AKH, AJH, JW, and AV designed the study. AKH, XL and AJH planned the manuscript. JG, SGB, and AJV led the biomarker component of the study. AA and BW supervised the study, and BW, RN, JG, SP, HA, MK, SA and PH implemented the study. LB and PB provided national leadership. XL, DW and AJH analysed the data from the study. AKH drafted the manuscript and interpreted the data. XL and AJH contributed to the writing of the manuscript. All authors reviewed and approved the manuscript.

Disclosure statement

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(aOR:1.6, 95%CI 1.1–2.4) than their older peers (≥25 years). Younger MSM/TGW had lower odds of having contact with a peer educator ≤12 months (aOR:0.6, 95%CI 0.4–0.9) and having tested for HIV (aOR:0.6, 95%CI: 0.4–0.9). All key populations have substantial sexual health needs, but those of younger members are greatest. Younger key populations would likely benefit from health services designed specifically for them.

Keywords

Surveillance; young people; key populations; Pacific; differentiated services

SDG KEYWORDS

SDG 3: good health and well-being; SDG 5: gender equality

Introduction

In 2020, young people (15–24 years) accounted for 26% of all new HIV infections in Asia and the Pacific, 99% of whom were key populations (KPs): female sex workers (FSW), men who have sex with men (MSM), transgender women (TGW), and people who inject drugs and their sexual partners (UNAIDS, 2022). While overall new infections among young people decreased in the region between 2010 and 2020, there are some notable exceptions, including the Philippines, Fiji, and Papua New Guinea (PNG) (UNAIDS, 2022). As the region refocuses its attention to countries that have not brought HIV under control, and recognises that young KPs have “escaped the attention and action needed” (UNAIDS, 2022, p. 3), it is timely that we examine the health needs of young KPs in PNG.

PNG’s HIV epidemic is concentrated among KPs and is the largest epidemic in the Pacific (Hakim et al., 2019; Kelly-Hanku, Weikum, et al., 2020). Recent data show HIV prevalence among young people increased by 51% (2010–2020) and in 2020 alone, 27% of all new HIV infections were among young people (UNAIDS, 2022). HIV prevalence among FSW and commercially and sexually exploited (CSE) girls[1] ranges from 11.9% in Lae, 15.2% in Port Moresby and as high as 19.6% in Mount Hagen (Kelly-Hanku, Weikum, et al., 2020). Most FSW/CSE girls first sold sex when aged between 15 and 24 years (Kelly-Hanku, Weikum, et al., 2020). Among MSM/TGW, HIV prevalence is 6.9% in Lae and 8.5% in Port Moresby (Hakim et al., 2019). Most MSM/TGW first had anal sex with a man or TGW between the ages of 15 and 24 years (Hakim et al., 2019). Detailed age differentiated data about HIV, risk factors, and health service utilisation remain scant. This is the first data to examine young KPs in this setting, or the Pacific more broadly.

Studies elsewhere have shown that younger KPs continue to be disproportionately affected with HIV and other sexually transmitted infections (STI) (Bekker et al., 2015; Bowring et al., 2019; Paiva et al., 2015; WHO, 2013, 2022). Despite this, KP services in PNG

[1]According to UNAIDS Terminology Guidelines (2015), sex work is defined as the consensual exchange of sex between adults 18 years and older. Children aged less than 18 years are victims of sexual exploitation. To avoid further marginalising sexually exploited children by not including information about them and their vulnerabilities, we included them in this survey and refer to them as CSE girls. The surveys were designed to recruit women and girls who sold or exchanged sex for goods, services and/or money.

are provided uniformly. In response to the limited data in PNG examining the intersection between age and KPs, we compare biobehavioural survey data among younger (15–24 years) and older (25 years and above) FSW/CSE girls and MSM/TGW. In this paper we have limited our analysis of younger KPs to 15–24 years to reflect the UNAIDS age category of young adults.

Methods

Eligibility criteria and sampling

We implemented biobehavioural surveys of FSW/CSE girls and MSM/TGW using respondent-driven sampling (RDS) (Heckathorn, 2011; Malekinejad et al., 2008). The surveys were conducted in three cities in PNG: (1) Port Moresby (June–October 2016); (2) Lae (January–June 2017); and (3) Mount Hagen (August–December 2017).

Eligible participants recruited their peers and were reimbursed for their time in the survey and for each successful recruit. Participants received 45 PNG kina (about US$14) for their first visit to the survey site, 10 PNG kina (about US$3) per successful recruit (up to three recruits), and 5 PNG kina (about US$1.50) for transportation at their second visit.

Eligibility criteria for FSW/CSE girls in this survey included: (1) assigned female sex at birth; (2) aged ≥12 years; (3) have sold or exchanged sex in the past 6 months; (4) speak English or *Tok Pisin*; and (5) have a valid study coupon. We enrolled 2,091 eligible FSW/CSE girls across the sites of which 1,789 are included for analysis in this paper – see data analysis. For MSM/TGW the eligibility criteria were: (1) assigned male sex at birth, (2) had sex with a man in the last 6 months; (3) aged ≥12 years; (4) speak English or Tok Pisin; and (5) have a valid study coupon. We enrolled 866 MSM/TGW across the study sites, of which 855 are included for analysis in this paper – see data analysis.

Our RDS survey methods have been described elsewhere (Hakim et al., 2019, 2021; Kelly-Hanku, Weikum, et al., 2020; Willie et al., 2021). Briefly, participants who started each recruitment chain (seeds) were purposively selected by the survey team to reflect the diversity of the population with regards to age, area of residence, language spoken, education level, access to health services, involvement with non-governmental organisations, and where they sell sex (for FSW/CSE). Consenting participants were interviewed by trained staff members about their demographics, behaviours, and healthcare utilisation. The questionnaire was administered in English or *Tok Pisin*. Participants were tested for HIV, syphilis, *Neisseria gonorrhoea* (NG), *Chlamydia trachomatis* (CT), Hepatitis B virus (HBV), and tuberculosis (TB). All test results were returned to participants at the end of the first study visit. Before leaving the study site, participants were given coupons to recruit peers to participate in the survey.

