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Nationwide Hepatitis C Serosurvey and Progress Towards Hepatitis C Virus Elimination in the Country of Georgia, 2021

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Abstract

Background.—The country of Georgia initiated its hepatitis C virus (HCV) elimination program in 2015, at which point a serosurvey showed the adult prevalence of HCV antibody (anti-HCV) and HCV RNA to be 7.7% and 5.4%, respectively. This analysis reports hepatitis C results of a follow-up serosurvey conducted in 2021, and progress towards elimination.

Methods.—The serosurvey used a stratified, multistage cluster design with systematic sampling to include adults and children (aged 5–17 years) providing consent (or assent with parental

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Supplementary Data

Supplementary materials are available at *The Journal of Infectious Diseases* online. Consisting of data provided by the authors to benefit the reader, the posted materials are not copy-edited and are the sole responsibility of the authors, so questions or comments should be addressed to the corresponding author.

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Potential conflicts of interest. F. A. and G. C. are employed by and own stock in Abbott Diagnostics. All other authors report no potential conflicts.

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consent). Blood samples were tested for anti-HCV and if positive, HCV RNA. Weighted proportions and 95% confidence intervals (CI) were compared with 2015 age-adjusted estimates.

Results.—Overall, 7237 adults and 1473 children were surveyed. Among adults, the prevalence of anti-HCV was 6.8% (95% CI, 5.9–7.7). The HCV RNA prevalence was 1.8% (95% CI, 1.3–2.4), representing a 67% reduction since 2015. HCV RNA prevalence decreased among those reporting risk factors of ever injecting drugs (51.1% to 17.8%), and ever receiving a blood transfusion (13.1% to 3.8%; both $P < .001$). No children tested positive for anti-HCV or HCV RNA.

Conclusions.—These results demonstrate substantial progress made in Georgia since 2015. These findings can inform strategies to meet HCV elimination targets.

Keywords

Georgia; elimination; hepatitis C; prevalence; serosurvey

Globally, in 2019 an estimated 58 million people were living with hepatitis C virus (HCV) infection and 290 000 people died from infection-related causes such as cirrhosis and hepatocellular carcinoma [1]. Due to the global burden, the World Health Organization (WHO) set a goal of eliminating hepatitis C as a public health threat by the year 2030. Georgia, a middle-income country with a population of 3.7 million, is on the forefront of this effort and launched an ambitious national HCV elimination program [2] in 2015.

Georgia provides hepatitis C screening and treatment via highly effective direct-acting antivirals to all citizens free of charge, aiming to achieve WHO elimination targets by 2030 [3]. To establish baseline prevalence, Georgia conducted its first nationally representative seroprevalence survey in 2015 [4], which estimated that 7.7% of the adult population had evidence of exposure to hepatitis C (anti-HCV) and 5.4% had chronic HCV infection (HCV RNA), corresponding to an estimated 150 000 people living with chronic HCV infection. Since then, Georgia's HCV elimination program has made great progress, and as of December 2021 has treated over 76 000 people, achieving a cure rate of 98.9% [5].

The achievements of the HCV elimination program have been critical in developing Georgia's public health capacity, which have contributed to laboratory testing capacity, data systems and management, and the ongoing response to 19 corona-virus disease 2019 (COVID-19). However, challenges remain in identifying HCV-infected individuals and linking them to care, especially among middle-aged men [6] and persons who inject drugs (PWID) [7]. Recognizing the need to monitor progress towards HCV elimination, the Government of Georgia, led by the Ministry of Internally Displaced Persons from the Occupied Territories, Health, Labor, and Social Affairs and the National Center for Disease Control and Public Health (NCDC), in partnership with the US Centers for Disease Control and Prevention (CDC), and Abbott, conducted a second nationwide serosurvey on hepatitis C, hepatitis B, and severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) in 2021.

The primary objectives of the serosurvey were to estimate exposure to and prevalence of HCV infection among children and adults, assess geographic distribution and risk factors associated with infection, and update information on knowledge and perceptions toward

viral hepatitis. This analysis reports on the hepatitis C components of the 2021 serosurvey, and progress towards elimination with comparisons to 2015 serosurvey results.

METHODS

Sample Selection

A cross-sectional, nationwide household survey was conducted in Georgia in 2021. Adults aged ≥18 years and children aged 5–17 years were recruited using a stratified, multistage cluster design with systematic sampling. A sample size of 8010 adults and 2692 children was calculated based on an estimated anti–SARS-CoV-2 prevalence of 10%, a design effect of 2, and an anticipated 70% participation rate to produce 95% confidence intervals (95% CI) with a margin of error of 1.1% as well as expected proportion of households with children of applicable age. This calculated sample size was confirmed to produce estimates of HCV infection among adults with a margin of error of 0.67% based on an estimated prevalence of 2.9%. The country was divided into 10 strata across all regions and the capital city of Tbilisi, excluding the separatist regions of Abkhazia and South Ossetia. To reach the target sample size, 267 clusters were selected across the 10 strata, and 30 households were selected per cluster. A household was defined as a group of persons who reside in the same place and prepare meals together. Households were chosen systematically using a skip pattern, and 1 adult and 1 child of eligible age (in households with ≥ 1 child) were selected per household using a Kish grid [8]. An additional 1880 households from 50 clusters in 4 undersampled strata were included for children to account for low initial enrollment. To maximize comparability between the 2015 and 2021 findings, sampling methods were kept as close as possible to those utilized for the 2015 survey and the same statisticians were consulted in the design of both.

