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*Research Article***Impact of COVID-19 public health responses on income, food security and health services among key and vulnerable women in South Africa†**Hilton Humphries^{1,2} , Lara Lewis¹ , Erik Lamontagne^{3,4} , Shakira Choonara¹ , Keabetswe Dikgale¹ , Anna Yakusik³ , Dianne Massawe⁵, Ntombenhle Mkhize⁶ , Farai Mzungu⁷  & Quarraisha Abdool Karim^{1,8*} ¹Centre for the AIDS Programme of Research in South Africa (CAPRISA), Nelson R Mandela School of Medicine, University of KwaZulu-Natal, Durban, South Africa²Department of Psychology, School of Applied Human Sciences, University of KwaZulu-Natal, Durban, South Africa³UNAIDS, Strategic Information, Geneva, Switzerland⁴Aix Marseille University, CNRS, Aix-Marseille School of Economics, Marseille, France⁵African Alliance, Johannesburg, South Africa⁶AIDS Foundation of South Africa, Durban, South Africa⁷Youth Health Africa, Johannesburg, South Africa⁸Mailman School of Public Health, Columbia University, New York, USA*Correspondence: Quarraisha.AbdoolKarim@caprisa.org

Globally, COVID-19 has impacted lives and livelihoods. Women living with HIV and/or at high risk of acquiring HIV are socially and economically vulnerable. Less is known of the impact of COVID-19 public health responses on women from key and vulnerable populations. The purpose of this cross-sectional survey conducted in four South African provinces with a high burden of HIV and COVID-19 from September to November 2021 was to advance understanding of the socio-economic and health care access impact of COVID-19 on women living with HIV or at high risk of acquiring HIV. A total of 2 812 women ≥ 15 years old completed the survey. Approximately 31% reported a decrease in income since the start of the pandemic, and 43% an increase in food insecurity. Among those accessing health services, 37% and 36% reported that COVID-19 had impacted their access to HIV and family planning services respectively. Economic and service disruptions were enhanced by living in informal housing, urbanisation and being in the Western Cape. Food insecurity was increased by being a migrant, having fewer people contributing to the household, having children and experience of gender-based violence. Family planning service disruptions were greater for sex workers and having fewer people contributing to the household. These differentiated impacts on income, food security, access to HIV and family planning services were mediated by age, housing, social cohesion, employment and household income, highlighting the need for improved structural and systemic interventions to reduce the vulnerability of women living with HIV or at high risk of acquiring HIV.

Keywords: adolescent girls, food insecurity, health care access, income disruptions, key and vulnerable populations**Online supplementary material:** Supplementary data for this article are available at <https://doi.org/10.2989/16085906.2022.2144392>

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Introduction

South Africa is home to less than 1% of the global population, but has about 20% of the global burden of HIV infection. In 2020, high HIV prevalence among young people of 15–49 years old (19.1%) (UNAIDS, 2021c) and incidence rates (4.6 per 1 000) (UNAIDS, 2021a; 2021c) characterised the South African generalised, hyper-endemic epidemic setting. While the estimated 8 million people living with HIV (PLHIV) have free access to antiretroviral treatment through South African public sector health facilities, there remain

gaps in ARV treatment access, particularly among key and vulnerable populations who do not typically access, or face challenges accessing, these health care facilities (Duby et al., 2018; Humphries et al., 2018; Maughan-Brown et al., 2018; Mabuto et al., 2019; McKinney et al., 2021; UNAIDS, 2021c). Further new HIV infections among adolescent girls and young women (AGYW) of 15–24 years old, who are more likely to acquire HIV from recently infected 25–40-year-old male partners, remain high, despite the roll-out of new HIV prevention options (de Oliveira et al., 2017). Challenges in HIV treatment and prevention have a negative impact on

achieving the 95-95-95 UNAIDS goals (Eisinger et al., 2019; UNAIDS, 2021b).

The generalised, hyper-endemic HIV epidemic in South Africa shows great variability across the country, with about 80% of all PLHIV living in five provinces, namely Gauteng, KwaZulu-Natal, Eastern Cape, Limpopo and Mpumalanga (Kim et al., 2021). While women bear a disproportionate burden of HIV infection, it is unevenly distributed among key and vulnerable populations (KVPs), defined here as adolescent girls and young women, female sex workers, displaced people, disabled persons, injecting drug users and members of the LGBTQ+ community. There is limited data on the heterogeneity of HIV infection in women, including differences in ARV treatment access and viral suppression (Parry & Gordon, 2021; UNAIDS, 2021a; Mutambara et al., 2022). UNAIDS estimates that the risk of acquiring HIV is 35 times higher among people who inject drugs (PWID), 26 times higher for female sex workers and 34 times higher for transgender people (UNAIDS, 2021a) compared to the general population (UNAIDS, 2021a).

Notwithstanding the global HIV prevention challenges in meeting the UNAIDS 2020 target of 500 000 new infections, the emergence of the SARS-CoV-2 pandemic in early 2020 shifted global attention away from HIV and other epidemics (UNAIDS, 2021a). In Africa, South Africa has reported the highest number of SARS-CoV-2 infections, with a cumulative 3 740 398 infections as of 19 April 2022 (Arndt et al., 2020; Baxter et al., 2020; National Institute of Communicable Diseases, 2022). The public health interventions used to slow the spread of SARS-CoV-2 has had major economic, health and social consequences globally. In South Africa, there were short-term disruptions to health services at the start of the national lockdown in early 2020 (Dorward et al., 2021) that were restored within a few weeks, but fear of acquiring SARS-CoV-2 infection may have made some people hesitant to access services (Benade et al., 2022; Bisnauth et al., 2022; Mutambara et al., 2022). Limitations imposed by restrictions on movement and the closure of non-essential businesses served to strain economic growth, causing job losses and income reductions (Baxter et al., 2020; Spaull & van der Berg, 2020; Dorward et al., 2021; Parry & Gordon, 2021; UNAIDS, 2021a). These impacts are likely to have affected those with pre-existing social and economic vulnerabilities, such as young African women living with HIV, those at high risk of acquiring HIV and women in key and vulnerable populations (Spaull & van der Berg, 2020; Parry & Gordon, 2021; UNAIDS, 2021a; Mutambara et al., 2022) as they exist outside of the formal economy, including economic measures instituted in the formal economy. Further concerns about the long-term impact of COVID-19 on constraining health care services, disrupting sexual reproductive health, HIV testing and treatment services, and a failure to get high COVID-19 vaccination uptake in nations with high rates of uncontrolled advanced HIV puts PLHIV at even greater risk (Msomi et al., 2021).

Understanding the impact of COVID-19 public health measures on women in key and vulnerable populations living with HIV or at high risk of acquiring HIV in high burden HIV and COVID-19 settings is key to informing interventions to build resilience and be better prepared for future and ongoing pandemics. In this analysis, we explore

how income, food security and health service utilisation of women from vulnerable groups who are living with HIV or are at risk of acquiring HIV in South Africa were affected by public health responses to COVID-19.

