Article

Decreasing Trends in HIV Testing among Adults in Georgia: Analysis of the 2010-2014 BRFSS Data

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Abstract: Georgia is ranked fifth highest among states for rates of HIV diagnosis. About 4% of persons living with HIV infection in the United States reside in Georgia, and almost 19% of these people do not know their HIV status. The present study examined the trends and associated factors of HIV testing among adults in Georgia between 2010 and 2014 by analyzing data of the Behavioral Risk Factor Surveillance System (BRFSS). A total of 30,791 persons aged ≥18 years were identified who responded to the question "Have you ever been tested for HIV?" Overall, there were 11,543 respondents who had been tested for HIV, with a decrease in percentage from 49.4% in 2010 to 43.7% in 2014 (p<0.001). Factors associated with HIV testing were being black (p<0.001), being younger than 55 years (p<0.001), single (p=0.02), attaining education level above high school (P<0.001), engaging in HIV high-risk behaviors (p<0.001), and not having healthcare coverage (p=0.03). Overall in Georgia, there has been a decline in the temporal trend of HIV testing, and more than half of adults have never been tested for HIV. For reducing HIV transmission in Georgia, enhancing access and utilization of HIV testing should be a public health priority.

Keywords: HIV/AIDS; testing; trends; Behavioral Risk Factor Surveillance System; socio-demographic; Georgia

1. Introduction

HIV testing contributes to the prevention and control of HIV/AIDS. Following HIV diagnosis, risk behaviors tend to decrease [1-3]; people diagnosed with HIV can make decisions that potentially lower HIV transmission risk by avoiding risk behaviors such as unprotected sex and needle sharing [4]. Also, people who test negative for HIV can make decisions to protect themselves from HIV by engaging in safer sex behaviors and in some cases, taking pre-exposure prophylaxis [4]. Enabling individuals to become diagnosed early is a public health priority [5], as late diagnosis of HIV infection can lead to increased morbidity, mortality, and healthcare costs [5].

According to the Centers for Disease Control and Prevention (CDC), an estimated 1.2 million people in the United States (U.S.) are living with HIV, and 13% (156,300) of these do not know they are infected [6]. Each year, nearly 45,000 people are diagnosed with HIV, with 30% of new HIV infections being transmitted by people who are living with undiagnosed HIV [4]. Geographically, the burden of HIV is not evenly distributed. In 2014, the rates (per 100,000 people) of persons diagnosed with HIV infection were the highest in the South (18.5), followed by the Northeast (14.2), the West (11.2), and the Midwest (8.2) [6].

Georgia (GA) with a population of 10,214,860 is the second most populous state in the southeast of the U.S [7]. The population is made up of 54% whites, 32% blacks/African Americans, 9.0% Hispanics/Latinos, and 5.0% other races/ethnicities [7]. With a rate of 27 per 100,000, GA is ranked fifth highest among states in regard to rates of HIV diagnosis. According to the CDC, 1 in 51 Georgians will be diagnosed with HIV in their lifetime (compared to 1 in 670 residents of North

Dakota) [8]. Despite comprising only 3.1% of the U.S. population in 2014, 6.4% (2,640) of new HIV diagnoses and 4.4% (53,230) of persons living with HIV infection in the U.S. were recorded in GA [9]. About 19% of those living with HIV are unaware of their HIV status, and almost 23% of persons in the state of GA were diagnosed with AIDS within 3 months, as a result of late testing for HIV [9, 10]. This means that they harbored the virus for a long period of time without receiving appropriate treatment that would have prevented further deterioration of their immune system.

In 2006, the CDC recommended that, as part of routine health care, everyone between the ages of 13 and 64 be tested for HIV at least once, with yearly HIV testing for high-risk individuals, in line with the National HIV/AIDS Strategy goal of increasing by 2015, the percentage (to 90%) of persons living with HIV who know their serostatus [11, 12]. The purpose of the present investigation was to evaluate the progress in HIV testing in GA by examining the temporal trends and factors associated with testing for HIV among adults residing in GA between 2010 and 2014.