Data collection in the field took place during June to October 2021. Individual interviews were administered face-to-face using a structured questionnaire with responses recorded electronically using tablets and uploaded to a cloud-based server (Open Data Kit software application). Participants were asked about their demographic information, medical and behavioral history, and knowledge of hepatitis C. Each participant’s questionnaire was labeled with a unique identifier (barcoded label) that was linked to their blood sample to maintain confidentiality and allow linking of laboratory results and notification to individuals. The hepatitis questionnaire was kept as similar to 2015 as possible to maximize comparability.

Inclusion/Exclusion Criteria

Randomly selected members of each household were enrolled for participation after obtaining voluntary informed consent (or parental/legal guardian consent for children aged 5–17 years, paired with assent for children ≥ 7 years of age). Persons with altered mental status precluding consent and any participants who could not give blood because of severe illness or hemophilia were excluded.

Laboratory Methods

Whole venous blood was collected from all participants, with serum separated on site and transported to the Serology Laboratory, Lugar Center for Public Health Research, NCDC for testing. All samples were tested for anti-HCV by the anti-HCV chemiluminescent microparticle immunoassay on a fully automated ARCHITECT i2000SR analyzer (Abbott Diagnostics). Positive samples were tested for HCV RNA by the Abbott RealTime HCV Assay (Abbott Molecular, Inc) on the Abbott m2000rt System (Abbott). Samples found to be anti-HCV positive and HCV RNA negative were further tested by immunoassay (INNO-LIA HCV Score, in vitro diagnostics, Innogenetics) to confirm the anti-HCV result. Test results were provided to participants within a maximum 6 months after sample collection, and infected individuals were counseled and referred to a local provider for linkage to care.

Statistical Analysis

All analysis was performed in SAS version 9.4. Data were weighted at cluster, household, and individual levels, and adjusted by sex, age, and geographic distribution using 2014 census data to produce nationally representative estimates. Sample weights were computed by taking the inverse probability of selection and then multiplied by the poststratification adjustment by age, sex, and region. Weighted proportions and 95% CIs were calculated and compared with 2015 survey results using χ^2 test with an α of .05. Variance was calculated using Taylor series linearization. For prevalence comparisons by age groups, 2015 data (collected May to August 2015) were age-adjusted by adding 6 years to participants' ages. Multivariable analysis was performed using weighted estimates to determine independent risk factors for anti-HCV and HCV RNA positivity, with variables associated in bivariate analysis included in the final model to produce adjusted odds ratios (aOR) after assessing for multicollinearity. For model stability, responses of "I don't remember/know" were treated as a separate category if they were >10% of all responses.

This study was approved by the ethical committee of Georgia's NCDC and was determined by US CDC's Human Subjects Research Office to be public health surveillance and therefore judged to not involve human subjects research.

RESULTS

Study Population

In total, 8710 individuals participated in the survey, including 7237 adults (90.3% participation rate) and 1473 children (72.2% participation rate). After weighting the results according to the age, sex, and regional distributions in the 2014 Georgian census, among adults, the median age was 46 years (interquartile range [IQR], 32–61 years), 53.3% (95% CI, 51.3%–55.2%) were female, and 31.8% (95% CI, 30.6%–33.0%) lived in Tbilisi (Table 1). Overall, 90.7% (95% CI, 87.7%–93.1%) of adults were of Georgian ethnicity, a plurality (42.2%; 95% CI, 39.8%–44.6%) completed university or higher education, and 18.9% (95% CI, 17.4%–20.6%) were unemployed. Among children, the median age was 10 years (IQR, 7–13 years), 52.3% (95% CI, 48.8%–55.8%) were male, and 33.0% (95% CI, 30.5%–35.6%) lived in Tbilisi.

Prevalence of Hepatitis C

The overall adult prevalence of anti-HCV in 2021 was 6.8% (95% CI, 5.9%–7.7%). Anti-HCV positivity differed by age, with the highest prevalence among those aged 40–49 years (11.5%; 95% CI, 8.8%–14.8%) and 50–59 years (10.7%; 95% CI, 8.5%–13.3%) and lowest among those aged 18–29 years (1.7%; 95% CI, .7%–3.8%) ($P < .001$) (Table 2). Anti-HCV prevalence was higher among men (11.1%; 95% CI, 9.4%–13.1%) than women (3.0%; 95% CI, 2.4%–3.7%) ($P < .001$) and varied by region with a high of 8.9% (95% CI, 6.2%–12.7%) in Guria (Western Georgia) and a low of 2.9% (95% CI, 1.7%–4.9%) in Mtskheta-Mtianeti (Eastern Georgia) ($P = .02$). Unemployed persons had a higher prevalence (13.4%; 95% CI, 10.8%–16.3%) than those who were employed, retired, a student, or homemaker (5.3%; 95% CI, 4.5%–6.2%).

