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Table of Contents

Editor's Note--January 2022

Hello and welcome to the (extremely) late Fall Issue of the Virginia Journal of Public Health. In addition to three all new public health manuscripts for your professional reading pleasure, we have a new Journal website, a new editor, a new associate editor, and a new policy forum for the new year.

Aligned with the core goal of the VPHA and the Journal to promote best public health policy and practice, two manuscripts share findings from two different Virginia populations regarding perspectives on knowledge and uptake of human papilloma virus vaccine. Both studies illuminate surprising predictors of knowledge and/or uptake of vaccine and point the way to advancing HPV vaccination for Virginians. And a third manuscript--applying findings from our Central Virginia International Family Medicine Clinic--illustrates barriers to U.S. citizenship, which turns out to be an important health achievement for refugees in this country. Finally, VPHA's own Ben Barber introduces an exploratory policy forum to which we hope to have ongoing contributions.

Surprisingly, there are NO coronavirus manuscripts in this issue (although the editor's infection is the reason for the delayed Fall issue), but we figure that everyone working on coronavirus is too busy to write just now. Speaking, however, of writing, the Spring issue (which, new variants notwithstanding, will be out on time) is open for manuscript submissions now. We especially welcome public health practitioner manuscripts to disseminate regional and best public health practices. If you're a practitioner and not a writer, email the Journal editors (below), let us help you find a co-author who loves to write, and let your much needed public health voice be heard. Letters to the Editor are also welcome and we will advance the ongoing discussion of these important issues and public health policy and practice in general.

One last note: thank you James Madison University Libraries, Librarians, staff, and most especially, Becca Kruse, Digital-Commons-Explainer-Extraordinaire, without whom the new Journal would not be possible. Thank you also Kim Baskette, VPHA Chair and Cheerleader; and Ben Barber, VPHA Chair and Cheerleader Elect. AND thank you 4VA Foundation for the mini-grant which pays the bills. It takes a village to raise a journal.

Welcome all and thank you for your patience,

Maria and Jen

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Introducing the VPHA Policy Forum

Benjamin Barber, President-Elect, Virginia Public Health Association

In 2015, the Virginia Department of Health (VDH) published a five-year Plan for Well-Being. This ambitious plan set 13 goals and 29 measures to track progress towards achieving these goals (VDH, 2015). By 2020, 15 measures showed improvement. Major successes include near-universal adoption of collaborative community health planning processes by local health districts, growing provider participation in electronic health information exchanges, and increasing uptake of the Human Papillomavirus vaccine among teenagers (VDH, 2020). However, 14 measures showed little or no improvement, including seven measures that *moved away* from the goal. Most notably, mental health and substance use disorder hospitalizations per 100,000 adults have increased by over 10 percent since 2013, and the percent of adults who are overweight or obese continues to rise unabated (VDH, 2020). This data paints a decidedly mixed picture of public health in Virginia.

Then came the COVID-19 pandemic. Most of the data for VDH's 2020 update on the Plan for Well-Being was collected in 2019, but there is little reason to think these measures have improved since the pandemic began. Meanwhile, over 15,000 Virginians have died from COVID-19 and thousands more have been sickened (VDH, 2021). In addition, nearly all Virginians have felt the pandemic in some way, whether it be losing a loved one, getting laid off, or adjusting to virtual work and school.

Despite the heroic efforts of public health officials, health care providers, and other essential workers, it is indisputable that Virginia's public health system needs reform. This reform starts with better policy.

The great public health achievements of the 20th century all hinged, in part, on good policy (Johnson, 2021). Clean air and water laws, school vaccination requirements, and free preventive screenings are all examples of how good policy creates good public health. However, less attention-grabbing policies are important too. Funding prevention and wellness initiatives and modernizing data systems are just two examples of critical but often overlooked policies that can have an outsized impact on public health.

What counts as public health? How are public health services funded? How are they delivered, and are they delivered fairly? This forum will seek to answer these questions and to use those answers to create better public health policy. For instance, the General Assembly updated the Cooperative Health Budget formula this year for the first time in 30 years (Virginia Association of Counties, 2021). This formula determines the state and local share of funding for each localities' health department. For a generation, each locality's share was stagnant regardless of increases or decreases to their financial capacity. This helped fuel a disparity in public health resources between localities that have grown poorer and those that have grown richer.

Legislation approved in 2021 requires VDH to review the funding formula every two years, which may prevent such disparities in the future (Virginia Association of Counties, 2021). But this episode raises different questions. Should the state's share of local public health spending depend on a locality's ability to pay? Should it be based on public health needs? Or on a different basis altogether? Moreover, should the state set core public health standards as it does for education, or should the localities set these standards?

This forum is a place to examine these questions. And in doing so, we can create better public health policies - and better health - for all Virginians.