2. Materials and Methods

2.1. Data source and study participants

The Behavioral Risk Factor Surveillance System (BRFSS) is a system of health-related telephone surveys in the U.S. that collect data on residents in all 50 states, the District of Columbia, and three U.S. territories, regarding their health-related risk behaviors, chronic health conditions, and use of preventive services [13]. Since it was established in 1984, GA has been part of the system [14]. BRFSS completes more than 400,000 adult interviews each year, making it the largest continuously conducted health survey system in the world; it is a useful tool for addressing and developing health promotion activities [13]. Secondary analyses of the BRFSS 2010-2014 data were performed to identify, during this time period, persons in the state of GA aged ≥18 years who reported having ever been tested for HIV.

2.2. Measures

Respondents were categorized under socio-demographic variables of gender (male or female); age in years (18-24, 25-34, 35-44, 45-54, 55-64, or 65+); race (non-Hispanic (NH) white, NH black, Hispanic, NH other, or NH multiracial); education (<high school, high school/GED, some post high school, or college graduate); annual income in USD (<15,000, 15,000 - <25,000, 25,000 - <35,000, 35,000 - <50,000, or 50,000+); marital status (married, divorced, widowed, separated, never married, or a member of an unmarried couple); healthcare coverage (yes/no); and HIV high-risk situations (yes/no). HIV high-risk situations included engaging in any of the following behaviors for the past year: use of intravenous drugs, treatment for sexually transmitted disease, giving or receiving money or drugs for sex, or having anal sex without a condom. The type of health coverage was assessed for the year 2014, for which data were available. The outcome variable was participants' response to the question "Have you ever been tested for HIV?" (Yes/no).

2.3. Statistical analyses

Descriptive statistics of socio-demographic variables and HIV high-risk situations related to HIV testing were generated for each year, using frequencies and proportions. Weighted percentages of respondents who had ever been tested for HIV were calculated for each variable category for each year. Joinpoint Trend Analysis software [15] was used to calculate the annual percent change (APC) over time. Logistic regression analyses were conducted to examine the association of socio-demographic variables, HIV high-risk situations and HIV testing. The model included data for the 3 years (2010-2012) in which HIV high-risk situations were recorded, and data were adjusted for gender, age, race, education, income, marital status, healthcare coverage, and HIV high-risk situations. Some of the variables were re-categorized to fit in the model. Odds ratios and related 95% confidence intervals were derived from regression analysis. The significance level was set at $p<0.05$, and all tests were two-sided. Unweighted counts, weighted percentages, and logistic regression analyses were performed using the IBM SPSS Complex Samples version 24 [16].

2.4. Ethical considerations

BRFSS datasets are publicly accessible and do not contain personally identifiable

information. CDC ensures that the process of data collection and release are governed by appropriate rules, regulations, and legislative authorizations [17].

3. Results

3.1. **Socio-demographic characteristics and HIV risk situations of respondents**

In the BRFSS database, 30,791 adults in GA responded to the question "Have you ever been tested for HIV?" The respondents were ≥18 years old, predominantly female (63.3%, n=19,481), white (66.6%, n=20,511), college graduates (35.0%, n=10,781), married (52.7%, n=16,219), with an annual income of ≥ $50,000 (36.5%, n=11,231) and with some form of healthcare coverage (84.9%, n=26,156) (Table 1). In addition, for the years data were available (2010-2012), 97.5% (n= 17,734) of respondents did not engage in HIV high-risk behaviors. For all the years under review, the results of the descriptive analyses of socio-demographic categories and having been tested for HIV were statistically significant (p <0.001).

Table 1. Socio-demographic characteristics and HIV risk situations of survey respondents to the question "Have you ever been tested for HIV?" in Georgia: 2010-2014 BRFSS data