Among adults, the overall HCV RNA prevalence in 2021 was 1.8% (95% CI, 1.3%–2.4%), which differed among men (3.1%; 95% CI, 2.1%–4.4%) and women (0.6%; 95% CI, .4%–1.0%) ($P < .001$). Among all infected persons, injection drug use (IDU) was reported by 29.9% (95% CI, 17.5%–46.2%), an additional 8.5% (95% CI, 3.9%–17.7%) received a blood transfusion, and 13.4% (95% CI, 6.2%–26.5%) had neither exposure but reported > 5 sex partners. The remaining 48.2% (95% CI, 33.3%–63.4%) reported none of these risk factors for HCV infection.

In bivariate analysis, HCV RNA positivity was associated with unemployment ($P = .005$), history of IDU ($P < .001$), past incarceration ($P < .001$), receipt of a blood transfusion ($P = .03$) or permanent tattoo ($P < .001$), number of lifetime sex partners ($P < .001$), and provider of last therapeutic injection ($P < .001$). After adjusting for all covariates associated with HCV RNA in bivariate analysis, ever injecting drugs (aOR, 3.09; 95% CI, 1.11–8.56), receipt of a blood transfusion (aOR, 3.10; 95% CI, 1.29–7.48), and having > 5 versus 1–5 lifetime sex partners (aOR, 3.14; 95% CI, 1.05–9.46) remained significantly associated with HCV infection (Table 3). Anti-HCV positivity was associated in a multivariable model with being unemployed (aOR, 1.7; 95% CI, 1.2–2.5), ever injecting drugs (aOR, 26.8; 95% CI, 12.5–57.4), receipt of a blood transfusion (aOR, 4.5; 95% CI, 2.9–7.1), and having 0 versus 1–5 lifetime sex partners (aOR, 0.3; 95% CI, .1–.9).

No children in the sample (n = 1473) tested positive for anti-HCV or HCV RNA.

Progress Towards Elimination

The prevalence of anti-HCV was not significantly different from 2015 (7.7%; 95% CI, 6.6%–8.8%; $P = .20$). However, HCV RNA prevalence decreased substantially (from 5.4% [95% CI, 4.5%–6.3%] to 1.8% [95% CI, 1.3%–2.4%]; $P < .001$). This represents a 67% (95% CI, 46.7%–79.4%) reduction in persons with chronic HCV infection, after the HCV elimination program had treated 51% (n = 76 644) of the 2015 estimate of 150 000 (95% CI, 128 000–173 000) infected. These findings were also observed at the regional level, with no significant changes in anti-HCV prevalence, but HCV RNA prevalence reductions from 47% to 85% (Supplementary Table 1). Prevalence of chronic HCV infection decreased significantly among adults aged 40–49 years (from 9.8% [95% CI, 7.4%–12.9%] in 2015 to 2.7% [95% CI, 1.6%–4.7%] in 2021; $P < .001$), 50–59 years (from 8.7% [95% CI,

6.5%–11.7%] to 1.6% [95% CI, .9%–3.0%]; $P < .001$), and ≥60 years (from 3.8% [95% CI, 2.9%–5.2%] to 2.0% [95% CI, 1.1%–3.4%]; $P = .02$) (Figure 1). Substantial decreases were observed for both men (from 9.0% [95% CI, 7.5%–10.9%] to 3.1% [95% CI, 2.1%–4.4%]) and women (from 2.2% [95% CI, 1.6%–3.0%] to 0.6% [95% CI, .4%–1.0%]) (both $P < .001$).

Independent risk factors for exposure to hepatitis C in 2015 included history of IDU and receipt of a blood transfusion. Both risk factors were reported less frequently in 2021: the proportion reporting ever injecting drugs decreased from 4.2% (95% CI, 3.4%–5.1%) in 2015% to 3.0% (95% CI, 2.3%–3.9%) in 2021 ($P = .03$), and blood transfusions decreased from 7.0% (95% CI, 6.1%–7.8%) to 4.7% (95% CI, 3.9%–5.5%) ($P < .001$). Among those reporting these risk factors, the proportion with chronic HCV infection also decreased substantially, from 51.1% (95% CI, 41.8%–60.3%) to 17.8% (95% CI, 10.5%–28.6%) among persons who ever injected drugs and 13.1% (95% CI, 8.9%–18.9%) to 3.8% (95% CI, 2.0%–7.4%) among those who received a blood transfusion (Figure 2). Although not independent risk factors in multivariable analysis, a significant prevalence decrease was observed in bivariate analysis for those with other established risk factors of past incarceration (32.2% [95% CI, 23.8%–42.0%] to 14.6% [95% CI, 7.9%–25.2%]; $P = .01$) and surgery (5.3% [95% CI, 4.2%–6.6%] to 2.2% [95% CI, 1.5%–3.1%]; $P < .001$).