Methods

Study design and study sample

Data for this cross-sectional study were collected between September and November 2021, coinciding with the tail-end of the third COVID-19 wave driven by the Delta variant in South Africa and the recent availability of free access to COVID-19 vaccines to the general population, and ended just as the fourth wave driven by the Omicron variant emerged. The study population included consenting women of ≥ 15 years old who self-reported living with HIV or were at high risk of HIV, and from key and vulnerable groups, including adolescent girls and young women (defined as those of 15–24 years old), sex workers (defined as women engaged in commercial sex work), LGBTQ+ women (women self-identifying as having sex with women exclusively, having sex with women and men, having non-heterosexual sexual orientations, or being transgendered), migrants, refugees and displaced people (defined as non-South Africans who have moved across an international border away from their habitual place of residence and referred to as migrants from here on), women living with disabilities (defined as person who has long-term physical or sensory impairments) and women using drugs (defined for this study as women injecting or using illegal drugs). In terms of HIV status and high-risk, the study included women that self-reported as HIV positive, while high-risk was defined as those belonging to key populations or vulnerable groups at high risk of HIV acquisition as defined by the WHO (see <http://www.emro.who.int/asd/health-topics/vulnerable-groups-and-key-populations-at-increased-risk-of-hiv.html>).

Recruitment

Volunteers were recruited from four provinces in South Africa, namely KwaZulu-Natal, Western Cape, Gauteng and Eastern Cape as these had the highest numbers of SAR-CoV-2 infections at the time of the survey and have a high prevalence of HIV infections. As the study involved key and vulnerable groups, three key community support organisation (CSO) partnerships were established with the AIDS Foundation of South Africa (AFSA), African Alliance (AA) and Youth Health Africa (YHA) to support data collection. During the data collection process, two gaps were identified, namely limited reach of migrant and displaced populations and injecting drug users. To fill this gap, additional support was sought from two non-governmental organisations, the Denis Hurley Centre and TB/HIV Care, who provide health care to these two populations respectively. CSO partners had well-established networks in the key groups identified for this study. The CSO developed outreach strategies to roll out and amplify the survey among the target sub-populations. They worked with key community-based organisations (CBOs) and support groups to roll out and promote the survey among the target population groups. Outreach included accessing populations through health-care clinics, venue community sampling (accessing KVPs through home visits, snowball sampling,

through CBO partners providing support services to these groups) and through facilities providing tailored support services to these vulnerable groups.

After protocol training, data collectors were linked to identified community leads to start community dialogue and engagement as well as plan the targeted community outreach and data collection activities. The research team continuously reviewed recruitment targets to ensure that the sample had good provincial representation, socio-economic diversity and achieved adequate representation across target subpopulations.

Data collection

A structured questionnaire was used to collect data on the following thematic areas: demographics; socio-economic status; HIV status; risk and safer sex practices; ARV treatment access (if applicable); health and well-being; mental health (PHQ-4); gender-based violence; substance use; transactional sex; sex work; COVID-19 vaccine uptake and beliefs; and the impacts of COVID-19. Consenting participants were able to complete the survey face-to-face with a data collector, or electronically via their mobile phones or a tablet in one of three languages – English, isiZulu, or isiXhosa. A web-based survey platform, LimeSurvey™, was used to capture the data collected in real-time online or uploaded for those completing the survey face-to-face on completion of the survey. Participants had the option not to respond to questions perceived to be sensitive, particularly those relating to behaviours, gender-based violence (GBV), mental health, stigma and discrimination. Civil society partners contributed to co-developing the data collection materials, including gender sensitisation and ensuring adherence to COVID-19 protocols. Participants were reimbursed approximately 3 USD for their time. The target sample size was between 2 300 and 3 000 unique participants.

The survey protocol was reviewed and approved by the University of KwaZulu-Natal Biomedical Research Ethics Committee (BREC, 00002727/2021). Additional approval was sought from the provincial and district health departments, where outreach included Department of Health facilities.

Referrals to health care and other services

All participants were offered referrals to local services if indicated, including HIV testing and counselling. If participants reported experiencing mental health issues or gender-based violence, information to local services was provided to them through links in the electronic survey that the participant could access while completing the survey or through a facilitated referral to local community health care workers or services.

Data analysis

An ecological framework was used to guide the analysis of the independent variables (Bronfenbrenner, 1994) by providing a theoretical framework for visualising and understanding the complexity of variables that influence the outcomes of interest. Ecological variables included were chosen from a review of the literature and emanate from multiple ecological levels, including the individual level (e.g. HIV status, age, substance use, KVP status), the relational/household level (e.g. marital status, experience

of gender-based violence, household type, number of people contributing to the household) and the structural and geospatial level (e.g. urban/rural area and province). KVP status (identified through CSO partner networks during recruitment), and HIV status (“Do you know your HIV status?”; responses: “I am HIV positive/I am HIV negative/Do not know/I cannot or do not want to answer this question”) were measured by self-report by the participant. We explored the relationship between ecological risk factors and the impact of the COVID-19 pandemic on income, food security, HIV service utilisation and family planning service utilisation in the study population. Outcome variables were defined as follows:

- 1) *Decrease in income* was defined as having occurred if a participant answered “decreased” to the question “Did your total income change since COVID-19 started?” (possible responses: increased, decreased, or no change) and having not occurred if the reported answer was “increased” or “no change”.
- 2) *Increase in food insecurity* was defined as having occurred if a participant answered “Yes” to the question “Since the COVID-19 crisis began, do you eat less or skip meals because there was not enough money for food?” (possible responses: Yes/No) and having not occurred if the reported answer was “No”.
- 3) *Reduced access to HIV service utilisation* was measured using the self-reported responses to “Did the COVID-19 pandemic have an impact on your attendance at the health facilities for HIV services when you needed them?” (possible responses: Yes/No/Not needed). Those responding “Yes” were defined as having reduced access to the service, those responding “No” were defined as not being impacted and those responding “Not needed” were excluded from the analysis of this outcome.
- 4) *Reduced access to family planning services* was measured using the self-reported responses to “Did the COVID-19 pandemic have an impact on your attendance at the health facilities for family planning services when you needed them?” (possible responses: Yes/No/Not needed). Those responding “Yes” were defined as having reduced access to the service, those responding “No” were defined as not being impacted and those responding “Not needed” were excluded from the analysis of this outcome.

Categorical data were summarised using frequency and proportions, while continuous data were summarised using medians and interquartile ranges (IQR). The proportion of women reporting an outcome was calculated and 95% Wald confidence intervals were estimated. Proportions were also estimated for each KVP group. To understand which characteristics of the study population placed them at greater risk of poor outcomes, the relative risk of an outcome for a given characteristic was estimated. Poisson regression with robust standard errors was used to measure the relative risk of an outcome for each KVP status, reported HIV status and other relevant demographic and behavioural variables. Demographic and behavioural variables considered were age, province, urban/rural location, dwelling type, the proportion of people contributing financially to a household, marital status, parental status, gender-based violence exposure and high alcohol use (whether an individual drinks

more than six drinks on any occasion). Source of income and highest-level of education were not included as model covariates as these variables could not be meaningfully measured for girls and women who were still in secondary or post-secondary education and had not started earning an income. Univariable and multivariable models were run. Multivariable models were first run including all variables and interaction terms between HIV status and KVP status, as it was deemed plausible that the COVID-19 pandemic may have affected HIV-positive women differently to HIV-negative ones in each KVP. Demographic/behavioural variables and interaction terms were excluded from the final multivariable model if their adjusted *p*-value > 0.05. Age, KVP status and self-reported HIV status were included in all multivariable models regardless of *p*-value as these variables were the exposures of interest. Analyses were performed using SAS version 9.4 (SAS Institute, Cary, USA).