	Total (N=30791)	2010 (n=3699)		2011 (n=8977)		2012 (n=5554)		2013 (n=7010)		2014 (n=5551)		p-value
	N	n	%	n	%	n	%	n	%	n	%	
Gender												<0.001
Male	11310	1333	36.0	3162	35.2	2062	37.1	2621	37.4	2132	38.4	
Female	19481	2366	64.0	5815	64.8	3492	62.9	4389	62.6	3419	61.6	
Age (years)												<0.001
18-24	1421	111	3.0	309	3.4	283	5.1	428	6.1	290	5.2	
25-34	3116	488	13.2	828	9.2	540	9.7	775	11.1	485	8.7	
35-44	4214	746	20.1	1170	13.0	697	12.6	943	13.4	658	11.9	
45-54	6067	1116	30.2	1683	18.8	1037	18.7	1281	18.3	950	17.1	
55-64	7568	1238	33.5	2177	24.3	1263	22.7	1630	23.2	1260	22.7	
65+	8405	-	-	2810	31.3	1734	31.2	1953	27.9	1908	34.4	
Race												<0.001
White, NH	20511	2450	66.2	6192	69.0	3687	66.4	4504	64.2	3678	66.2	
Black, NH	7403	936	25.3	2012	22.4	1340	24.1	1766	25.2	1349	24.3	
Hispanic	1206	134	3.6	341	3.8	206	3.7	308	4.4	217	3.9	
Other, NH	827	94	2.5	216	2.4	187	3.4	210	3.0	120	2.2	
Multiracial, NH	437	46	1.3	106	1.2	74	1.3	117	1.7	94	1.7	
Don't know/Refused	*407*	*39*	*1.1*	*110*	*1.2*	*60*	*1.1*	*105*	*1.5*	*93*	*1.7*	
Education												<0.001

<High school	3386	309	8.4	997	11.1	694	12.4	771	11.0	615	11.1	
High School/GED	8479	932	25.2	2550	28.4	1605	28.9	1923	27.4	1469	26.5	
Some Post High School	8074	1019	27.5	2314	25.8	1442	26.0	1825	26.1	1474	26.5	
College Grad	10781	1437	38.8	3090	34.4	1797	32.4	2477	35.3	1980	35.7	
Don't know/Refused	*71*	*2*	*0.1*	*26*	*0.3*	*16*	*0.3*	*14*	*0.2*	*13*	*0.2*	
Annual Income (USD ($))												<0.001
<15k	3435	308	8.3	995	11.1	697	12.6	825	11.8	610	11.0	
15k - <25k	5104	520	14.0	1536	17.1	996	17.9	1122	16.0	930	16.7	
25k - <35K	3271	376	10.2	998	11.1	595	10.7	738	10.5	564	10.2	
35k - <50k	3633	433	11.7	1079	12.0	625	11.3	856	12.2	640	11.5	
50k +	11231	1678	45.4	3142	35.0	1917	34.5	2451	35.0	2043	36.8	
Don't know/Refused	*4117*	*384*	*10.4*	*1227*	*13.7*	*724*	*13.0*	*1018*	*14.5*	*764*	*13.8*	
Marital status												<0.001
Married	16219	2291	61.9	4835	53.9	2845	51.2	3461	49.4	2787	50.2	
Divorced	4555	563	15.2	1313	14.6	798	14.4	1073	15.3	808	14.5	
Widowed	4069	166	4.5	1312	14.6	830	14.9	903	12.9	858	15.5	
Separated	837	99	2.7	226	2.5	138	2.5	223	3.2	151	2.7	
Never married	4342	477	12.9	1090	12.1	824	14.8	1142	16.3	809	14.6	
A member of an unmarried couple	641	86	2.3	170	1.9	103	1.9	171	2.4	111	2.0	
Refused	*128*	*17*	*0.5*	*31*	*0.4*	*16*	*0.3*	*37*	*0.5*	*27*	*0.5*	
Healthcare coverage												<0.001
Yes	26156	3043	82.3	7680	85.6	4695	84.5	5872	83.8	4866	87.6	
No	4545	646	17.5	1272	14.2	847	15.3	1116	15.9	664	12.0	
Don't	*90*	*10*	*0.2*	*25*	*0.2*	*12*	*0.2*	*22*	*0.3*	*21*	*0.4*	

know/Refused												
HIV high risk situations	N=18185	n=3688		n=8959		n=5538						<0.001
Yes	397	88	2.4	185	2.1	124	2.2	N/A	N/A	N/A	N/A	
No	17734	3592	97.4	8748	97.6	5394	97.4	N/A	N/A	N/A	N/A	
Don't know/Refused	*54*	*8*	*0.2*	*26*	*0.3*	*20*	*0.4*	*N/A*	*N/A*	*N/A*	*N/A*	

Acronyms: NH – non-Hispanic, GED – General Educational Development, N/A – data not available