Hepatitis C Knowledge

Overall, 66.1% (95% CI, 63.9%–68.2%) reported ever having heard of the hepatitis C virus in 2021, a decline from 73.0% (95% CI, 71.1%–74.9%) in 2015 ($P < .001$). Among those who had heard of the virus, a higher proportion in 2021 knew it could be cured with medications (77.2% [95% CI, 75.1%–79.2%] vs 70.5% [95% CI, 68.5%–72.6%]; $P < .001$) and could be transmitted through blood (91.6% [95% CI, 90.2%–92.9%) vs 77.0% [95% CI, 74.8%–79.1%]; $P < .001$). However, a lower proportion in 2021 correctly identified sharing needles or syringes as a transmission route for HCV infection (54.3% [95% CI, 50.5%–58.0%] vs 71.7% [95% CI, 69.5%–74.0%]; $P < .001$). Among those who tested HCV RNA positive, 33.1% (95% CI, 21.8%–46.8%) reported having previously been told by a health care provider of their HCV infection.

DISCUSSION

This analysis is among the first to present results of a follow-up serosurvey after implementation of a national HCV elimination program. Overall, the prevalence of anti-HCV and HCV RNA in Georgia in 2021 was 6.8% and 1.8%, respectively, representing a 67% decline in chronic infections among adults. Given the country's adult population of 2.7 million [9], this corresponds to 48 600 (95% CI, 35 100–64 800) persons remaining with chronic HCV infection. Proportions reporting IDU and blood transfusions, both significant risk factors for exposure in 2015, were significantly lower in 2021, and HCV RNA prevalence among those groups also decreased substantially. However, this analysis still found IDU and receipt of a blood transfusion to be risk factors for HCV infection.

The significant decline in HCV RNA positivity 6 years into a national HCV elimination program is commendable. As of December 2021, Georgia had treated 51% of the 2015

estimate of 150 000 persons chronically infected with HCV in the country [5]. Nevertheless, prevalence dropped 67% by 2021, the reasons for which are likely multifactorial. Uncertainty around point estimates in both 2015 and 2021 must be considered; there is a possibility of overestimation in baseline prevalence and/or underestimation in the current survey. However, anti-HCV prevalence, which is unaffected by treatment, did not change significantly which suggests those estimates are reliable. Mortality, including from COVID-19, and migration within the population could also influence prevalence estimates. Georgia's population is likely also experiencing the effects of treatment as a means of prevention, whereby the smaller pool of infected persons reduces transmission in the greater population. The benefits of hepatitis C treatment as prevention have previously been demonstrated in prison settings [10] and hypothesized for PWID [11]. This likely contributed to the substantial decrease in HCV infection among those who ever injected drugs, from 51% in 2015 to 18% in 2021. In 2018, Georgia implemented a decentralized approach to hepatitis C care and treatment in 4 sites that offer syringe services [12], which increased access for PWID and served as a model for further expansion to enhance the preventative effects of treatment in this vulnerable population. Georgia has also been providing free screening and treatment for hepatitis C in prisons since 2013 [13]. Although past incarceration was not an independent risk factor for infection in multivariable analysis, HCV RNA prevalence among those with a history of incarceration was 15% in 2021. Additional studies among those currently incarcerated could confirm whether a similar reduction in prevalence has been achieved in prison settings.

Receipt of a blood transfusion was a risk factor for exposure to hepatitis C in 2015 and was associated with active infection in the 2021 multivariable model. The proportion of people reporting a past blood transfusion reduced from 7% to 5%, and among them the prevalence of HCV infection decreased from 13% to under 4%, although still capturing historic transfusion. Although screening for hepatitis C has been mandatory for all blood donations in Georgia since 1997, increasing blood safety has been a focus of the HCV elimination program through encouraging voluntary versus paid donations [14], and implementing nucleic acid amplification testing for HCV, hepatitis B, and human immunodeficiency virus (HIV) for all donations since January 2020 [5]. A separate analysis has also shown a significant decrease in anti-HCV positivity in blood donors since the beginning of the elimination program [14]. Additionally, the fact that no children in the survey tested positive for exposure to hepatitis C is suggestive that improved infection control practices and blood safety are limiting exposure in these younger age groups, in addition to their shorter cumulative exposure to other risk factors. Although mother-to-child transmission is not a primary mode of HCV transmission in Georgia, screening during antenatal care has also been implemented through the program. Since November 2015, HCV screening during the first trimester has been mandatory for pregnant women [15], and reflex confirmatory HCV core antigen testing was implemented by antenatal clinics in 2018 [12]. Continued commitment to blood safety and infection control and prevention is essential to mitigate the risks of iatrogenic HCV infections.

The findings of this analysis show the impact of a widescale, national campaign to eliminate hepatitis C, and are a testament to the efforts made by the Georgian program. Despite substantial progress thus far, approximately 50 000 people still need treatment, and many

may be unaware of their infection and therefore more difficult to reach. Treatment numbers have declined since peaking in 2016, prompting Georgia to make all diagnostics free of charge and simplify treatment guidelines [12]. However, the program has since suffered setbacks from the COVID-19 pandemic, which further reduced screening and treatment initiation [16]. To meet elimination goals, both testing and treatment numbers will need to rebound. Two-thirds of HCV RNA-positive persons did not know their infection status, meaning more needs to be done to link these persons to screening and viremia testing. Increased awareness of the HCV elimination program could also help bolster enrollment in the treatment program. A smaller percentage had heard of the hepatitis C virus in 2021 than in 2015, likely due to promotional media efforts being more prominent during the launch of the program. However, among those who had heard of the virus, a greater percentage knew it could be cured with medication. Interventions to target those remaining with HCV infection are needed to link them to testing and treatment to ensure Georgia meets its HCV elimination goals.