Results

Sociodemographic characteristics

A total of 2 812 consenting women aged 15 years and older at high risk of HIV or living with HIV completed the survey for the study across the four provinces. Sociodemographic characteristics of the sample are provided in Table 1. The table also provides the proportion of the sample that self-reported as HIV positive or negative. As the survey purposefully sampled HIV-positive women, these proportions

are not reflective of general population prevalence values. Most of the participants were between the ages of 19 and 39 years (69.0%) and 87.7% identified as cis woman, with 6.9% identifying as transgender women. Overall, 89.7% of the cohort were South African and 90.4% were black Africans. Among all participants, 83.4% of the women had completed secondary school.

Table 2 provides the behavioural characteristics of the sample who participated in this survey. At an individual level, 38.2% of the sample were AGYW, 15.1% self-reported as sex-workers, 15.8% self-reported as LGBTQ+, 3.6% as migrants, 6.0% as being disabled and 9.9% as drug users. Approximately 20% of the sample defined themselves as being in more than one of the KVP categories. Among AGYW, approximately one third defined themselves as belonging to at least one other KVP group. Most of the cohort (60.6%) reported having children and a total of 43.3% of the sample self-reported being HIV positive. Among self-reporting HIV positive participants, 93.5% said they were on ARV treatment.

At a relational and household level, 22.1% of participants reported experiencing gender-based violence, 60.2% were single, 78.0% of participants reported not having enough money for the next two days and 56.8% reported not having worked in the last 30 days. At a structural/geospatial level, most participants lived in urban or peri-urban areas (68.1%), and were from KwaZulu-Natal (33.0%) and Gauteng (35.2%).

Table 1: Demographics characteristics of women at high risk of HIV or living with HIV

Question	Response	Total		Self-reported HIV-positive		Self-reported HIV-negative	
		N = 2 812	Per cent (n)	n = 1 217	Per cent (n)	n = 1 115	Per cent (n)
Age (years)	15–18	14%	(394)	45.2%	(178)	33.8%	(133)
	19–24	24.2%	(681)	28.8%	(196)	52.1%	(355)
	25–30	22.8%	(641)	30%	(192)	49.9%	(320)
	31–39	22%	(618)	53.2%	(329)	32.2%	(199)
	40+	17%	(478)	67.4%	(322)	22.6%	(108)
Race	African/Black	90.4%	(2 543)	42.5%	(1 082)	40.3%	(1 025)
	Coloured	7.3%	(205)	54.1%	(111)	32.7%	(67)
	Other	1.4%	(38)	36.8%	(14)	39.5%	(15)
	Missing	0.9%	(26)	38.5%	(10)	30.8%	(8)
Nationality	Other African country	3.9%	(110)	34.5%	(38)	52.7%	(58)
	Other non-African country	0.1%	(4)	25%	(1)	50%	(2)
	South Africa	89.7%	(2 522)	46.2%	(1 166)	41%	(1 034)
	Missing	6.3%	(176)	6.8%	(12)	11.9%	(21)
Gender identity	Woman	87.7%	(2 467)	45%	(1 111)	39.7%	(980)
	Transgender woman (male to female)	6.9%	(193)	34.7%	(67)	35.2%	(68)
	Transgender man (female to male)	1%	(27)	25.9%	(7)	33.3%	(9)
	I cannot or do not wish to answer this question	1.1%	(31)	25.8%	(8)	38.7%	(12)
	I don't know	0.6%	(17)	23.5%	(4)	47.1%	(8)
	Other	1.8%	(50)	26%	(13)	56%	(28)
	Missing	1%	(27)	25.9%	(7)	37%	(10)
Education	No formal education	3%	(83)	43.4%	(36)	37.3%	(31)
	Primary school	8.4%	(237)	61.2%	(145)	18.6%	(44)
	Quranic only	0.3%	(9)	33.3%	(3)	44.4%	(4)
	Trade school, vocational training, apprenticeship	4.1%	(115)	33.9%	(39)	45.2%	(52)
	Post-secondary or some college	9.7%	(273)	32.2%	(88)	52%	(142)
	High school or secondary school	65.6%	(1 844)	46.8%	(863)	37.3%	(688)
	University	8.1%	(229)	16.6%	(38)	62.4%	(143)
Missing	0.8%	(22)	22.7%	(5)	50%	(11)	

Table 2: Behavioural characteristics of women at high risk of HIV or living with HIV

Level & question	Response	Total N = 2 812 Per cent (n)	Self-reported HIV-positive (n = 1 217) Per cent (n)	Self-reported HIV-negative (n = 1 115) Per cent (n)
Individual				
Adolescent girl young woman (AGYW)	Yes	38.2% (1 075)	43.4% (374)	56.6% (488)
Sex worker	Yes	15.1% (424)	56.4% (239)	28.3% (120)
	Missing	16.2% (456)	28.1% (128)	23.5% (107)
LGBTQ+	Yes	15.8% (445)	32.6% (145)	39.3% (175)
	Missing	5.2% (147)	28.6% (42)	44.9% (66)
Migrant	Yes	3.6% (100)	34% (34)	54% (54)
Disabled	Yes	6% (168)	48.2% (81)	35.7% (60)
	Missing	2.8% (78)	33.3% (26)	28.2% (22)
Drug use	I cannot or do not wish to answer	4.9% (137)	43.1% (59)	32.1% (44)
	I don't know	2.4% (68)	30.9% (21)	48.5% (33)
	Yes	9.9% (278)	45.3% (126)	35.3% (98)
	Missing	7.6% (215)	19.5% (42)	12.1% (26)
HIV status	I am HIV-negative	39.7% (1 115)	–	100% (1 115)
	I am HIV-positive	43.3% (1 217)	100% (1 217)	–
	I cannot or do not wish to answer	6.1% (172)	–	–
	I don't know	6.1% (171)	–	–
	Missing	4.9% (137)	–	–
ARV treatment (among self-reported HIV+)	Yes	93.5% (1 138)	–	–
Children	Has children	60.6% (1 703)	51.9% (884)	34.6% (589)
Do you ever have 6 or more drinks on one occasion? (Alcohol abuse)	Yes	34.9% (980)	45.9% (450)	40% (392)
	Missing	7.9% (221)	19.5% (43)	12.7% (28)
Relational				
Relationship status	Single	60.2% (1 692)	42.4% (717)	40.7% (688)
	Married	11.3% (317)	44.8% (142)	40.7% (129)
	In relationship	19.8% (556)	44.1% (245)	38.8% (216)
	In multiple relationships	3.1% (86)	41.9% (36)	31.4% (27)
GBV	I am not experiencing any violence	63.7% (1 790)	44.1% (789)	44.9% (804)
	I am experiencing violence	22.1% (622)	50.6% (315)	35.1% (218)
	I cannot or do not wish to answer this question	6.9% (195)	37.4% (73)	36.9% (72)
	Missing	7.3% (205)	19.5% (40)	10.2% (21)
Household				
Dwelling type	A house or a flat	64.6% (1 817)	40.8% (742)	43% (781)
	A traditional house like a mud hut	9.8% (275)	48.7% (134)	35.6% (98)
	An informal house like a shack	19.2% (540)	47.8% (258)	32.8% (177)
	Other	5.8% (163)	47.2% (77)	34.4% (56)
	Missing	0.6% (17)	35.3% (6)	17.6% (3)
Had work in the last 30 days	Yes	38.3% (1 076)	42.8% (460)	42.6% (458)
	Missing	4.9% (138)	16.7% (23)	12.3% (17)
Had enough money for 2 days	Yes	17.5% (491)	32.6% (160)	53.8% (264)
	Missing	4.5% (127)	7.1% (9)	18.9% (24)
Proportion of individuals working in the household, median (IQR)		0.37 (0.25–0.5)	0.33 (0.25–0.5)	0.4 (0.25–0.6)
Structural/geospatial				
Urban location	Yes	68.1% (1 914)	36.6% (701)	45.4% (868)
Province	Eastern Cape	14.8% (415)	35.4% (147)	38.8% (161)
	Gauteng	35.2% (990)	23.1% (229)	55.9% (553)
	KwaZulu-Natal	33% (927)	62.6% (580)	26.2% (243)
	Western Cape	15.6% (438)	57.1% (250)	31.7% (139)
	Other	1% (29)	27.6% (8)	48.3% (14)
	Missing	0.5% (13)	23.1% (3)	38.5% (5)

