Background

The Clark-Hill Institute for Positive Youth Development regularly examines trends of youth violence in Richmond City. This factsheet examines trends of intentional injury visits at Virginia Commonwealth University Medical Center's Emergency Department (VCU ED) from July 2002 through June 2021 among 10-24 year-old Richmond City residents. The VCU ED is the only level I trauma center in Central Virginia and is estimated to serve approximately three-quarters of Richmond City's trauma patients.

Data were analyzed in fiscal years, starting July 1st and ending June 30th. To determine injury groupings, the CDC-recommended framework for categorizing external cause of injury was used¹. Specifically, data from 2003-2015 were coded using ICD-9 codes. In October 2015, ICD-10 codes were implemented in the VCU Health System, thus the 2016 fiscal year injury groupings were coded using both ICD-9 and ICD-10 codes, and 2017 used ICD-10 codes only. This change may impact how injuries were coded by ED staff and, subsequently, rates by injury groupings may be affected. Caution should be exercised when interpreting changes observed across multiple ICD coding systems. The injury groupings included external injury, assault, abuse, suicide, and firearm injury. A composite variable for intentional injuries was created for this analysis where a visit for assault, abuse, or suicide injuries was defined as an intentional injury. Patients' residential addresses were geocoded using ArcGIS software and examined at the census tract level. Rates for intentional injury visits to the VCU ED were calculated by dividing the number of visits by population estimates derived from the U.S. Census Bureau's American Community Survey 5-year population data.

Rates of Injury Visits

The rate of injury visits to the VCU ED among 10-24 year-olds declined overall between 2003 (61.7 per 1,000) and 2020 (25.8 per 1,000). The trend for the subset of injuries that were unintentional mirrored that of all injury visits (Figure 1). Rates of intentional injury remained relatively stable, with a less pronounced decreasing trend than the overall and intentional injury rates during this time period. Intentional injury rates were generally higher in the mid-2000s (i.e., 13.9 per 1,000 in 2006) and were at their lowest between 2016 and 2019 where rates ranged from 3.7 to 3.7 per 1,000. The corresponding numbers and rates per 1,000 for intentional injury and all injury visits are shown in Alternative Table 1 in the Appendix.

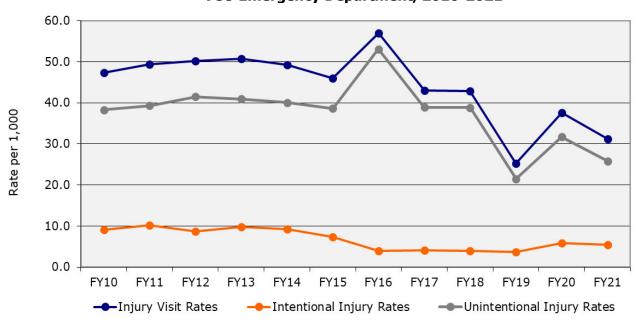


Figure 1: Rate of Injury Visits, Ages 10-24 Years, VCU Emergency Department, 2010-2021

Note: The specific yearly data for figures and data for years not displayed can be found in the alternative tables in the appendices.

¹ ICD Injury Matrices: https://www.cdc.gov/nchs/injury/injury matrices.htm

² Intentional injuries include visits for assault, firearm, abuse, or attempted suicide

Demographic Characteristics

Overall, males accounted for two-thirds of intentional injury visits to the VCU ED and, similar to females (18.8 years), were on average 19.3 years of age at the time of their visit (Table 1). Further, rates of intentional injury by sex, race, and ethnicity fluctuated from year to year (Figure 2). Black males had the highest rates of intentional injury visits. While the rate increased generally and peaked in 2011, it then declined and stabilized through 2019; however, this was followed by increases in 2020 and 2021. Rates among black females had a similar trend pattern compared to their male counterparts except for 2021 when the rate decreased. The trend among Hispanic males differed in that the rate decreased in 2011 and 2012, prior to an increase in 2013 and subsequent annual fluctuations. Rates among Hispanic and White females and White males were comparatively low and varied yearly. Additionally, White males, White females, and Hispanic males seen in the ED for intentional injuries tended to be older at 20.8, 20.1 and 20.1 years of age on average during this time period whereas Black males, Black females, and Hispanic females were comparatively younger overall with mean ages of 19.1, 18.9, and 18.0, respectively (not shown).