Data analysis

Dependent variable—Age category was the dependent variable. Participants were asked to answer, “how old were you at your last birthday?” We categorised age as “15–24 years old” and “25 or above” in line with global definitions of adolescents and young adults. Participants who did not know their age were excluded from the analysis.

Independent variable—We examined three independent variables in this analysis: (1) sociodemographic characteristics; (2) sexual behaviours; and (3) stigma/discrimination, health service utilisation, and biomarkers. The survey questionnaire was modelled on that provided in the WHO Biohavioral Survey Guidelines for Populations at Risk of HIV (WHO, 2017).

Statistical analysis—Continuous variables were presented with median values with interquartile ranges. Categorical variables were presented with unweighted counts, unweighted percentages, and weighted percentages with 95% confidence intervals (95% CI). RDS weights and aggregate weighted percentages were calculated using RDS-Analyst version 0.62 (RDS-A, Los Angeles, CA USA) using Gile's Successive Sampling Estimator.

Bivariate analyses were performed between age category and independent variables. Variables with a p-value <0.1 were considered for inclusion in the multivariable analysis. Among variables with a p-value <0.1, we excluded those that had collinearity with age and performed multivariable analysis with remaining variables. Two logistic regression models, one for FSW/CES girls and one for MSM/TGW, were built to investigate correlates with age. Backward elimination was performed and started with the variable with the largest p-value, and only variables with a p-value <0.05 were retained in the final model. Adjusted odds ratio (aOR) and 95% CI were reported. All the analyses were performed using SAS 9.4 (Cary, NC, USA).

Variables examined in the multivariable model for FSW/CES girls were: education, sex work as main source of income, average monthly income, years of selling sex, had someone facilitated meeting clients, used internet or mobile apps to meet clients, ever had anal sex, condom negotiation with a client, being ashamed to be FSW/CSE girls, ever been arrested because FSW/CSE, physical violence, sexual violence, comprehensive knowledge of HIV, active syphilis, had chlamydia and/or gonorrhoea, ever tested for HIV, and HIV status.

Variables examined in the multivariable model for MSM/TGW were: used internet or mobile apps to meet partners, number of female sex partners, paid men/TG for sex, got paid for sex from men/TG, physical violence, spoke with peer educator or outreach worker, given free condoms, comprehensive knowledge of HIV, had chlamydia and/or gonorrhoea, and ever tested for HIV.

Ethics—Information sheets were written in plain English and *Tok Pisin* describing the study, and the study and the procedures were explained to all participants by a trained Papua New Guinean staff member skilled at adapting language to age as well as literacy needs. The study was implemented by a team of highly trained Papua New Guinean researchers in line with our decolonial approach to research (Kelly-Hanku et al., 2021). Visual tools were designed and used to explain the study procedures, including biological testing. Verbal consent for the interview, and syphilis, NG, CT, HBV, and TB testing was sought following this process. Written consent was obtained for HIV testing as required by PNG law, and this was obtained by the health care worker following pre-test counselling. Study staff were trained by an international non-government organisation mandated to work with children to

identify and refer sexually exploited girls <18 years to partner organisations experienced in providing psychosocial and protective services.

The biobehavioural survey was approved by the PNG National Department of Health's Medical Research Advisory Committee, the Research Advisory Committee of the National AIDS Council Secretariat, the PNG Institute of Medical Research's Institutional Review Board, and the Human Research Ethics Committee, UNSW Sydney. The protocol was reviewed according to the Centers for Disease Control and Prevention (CDC) human research protection procedures and was determined to be research, but CDC investigators did not interact with human subjects or have access to identifiable data or specimens for research purposes.

Results

In line with global categories of young people (15–24 years), analysis for this paper is limited to participants ≥15 years. Seven CSE girls aged 12–14 years have been excluded from this analysis. Two hundred and ninety-five FSW/CSE girls (13.6%) and 11 MSM/TGW (0.78%) were not able to report their age and were excluded from the analysis. Among FSW/CSE girls, low literacy was associated with not reporting age. There were some other differences. Compared to FSW/CSE who reported their age, higher proportions of FSW/CSE who did not know their age had no formal education, were divorced, separated, or widowed, and earned less than 200 Kina per month, screened positive for depression, and were not able to negotiate condom use with a client. This follows the idea that those who do not know their age likely were from lower socioeconomic environments and continue to experience lower socioeconomic status. While these FSW/CSW were not included in the analysis presented in the manuscript, we do account for differences in socioeconomic status in our analysis.

FSW and CSE

Among FSW/CSE girls, 43.3% were aged 15–24 years (referred to as "younger women/CSE girls") and 56.7% were aged ≥25 years (referred to as "older women"). Similar proportions of younger and older women/CSE girls reported no formal education (26.2% versus 23.6%, respectively) (Table 1). Younger women/CSE girls had higher monthly earnings than their older peers, with 53.8% earning 500 Kina or more per month (≥ USD$157) compared with 41.5% of older women. Just over one-third of both groups screened positive for depression using the Patient Health Questionnaire-2 (35.6% versus 38.3%, respectively).

More than half of younger women/CSE girls (51.7%) had sold sex for less than 2 years compared to 21.9% of older women (Table 2). More younger women/CSE girls had someone facilitate meeting clients than older women (49.9% versus 40.4%, respectively). Roughly equal proportions of younger women/CSE girls (72.4%) and older women (67.9%) reported five or more male partners for vaginal or anal sex in the last 6 months.

A higher proportion of younger women/CSE girls experienced physical violence in the last year than older women (28.3% versus 17.4%, respectively) (Table 3). Similarly, 17.2% of

younger women/CSE girls, and 13.0% of older women experienced sexual violence in this period.

In the last year, 43.7% of younger women/CSE girls and 51.1% of older women had spoken with a peer educator (Table 3). In the same period, 47.9% of younger women/CSE girls and 58.0% of older women received free condoms. Using the UNAIDS definition, comprehensive HIV knowledge was 27.1% among younger women/CSE girls and 35.5% among older women. Prevalence of active syphilis was 3.9% in younger women and CSE girls and 6.0% in older women. Nearly one-fifth (18.9%) of younger women/CSE girls had both urogenital NG and CT compared to 6.2% of older women. A higher proportion of younger women/CSE girls with HIV knew their HIV status (57.2%) compared to older women (30.3%).