Overall reporting of the impact of the COVID-19 pandemic on income and food security

Figure 1 shows the proportion of participants who reported a decrease in income and/or an increase in food insecurity, both overall and additionally for KVPs. An additional category that included individuals who reported being in more than one KVP was also created (these individuals were also included in their respective KVP groups). The figure highlights variation in the impact of COVID-19 on key groups, suggesting heterogeneity in the impact among women. Overall, 31% of the sample reported a decrease in income since the start of the pandemic. Income decreases were reported most frequently in migrants (63%), sex workers (53%), members of the LGBTQ+ community (41%) and drug users (40%). Approximately 43% of the sample reported experiencing an increase in food insecurity during the COVID-19 pandemic. Similar to income, increases in food insecurity were reported most frequently in migrants (66%), sex workers (60%) and drug users (58%). Importantly, for both income and food insecurity, women belonging to more than one KVP in this sample may have had enhanced vulnerability to these outcomes, reporting a greater decrease in income (39%) and food security (53%), than was reported overall (31% and 43% respectively).

Impact of the COVID-19 pandemic on income

Of the 2 598 who responded to the question related to income changes following the onset of the COVID-19 pandemic, 818 (31%) reported experiencing a drop in income. The multivariable analysis identified factors associated with increased risk of experiencing a decrease in income (Figure 2 and Table S1). At an individual level, when compared to being 15 to 18 years old, being 25 years and older (25–30 years, aRR = 1.43, 95% CI 1.04–1.98; 31–39 years, aRR = 1.94, 95% CI 1.42–2.63; 40 years and older, aRR = 2.34 95% CI 1.72–3.17) was associated with increased risk of experiencing an income reduction. Sex workers (aRR = 1.58, 95% CI 1.34–1.86) and migrants (aRR = 1.19, 95% CI 1.1–1.8) were associated with a higher risk of experiencing a decrease in income. At a household level, those who reported living in informal housing (aRR = 1.19, 95% CI 1.01–1.41) and other forms of housing other than a house, flat or traditional home (aRR = 1.44, 95% CI 1.15–1.8) were at greater risk of experiencing reduced income. At a structural/geospatial level, living in the Western Cape (when compared to living in KZN) (aRR = 1.61, 95% CI 1.33–1.94) and living in an urban setting (aRR = 2.0, 95% CI 1.57–2.54) were associated with a higher risk of reporting a reduced income since the COVID-19 pandemic.

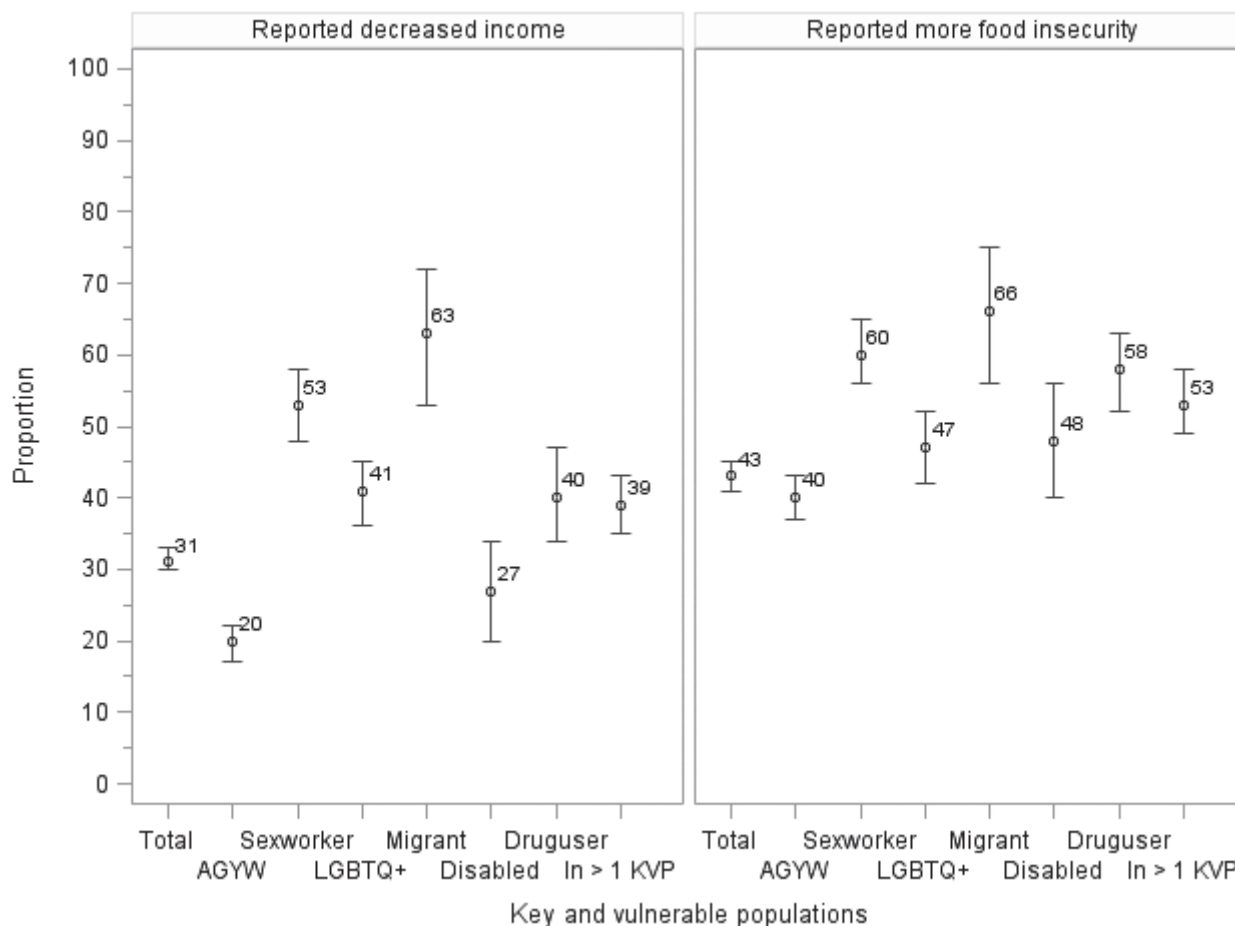


Figure 1: Overall proportion (%) of key groups reporting decreased income and more food insecurity