24 Years, VCU Emergency Department, 2010-2021							
	Numb	er of Inj	uries	Mean Age (yrs)			
	Female (%)	Male (%)	Total (n)	Female	Male		
FY2010	41.1	58.9	453	19.4	19.4		
FY2011	41.1	58.9	509	19.3	19.7		
FY2012	42.1	57.9	437	19.6	19.8		
FY2013	42.9	57.1	476	19.4	19.7		
FY2014	40.2	59.8	393	8.9*	19.9*		
FY2015	43.2	56.8	336	19.3	19.7		
FY2016	37.5	62.5	176	19.4	19.7		
FY2017	42.6	57.4	183	19.5	19.0		
FY2018	41.6	58.4	178	19.4	19.8		
FY2019	42.1	57.9	164	18.7	18.9		
FY2020	44.0	56.0	257	18.3	18.9		
FY2021	36.0	64.0	236	18.8	19.3		
* Denotes <= 0.05	* Denotes statistically significant mean age difference, p-value <= 0.05						

Table 1: Intentional Injury Visits by Say Ages 10.

Figure 2: Rate of Intentional Injury Visits by Sex, Race, and Ethnicity, Ages 10-24 Years, VCU Emergency Department, 2011-2021

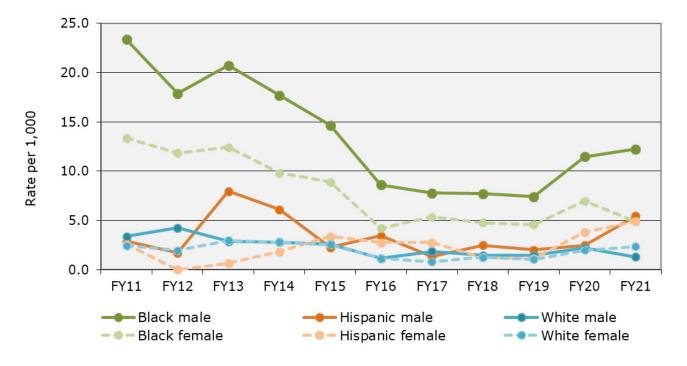
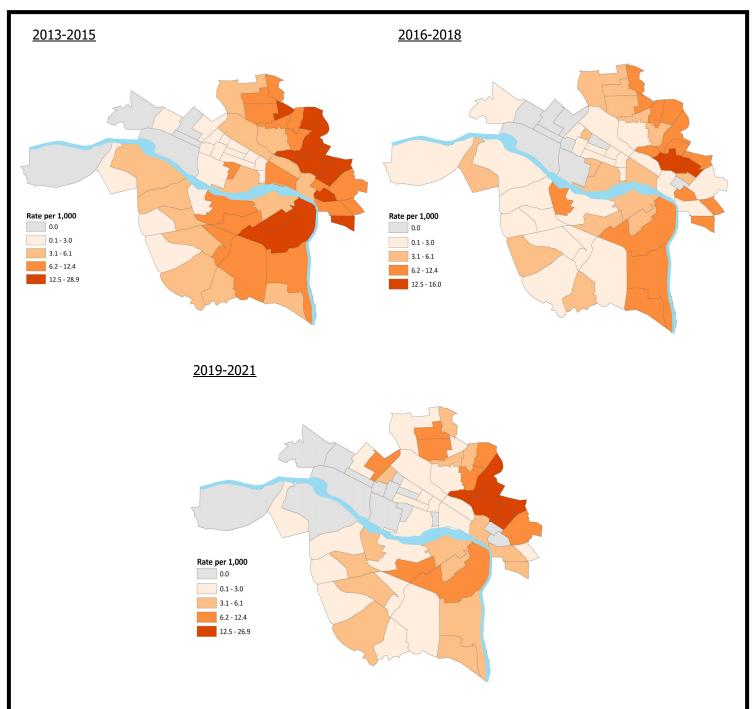


Figure 2 Note: Between FY2003 and FY2010, patient race and ethnicity were not captured independently; however, starting in FY2011, ethnicity was collected separately from race, thus race and ethnicity data from FY2011 forward are not comparable to previous years and are not shown in the figure. The yearly specific rates can be found in Figure 2 Alternative Table in the Appendix.

Note: The specific yearly data for figures and data for years not displayed can be found in the alternative tables in the appendices.