Younger women/CSE girls had greater odds than older women of having sex work as their main source of income (aOR: 1.4, 95% confidence interval [95%CI] 1.0–1.9) and of making ≥500 Kina a month (≥ USD $157) (aOR: 2.0, 95%CI 1.2–3.2) (Table 4). They also had greater odds of having a person who facilitates meeting clients (aOR:1.6, 95%CI 1.2–2.1) and of experiencing physical violence in the last year (aOR: 1.9, 95%CI 1.4–2.7). Younger women/CSE girls had greater odds of having both NG and CT (aOR: 3.2, 95%CI 2.0–5.0) or one of either infection (aOR: 2.2, 95%CI 1.2–4.1). Conversely, compared to older women, younger women/CSE girls had lower odds of having ever been arrested (aOR: 0.4, 95%CI 0.2–0.7), being given free condoms (aOR: 0.7, 95%CI 0.5–1.0), and being tested for HIV (aOR: 0.6, 95%CI 0.4–0.8).

MSM and TGW

Among all MSM/TGW, 44.2% were aged 15–24 years (referred to as “younger MSM/TGW”) and 55.8% were ≥25 years and older (referred to as “older MSM/TGW”). Almost equal proportions of younger and older MSM/TGW had some formal education (irrespective of level of completion) (88.8% and 90.4% respectively) (Table 1). About half of younger and older MSM/TWG earned ≥500 Kina per month (≥ USD$157) (44.9% and 51.9% respectively), and 28.3% and 32.5% of each group, respectively, screened positive for depression.

The median age younger MSM/TGW first had sex with a man or TGW was 18 years while for older MSM/TGW it was 22 years (Table 2). Less than one-third of younger and older MSM/TGW used the internet and mobile phone applications to meet sexual partners (30.4% and 22.5% respectively). Nearly 60% of younger and older MSM/TGW reported having one to two male sex partners in the previous 6 months (60.5% and 52.8% respectively). Among MSM/TGW who had sex with a female, 68.4% of younger and 71.4% of older MSM/TGW reported having one to four female partners in the previous 6 months (Table 2).

In the last 12 months 25.7% of younger and 29.9% of older MSM/TGW experienced physical violence, while 6.3% and 9.8% respectively experienced sexual violence. In the last 12 months 46.4% of younger MSM/TGW had spoken to an outreach worker compared to 56.6% of older MSM/TGW (Table 3).

While 34.5% of younger MSM/TGW had comprehensive HIV knowledge, 45.9% of older MSM/TGW did. Prevalence of active syphilis was 5.7% among younger MSM/TGW and 3.7% among older MSM/TGW. Similar proportions of both groups had either NG or CT (15.8% versus 13.9%, respectively), while 10.5% of young MSM/TGW had both compared to 4.9% of older MSM/TGW. While 31.8% of younger MSM/TGW had ever tested for HIV, 41.8% of older MSM/TGW had ever tested. HIV prevalence was significantly lower in the younger MSM/TGW (13.3%) than in older MSM/TGW (17.9%) (Table 3).

In multivariable analysis, compared to older MSM/TGW, younger MSM/TGW had greater odds of using the internet or a mobile phone app to meet sexual partners in the last 6 months (aOR: 1.8, 95% CI: 1.2–2.9). They also had greater odds of paying for sex in the last 6 months (aOR: 2.2, 95%CI: 1.5–3.1) and of having been paid for sex (aOR: 1.6, 95% CI 1.1–2.4) compared with older MSM/TGW. Conversely, younger MSM/TGW had lower odds of having spoken with a peer educator in the last 12 months (aOR: 0.6, 95%CI 0.4–0.9), having ever tested for HIV (aOR:0.6, 95%CI: 0.4–0.9), and having comprehensive HIV knowledge (aOR: 0.6, 95%CI:0.4–0.9) (Table 5).

Discussion

This is the first study in PNG, and the wider Pacific, to differentiate the HIV and sexual health needs of younger key populations. Our findings show that both younger FSW/CSE girls and younger MSM/TGW have greater odds of never having tested for HIV compared to their older peers.

Younger FSW/CSE girls had greater odds of having someone facilitate meeting clients, of relying on sex work as their main form of income, having experienced physical violence in the past year, and of having both NG and CT or one of either infection. Conversely, younger FSW/CSE girls had lower odds of ever testing for HIV and having been given free condoms. These interventions are considered central to the global HIV response (WHO, 2022). The overall health and social outcomes for women and girls are poor and warrant increased attention and investment. The proportion of young FSW/CSE girls experiencing physical violence in the last year is a pressing concern. The greater odds of young FSW/CSE girls having experienced physical violence shows that experience of such violence starts early, and tailored support programmes and policies may be warranted to support and engage them in services.

Young FSW/CSE girls have limited access to free condoms and have greater odds of having STIs. Other than testing for syphilis, which is hampered by regular stockouts of test kits and treatment, public health services do not provide STI testing in PNG. The data from this study suggest that STI testing (and etiology-based treatment) is warranted for syphilis, CT and NG, with analysis based on age and risk behaviours suggesting if testing was to be made available in the country it may be worth targeting interventions based on age.

Highlighting issues of intersectionality (sexuality and gender diversity and selling/exchanging sex), younger MSM/TGW had greater odds of paying for sex in the last 6 months (aOR: 2.2, 95%CI: 1.5–3.1) and of having been paid for sex (aOR: 1.6, 95%CI

1.1–2.4). Conversely, younger MSM/TGW have lower odds of having been reached by a peer educator in the last year, having comprehensive HIV knowledge, and having tested for HIV testing. Comprehensive knowledge of HIV, undergoing HIV testing, and being engaged in peer outreach are hallmarks of HIV prevention and outreach forms the start of the KP-cascade (WHO, 2022). Alternative approaches to peer education, including online platforms, could be harnessed to reach younger MSM/TGW as they were more likely than older peers to use the internet and mobile apps to meet partners.