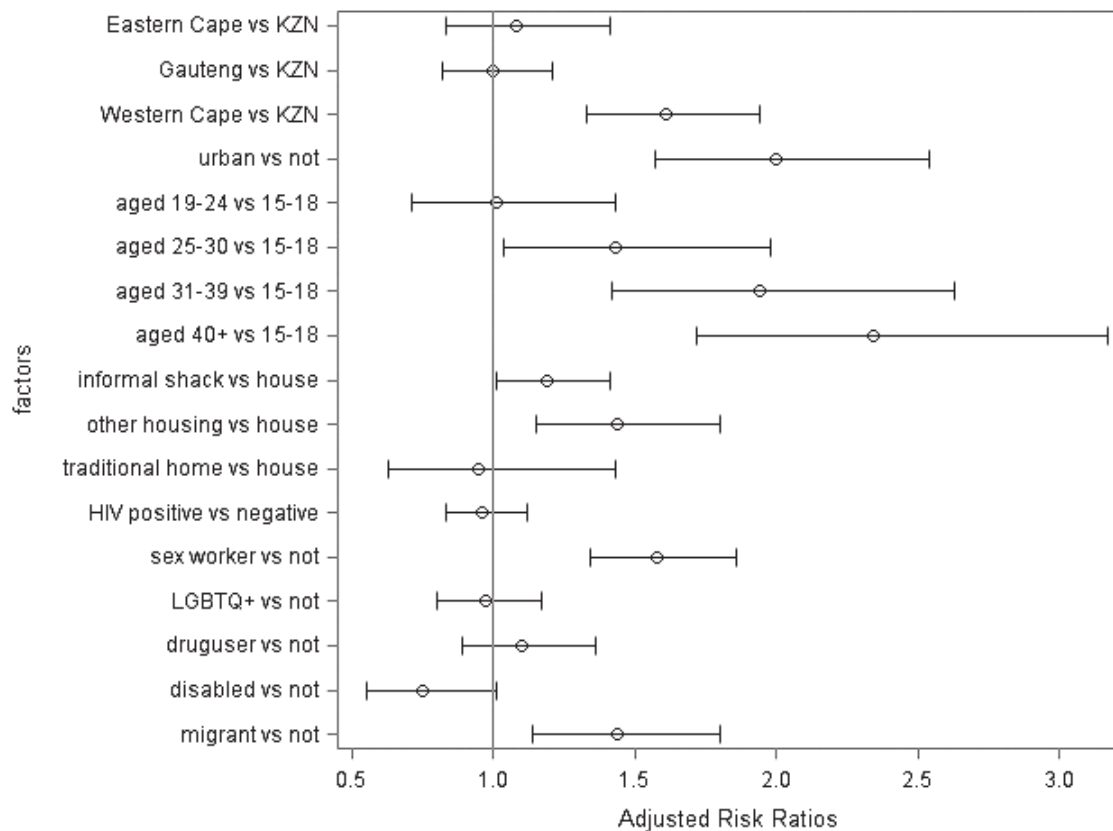


Figure 2: Relative risk of experiencing a decrease in income

Impact of the COVID-19 pandemic on food insecurity

Of the 2 677 women who responded to the question related to food insecurity, 1 148 (43%) reported skipping or missing meals because of a lack of money following the onset of the COVID-19 pandemic. The multivariable analysis identified several factors associated with increased food insecurity as a result of the COVID-19 pandemic (Figure 3 and Table S2). At an individual level, those who self-identified as migrants (aRR = 1.38, 95% CI 1.11–1.73) and HIV-positive sex workers (aRR = 1.27, 95% CI 1.07–1.52) were at higher risk of experiencing food insecurity. Additionally, those reporting that they had children were also at greater risk of experiencing food insecurity (aRR = 1.34, 95% CI 1.14–1.57). At a household level, those who reported living in informal housing (aRR = 1.45, 95% CI 1.28–1.64), other forms of housing (aRR = 1.24, 95% CI 1.02–1.5) and traditional housing (when compared to a house/flat) (aRR = 1.5, 95% CI 1.17–1.91) were at greater risk of food insecurity. Further, having a greater proportion of individuals contributing to the household was protective against food insecurity (aRR = 0.77, 95% CI 0.61–0.96). At a relational level, those experiencing gender-based violence reported higher levels of food insecurity compared to those who were not (aRR = 1.41, 95% CI 1.24–1.60). Living in the Western Cape (when compared to living in KZN) (aRR = 1.78, 95% CI 1.54–2.05) and living in an urban setting (aRR = 1.66, 95% CI 1.39–1.98) were associated with a higher risk of reporting food insecurity.

HIV and family planning services among key groups

The impact of COVID-19 on access to HIV services (among HIV-positive women only) and family planning services is summarised overall and by KVP category in Figure 4. An additional category that included individuals who reported being in more than one KVP was also created (these individuals were also included in their respective KVP groups). HIV positive sex workers, drug users, LGBTQ+ women, and AGYW reported the highest disruptions to HIV services. Those belonging to more than one KVP reported greater disruptions to HIV services (50%), suggesting enhanced vulnerability among those belonging to more than one KVP. For family planning services, AGYW (43%) and sex workers (40%) reported the highest disruption.

Impact of the COVID-19 pandemic on access to HIV services

Of the 1 167 women who reported being HIV positive and accessing HIV services, 430 (37%) reported that the COVID-19 pandemic impacted their access to these services. In the multivariable analysis (Figure 5 and supplementary Table S3), sex workers (aRR = 1.47, 95% CI 1.13–1.89) were at higher risk of experiencing disruptions to HIV services when compared to women who did not self-identify as sex workers. Being older was associated with a lower risk of experiencing disruptions to accessing HIV services, with those older than 25 years being at lower risk when compared to those between 15 and 18 years old (aRR = 0.65, 95% CI 0.46–0.91; aRR = 0.71, 95% CI 0.53–0.96; aRR = 0.57, 95% CI