Three-year averaged rates of intentional injury visits among 10-24 year-olds by census tract of residence are shown for 2013 through 2021 in Figure 3. In 2013-2015, the tracts with the highest rates were located in the northeastern and southeastern areas of the city and were more widespread compared to 2016-18 and 2019-2021. In subsequent 3-year periods, tracts with the highest rates were located only in the northeastern areas and in relatively fewer tracts. Further, rates generally tended to be lower in the western areas of the city.

Figure 3: Intentional Injury Visits by Census Tract of Patient's Residence, Ages 10-24 Years, VCU Emergency Department, 2013-2021



Assault-Related Injury Visits

The rate of ED visits due to assault among 10-24 year-olds was highest in 2006 at 11.1 per 1,000 and subsequently declined through 2019 to 2.3 per 1,000. In 2020, the rates increased slightly overall (3.1 per 1,000) and among all races and ethnicities; however, this was followed by a slight decrease overall in 2021. Rates were consistently highest among Black individuals and followed the same general pattern as the overall rate; however, by 2021, the rate was similar to that of White and Hispanic individuals. The rate was lowest among Whites and has declined overall since 2008. Among Hispanics, the rate differed between 2004-2007 and 2020-2021 compared to the rate overall and among blacks in that it increased during those years. The rate then declined overall and stabilized to 1.4 per 1000 in 2019, despite increases in some years (Figure 4).

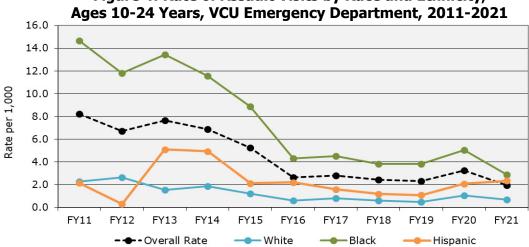


Figure 4: Rate of Assault Visits by Race and Ethnicity,

While males comprised nearly 60% of the ED visits for assault injuries overall, the difference in the proportion of visits and rates among males and females has decreased over time (Figure 5, Table 2A in Appendix A). The rate peaked for males in 2006, whereas the rate for females was highest in 2008 at 14.2 and 8.4 per 1,000, respectively. Then rates for both sexes declined generally to 2016. Rates then stabilized with some yearly fluctuations among males while among females, rates initially fluctuated but then increased between 2018 and 2020 to 3.3 per 1,000. (Figure 5). Additionally, the average age for males and females was similar at 19 years overall, however, in 2006 and 2008, there were statistically significant age differences by sex (Table 2A in Appendix A).

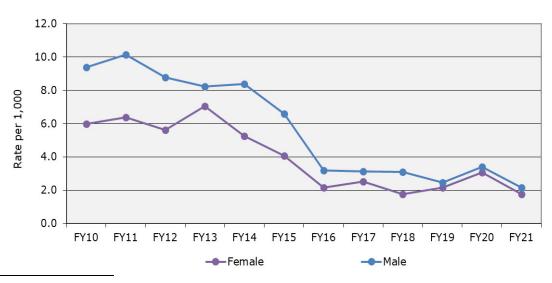


Figure 5: Rate of Assault Visits by Sex, Ages 10-24 Years, VCU Emergency Department, 2010-2021

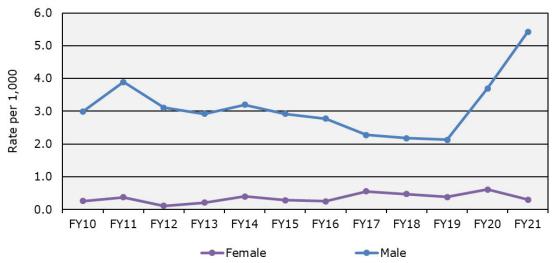
Figure 4 Note: Between FY2003 and FY2010, patient race and ethnicity were not captured independently; however, starting in FY2011, ethnicity was collected separately from race, thus race and ethnicity data from FY2011 forward are not comparable to previous years and are not shown in the figure. Note: The specific yearly data for figures and data for years not displayed can be found in the alternative tables in the appendices.