3.2. Trends in HIV testing among Adults in GA, 2010-2014

In GA, there were 11,543 respondents who had ever been tested for HIV. The weighted population estimates of those, by year of interview, and the APC for each variable are shown in Table 2. There was a decrease in the percentages of respondents who had ever been tested for HIV, from 49.4% in 2010 to 43.7% in 2014 (p<0.001); however, the APC of -2.86 was not significantly different from zero. During this time, the annual percentages of those tested were higher for GA than nationally (US [38.8% in 2010, 34.4% in 2014). Also for GA, APCs over time were significant for the decreasing number of HIV testers among respondents who were males (APC= -3.27), attained high school education (APC= -2.92) or less (APC= -7.28), earned less than $25,000 annually (APC= -4.53 and -4.51 for <$15,000 and $15,000 - <$25,000, respectively), and never married (APC= -2.88).

Table 2. Weighted percentages and annual percent change of adults who have ever been tested for HIV in Georgia by year of interview: 2011-2014 BRFSS data

	Total	2010		2011		2012		2013		2014		
	Unwt. N	Unwt. N	Wt. % (95% CI)	Unwt. N	Wt. % (95% CI)	Unwt. N	Wt. % (95% CI)	Unwt. N	Wt. % (95% CI)	Unwt. N	Wt. % (95% CI)	APC
Overall GA	11543	1665	49.4 (47.1, 51.6)	3174	45.6 (44.0, 47.2)	1961	44.3 (42.4, 46.1)	2753	43.6 (42.0, 45.3)	1990	43.7 (41.9, 45.5)	-2.86
Gender												
Male	4393	599	48.7 (45.1, 52.3)	1145	45.0 (42.5, 47.6)	746	43.0 (40.1, 45.9)	1101	43.6 (41.1, 46.2)	802	41.9 (39.2, 44.7)	-3.27*
Female	7150	1066	50.1 (47.4, 52.7)	2029	46.1 (44.1, 48.0)	1215	45.5 (43.1, 47.8)	1652	43.6 (41.6, 45.6)	1188	45.4 (43.1, 47.7)	-2.50
Age (years)												
18-24	646	53	40.6 (30.0, 52.2)	140	42.4 (36.3, 48.8)	352	46.2 (39.9, 52.7)	191	39.5 (34.3, 45.0)	122	40.4 (34.5, 46.6)	-0.80
25-34	1996	314	60.9 (55.3, 66.2)	540	65.4 (61.1, 69.6)	352	62.5 (57.2, 67.4)	493	62.6 (58.2, 66.9)	297	60.9 (55.8, 65.8)	-0.44
35-44	2572	458	58.7 (54.3, 63.0)	712	62.0 (58.4, 65.4)	397	57.2 (52.6, 61.7)	594	60.7 (56.7, 64.6)	411	60.1 (55.5, 64.6)	0.26
45-54	2834	495	44.2 (40.8, 47.8)	769	46.0 (43.0, 49.0)	494	49.3 (45.4, 53.2)	615	44.4 (40.9, 47.9)	461	46.8 (42.9, 50.7)	0.79
55-64	2296	345	26.7 (23.8, 29.7)	653	31.9 (29.4, 34.5)	352	28.8 (25.6, 32.3)	540	33.5 (30.6, 36.6)	406	33.9 (30.6, 37.4)	5.41
65+	1199	-	-	360	13.9 (12.3, 15.7)	226	14.6 (12.4, 17.1)	320	16.0 (14.0, 18.2)	293	15.8 (13.9, 18.0)	4.87[a]
Race												
White, NH	6058	921	42.3 (39.6, 45.1)	1716	36.9 (35.1, 38.8)	983	33.4 (31.2, 35.6)	1460	36.3 (34.5, 38.2)	978	34.3 (32.2, 36.5)	-4.26
Black, NH	4201	579	69.0 (64.9, 72.8)	1127	65.3 (62.1, 68.4)	753	65.6 (62.1, 68.9)	970	59.3 (56.0, 62.6)	772	63.4 (59.9, 66.8)	-2.62
Hispanic	549	73	55.3 (43.8, 66.3)	155	40.8 (33.8, 48.1)	88	42.0 (34.0, 50.5)	138	43.9 (37.5, 50.5)	95	38.1 (30.8, 46.0)	-6.50
Multiracial, NH	237	29	57.4 (38.1, 74.6)	52	54.2 (41.4, 66.5)	43	59.5 (44.9, 72.7)	60	55.0 (42.2, 67.3)	53	57.1 (42.7, 70.4)	0.04
Other, NH	326	41	43.9 (30.7, 58.1)	79	39.1 (30.6, 48.3)	75	40.2 (31.4, 49.6)	82	29.8 (20.3, 39.3)	49	39.7 (28.4, 51.0)	-4.62
Don't know/Refused	172	22	59.9 (40.0, 77.0)	45	53.6 (39.8, 66.8)	19	39.3 (22.5, 59.0)	43	45.5 (34.0, 57.6)	43	53.6 (39.9, 66.8)	-
Education												
<High School	1051	148	47.9 (40.1,	280	40.2 (35.5,	207	38.0 (32.8,	235	36.2 (31.5,	181	34.6 (29.4,	-7.28*