HIV testing among younger FSW/CSE girls and younger MSM/TGW, was particularly concerning, with both less likely to have ever had testing for HIV. The lower odds of ever testing for HIV was the only similarity across young KPs in our study, highlighting the importance of this as an issue. Strategies for engaging young KPs in HIV testing in PNG need to be radically rethought. Younger MSM/TGW were more likely to use online platforms to meet sexual partners than their older peers, and this may be a new means by which to create demand for testing and advertise for safe and youth-friendly spaces and models of testing. Younger FSW/CSE girls were more likely than their older peers to use another person to meet clients; these moderators could be used to engage young women and girls in HIV testing. For example, managers of guest houses could arrange suitably skilled and trained people to provide HIV testing. It has already been recommended in PNG that community-based, community led testing could be used as a pathway to HIV self-testing (Kelly-Hanku & Bell, 2019).

Limitations

Our findings are limited by the cross-sectional nature of our study and the small sample of MSM/TGW. The sampling approach was unable to reach many high-earning FSW/CSE girls and MSM/TGW above the age of 35 years. The self-reported nature of the interview data and the use of face-to-face interviews make the data prone to bias. That 295 FSW/CSE girls did not report their age was a possible limitation, but not reporting was only associated with literacy, and not different health needs or outcomes when compared to those who reported their age. Finally, given small population sizes we combined MSM and TGW into one group for the purposes of sampling and analysis. This was done with support of the respective communities in PNG. It is important to note that these populations have unique needs as well.

Conclusions

To reach UNAIDS targets and fast track the HIV response, it is important to respond to the differentiated health needs of young KPs, particularly as PNG's epidemic continues to increase exponentially in this age group. Our data show where to start in providing differentiated services, and in the years since the data was collected the epidemiological nature of HIV in PNG shows the needs of these key populations remain the same, if not have exacerbated further. Discussion of what the situation may be now is beyond the scope of this manuscript and is limited within the manuscript. Moving forward, it will be incumbent upon those working with KPs to monitor the evolving health needs of younger and older KPs to ensure health services are responsive to their health needs and that what is being

offered is acceptable to and appropriate for them. Gains can be made by working from a strengths-based approach and with young people as resilient and capable of charting their own future.

Our analysis shows that there are differentiated HIV and sexual health needs to be addressed between the younger and older key populations and that these are also distinct for younger key populations based on their key population membership. The legal environment in PNG for HIV provides an important framework by which to facilitate research and programming for young KPs (Kelly-Hanku, Redman-MacLaren, et al., 2020). An improved response requires renewed focus and energy for "making it a lot easier and more attractive for young people from key populations to use and benefit from HIV, health, education and other essential services" (UNAIDS, 2022, p. 4). Understanding the immediate and emerging health needs of KPs is essential for designing appropriate and targeted intervention programmes and support services that meet those appropriate health needs, so that no individual irrespective of their age or KP status, is left behind in our collective efforts to #EndAIDS.

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Data availability statement

Data are available upon reasonable request and ethical approval from the governing bodies and the key populations in PNG.

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Table 1.

Characteristics of female sex workers or commercially and sexually exploited (FSW/CSE) girls and men who have sex with men or transgender women (MSM/TGW) by age group in Papua New Guinea (2016–2017).

	FSW/CSE (n = 1789)						MSM/TGW (n = 855)					
	15–24 years (n = 720)	**Sample proportion (unweighted) %**	**Population proportion (weighted) % (95% CI)**	**≥25 years (n = 1069)**	**Sample proportion (unweighted) %**	**Population proportion (weighted) % (95% CI)**	**15–24 years (n = 378)**	**Sample proportion (unweighted) %**	**Population proportion (weighted) % (95% CI)**	**≥25 years (n = 477)**	**Sample proportion (unweighted) %**	**Population proportion (weighted) % (95% CI)**
Median Age (IQR)	21 (19–23)			32 (28–37)			21 (19–23)			30 (27–35)		
Highest level of education completed												
No formal education	200	27.8	26.2 (22.4–30.0)	256	24.0	23.6 (20.3–27)	50	13.2	11.2 (7.4–15.0)	52	10.9	9.6 (6.5–12.8)
Primary	390	54.2	56.2 (51.9–60.6)	593	55.5	56.8 (52.9–60.6)	163	43.1	47.9 (40.7–55.1)	214	44.9	45.1 (39.3–50.8)
High school or higher	130	18	17.6 (14.1–21.1)	219	20.5	19.6 (16.5–22.7)	165	43.7	40.9 (34.0–47.8)	211	44.2	45.3 (39.6–51.1)
Marital status												
Never married	281	39	40.4 (36.0–44.7)	74	6.9	6.0 (4.3–7.7)	339	89.7	91.6 (88.7–94.6)	230	48.2	46.6 (40.5–52.7)
Married	60	8.4	7.3 (5.0–9.6)	120	11.2	10.8 (8.5–13)	21	5.5	4.9 (2.5–7.1)	116	24.3	25.5 (19.7–31.2)
Divorced, separated, or widowed	379	52.6	52.3 (48.0–56.7)	875	81.9	83.2 (80.5–85.9)	18	4.8	3.5 (1.5–5.5)	131	27.5	27.9 (22.6–33.2)
Sex work as main source of income												
Yes	407	56.8	55.8 (51.3–60.3)	544	50.9	48.0 (44.3–51.7)	–	–	–	–	–	–
No	310	43.2	44.2 (39.7–48.7)	525	49.1	52.0 (48.3–55.7)	–	–	–	–	–	–
Average monthly income												
<200 Kina (~USD$63)	52	8.8	9.4 (6.3–12.4)	110	12.2	13.7 (10.6–16.7)	28	13	14.8 (7.2–22.3)	29	8.0	8.4 (4.8–12.0)