Firearm-Related Injury Visits

The majority of firearms-related injury visits were by males. While rates for males initially increased and peaked in 2006 at 6.2 per 1,000, this was followed by an overall decline through 2019 to 2.1 per 1,000 and subsequent increases in 2020 to 3.7 and 5.4 per 1,000. Firearm-related injury visits for females were generally consistent and below 1.0 per 1,000 during this time (Figure 6). The mean age of males and females seen in the ED for firearms-related injuries were similar overall and ranged from 18 to 21 years, however males tended to be slightly older in general (Table 3).

Table 3: Firearm-Related Injury Visits to the VCU Emergency Department by Sex, Ages 10-24 Years, 2010-2021					
	Nur	nber of Vis	its	Mean Ag	ge (yrs)
	Female (%)	Male (%)	Total (n)	Female	Male
FY2010	9.0	91.0	78	19.7	19.8
FY2011	9.7	90.3	103	18.7	20.0
FY2012	3.9	96.1	76	18.0	20.2
FY2013	6.3	93.8	80	21.6	20.0
FY2014	11.1	88.9	90	19.7	20.5
FY2015	9.9	90.1	71	21.6	20.1
FY2016	9.1	90.9	66	20.2	19.1
FY2017	21.0	79.0	62	18.6	19.6
FY2018	19.0	81.0	58	18.9	20.1
FY2019	16.7	83.3	54	17.7	19.2
FY2020	15.4	84.6	91	17.1	19.0
FY2021	5.8	94.2	120	17.1	19.2
* Denotes	statistically	significant m	nean age dit	ference, p-va	alue < 0.05

Figure 6: Rate of Firearm-Related Visits by Sex, Ages 10-24 Years, VCU Emergency Department, 2010-2021



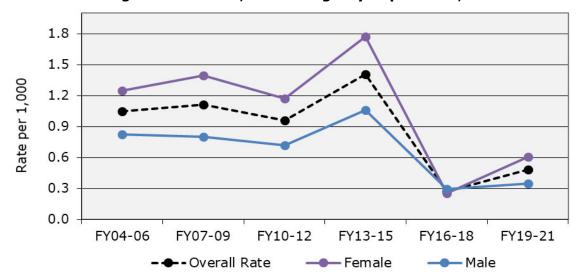
Note: The specific yearly data for figures and data for years not displayed can be found in the alternative tables in the appendices.

Suicide-Related Injury Visits

The overall rate of suicide-related injury visits fluctuated between 2004 and 2015 ranging from 1.0 to 1.4 per 1,000 and was followed by a marked decrease to 0.3 and 0.5 per 1,000 for the combined 3-year periods of 2016-18 and 2019-21, respectively. Rates for females and males followed a similar trend as the overall rates with females slightly higher than both overall rates and male (Figure 7). Further, compared to males, females tended to be younger when they visited the VCU ED for suicide-related injuries and in 2014 and 2018, this difference was statistically significant (Table 4).

Table 4: Suicide-Related Injury Visits to the VCU Emergency Department by Sex, Ages 10-24 Years, 2010-2021						
	Numbe	r of Visits	(%)	Mean A	ge (yrs)	
	Female (%)	Male (%)	Total (n)	Female	Male	
FY2010	57.5	42.5	40	19.7	19.6	
FY2011	67.3	32.7	55	18.7	18.1	
FY2012	65.4	34.6	52	18.8	19.2	
FY2013	55.4	44.6	74	18.5	19.5	
FY2014	60.6	39.4	66	18.5*	21.5*	
FY2015	70.0	30.0	60	19.5	20.2	
FY2016	37.5	62.5	8	20.0	21.0	
FY2017	40.0	60.0	10	17.8	21.0	
FY2018	57.9	42.1	19	18.1*	21.6*	
FY2019	53.8	46.2	13	17.1	18.3	
FY2020	73.1	26.9	25	16.4	18.7	
FY2021	64.0	36.0	25	18.8	18.4	
* Denotes st	* Denotes statistically significant mean age difference, p-value < 0.05					

Figure 7: Rate of Suicide-Related Visits,
Ages 10-24 Years, VCU Emergency Department, 2004-2021



Note: The specific yearly data for figures and data for years not displayed can be found in the alternative tables in the appendices.