	N	n	% (CI)	n	% (CI)	n	% (CI)	n	% (CI)	n	% (CI)	diff
			55.9)		45.1)		43.4)		41.3)		40.1)	
HS/GED	2722	373	45.1 (40.6, 49.8)	788	42.0 (39.0, 45.0)	493	40.6 (37.1, 44.1)	628	39.5 (36.5, 42.6)	440	40.1 (36.8, 43.6)	-2.92*
Some Post HS	3371	477	51.8 (47.5, 56.1)	913	51.8 (48.8, 54.7)	559	47.8 (44.4, 51.3)	820	48.9 (45.9, 52.0)	602	50.3 (47.0, 53.6)	-1.16
College Grad	4379	666	50.6 (47.1, 54.0)	1185	46.5 (44.0, 48.9)	696	48.3 (45.3, 51.5)	1066	47.0 (44.5, 49.5)	766	46.0 (43.2, 48.8)	-1.78
Don't know/Refused	20	1	70.0 (12.7, 97.4)	8	44.9 (17.4, 75.8)	6	58.7 (29.5, 82.8)	4	40.2 (14.6, 72.6)	1	3.1 (0.4, 21.7)	-
Annual Income (USD)												
<15k	1476	172	58.1 (49.6, 66.2)	394	52.6 (47.5, 57.6)	308	51.1 (45.6, 56.6)	353	49.9 (45.3, 54.5)	249	47.3 (41.4, 53.2)	-4.53*
15k - <25k	1995	260	52.0 (45.4-58.4)	570	49.7 (45.7-53.6)	350	46.8 (42.3-51.4)	475	46.7 (42.7-50.7)	340	42.6 (38.2, 47.1)	-4.51*
25k - <35K	1171	167	51.6 (44.7-58.5)	335	45.3 (40.5-50.2)	201	45.0 (39.2-50.9)	267	46.6 (41.5-51.8)	201	46.3 (40.7, 52.0)	-1.87
35k - <50k	1332	180	47.4 (41.1, 53.9)	377	46.1 (41.6, 50.6)	206	42.3 (37.1, 47.7)	337	47.4 (42.7, 52.1)	232	47.2 (42.0, 52.5)	0.19
50k+	4461	749	49.2 (46.1, 52.4)	1197	45.0 (42.5, 47.4)	710	43.5 (40.5, 46.5)	1034	42.5 (40.0, 45.1)	771	43.7 (40.9, 46.5)	-2.90
Don't know/Refused	1108	137	40.4 (33.5, 47.7)	301	34.9 (30.3, 39.8)	186	36.1 (30.9, 41.7)	287	32.1 (27.8, 36.7)	197	36.8 (31.8, 42.1)	-
Marital status												
Married	5534	921	46.2 (43.4, 48.9)	1586	41.1 (39.2, 43.1)	890	36.6 (34.3, 39.0)	1218	38.4 (36.3, 40.5)	919	39.1 (36.8, 41.5)	-3.94
Divorced	2116	293	60.7 (55.1, 66.0)	574	51.6 (47.6, 55.6)	346	55.0 (50.1, 59.8)	540	56.4 (51.9, 60.8)	363	53.1 (48.2, 57.8)	-1.77
Widowed	704	56	41.7 (32.7, 51.2)	204	21.6 (18.3, 25.2)	127	21.7 (17.4, 26.7)	166	20.6 (17.2, 24.6)	151	22.8 (18.4, 27.9)	-11.79
Separated	512	54	50.7 (38.9, 62.4)	143	68.5 (59.4, 76.4)	87	69.5 (58.7, 78.6)	140	68.9 (60.0, 76.6)	88	66.5 (55.4, 76.0)	5.64
Never married	2255	277	56.4 (49.7, 62.8)	553	53.7 (49.5, 57.9)	440	54.8 (50.3, 59.1)	585	50.2 (46.3, 54.1)	400	50.4 (46.0, 54.8)	-2.88*
A member of an unmarried couple	366	53	55.5 (40.6, 69.5)	100	53.6 (43.9, 63.1)	64	61.5 (48.9, 72.6)	90	50.3 (41.4, 59.1)	59	50.2 (38.8, 61.5)	-2.61
Refused	56	11	78.6 (53.5, 92.2)	14	39.5 (18.4, 65.4)	7	35.6 (12.0, 69.1)	14	42.5 (23.5, 64.0)	10	53.4 (28.6, 76.7)	-6.76
Health Care Coverage												
Yes	9216	1332	48.0 (45.5, 50.4)	2541	43.0 (41.3, 44.7)	1524	41.2 (39.3, 43.2)	2157	40.6 (38.9, 42.3)	1662	42.2 (40.4, 44.1)	-3.10
No	2303	331	56.7 (51.4, 61.9)	629	53.6 (49.6, 57.6)	435	54.8 (50.2, 59.3)	584	53.9 (49.9, 57.8)	324	49.5 (44.6, 54.4)	-2.63