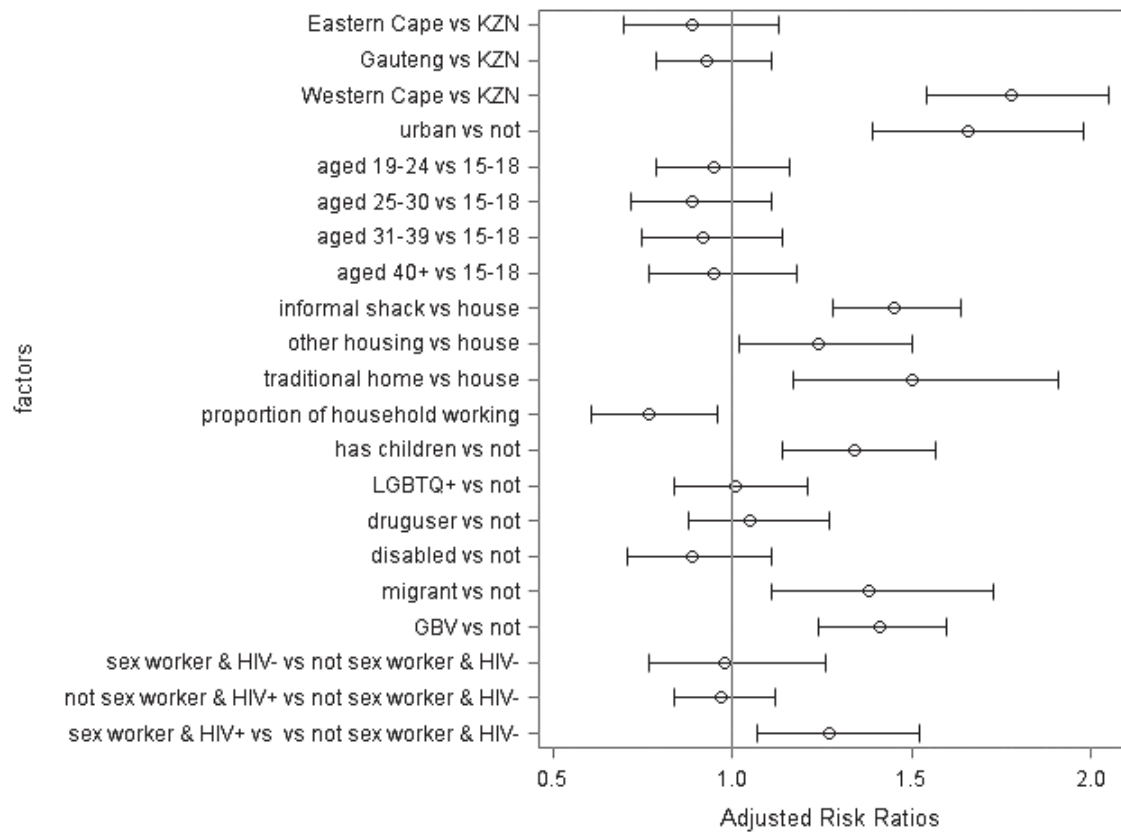


Figure 3: Relative risk of experiencing increased food insecurity

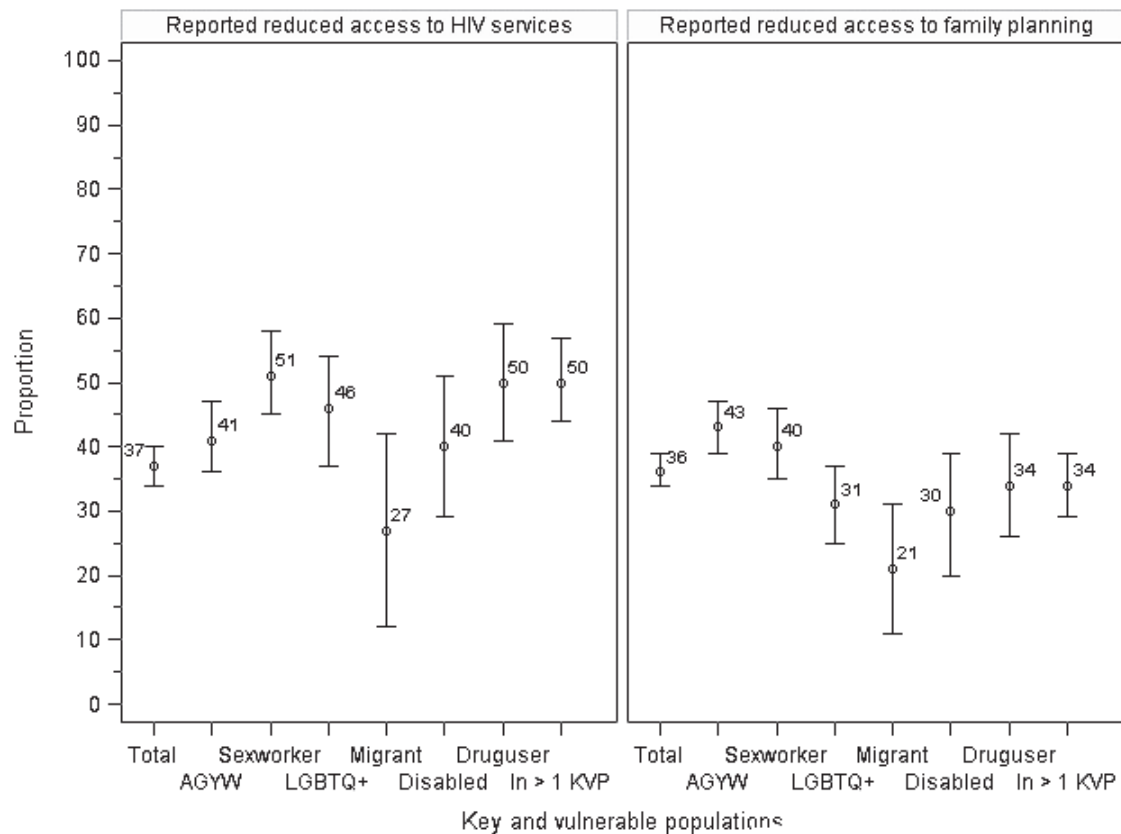


Figure 4: Overall proportion (%) of key groups reporting reduced access to HIV and family planning services

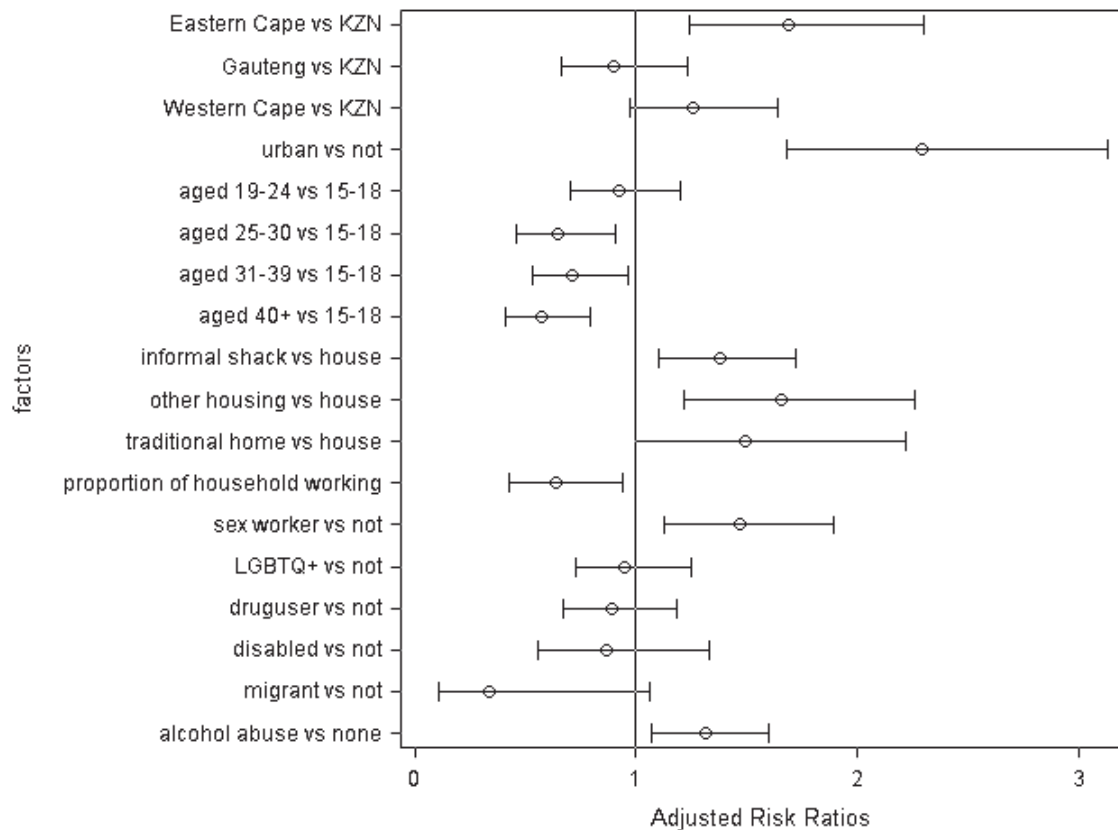


Figure 5: Relative risk of experiencing reduced access to HIV services (among self-reported HIV-positive girls and women)