Appendix A: Expanded data tables, 2003 – 2021

Table 1A: Intentional Injury Visits by Sex, Ages 10-24 Years, VCU Emergency Department, 2003-2021						
	Numb	er of Inju	ıries	Mean Ag	ge (yrs)	
	Female (%)	Male (%)	Total (n)	Female	Male	
FY2003	36.1	63.9	501	18.8	19.0	
FY2004	36.1	63.9	424	18.6	18.7	
FY2005	32.1	67.9	498	18.7	18.7	
FY2006	38.1	61.9	593	8.4*	19.2*	
FY2007	40.0	60.0	5 4 8	19.2	19.2	
FY2008	44.3	55.7	508	8.9*	9.4*	
FY2009	39.5	60.5	440	18.8	18.9	
FY2010	41.1	58.9	453	19.4	19.4	
FY2011	41.1	58.9	509	19.3	19.7	
FY2012	42.1	57.9	437	19.6	19.8	
FY2013	42.9	57.1	476	19.4	19.7	
FY2014	40.2	59.8	393	8.9*	19.9*	
FY2015	43.2	56.8	336	19.3	19.7	
FY2016	37.5	62.5	176	19.4	19.7	
FY2017	42.6	57.4	183	19.5	19.0	
FY2018	41.6	58.4	178	19.4	19.8	
FY2019	42.1	57.9	164	18.7	18.9	
FY2020	44.0	56.0	257	18.3	18.9	
FY2021	36.0	64.0	236	18.8	19.3	
* Denotes s	tatistically sign	ificant mean	age differer	nce, p-value <	= 0.05	

Table 2A: Assault-Related Injury Visits to the VCU Emergency Department by Sex, Ages 10-24 Years, 2003-2021					
	N	umber of Inju	uries	Mean Ag	je (yrs)
	Female (%)	Male (%)	Total (n)	Female	Male
FY2003	37.7	62.3	385	18.9	19.3
FY2004	36.3	63.7	339	18.5	18.7
FY2005	34.2	65.8	398	18.7	18.6
FY2006	38.4	61.6	474	18.4*	19.1*
FY2007	39.2	60.8	451	19.4	19.3
FY2008	44.5	55.5	422	18.8*	19.4*
FY2009	38.8	61.2	363	19.0	19.0
FY2010	41.6	58.4	380	19.3	19.3
FY2011	41.0	59.0	410	19.4	19.9
FY2012	42.0	58.0	355	19.8	19.8
FY2013	43.3	56.7	372	19.5	19.7
FY2014	36.1	63.9	327	19.0	19.6
FY2015	40.5	59.5	242	19.1	19.7
FY2016	4 2.5	57.5	120	19.9	19.8
FY2017	46.8	53.2	126	19.7	18.7
FY2018	38.0	62.0	108	19.8	19.4
FY2019	49.9	51.0	102	19.3	18.8
FY2020	49.6	50.4	141	19.1	18.8
FY2021	47.1	52.9	85	19.7	19.6
* Denotes	statistically s	ignificant mean a	ige difference, p-	value < 0.05	

Table 3A: Firearm-Related Injury Visits to the VCU Emergency Department by Sex, Ages 10-24 Years, 2003-2021

	Number of Visits			Mean Age (yrs)	
	Female (%)	Male (%)	Total (n)	Female	Male
FY2003	14.2	85.8	134	18.9	18.8
FY2004	8.9	91.1	124	19.4	20.2
FY2005	6.6	93.4	136	18.9	19.1
FY2006	12. 4	87.6	145	19.3	18.2
FY2007	12.9	87.1	116	18.9	19.3
FY2008	9.3	90.7	97	19.9	20.0
FY2009	4.8	95.2	84	15.5*	18.8*
FY2010	9.0	91.0	78	19.7	19.8
FY2011	9.7	90.3	103	18.7	20.0
FY2012	3.9	96.1	76	18.0	20.2
FY2013	6.3	93.8	80	21.6	20.0
FY2014	11.1	88.9	90	19.7	20.5
FY2015	9.9	90.1	71	21.6	20.1
FY2016	9.1	90.9	66	20.2	19.1
FY2017	21.0	79.0	62	18.6	19.6
FY2018	19.0	81.0	58	18.9	20.1
FY2019	16.7	83.3	54	17.7	19.2
FY2020	15. 4	84.6	91	17.1	19.0
FY2021	5.8	94.2	120	17.1	19.2

^{*} Denotes statistically significant mean age difference, p-value < 0.05

Table 4A: Suicide-Related Injury Visits to the VCU Emergency Department by Sex, Ages 10-24 Years, 2003-2021