Don't know/Refused	24	2	51.4 (50.6, 98.9)	4	12.6 (2.3, 43.3)	2	23.4 (2.6, 77.4)	12	51.0 (20.4, 82.2)	4	37.0 (9.6, 76.4)	-
HIV High Risk Situations	N=6770	n=1656		n=3164		n=1950						
Yes	272	61	69.9 (56.2, 80.8)	130	74.0 (63.8, 82.1)	81	69.4 (58.1, 78.7)	N/A	N/A	N/A	N/A	-0.36[a]
No	6474	1590	48.7 (46.4, 50.9)	3020	44.2 (42.6, 45.8)	1864	43.2 (41.3, 45.1)	N/A	N/A	N/A	N/A	-5.82[a]
Don't know/Refused	24	5	63.3 (20.0, 95.0)	14	75.3 (41.8, 90.0)	5	25.0 (6.0, 49.4)	*N/A*	*N/A*	*N/A*	*N/A*	-
Overall USA	608,484	100,298	38.8 (38.5, 39.2)	132,471	35.9 (35.6, 36.2)	128,927	35.3 (35.0, 35.5)	130,922	35.9 (35.6, 36.2)	115,866	34.4 (34.1, 34.7)	-2.38

Acronyms: Unwt. N – unweighted counts, Wt. % - weighted population estimates, CI – confidence interval, APC – Annual Percent Change, NH – non-Hispanic, GED – General Educational Development, N/A – data not available.

Note: p-values were significant for the association between all the socio-demographic categories and having ever been tested for HIV. * APC is significantly different from zero at alpha=0.05. [a] APC calculated for years with available data. (-) APC was not calculated for respondents who don't know or refused to respond to questions asked.

There was a decrease in the numbers of males being tested for HIV (testers) from 48.7% in 2010 to 41.9% in 2014, compared to female testers, 50.1% in 2010, and 45.4% in 2014 (p<0.001). The number of respondents who had been tested for HIV with less than high school education decreased from 47.9% in 2010 to 34.6% in 2014 (p<0.001), and those with a high school education also decreased from 45.1% in 2010 to 40.1% in 2014 (p<0.001). Similarly, there was a decline in the number of testers among earners of less than $25,000 annual income, from 52.0% in 2010 to 42.6% in 2014 (p<0.001) and those who were never married, from 56.4% in 2010 to 50.4% in 2014 (p<0.001). For the other socio-demographic categories, the trends in HIV testing were stable, and the APCs were not significant. Overall, approximately 60% of persons between the ages of 25 and 44 had been tested for HIV, compared to <50% of those aged 18-24 and greater than 45 years of age. There was a slight increase of 0.04 in APC (not significant) among NH multiracial group and a significant decrease in the number of testers, though with stable APC, was noted among the different racial/ethnic groups.