0.41–0.79). At a household level, HIV-positive women who reported living in informal housing (aRR = 1.38, 95% CI 1.1–1.72), other forms of housing (aRR = 1.66, 95% CI 1.22–2.26) and traditional housing (when compared to a house/flat) (aRR = 1.49, 95% CI 1.0–2.22) were at greater risk of experiencing disruptions to HIV services. Having a greater proportion of individuals contributing financially to the household was protective (aRR = 0.64, 95% CI 0.43–0.94), while abusing alcohol was associated with a greater risk of experiencing disruptions to HIV services (aRR = 1.31, 95% CI 1.07–1.6). At a structural/geospatial level, living in the Western Cape (when compared to living in KZN) (aRR = 1.26, 95% CI 0.97–1.64) and living in an urban setting (aRR = 2.29, CI 95% 1.68–3.13) were associated with a higher risk of experiencing disruptions to HIV services among HIV-positive women.

Impact of the COVID-19 pandemic on access to family planning services

Of the 1 674 women who reported accessing family planning services, 609 (36%) reported that the COVID-19 pandemic impacted their access to these services. Adjusting for possible confounding (Figure 6 and Table S4) we found that those who self-identified as sex workers were at greater risk of experiencing reduced access to family planning services, while migrants (aRR = 1.64, 95% CI 1.3–2.07) were at lower risk of experiencing reduced access to family planning services. At a household level, those who reported living in traditional housing (when compared to a house/

flat) (aRR = 1.79, 95% CI 1.24–2.57) were at greater risk of experiencing reduced access to family planning services. As with HIV services, having a greater proportion of individuals contributing to the household was protective against disruptions to family planning service access (aRR = 0.6, 95% CI 0.41–0.89). As with the other three outcomes in this analysis, living in the Western Cape (when compared to living in KZN) (aRR = 1.75, 95% CI 1.05–1.75) and living in an urban setting (aRR = 1.75, 95% CI 1.29–2.37) were associated with a higher risk of having reduced access to family planning services since the COVID-19 pandemic.

Discussion

This study provides some of the first insights into how the COVID-19 pandemic impacted the economic resilience and health care service access of girls and women living with HIV or at high risk of acquiring HIV and in KVPs, who were already vulnerable prior to the onset of the COVID-19 pandemic. Further, our data provide insight into the effects of COVID-19 on vulnerable and KVP populations, where data are rare, providing insight for improving the public health response in these populations.

Previous research has shown that the COVID-19 pandemic has had a negative impact on the livelihoods of many South Africans (Arndt et al., 2020; Parry & Gordon, 2021; Pillay et al., 2021). Our findings concur with previous research; however, because the women included in this sample were very vulnerable, these consequences may have

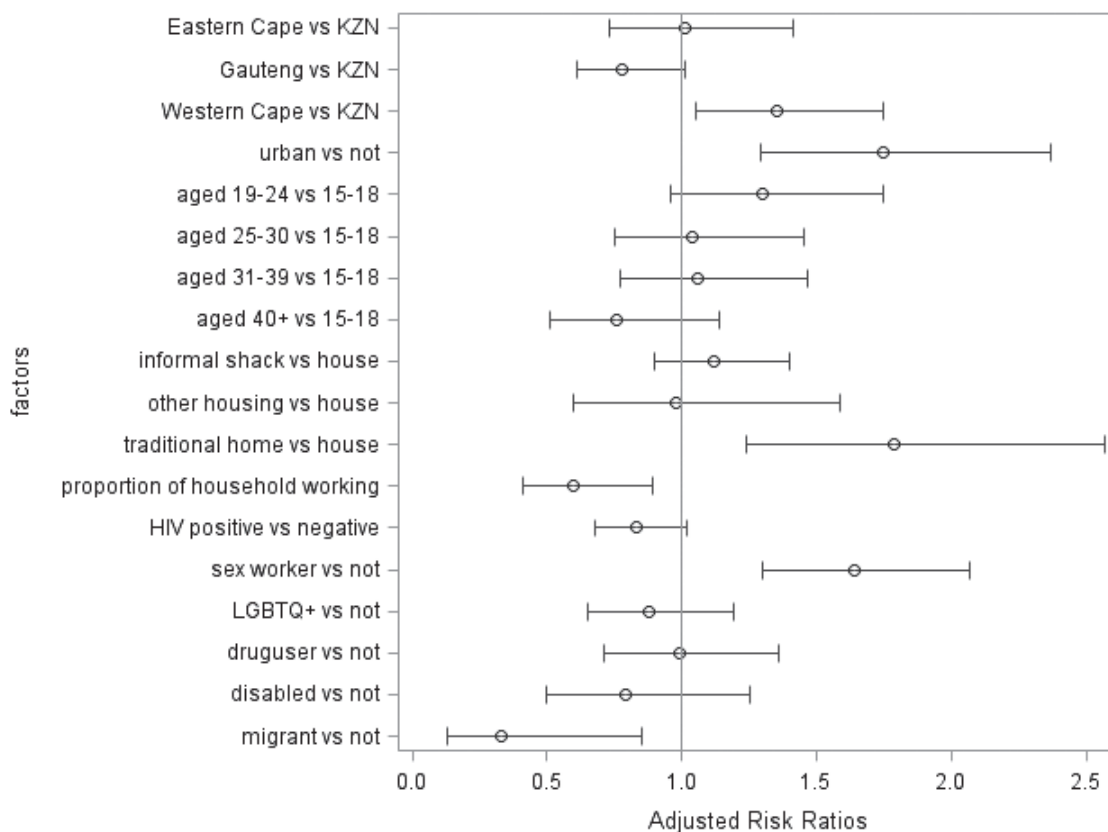


Figure 6: Relative risk of experiencing reduced access to family planning services

been particularly acute. While KVPs have an overall high social vulnerability (which have negative consequences for their health and well-being) (UNAIDS, 2021b), our findings suggest that the impact of COVID-19 may have affected KVPs differently, mediated through ecological factors such as social status, wealth and household resilience. Our findings suggest that sex workers were particularly vulnerable to the COVID-19 pandemic, more frequently suffering higher risk of economic and health service disruptions when compared to other women in the sample. A particularly striking finding of this analysis was that sex workers were at higher risk of experiencing disruptions to family planning services. This is important considering the vulnerability of this group to unintended pregnancies from non-primary partners, poorer maternal health outcomes and increased risk of stigma when accessing SRH services (Slabbert et al., 2017; Ampt et al., 2018). Lockdowns, restrictions to movement and curfews would have served to negatively impact the ability of sex workers to earn an income, and high social stigma may have reduced their ability to access social protection services aimed at alleviating the economic consequences of COVID-19 (Baxter et al., 2020; Parry & Gordon, 2021; Duby et al., 2022). However, other groups also experienced disruptions to income, food security and health services. Those groups (such as migrants and drug users) with lower social status and greater stigma appeared to be at higher risk (Parry & Gordon, 2021; Mutambara et al., 2022). Additionally, a greater proportion of women who belonged to more than one KVP group reported disruptions to income,

food security and disruptions to HIV services, highlighting the intersection of social status and vulnerability to the impacts of the COVID-19 pandemic.