	FSW/CSE (n = 1789)						MSM/TGW (n = 855)					
	15–24 years (n = 720)	**Sample proportion (unweighted) %**	**Population proportion (weighted) % (95% CI)**	**≥25 years (n = 1069)**	**Sample proportion (unweighted) %**	**Population proportion (weighted) % (95% CI)**	**15–24 years (n = 378)**	**Sample proportion (unweighted) %**	**Population proportion (weighted) % (95% CI)**	**≥25 years (n = 477)**	**Sample proportion (unweighted) %**	**Population proportion (weighted) % (95% CI)**
200–499 Kina (~USD$64 – USD$156)	221	37.6	36.8 (32.0–41.7)	405	45.0	44.8 (40.7–48.9)	91	42.1	35.2 (27.5–42.9)	145	40.1	38.2 (31.5–44.8)
≥500 Kina (≥USD$157)	315	53.6	53.8 (48.7–59.0)	385	42.8	41.5 (37.3–45.6)	97	44.9	50.0 (40.8–59.3)	188	51.9	53.4 (46.5–60.4)
Screened positive for depression												
Yes	248	34.5	35.6 (31.6–39.7)	389	36.4	38.3 (34.8–41.8)	159	42.3	28.3 (23.7–32.9)	155	32.6	32.5 (27.8–37.1)
No	471	65.5	64.4 (60.3–68.4)	680	63.6	61.7 (58.2–65.2)	217	57.7	71.7 (67.1–76.3)	321	67.4	67.5 (62.9–72.2)
Ever been pregnant												
Yes	381	52.9	52.6 (48.2–57.1)	875	81.9	82.5 (79.6–85.3)	–	–	–	–	–	–
No	339	47.1	47.4 (42.9–51.8)	193	18.1	17.5 (14.7–20.4)	–	–	–	–	–	–
Ever induce an abortion if pregnant												
Yes	78	20.5	22.2 (17.1–27.4)	174	19.9	19.8 (16.3–23.3)	–	–	–	–	–	–
No	303	79.5	77.8 (72.6–82.9)	701	80.1	80.2 (76.7–83.7)	–	–	–	–	–	–

Table 2.

Sexual behaviours of female sex workers or commercially and sexually exploited (FSW/CSE) girls and men who have sex with men or transgender women (MSM/TGW) in Papua New Guinea (2016–2017).

	FSW/CSE Girls (n = 1789)						MSM/TGW (n = 855)					
	15–24 years (n = 720)	**Sample proportion (unweighted) %**	**Population proportion (weighted) % (95% CI)**	**≥25 years (n = 1069)**	**Sample proportion (unweighted) %**	**Population proportion (weighted) % (95% CI)**	**15–24 years (n = 378)**	**Sample proportion (unweighted) %**	**Population proportion (weighted) % (95% CI)**	**≥25 years (n = 477)**	**Sample proportion (unweighted) %**	**Population proportion (weighted) % (95% CI)**
Median age first had vaginal sex (IQR)	16 (15–17)			17 (15–18)			–	–	–	–	–	–
Median age first had sex with a man or TGW (IQR)	–	–	–	–	–	–	18 (17–20)			22 (18–27)		
Median age first sold or exchanged sex (IQR)	18 (16–20)			25 (20–29.5)			–	–	–	–	–	–
Years selling sex												
≤2 years	349	48.6	51.7 (47.4–56.0)	222	21.0	21.9 (18.8–25)	–	–	–	–	–	–
3–4 years	200	27.9	27.1 (23.2–30.9)	209	19.8	22 (18.7–25.2)	–	–	–	–	–	–
≥5 years	169	23.5	21.2 (17.6–24.9)	624	59.2	56.1 (52.3–60.0)	–	–	–	–	–	–
Has someone who facilitates meeting clients												
Yes	345	48.6	49.9 (45.3–54.5)	433	40.9	40.4 (36.6–44.3)	–	–	–	–	–	–
No	365	51.4	50.1 (45.5–54.7)	626	59.1	59.6 (55.7–63.4)	–	–	–	–	–	–
Used internet or mobile apps to meet clients (FSW) or partners (MSM/TGW), last 6 months												

	FSW/CSE Girls (n = 1789)						MSM/TGW (n = 855)					
	15–24 years (n = 720)	**Sample proportion (unweighted) %**	**Population proportion (weighted) % (95% CI)**	**≥25 years (n = 1069)**	**Sample proportion (unweighted) %**	**Population proportion (weighted) % (95% CI)**	**15–24 years (n = 378)**	**Sample proportion (unweighted) %**	**Population proportion (weighted) % (95% CI)**	**≥25 years (n = 477)**	**Sample proportion (unweighted) %**	**Population proportion (weighted) % (95% CI)**
Yes	116	16.1	15.7 (12.5–18.9)	154	14.4	13.0 (10.6–15.4)	119	31.7	30.4 (23.6–37.2)	109	22.9	22.5 (17.2–27.8)
No	604	83.9	84.3 (81.1–87.5)	914	85.6	87.0 (84.6–89.4)	257	68.3	69.6 (62.8–76.4)	368	77.1	77.5 (72.2–82.8)
Ever had anal sex												
Yes	416	57.9	56.9 (52.6–61.3)	666	62.4	61.3 (57.4–65.1)	–	–	–	–	–	–
No	303	42.1	43.1 (38.7–47.4)	402	37.6	38.7 (34.9–42.6)	–	–	–	–	–	–
Age first had anal sex with a man or TGW												
10–14 years old	–	–	–	–	–	–	36	10	11.0 (7.1–15.0)	27	6.0	4.3 (2–6.6)
15–19 years old	–	–	–	–	–	–	199	55.1	57.5 (50.8–64.3)	120	26.4	25.7 (20.5–31)
20–24 years old	–	–	–	–	–	–	126	34.9	31.5 (25.0–37.8)	121	26.6	27.6 (22.2–33)
≥25 years old	–	–	–	–	–	–	–	–	–	186	41.0	42.3 (36–48.5)
Number of male anal or vaginal sex partners, last 6 months												
0 partners	–	–	–	–	–	–	3	0.8	1.6 (0.0–4.0)	5	1.1	1.3 (−0.1–2.7)
1–2 partners	76	10.6	11.1 (8.3–13.9)	132	12.4	12 (9.6–14.4)	217	60.5	58.1 (50.4–65.7)	239	52.8	59.0 (52.9–65.1)
3–4 partners	118	16.4	16.5 (13.2–19.7)	186	17.4	20.1 (16.9–23.3)	73	20.3	20.1 (14.3–25.9)	103	22.7	20.4 (15.7–25.1)
≥5 partners	523	73.0	72.4 (69.0–75.7)	523	70.2	67.9 (64.2–71.6)	66	18.4	20.2 (13.5–26.8)	106	23.4	19.3 (14.3–24.3)
Number of female sex partners, last 6 months												