Over the period of 2010-2014, (results not shown in table 2), the highest numbers of testers were NH black respondents (66.4% vs. 37.6% white and 44.5% Hispanic (p<0.001). Fewer persons with healthcare coverage compared with those with no coverage (44% and 54.8% respectively, p<0.001); and almost 50% of respondents with greater than high school education, earning annual income of <$15,000 (53%), separated (65%), or in an unmarried couple relationship (57%) had been tested for HIV. More persons engaged in high-risk behaviors had been tested for HIV than those who had not (71.4% vs. 45.2%; p<0.001). Data for HIV high-risk activities and for the type of healthcare coverage were available for only 2010-2012 and 2014 respectively. As shown in Figure 1, respondents on the military (Tricare) plan were the highest testers (68.2% [95% C.I=58.9-76.2%]), followed by those on Medicaid (66.9% [95% C.I=56.1-76.1%]).

Figure 1. Weighted percentages of adults who have ever tested for HIV in Georgia based on the type of healthcare coverage: BRFSS 2014 data
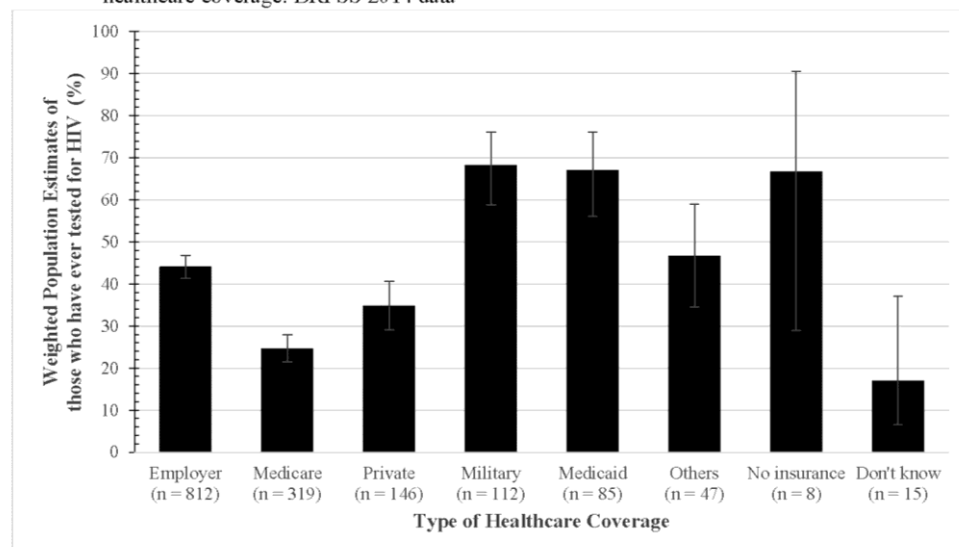
Note: Error bars indicate 95% confidence intervals for each estimate

3.3. HIV risk situations and socio-demographic determinants of HIV testing in GA

In Table 3 are the results of logistic regression analyses for the association between socio-demographic factors, HIV high-risk situations, and the dependent variable, having ever been tested for HIV, after adjusting for all the variables in the model. The model included data for the 3 years (2010-2012) for which responses to HIV high-risk situations were recorded. Except for gender and income, all the variables entered had a significant effect. NH black/African American respondents (OR=3.26 [95% C.I.= 2.87, 3.69]; p<0.001), and respondents of other ethnic groups combined (OR=1.10 [95% C.I=0.912, 1.32]; p=0.33) were more likely to have been tested than NH white respondents. People who were younger than 55 years were more likely to have been than older people; 18-34 years (OR=3.87 [95% C.I= 3.37, 4.44]; p<0.001); 35-54 years (OR=3.68 [95% C.I=

3.30, 4.10]; p<0.001). The likelihood of being tested for HIV was also associated with levels of education greater than high school (OR=1.55 [95% C.I=1.36, 1.78]; p<0.001 for college graduate, and OR=1.45 [95% C.I=1.28, 1.68]; p<0.001 for some post high school), being single (OR=1.15 [95% C.I=1.02, 1.29]; p=0.023), not having healthcare coverage (OR=1.19 [95% C.I=1.02, 1.38]; p=0.03) and engaging in HIV high-risk behaviors (OR=2.18 [95% C.I= 1.54, 3.07]; p<0.001), compared to less than high school education, being in a couple relationship, having healthcare coverage, and not engaging in HIV high-risk situations respectively.