	Number of Visits			Mean A	ge (yrs)
	Female (%)	Male (%)	Total (n)	Female	Male
FY2003	53.3	46.7	45	17.8	18.0
FY2004	81.3	18.8	32	18.8	18.5
FY2005	52.5	47.5	40	18.4	19.8
FY2006	58.7	41.3	63	18.7	20.3
FY2007	64.3	35.7	56	18.7	20.0
FY2008	64.6	35.3	51	19.7	20.1
FY2009	67.4	32.6	46	18.3	18.1
FY2010	57.5	42.5	40	19.7	19.6
FY2011	67.3	32.7	55	18.7	18.1
FY2012	65.4	34.6	52	18.8	19.2
FY2013	55.4	44.6	74	18.5	19.5
FY2014	60.6	39.4	66	18.5*	21.5*
FY2015	70.0	30.0	60	19.5	20.2
FY2016	37.5	62.5	8	20.0	21.0
FY2017	40.0	60.0	10	17.8	21.0
FY2018	57.9	42.1	19	18.1*	21.6*
FY2019	53.8	46.2	13	17.1	18.3
FY2020	73.1	26.9	25	16.4	18.7
FY2021	64.0	36.0	25	18.8	18.4
* Denotes sta	tistically signific	ant mean ag	je difference	e, p-value < 0.	.05

Appendix B: Data tables as an alternative to figures

Fi	Figure 1 Alternative Table: Injury Visits, Ages 10-24 Years, VCU Emergency Department, 2003-2021					
	Intentional Injury Visits (%)	Unintentional Injury Visits (%)	All Injury Visits (n)	Injury Visit Rate per 1,000	Intentional Injury Rate per 1,000	
FY2003	18.5	81.5	2,709	61.7	11.4	
FY2004	17.3	82.7	2,455	56.7	9.8	
FY2005	19.6	80.4	2,543	59.0	11.6	
FY2006	21.4	78.6	2,767	64.9	13.9	
FY2007	20.9	79.1	2,618	61.2	12.8	
FY2008	20.6	79.4	2,471	57.6	11.8	
FY2009	19.2	80.8	2,286	44.1	8.5	
FY2010	19.1	80.9	2,372	47.3	9.0	
FY2011	20.5	79.5	2,481	49.4	10.1	
FY2012	17.4	82.6	2,508	50.2	8.7	
FY2013	19.3	80.7	2,463	49.3	9.5	
FY2014	18.7	81.3	2,338	48.2	9.2	
FY2015	15.9	84.1	2,112	43.5	6.9	
FY2016	6.8	93.2	2,581	57.0	3.9	
FY2017	9.5	90.5	1,932	43.0	4.0	
FY2018	9.3	90.7	1,919	42.8	4.0	
FY2019	14.7	85.3	1,115	25.2	3.7	
FY2020	15.7	84.3	1,642	37.6	5.9	
FY2021	17.3	82.7	1,364	31.2	5.4	

Figure 2 Alternative Table: Intentional Injury Visits by Sex, Race, and Ethnicity (Rate per 1,000),
Ages 10-24 Years, VCU Emergency Department, 2003-2021

	Black female	Black male	White female	White male	Hispanic female	Hispanic male
FY2003	10.8	20.5	2.8	4.1	3.1	10.9
FY2004	7.6	14.8	1.9	2.4	2.4	11.3
FY2005	8.7	18.5	1.7	3.7	0.0	10.1
FY2006	11.4	21.7	2.9	4.8	3.1	10.5
FY2007	12.8	20.6	2.8	5.3	5.6	12.4
FY2008	13.2	17.9	3.5	4.8	2.6	10.9
FY2009	10.4	18.2	2.8	3.3	1.8	7.4
FY2010	11.7	19.1	2.0	3.3	2.7	9.4
FY2011	13.4	23.4	2.5	3.4	2.6	2.9
FY2012	11.9	17.9	2.0	4.3	0.0	1.7
FY2013	12.4	20.7	3.0	2.9	0.7	8.0
FY2014	9.8	17.7	2.8	2.8	1.8	6.1
FY2015	8.9	14.7	2.5	2.6	3.4	2.3
FY2016	4.2	8.6	1.1	1.1	2.8	3.4
FY2017	5.4	7.8	0.8	1.9	2.8	1.4
FY2018	4.8	7.7	1.3	1.5	1.2	2.5
FY2019	4.6	7.4	1.0	1.5	1.2	2.0
FY2020	7.0	11.5	2.0	2.2	3.8	2.5
FY2021	4.9	12.2	2.4	1.3	4.9	5.4