	FSW/CSE Girls (n = 1789)						MSM/TGW (n = 855)					
	15–24 years (n = 720)	Sample proportion (unweighted) %	Population proportion (weighted) % (95% CI)	≥25 years (n = 1069)	Sample proportion (unweighted) %	Population proportion (weighted) % (95% CI)	15–24 years (n = 378)	Sample proportion (unweighted) %	Population proportion (weighted) % (95% CI)	≥25 years (n = 477)	Sample proportion (unweighted) %	Population proportion (weighted) % (95% CI)
0 partners	–	–	–	–	–	–	2	0.6	0.7 (−0.4–1.8)	2	0.5	1 (−0.7–2.7)
1–2 partners	–	–	–	–	–	–	102	32.4	38.8 (31.6–46.0)	145	39.4	42.6 (35.8–49.4)
3–4 partners	–	–	–	–	–	–	85	27	29.6 (22.4–36.8)	95	25.8	28.8 (28.3–35.1)
≥5 partners	–	–	–	–	–	–	126	40	30.8 (24.0–37.6)	126	34.2	27.6 (21.9–33.3)
Condom use at last sex act												
Yes	235	32.6	31.2 (27.0–35.5)	393	36.9	33.8 (30.1–37.4)	91	24.5	23.5 (18.0–29.1)	140	29.7	29.7 (24.1–29.8)
No	485	67.4	68.8 (64.5–73.0)	671	63.1	66.2 (62.6–69.9)	280	75.5	76.5 (70.9–82.0)	332	70.3	70.3 (64.7–70.4)
Paid men/TGW for sex, last 6 months												
Yes	–	–	–	–	–	–	222	61.8	62.0 (58.6–64.9)	200	44.1	36.8 (33.2–40.5)
No	–	–	–	–	–	–	137	38.2	38.0 (35.1–41.4)	253	55.9	63.2 (59.5–66.8)
Got paid for sex from men/TGW, last 6 months												
Yes	–	–	–	–	–	–	174	48.5	53.4 (46.2–60.6)	199	43.9	40.9 (34.9–46.9)
No	–	–	–	–	–	–	185	51.5	46.6 (39.4–53.8)	254	56.1	59.1 (53.1–65.1)
Able to negotiate condom use with a client, last 6 months												
Never	85	14.4	15.7 (12.1–19.4)	84	9.7	10.9 (7.8–13.9)	–	–	–	–	–	–

	FSW/CSE Girls (n = 1789)						MSM/TGW (n = 855)					
	15–24 years (n = 720)	Sample proportion (unweighted) %	Population proportion (weighted) % (95% CI)	≥25 years (n = 1069)	Sample proportion (unweighted) %	Population proportion (weighted) % (95% CI)	15–24 years (n = 378)	Sample proportion (unweighted) %	Population proportion (weighted) % (95% CI)	≥25 years (n = 477)	Sample proportion (unweighted) %	Population proportion (weighted) % (95% CI)
Rarely	79	13.4	14.7 (11.3–18.2)	79	9.2	9.2 (6.9–11.5)	–	–	–	–	–	–
Sometimes	226	38.2	37.9 (33.0–42.9)	310	35.9	40.4 (36–44.7)	–	–	–	–	–	–
Frequently	201	34.0	31.7 (26.8–36.4)	390	45.2	39.5 (35.2–43.9)	–	–	–	–	–	–

Table 3.

Stigma/discrimination, HIV services, and biomarkers among female sex workers (FSW), commercially and sexually exploited (CSE) girls and men who have sex with men and transgender women (MSM/TGW) in Papua New Guinea (2016–2017).

	FSW/CSE Girls (n = 1789)						MSM/TGW (n = 855)					
	15–24 years (n = 720)	Sample proportion (unweighted) %	Population proportion (weighted) % (95% CI)	≥25 years (n = 1069)	Sample proportion (unweighted) %	Population proportion (weighted) % (95% CI)	15–24 years (n = 378)	Sample proportion (unweighted) %	Population proportion (weighted) % (95% CI)	≥25 years (n = 477)	Sample proportion (unweighted) %	Population proportion (weighted) % (95% CI)
Ashamed to be FSW/CES girls or MSM/TGW												
Yes	342	49.7	51.8 (47.6–56.0)	469	45.2	48.1 (44.6–51.6)	109	29.9	31.9 (25.1–38.6)	135	29.2	30.6 (25.2–35.9)
No	346	50.3	48.2 (44.0–52.4)	568	54.8	51.9 (48.4–55.4)	256	70.1	68.1 (61.4–74.9)	328	70.8	69.4 (64.1–74.8)
Ashamed to disclose sex work to healthcare worker												
Yes	171	32.5	33.0 (28.4–37.6)	240	28.9	29.5 (25.6–33.4)	–	–	–	–	–	–
No	356	67.5	67 (62.4–71.6)	590	71.1	70.5 (66.6–74.4)	–	–	–	–	–	–
Family's attitude to MSM/TGW status												
Accepts me	–	–	–	–	–	–	41	11	10.8 (6.2–15.3)	70	14.8	12.8 (8.6–17)
Doesn't know	–	–	–	–	–	–	324	86.6	86.2 (81.2–91.2)	394	83.1	85.2 (80.8–89.6)
Rejects me	–	–	–	–	–	–	9	2.4	3.0 (0.6–5.4)	10	2.1	2 (0.4–3.6)
Ever been arrested because FSW or MSM/TGW												
Yes	47	6.6	5.5 (3.8–7.3)	105	9.8	10 (7.6–12.4)	6	1.6	1.7 (1.3–2.3)	15	3.1	3.8 (1.3–6.2)
No	671	93.4	94.5 (92.7–96.3)	963	90.2	90 (87.5–92.4)	372	98.4	98.3 (97.7–98.7)	462	96.9	96.2 (93.8–98.7)
Experienced physical violence, last 12 months												