Factors at different ecological levels worked to affect the risk of poorer outcomes because of the COVID-19 pandemic. At the individual level, this diversity appeared to be mediated by age, social status and the type of disruption. While we expected to see major differences between those who are at high risk of HIV and those who self-reported as HIV positive, we did not see any major distinctions between these groups. This may be because HIV can be kept confidential, that HIV treatment services were disrupted for only a short time, or because most participants were already accessing treatment and may have already had time to cope with their diagnosis (Dorward et al., 2021). Additionally, as the sample was purposefully selected to represent a broad range of already vulnerable people, HIV status may not have meaningfully served to further enhance risk in this sample.

Having children appeared to have a greater impact on food security, likely mediated through income reduction and household vulnerability. As children have greater economic and social needs, COVID-19 interventions which enhanced economic vulnerabilities may have had greater implications for those women who had to support children. Further, disruptions to school and school feeding programmes may have served to enhance food insecurity among many poorer families who rely on these schemes (Spaull & van der Berg, 2020). This is further supported by the fact that women living in informal housing were at greater risk of

food insecurity than those in formal housing, suggesting that more indigent households were more vulnerable to the negative consequences of the COVID-19 pandemic.

Age was an important factor, mediating three of the primary outcomes of this analysis. Older women were particularly vulnerable to income reductions, and these appeared long lasting because, at the time of the survey, most women reported that they had not worked in the last 30 days. Greater income reductions among older women may be because of disruptions to the informal and formal economies, and because younger people (especially those 18 years old and younger) may have greater familial support and less income-generating responsibilities than older women (Arndt et al., 2020). However, it is important to note that self-reported food insecurity was still high among the AGYW group, suggesting that while AGYW may not be responsible for ensuring food security, they will be impacted by enhanced familial vulnerability.

Older age was protective against disruptions to HIV services among HIV-positive women in this survey. A similar pattern emerged for family planning services, but did not remain significant when adjusted, and may indicate only temporal disruptions (Siedner et al., 2020). This may be because younger women faced greater disruptions to school-based sexual health programmes (because of school closures and limited-service provision by service organisations during COVID-19), and because younger women would have faced greater difficulties in accessing services which afforded greater anonymity.

Despite the importance of age, social status likely mediated resilience to the impacts of the COVID-19 pandemic. As seen with the proportions of KVPs reporting disruptions to economic and health care service outcomes, sex workers and migrants were particularly vulnerable to negative economic and service access outcomes in the multivariable analysis (Platt et al., 2020; Mutambara et al., 2022). This highlights that pre-existing vulnerabilities (lower social status and greater difficulty in accessing social support and health care services) may have served to enhance the impacts of COVID-19 regardless of age. Further, we found that sex workers who self-reported HIV positive were at higher risk of food insecurity issues, the only instance where HIV status enhanced the risk of the KVP. This highlights the need for interventions that protect the most vulnerable, but that also can create safe spaces in which disenfranchised groups can seek services without stigma or fear of negative repercussions.

COVID-19 and the interventions used to prevent transmission may have served to increase the risk beyond the individual level. Poorer households experienced greater risk of reductions in income, food security and disruptions to HIV and family planning services (Arndt et al., 2020; Siedner et al., 2020; Spaul & van der Berg, 2020; Parry & Gordon, 2021; DUBY et al., 2022; Mutambara et al., 2022). Households where a greater proportion of individuals were financially contributing were more resilient to negative outcomes and highlights the important role that household poverty plays in mediating poorer health outcomes and well-being among the most vulnerable.

Lockdowns, business closures and curfews have had serious consequences for the South African economy, and

especially for those in the informal sector. As many of the women in our sample were working in the informal sector or engaging in sex work, these interventions likely had devastating impacts on their household income, increasing their vulnerability. The vulnerability characteristics of households was further illustrated by the increased risk of women experiencing gender-based violence. Public health interventions such as lockdowns may have served to increase women's vulnerability to gender-based violence and made it even more difficult for women to report having experienced violence, or to escape the perpetrators. Coupled with lower social status, disrupted school-based and facility-based health service access, restrictions in movement and huge job losses, the COVID-19 pandemic may have disproportionately enhanced the risk of those households, and of individuals who were living in high-risk relationships, were socially isolated, relied on the informal economy and were living in poor households.

Beyond the intersection of social status and household characteristics, structural, and geospatial factors served to mediate the risk of economic and health service disruptions among our KVPs. Working with the other ecological factors, those in wealthier provinces such as the Western Cape were at greater risk of all the reported outcomes when compared to those in KwaZulu-Natal (KZN). It is possible that lockdown interventions were more strictly enforced in these settings or because disruptions that impacted income may have made it harder to cope in provinces and settings where the cost of living is higher (STATS SA, 2020). We also found that those living in urban settings, particularly in informal urban areas, were at greater risk of poorer outcomes. This may be because access to health services and formal and informal employment opportunities in urban settings could have been more difficult because of disruptions to travel, restrictions in movement and reductions in the financial means to afford transport to access health services. Further, there is reduced ability to supplement food insecurity issues with subsistence farming activities in urban settings, which would further enhance the impact of income reductions. This highlights how the intersection of factors may have served to enhance the risk of KVPs, eroding the resilience of these individuals and households to cope with the fall-out of interventions aimed at reducing SARS-CoV-2 transmission.

Due to the cross-sectional nature of the data in this analysis, a cautious interpretation of the findings is needed. Our findings highlight the need to look at these factors across time to better explain some of the findings from this analysis. HIV status and many of the other variables were self-reported and so it is possible that we may overestimate some factors due to the limitations of self-report measures. Further, the sample in this survey was purposefully selected to represent very vulnerable groups in South Africa and so comparisons to the general population should be done with caution. While our analysis provides an interesting starting point to develop a more nuanced understanding of the impact that COVID-19 has had on key and vulnerable groups, the limitations of the self-collected data mean our results require confirmation in future studies. Importantly, we were able to reach these key and vulnerable populations because of the partnership established with organisations that have long-standing relationships of trust with these

communities. The data collection instruments were co-created and validated with the partner organisations increasing the reliability of the data collected.

The findings from this cross-sectional survey provide some preliminary insights into how the COVID-19 pandemic and how the public health interventions used to prevent the transmission of SARS-CoV-2 may have served to enhance and exacerbate pre-existing vulnerability among women at high risk of HIV and those living with HIV in vulnerable populations. The ecological approach highlighted that it is not necessarily the single factors alone, but rather how multiple factors intersect, that served to exacerbate vulnerability. Traditional risk factors such as age, the experience of gender-based violence, social status, poverty, household resilience and service worked together with restrictions in movement, lockdowns and the resultant economic shock, enhancing the risk of already at-risk women in key and vulnerable groups. These intersections of risk need to be better understood and studied to design more resilient and responsive public health interventions for future pandemics.

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