Figure 2 Note: Between FY202003 and FY202010, patient race and ethnicity were not captured independently; however, starting in FY202011, ethnicity was collected separately from race, thus race and ethnicity data from FY202011 forward are not comparable to previous years

	Figure 4 Alternative Table: Assault Visits by Race and Ethnicity (Rate per 1,000), Ages 10-24 Years, VCU Emergency Department, 2003-2021					
	Black	White	Hispanic	Overall Rate		
FY2003	12.2	2.7	6.9	8.8		
FY2004	11.3	1.6	7.5	7.8		
FY2005	16.7	2.1	7.4	9.2		
FY2006	16.2	2.8	9.3	11.1		
FY2007	14.9	3.0	12.9	10.5		
FY2008	13.9	3.5	10.6	9.8		
FY2009	11.9	2.2	4.0	7.0		
FY2010	12.5	2.1	6.3	7.6		
FY2011	14.7	2.2	2.1	8.2		
FY2012	11.8	2.6	0.3	6.7		
FY2013	13.4	1.5	5.1	7.7		
FY2014	11.6	1.9	4.9	6.9		
FY2015	8.9	1.2	2.1	5.3		
FY2016	4.3	0.6	2.2	2.6		
FY2017	4.5	0.8	1.6	2.8		
FY2018	3.8	0.6	1.2	2.4		
FY2019	3.8	0.5	1.1	2.3		
FY2020	5.0	1.0	2.1	3.2		
FY2021	2.9	0.7	2.3	1.9		

Figure 5 Alternative Table: Assault Visits by Sex (Rate per 1,000), Ages 10-24 Years, VCU Emergency Department, 2003-2021				
	Female	Male		
FY2003	6.4	11.3		
FY2004	5.5	10.4		
FY2005	6.0	12.7		
FY2006	8.2	14.2		
FY2007	8.0	13.3		
FY2008	8.4	11.3		
FY2009	5.2	9.0		
FY2010	6.0	9.4		
FY2011	6.4	10.1		
FY2012	5.6	8.8		
FY2013	7.0	8.2		
FY2014	5.3	8.4		
FY2015	4.1	6.6		
FY2016	2.2	3.2		
FY2017	2.5	3.1		
FY2018	1.8	3.1		
FY2019	2.2	2.5		
FY2020	3.1	3.4		
FY2021	1.7	2.2		

Figure 6 Alternative Table: Firearm-Related Injury Visits by Sex (Rate per 1,000), Ages 10-24 Years, VCU Emergency Department, 2003-2021						
	Female	Male				
FY2003	0.8	5.4				
FY2004	0.5	5.5				
FY2005	0.4	6.2				
FY2006	0.8	6.2				
FY2007	0.7	4.9				
FY2008	0.4	4.3				
FY2009	0.1	3.2				
FY2010	0.3	3.0				
FY2011	0.4	3.9				
FY2012	0.1	3.1				
FY2013	0.2	2.9				
FY2014	0.4	3.2				
FY2015	0.3	2.9				
FY2016	0.3	2.8				
FY2017	0.6	2.3				
FY2018	0.5	2.2				
FY2019	0.4	2.1				
FY2020	0.6	3.7				
FY2021	0.3	5.4				

Figure 7 Alternative Table: Suicide-Related Injury Visits (Rate per 1,000), Ages 10-24 Years, VCU Emergency Department, 2004-2021						
	FY2004-06	FY2007-09	FY2010-12	FY2013-15	FY2016-18	FY2019-21
Female	1.3	1.4	1.2	1.8	0.3	0.6
Male	0.8	0.8	0.7	1.1	0.3	0.4
Overall Rate	1.0	1.1	1.0	1.4	0.3	0.5

Suggested citation: Bishop DL, Lee JH, & Chapman DA. August 2022. Trends in Emergency Department Visits for Intentional Injury at Virginia Commonwealth University's Medical Center, Ages 10-24 Years, 2003-2021. The VCU Clark-Hill Institute for Positive Youth Development. www.clarkhill.vcu.edu (and date accessed).

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