Nearly half of HCV RNA-positive persons in this analysis had no identified risk factor for infection, similar to the 2015 survey findings [4]. As previously described, Georgia has made significant headway in reducing the burden of HCV infection among PWID and prison populations and has implemented effective blood safety measures, but ensuring all possible transmission routes are accounted for is essential. Number of lifetime sex partners was also associated with HCV RNA positivity. Future studies could be considered to elucidate the role of sex behaviors in HCV infections, and to better understand the underlying implications. Very few participants (2 of 2409 men) identified themselves as men who have sex with men (MSM), which is likely underestimated. Given that recent pooled estimates showed that prevalence of HCV infection was higher among MSM than the general population [17], this may be a hidden risk for HCV transmission in Georgia. Previous studies have shown a concerning increase in HIV prevalence among MSM in Georgia since 2010 [18], and HCV infection has been shown to be disproportionately higher among MSM living with HIV [19]. Fortunately, a 2018 biobehavioral surveillance study showed a 63% reduction in hepatitis C infections among MSM in Tbilisi between 2015 and 2018, similar to our findings in the general population [20]. Finally, elucidating risk factors related to substandard infection control practices is difficult, given a wide range of service quality and changes over time. Understanding the etiology of these infections with an unknown or ambiguous transmission route could help guide future prevention efforts.

This study was subject to limitations. The cross-sectional design of the study prohibits inference of causal associations; HCV infection could have been acquired at any time prior to the survey and could have preceded the risk behaviors evaluated. Risk factor data were self-reported during face-to-face interviews, and therefore could be subject to recall and/or social desirability biases leading to an underrepresentation of exposures such as IDU and sexual behavior. As in 2015, the current household survey did not include currently incarcerated persons, which could lead to an underestimation of hepatitis C prevalence. The relatively low number of HCV-infected persons likely affected risk factor analysis and regional prevalence estimates. Although every effort was made to adhere to methodology of the 2015 serosurvey, slight differences in sampling strategies may have resulted in findings that are not directly comparable.

This survey demonstrated the substantial progress made since Georgia launched its HCV elimination program in 2015, resulting in decline of HCV RNA prevalence among adults to 1.8%, corresponding to approximately 48 600 people with chronic HCV infection. Findings from this survey can guide future strategies to meet elimination targets and should be encouraging for other jurisdictions and countries seeking to achieve hepatitis C elimination.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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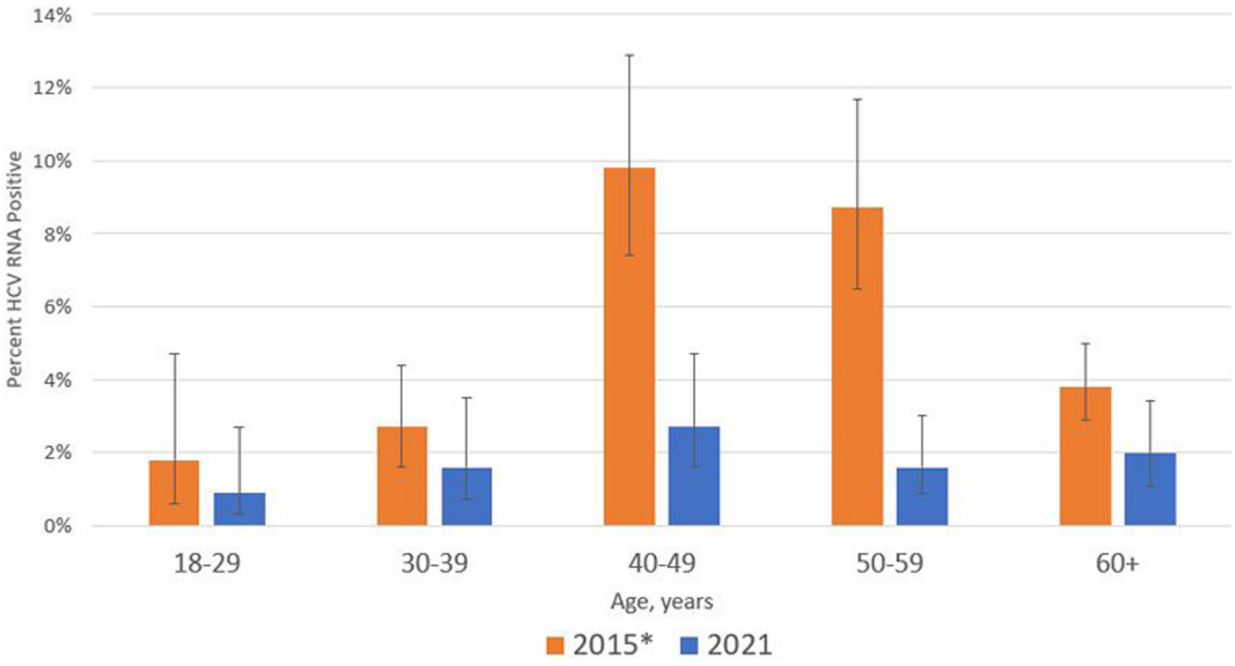

Figure 1.