	FSW/CSE Girls (n = 1789)						MSM/TGW (n = 855)					
	15–24 years (n = 720)	Sample proportion (unweighted) %	Population proportion (weighted) % (95% CI)	≥25 years (n = 1069)	Sample proportion (unweighted) %	Population proportion (weighted) % (95% CI)	15–24 years (n = 378)	Sample proportion (unweighted) %	Population proportion (weighted) % (95% CI)	≥25 years (n = 477)	Sample proportion (unweighted) %	Population proportion (weighted) % (95% CI)
Yes	201	27.9	28.3 (24.3–32.4)	201	19.0	17.4 (14.6–20.1)	104	27.9	25.7 (20.0–31.5)	129	27.5	29.9 (24.5–35.2)
No	519	72.1	71.7 (67.6–75.7)	857	81.0	82.6 (79.9–85.4)	269	72.1	74.3 (68.5–80.0)	341	72.6	70.1 (64.8–75.5)
Access support services after any physical violence												
Yes	69	34.3	34.8 (26.4–43.2)	92	45.8	39.4 (30.1–48.7)	28	31.5	25.3 (13.4–37.1)	35	34.3	38.6 (27.3–49.9)
No	132	65.7	65.2 (56.8–73.6)	109	54.2	60.6 (51.3–69.9)	61	68.5	74.7 (62.9–86.5)	67	65.7	61.4 (50.1–72.7)
Experienced sexual violence, last 12 months												
Yes	134	18.7	17.2 (13.8–20.6)	148	14.0	13.0 (10.5–15.5)	32	8.5	6.3 (3.5–9.1)	40	8.4	9.8 (6.2–13.4)
No	583	81.3	82.8 (79.4–86.2)	910	86.0	87.0 (84.5–89.5)	346	91.5	93.7 (90.9–96.5)	435	91.6	90.2 (86.6–93.8)
Access support services after any sexual violence												
Yes	51	38.1	42.4 (31.6–53.2)	47	31.8	27.0 (20.1–33.9)	2	6.7	13.6 (−5.9–33.1)	1	2.6	3.5 (1.1–5.9)
No	83	61.9	57.6 (46.8–68.4)	101	68.2	73.0 (66.1–79.9)	28	93.3	86.4 (66.9–105.9)	37	97.4	96.5 (94.1–98.9)
Spoke with peer educator or outreach worker, last 12 months												
Yes	338	48.6	43.7 (39.1–48.4)	561	53.9	51.1 (47.2–55)	194	52.4	46.4 (39.3–53.5)	276	59.5	56.6 (50.6–62.6)
No	358	51.4	56.3 (51.7–60.9)	479	46.1	48.9 (45–52.8)	176	47.6	53.6 (46.5–60.7)	188	40.5	43.4 (37.4–49.4)
Given free condoms, last 12 months												
Yes	359	50.2	47.9 (43.4–52.5)	667	62.6	58.0 (54.1–61.8)	200	53.5	55.1 (48.4–61.9)	308	64.8	59.9 (54.2–65.6)

	FSW/CSE Girls (n = 1789)						MSM/TGW (n = 855)					
	15–24 years (n = 720)	Sample proportion (unweighted) %	Population proportion (weighted) % (95% CI)	≥25 years (n = 1069)	Sample proportion (unweighted) %	Population proportion (weighted) % (95% CI)	15–24 years (n = 378)	Sample proportion (unweighted) %	Population proportion (weighted) % (95% CI)	≥25 years (n = 477)	Sample proportion (unweighted) %	Population proportion (weighted) % (95% CI)
No	356	49.8	52.1 (47.5–56.6)	399	37.4	42.0 (38.2–45.9)	174	46.5	44.9 (38.1–51.6)	167	35.2	40.1 (34.4–45.8)
Comprehensive knowledge of HIV												
Yes	193	26.8	27.1 (23.4–30.7)	419	39.2	35.5 (31.8–39.2)	145	38.4	34.5 (27.8–41.3)	221	46.3	45.9 (40.1–51.7)
No	527	73.2	72.9 (69.3–76.6)	650	60.8	64.5 (60.8–68.2)	233	61.6	65.5 (58.7–72.2)	256	53.7	54.1 (48.3–59.9)
Active syphilis												
Yes	31	4.3	3.9 (3.4–4.5)	61	5.7	6.0 (4.4–7.6)	22	5.8	5.7 (4.6–7.2)	26	5.5	3.7 (1.9–5.5)
No	687	95.7	96.1(95.5–96.6)	1003	94.3	94.0 (92.4–95.6)	355	94.2	94.3 (92.9–95.4)	449	94.5	96.3 (94.5–98.1)
Have chlamydia and/or gonorrhea												
Yes, have both	128	18.2	18.9 (15.2–22.5)	81	7.7	6.2 (4.3–8.1)	35	9.6	10.5 (6.1–14.8)	19	4.1	4.9 (2.4–7.3)
Yes, have either	52	7.4	5.9 (4.1–7.6)	54	5.1	3.7 (2.5–5)	71	19.5	15.8 (11.6–20.1)	65	14.0	13.9 (10–17.9)
No	524	74.4	71.4 (79.2–89.9)	920	87.2	90.1 (87.8–92.4)	258	70.9	73.6 (67.6–79.5)	381	81.9	81.2 (76.6–85.8)
Ever tested for HIV												
Yes	439	61	57.8 (53.3–62.3)	767	71.9	71.5 (67.8–75.1)	112	29.6	31.8 (25.4–38.3)	204	42.8	41.8 (35.4–48.2)
No	281	39	42.2 (37.8–46.7)	300	28.1	28.5 (24.9–32.2)	266	70.4	68.2 (61.7–74.6)	273	57.2	58.2 (51.8–64.6)
HIV Status												
Positive	105	14.8	13.3 (10.2–16.4)	165	15.7	17.9 (14.6–21.2)	17	4.6	13.3 (10.3–16.3)	37	7.9	17.9 (14.6–21.2)
Negative	605	85.2	86.7 (83.6–89.8)	887	84.3	82.1 (78.8–85.4)	356	95.4	86.7 (83.7–89.7)	430	92.1	82.1 (78.8–85.4)
Know their HIV status (First 90)												
Yes	57	54.3	57.2 (53.3–61.1)	47	29.2	30.3 (23.7–37.0)	9	52.9	53.7 (45.6–61.6) *	22	59.5	67.48 (62.4–72.9) *