Table 3. Logistic regression analysis of socio-demographic factors and HIV risk situations associated with having ever been tested for HIV in Georgia

Variable	Odds ratio	95% C.I	p-value
Gender			
Female	1.049	0.945, 1.165	0.367
Male	Ref		
Age (years)			
18-34	3.868	3.373, 4.436	<0.001
35-54	3.678	3.297, 4.103	<0.001
≥55	Ref		
Race			
Black, NH	3.256	2.872, 3.690	<0.001
Others	1.097	0.912, 1.320	0.327
White, NH	Ref		
Education			
College graduate	1.554	1.355, 1.781	<0.001
Some post high school	1.446	1.283, 1.675	<0.001
≤HS	Ref		
Income			
<25k	1.090	0.928, 1.280	0.292
25k-50k	0.971	0.845, 1.117	0.682
>50k	Ref		
Marital status			
Single	1.148	1.019, 1.292	0.023
Couple	Ref		
Healthcare coverage			
No	1.185	1.018, 1.378	0.028
Yes	Ref		
HIV high risk situations			
Yes	2.175	1.541, 3.070	<0.001
No	Ref		

4. **Discussion**

BRFSS data from 2010 to 2014 (the year of the most current data) were analyzed to examine the temporal trends and socio-demographic factors associated with HIV testing among adults in GA. Overall in GA, there was a decrease in the percentages of respondents who had ever been tested for HIV, from 49.4% in 2010 to 43.7% in 2014, with a non-significant APC. The factors associated with HIV testing included being black/African American, single, younger than 55 years, having greater than high school education, engaging in HIV high-risk behaviors, and not having healthcare coverage.

The results show that, after 2010, less than half of the adults had been tested for HIV. Results of previous studies conducted nationally and in other parts of the U.S., show that the percentages of adults who had ever tested for HIV increased significantly between 2000 and 2010 [18, 19].   Barriers to HIV testing include HIV-related stigma, sexuality, religion, race, and class,

emphasizing responsibility, testing concerns, and media influences [20, 21]. The percentages of respondents who had been tested for HIV were highly associated with the presence of HIV risk factors and with self-reported current risks of contracting HIV. Racial minorities, younger persons, especially young black/African American (men having sex with men (MSM)), have the highest risk and prevalence of HIV/AIDS [19]. A disadvantage of low HIV testing among persons who are perceived as low-risk is missing of opportunities to diagnose HIV-infected persons and linking them to care. Reasons for fewer people with healthcare coverage not being tested may be because (a) routine HIV testing is not offered in the places where most people get their health care and (b) awareness of CDC's 2006 recommendations for HIV screening has been low among primary care providers [22, 23]. Release of the United States Preventive Services Task Force recommendations for HIV testing in 2013, and the provision of the Affordable Care Act that both HIV screening and targeted risk-based testing are now covered without cost-sharing as part of the essential benefits package, may boost future HIV testing rates [22].

A strength of the present report is utilization of the most currently available BRFSS data. It is also among the few studies that have examined the trends of HIV testing with the APCs, and the associated socio-demographic factors of HIV testing and is the only report solely for the state of GA. There are some limitations. The BRFSS data are self-reported by respondents and are subject to recall bias. The survey is based on non-institutionalized populations and excludes persons with the same risk of exposure who are residing elsewhere, such as nursing homes or long-term-care facilities. Since data are collected by telephone, individuals who live in households without a residential telephone or cell phone are not included. Further, the sampling frame of the BRFSS is the entire state; therefore, some rural areas might be represented by relatively few interviews. Because of these limitations, the results might be either underestimated or overestimated. Despite these limitations, data from the BRFSS are reliable and generally valid because the content of the survey questions, questionnaire design, data collection, procedures, interviewing techniques, and data processing have been developed to improve data quality [24].

5. Conclusions

Between 2010 and 2014, there has been a decline in the percentage of adults in GA who have ever been tested for HIV with less than 50% now reporting to have been tested. A strong indicator for testing is the engagement in HIV high-risk behaviors. In GA, increasing access to and utilization of HIV testing should be a public health priority, and more programs that will increase awareness to recommendations for testing among healthcare providers are warranted.

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