Prevalence of hepatitis C virus (HCV) RNA positivity with 95% confidence intervals by age group among adults in nationwide hepatitis C serosurveys—Georgia, 2015 and 2021. The 2015 data were age-adjusted by adding 6 years to participants' ages.

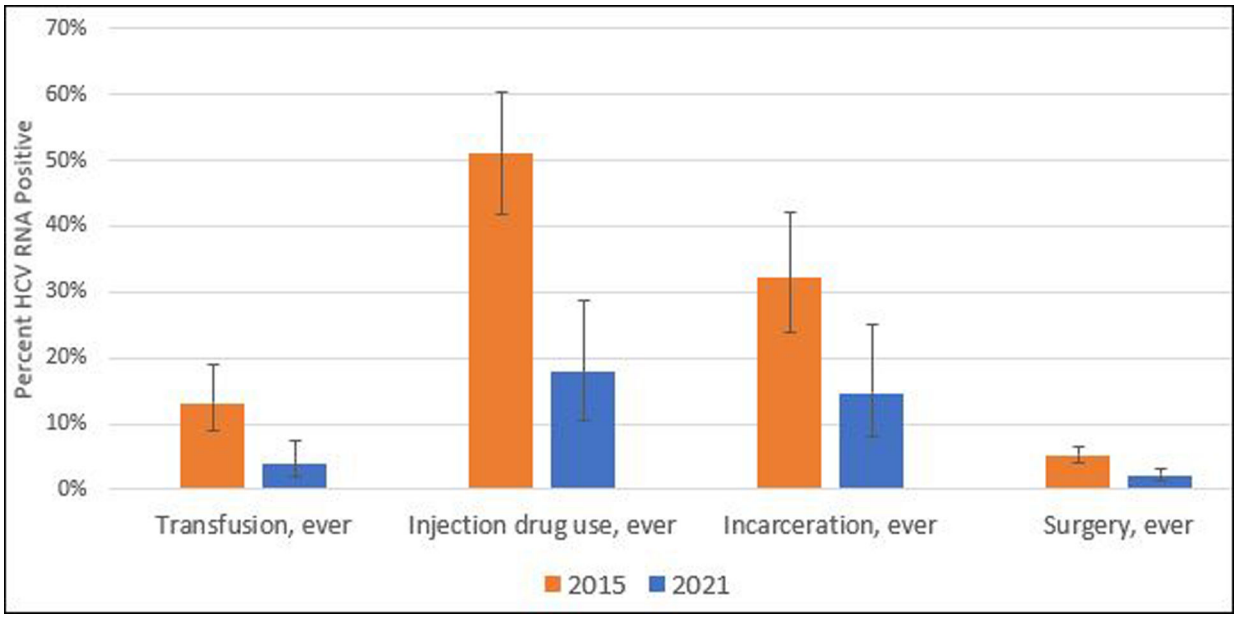

Figure 2.

Prevalence of hepatitis C virus (HCV) RNA positivity with 95% confidence intervals by risk factors among adults in nationwide hepatitis C serosurveys—Georgia, 2015 and 2021.

Table 1.

Demographic characteristics of all adults and children enrolled in nationwide hepatitis C serosurve — Georgia, 2021

Variables	Adults, overall		Children, overall	
	Participants, No.	Weighted % (95% CI)	Participants, No.	Weighted % (95% CI)
Age				
5–9	––	––	493	42.3 (38.8–45.9)
10–14	––	––	660	38.2 (35.1–41.5)
15–17	––	––	320	19.4 (16.9–22.3)
18–29	762	19.2 (17.7–20.8)	––	––
30–39	1,249	19.0 (17.6–20.5)	––	––
40–49	1,233	16.8 (15.6–18.1)	––	––
50–59	1,517	16.9 (15.8–18.0)	––	––
≥60	2,476	28.1 (26.6–29.7)	––	––
Sex				
Male	2,409	46.7 (44.8–48.7)	773	47.7 (44.2–51.2)
Female	4,828	53.3 (51.3–55.2)	700	52.3 (48.8–55.8)
Region [a]				
Tbilisi	1,282	31.8 (30.6–33.0)	400	33.0 (30.5–35.6)
Eastern Georgia	3,121	33.1 (31.9–34.4)	604	34.6 (31.7–37.6)
Western Georgia	2,834	35.0 (33.9–36.2)	469	32.4 (29.9–35.1)
Ethnicity				
Georgian	6,407	90.7 (87.7–93.1)	1359	93.4 (90.7–95.3)
Armenian	353	2.9 (2.0–4.2)	32	1.9 (1.1–3.4)
Azerbaijani	280	4.7 (2.7–8.1)	48	4.0 (2.4–6.6)
Other	133	1.6 (1.2–2.3)	13	0.7 (0.4–1.2)
Missing	64			
Highest level of education completed				
≤ Elementary/primary school	645	7.9 (6.7–9.4)	––	––
Secondary school	2,355	32.2 (30.3–34.3)	––	––
Professional/technical school	1,465	17.6 (16.3–19.0)	––	––
≥ University/college	2,704	42.2 (39.8–44.6)	––	––
Missing	68			
Employment Status				
Employed, student, homemaker, retired	5,904	81.1 (79.4–82.6)	––	––
Unemployed	1,263	18.9 (17.4–20.6)	––	––
Missing	70			