	FSW/CSE Girls (n = 1789)						MSM/TGW (n = 855)					
	15–24 years (n = 720)	**Sample proportion (unweighted) %**	**Population proportion (weighted) % (95% CI)**	**≥25 years (n = 1069)**	**Sample proportion (unweighted) %**	**Population proportion (weighted) % (95% CI)**	**15–24 years (n = 378)**	**Sample proportion (unweighted) %**	**Population proportion (weighted) % (95% CI)**	**≥25 years (n = 477)**	**Sample proportion (unweighted) %**	**Population proportion (weighted) % (95% CI)**
No	48	45.7	42.8 (38.9–46.8)	114	70.8	69.7 (63–76.3)	8	47.1	46.3 (38.4–54.5) *	15	40.5	32.52 (27.4–38) *
HIV positive and on treatment (Second 90)												
Yes	41	85.4	83.5 (78.5–87.5)	109	95.6	95.5 (92.1–98.9)	7	87.5	95.1 (87.0–98.2) *	11	73.3	74.7 (65–88.1) *
No	7	14.6	16.5 (12.5–21.5)	5	4.4	4.5 (1–7.9)	1	12.5	4.9 (1.8–13.0) *	4	26.7	25.3 (15.6–38.2) *
On treatment with HIV viral suppression (Third 90)												
Yes	30	73.2	83.2 (77.6–87.6)	86	78.9	80.8 (72.8–88.8)	7	100.0	100.0 *	8	72.7	74.8 (61.8–84.4) *
No	11	26.8	16.8 (12.4–22.3)	23	21.1	19.2 (11.2–27.2)	0	0.0	0.0 *	3	27.3	25.2 (15.6–38.2) *

* Wilson binomial estimates.

Table 4.

Correlates of age in FSW and CSE girls in Papua New Guinea (2016–2017).

	Younger versus older FSW/CSE			
	Bivariate Analysis		Multivariable Analysis	
	OR (95%CI) *	*p*-value	aOR (95%CI)	*p*-value
Sex work as main source of income		0.0182		0.0398
Yes	1.3 (1.1–1.7)	0.0182	1.4 (1.0–1.9)	0.0398
No	ref		ref	
Average monthly income		0.0004		0.0016
<200 Kina (~USD$63)	ref		ref	
200–499 Kina (~USD$64–USD$156)	1.2 (0.7–1.9)	0.2953	1.2 (0.7–2)	0.3411
≥500 Kina (≥USD$157)	2 (1.2–3.1)	0.0002	2.0 (1.2–3.2)	0.0006
Has someone who facilitates meeting clients		0.0023		0.0023
Yes	1.5 (1.1–1.9)	0.0023	1.6 (1.2–2.1)	0.0023
No	ref		ref	
Ever been arrested and held in a police holding cell because FSW or MSM/TGW		0.0065		0.0005
Yes	0.5 (0.3–0.8)	0.0065	0.4 (0.2–0.7)	0.0005
No	ref		ref	
Experienced physical violence, last 12 months		<.0001		0.0001
Yes	1.9 (1.4–2.5)	<.0001	1.9 (1.4–2.7)	0.0001
No	ref		ref	
Given free condoms, last 12 months		0.0005		0.0295
Yes	0.6 (0.5–0.8)	0.0005	0.7 (0.5–1.0)	0.0295
No	ref		ref	
Have chlamydia and gonorrhea		<.0001		<.0001
Yes, have both	3.6 (2.4–5.3)	<.0001	3.2 (2.0–5.0)	0.0047
Yes, had either one	1.9 (1.2–3.1)	0.9665	2.2 (1.2–4.1)	0.4859
No	ref		ref	
Ever tested for HIV		<.0001		0.0008
Yes	0.6 (0.4–0.7)	<.0001	0.6 (0.4–0.8)	0.0008
No	ref		ref	

* Variables associated with age in the bivariate analysis at a *p*-value <0.1 are: education, sex work as main source of income, average monthly income, years of selling sex, had someone facilitated meeting clients, used internet or mobile apps to meet clients, ever had anal sex, condom negotiation with a client, being ashamed to be FSW/CSE, ever been arrested because FSW/CSE, physical violence, sexual violence, comprehensive knowledge of HIV, active syphilis, had chlamydia and/or gonorrhea, ever tested for HIV, and HIV status. Only variables that were significantly associated with age in the bivariate and multivariable analyses are presented in this table.

Table 5.

Correlates of age in MSM/TGW in Papua New Guinea (2016–2017).

	Younger versus older MSM/TGW			
	Bivariate Analysis		Multivariable Analysis	
	OR (95%CI) *	*p*-value	aOR (95%CI)	*p*-value
Used internet or mobile apps to meet clients (FSW) or partners (MSM/TGW), last 6 months		0.01		0.0084
Yes	1.7(1.1–2.5)	0.01	1.8(1.2–2.9)	0.0084
No	ref		ref	
Paid a man/TGW for sex, last 6 months		0.0001		<.0001
Yes	2.0(1.4–2.8)	0.0001	2.2(1.5–3.1)	<.0001
No	ref		ref	
Got paid for sex, last 6 months		0.0748		0.0172
Yes	1.4(1.0–2.0)	0.0748	1.6(1.1–2.4)	0.0172
No	ref		ref	
Spoke with peer educator or outreach worker, last 12 months		0.0078		0.0203
Yes	0.6(0.4–0.9)	0.0078	0.6(0.4–0.9)	
No	ref		ref	
Ever tested for HIV		0.0074		0.0153
Yes	0.6(0.4–0.9)	0.0074	0.6(0.4–0.9)	0.0153
No	ref		ref	
Comprehensive knowledge of HIV		0.0429		0.0138
Yes	0.7(0.5–1)	0.0429	0.6(0.4–0.9)	0.0138
No	ref		ref	

* Variables associated with age in the bivariate analysis at a *p*-value <0.1 are: used internet or mobile apps to meet partners, number of female sex partners, paid men/TG for sex, got paid for sex from men/TG, physical violence, spoke with peer educator or outreach worker, given free condoms, comprehensive knowledge of HIV, had chlamydia and/or gonorrhea, and ever tested for HIV. Only variables that were significantly associated with age in the bivariate and multivariable analyses were presented in this table.