[a] Eastern Georgia = Kakheti, Mtskheta-Mtaineti, Samtkhe-Javakheti, Kvemo Katrtli, Shida Kartli

Western Georgia = Adjara, Guria, Imereti, Racha-Lechkhumi and Kvemo Svaneti, Samegrelo-Zemo SvanetiAbbreviations: CI = confidence interval

Table 2.

Hepatitis C prevalence by demographics and risk behaviors from all adults enrolled in nationwide hepatitis C serosurvey in Georgia — 2021

Variables	Total No.	Anti-HCV Positive			HCV RNA Positive		
		No.	Weighted Row % (95% CI)	Chi-square P-value	No.	Weighted Row % (95% CI)	Chi-square P-value
Overall							
All adults	7,237	418	6.8 (5.9–7.7)	--	87	1.8 (1.3–2.4)	--
Age							
18–29	762	8	1.7 (0.7–3.8)		4	0.9 (0.3–2.7)	
30–39	1,249	44	5.7 (3.9–8.4)		15	1.6 (0.7–3.5)	
40–49	1,233	104	11.5 (8.8–14.8)	<0.001	20	2.7 (1.6–4.7)	0.34
50–59	1,517	133	10.7 (8.5–13.3)		18	1.6 (0.9–3.0)	
≥60	2,476	129	5.8 (4.6–7.4)		30	2.0 (1.1–3.4)	
Sex							
Male	2,409	273	11.1 (9.4–13.1)	<0.001	64	3.1 (2.1–4.4)	<0.001
Female	4,828	145	3.0 (2.4–3.7)		23	0.6 (0.4–1.0)	
Region [a]							
Tbilisi	1,282	88	8.0 (6.3–10.2)		17	1.8 (1.0–3.2)	
Eastern Georgia	3,121	29	4.6 (3.7–5.6)	0.002	26	1.1 (0.7–1.8)	0.14
Western Georgia	2,834	55	7.7 (6.2–9.6)		6	2.4 (1.5–3.8)	
Ethnicity							
Georgian	6,407	389	7.0 (6.1–8.1)		81	1.9 (1.4–2.6)	
Armenian	353	7	3.7 (1.6–8.3)		1	0.5 (0.1–2.6)	
Azerbaijani	280	9	3.3 (1.7–6.4)	0.05	3	0.5 (0.2–1.3)	0.06
Other	133	10	9.7 (4.7–18.9)		2	1.6 (0.3–6.7)	
Missing	64						
Highest level of education completed							
≤ Elementary/primary	645	36	5.8 (3.7–9.0)		7	1.5 (0.6–3.7)	
Secondary school	2,355	127	5.8 (4.7–7.2)		34	1.6 (1.0–2.3)	
Professional/technical	1,465	100	8.4 (6.5–10.9)	0.15	20	2.0 (1.2–3.5)	0.84
≥ University/college	2,704	152	7.1 (5.7–8.7)		26	1.9 (1.1–3.1)	
Missing	68						
Employment Status							
Employed, student, homemaker, retired	5,904	266	5.3 (4.5–6.2)		52	1.5 (1.0–2.2)	
Unemployed	1,263	148	13.4 (10.8–16.3)	<0.001	35	3.0 (2.0–4.5)	0.005
Missing	70						
Health care occupation, ever							
Yes	455	19	4.1 (2.3–7.3)		3	1.1 (0.2–4.6)	
No	6,720	396	7.0 (6.1–8.0)	0.08	84	1.8 (1.3–2.5)	0.48
Missing	62						

Variables	Total No.	Anti-HCV Positive			HCV RNA Positive		
		No.	Weighted Row % (95% CI)	Chi-square P-value	No.	Weighted Row % (95% CI)	Chi-square P-value
Injection drug use, ever							
Yes	120	90	70.6 (57.3–81.1)		21	17.8 (10.5–28.6)	
No	6,987	310	4.6 (4.0–5.4)	<0.001	62	1.2 (0.9–1.8)	<0.001
Missing	130						
Incarceration, ever							
Yes	169	67	39.6 (29.1–51.1)		21	14.6 (7.9–25.2)	
No	6,993	346	5.4 (4.7–6.2)	<0.001	66	1.3 (0.9–1.8)	<0.001
Missing	75						
Invasive dental procedure, ever							
Yes	6,713	387	6.7 (5.9–7.7)		83	1.8 (1.3–2.4)	
No	462	28	7.6 (4.7–12.1)	0.23	4	1.5 (0.4–5.3)	0.8
Missing	62						
Blood transfusion, ever							
Yes	9	58	18.6 (13.5–25.2)		13	3.8 (2.0–7.4)	
No	7,129	350	6.1 (5.3–7.1)	<0.001	72	1.6 (1.2–2.3)	0.03
Missing	114						
Surgery, ever							
Yes	347	266	7.9 (6.8–9.2)		55	2.2 (1.5–3.1)	
No	6,776	149	5.5 (4.4–6.9)	0.006	32	1.3 (0.8–2.1)	0.09
Missing	77						
Who administered last injection							
Healthcare worker	4,802	293	7.2 (6.1. 8.4)		55	1.6 (1.1–2.4)	
Non-healthcare worker	694	32	5.7 (3.7–8.4)		7	1.6 (0.7–3.5)	
Self	204	21	18.0 (9.8–30.8)	0.0003	8	10.0 (3.6–25.6)	<0.001
Don’t know/remember	1,218	59	4.9 (3.4–7.0)		14	1.2 (0.6–2.3)	
Missing	62						
Receipt of permanent tattoo							
Yes	561	83	15.6 (12.1–19.8)		21	4.2 (2.5–6.9)	
No	6,607	332	5.8 (5.0–6.7)	<0.001	66	1.5 (1.0–2.1)	0.0005
Missing	69						
Sex with a commercial sex worker							
Yes	302	38	12.3 (8.2–18.1)		8	3.2 (1.3–7.5)	
No	6,626	352	6.1 (5.3–7.1)	0.002	72	1.6 (1.1–2.2)	0.15
Missing	309						
Sex partners, lifetime							
0	477	9	0.8 (0.3–1.9)		2	0.2 (0.0–0.8)	
1–5	4,824	168	3.8 (3.2–4.5)	<0.001	27	0.7 (0.5–1.1)	<0.001
>5	417	238	13.1 (9.5–17.8)		58	4.2 (2.3–7.5)	
Don’t know/remember	938	108	11.1 (8.6–14.3)		23	2.6 (1.4–4.6)	

Variables	Total No.	Anti-HCV Positive			HCV RNA Positive		
		No.	Weighted Row % (95% CI)	Chi-square P-value	No.	Weighted Row % (95% CI)	Chi-square P-value
Missing	581						
MSM, ever							
Yes	2	1	60.7 (8.7–96.2)		0	--	
No	2,262	257	11.0 (9.2–13.1)	0.03	61	3.2 (2.2–4.6)	--
Missing	145						

[a]Eastern Georgia = Kakheti, Mtskheta-Mtaineti, Samtkhe-Javakheti, Kvemo Katrtli, Shida Kartli

Western Georgia = Adjara, Guria, Imereti, Racha-Lechkhumi and Kvemo Svaneti, Samegrelo-Zemo SvanetiAbbreviations: HCV = hepatitis C virus; MSM = men who have sex with men

Table 3.

Association of selected risk factors with hepatitis C virus infection reported by adults enrolled in nationwide hepatitis C serosurvey — Georgia, 2021

Variables	HCV RNA Positive Weighted Row % (95% CI)	Unadjusted Odds Ratio (95% CI)	Adjusted[a] Odds Ratio (95% CI)
Injection drug use, ever			
Yes	17.8 (10.5–28.6)	17.28 (8.36–35.72)	3.09 (1.11–8.56)
No	1.2 (0.9–1.8)	1	1
Incarceration, ever			
Yes	14.6 (7.9–25.2)	13.46 (6.17–29.38)	1.95 (0.82–4.65)
No	1.3 (0.9–1.8)	1	1
Blood transfusion, ever			
Yes	3.8 (2.0–7.4)	2.39 (1.09–5.28)	3.10 (1.29–7.48)
No	1.6 (1.2–2.3)	1	1
Who administered last injection			
Healthcare worker	1.6 (1.1–2.4)	1	1
Non-healthcare worker	1.6 (0.7–3.5)	1.00 (0.41–2.42)	1.24 (0.47–3.26)
Myself	10.0 (3.6–25.6)	6.78 (2.12–21.74)	3.78 (0.97–14.71)
Don’t remember/know	1.2 (0.6–2.3)	0.75 (0.36–1.54)	0.85 (0.35–2.08)
Receipt of permanent tattoo			
Yes	4.2 (2.5–6.9)	2.92 (1.54–5.53)	1.47 (0.56–3.85)
No	1.5 (1.0–2.1)	1	1
Sex partners, lifetime			
’0	0.2 (0.0–0.8)	0.27 (0.06–1.15)	0.14 (0.02–0.99)
1–5	0.7 (0.5–1.1)	1	1
>5	4.2 (2.3–7.5)	6.16 (2.84–13.38)	3.14 (1.05–9.46)
Don’t remember/know	2.6 (1.4–4.6)	3.72 (1.79–7.75)	2.46 (0.95–6.38)

[a]Weighted estimates adjusted for sex, employment status, and all variables shown here

Abbreviations: HCV = hepatitis C virus; CI = confidence interval