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HPV Vaccination in the Virginia Context: Demographic Disparities, Patient-Provider Gender Concordance and the Impact of Changing Recommendations

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Abstract

Objective: Despite its effectiveness in preventing several cancers, there are marked disparities in HPV vaccination initiation and series completion. The present study sought to understand disparities in HPV vaccinations among patients in northern Virginia (ages 9-26) and the impact of patient and provider gender concordance, in lieu of CDC's vaccine recommendation changes in 2016, which reduced the recommended doses from three to two, in this population.
Design: Analyses of electronic medical records collected from 2012 to 2017.
Setting: A large health care system in Northern Virginia.
Participants: A total of 37,427 patients, ages 9 to 26, were included in analyses.
Main outcome measures: We examined odds of initiating vaccination, completing vaccination at 6 months, completing vaccination at 12 months and clinical completion. We examined if patient and provider characteristics were associated with initiating vaccination and vaccination completion at different durations.
Results: Racial minorities had higher odds of getting vaccinated, relative to non-Latino whites. Each additional year between the patient's first and last visit was associated with higher odds of initiating vaccination, completing vaccination at both 6 and 12 months, and clinical completion. Compared to female patients who were 19 years and older, female patients aged 9-18 years had higher odds of initiating vaccination and clinical completion. Compared to male patients who were 19 years and older, female patients aged 9-18 years had higher odds of clinical completion Female and male patients had better outcomes when seen by female primary care providers than male primary care providers.
Conclusions and Relevance: Further research should investigate the observed benefit of female providers and to understand the long-term impact of changes in CDC recommendations.

Introduction

Globally, human papillomavirus (HPV) accounts for 690,000 incident cancer cases a year, with cervical, anogenital and oropharyngeal cancers comprising the majority of cases.[1, 2] In 2018, in North America, this amounts to 39,000 cases annually.[2] HPV vaccines are effective at preventing several cancers caused by HPV infections, including cervical,[3-5] vaginal,[6] and anal[7] cancers. Since the vaccine recommendations targeting adolescents were introduced in the United States in 2006, the prevalence of HPV types targeted by the vaccine has dropped by more than half in teenage women from 2003-2006 to 2007-2010.[8] Additionally, the prevalence of oral HPV infections was 88.2% among young adults who reported receipt of at least one dose of HPV vaccine compared to unvaccinated individuals.[9] Despite the demonstrated benefits, in 2015, among adolescents aged 13-15 years, only 37.1% girls and 27.1% of boys, respectively, had completed the three-dose HPV vaccine series.[10]

Prior studies have demonstrated that disparities exist in HPV vaccine series initiation. In general, those that are older, non-Latino-white (relative to other races) and those with private health insurance (relative to those who have publicly funded coverage) are more likely to initiate the vaccine series.[11-13] However, these associations vary by study, suggesting that differences in the population under examination are important. Disparities by medical department and health care provider specialty have also been documented, with family medicine practices showing higher rates of vaccine initiation, relative to general medicine or obstetrics and gynecology (OBGYN).[11]

Emerging research has also shown that provider characteristics, like provider gender, may influence HPV vaccination rates. Female providers are more likely to deliver adolescent vaccines than their male counterparts.[14] Providers are also more likely to recommend the vaccine to female patients than male patients.[15, 16] Furthermore, female patients report being more likely to get the vaccine if recommended by a female health care provider.[17] In all, studies highlight a complex interplay of patient and provider gender in determining vaccine recommendations and administration, however, examinations of the interaction between patient and provider gender are limited.

In Virginia, beginning October 1, 2008, all doses of the HPV vaccine series are mandatory for females attending all schools, with the 1st dose required to be administered before the start of 6th grade.[18] However, unlike other vaccines, parents can opt out of their children getting vaccinated against HPV because of its non-communicable nature in a school setting.[19] Parental barriers to HPV vaccination for their children include lack of physician recommendation for the vaccine, need for more information about the vaccine, low perceived risk of HPV infection, potential effect on sexual behavior, social influences, and vaccine cost. Of note, one barrier to completing all the doses of the HPV vaccination series is the lack of awareness or forgetfulness among parents that HPV vaccine is administered via multiple doses.[20]

Parents and guardians in Virginia are encouraged to submit the HPV immunization documents when their child starts school.[19, 21] According to the 2016 National Immunization Survey, in the state of Virginia, 41.1% of female and 37.4% of male adolescents aged 13-17 years had ≥3 HPV vaccine doses, including 2 doses received before 15 years of age. HPV immunization rates for

Virginia were similar to the national data from the same survey, where 49.5% of female and 37.5% of male adolescents aged 13-17 years in the United States received ≥3 HPV doses.[22]

Recent factors may make it easier to ensure compliance with HPV vaccine recommendations in the US and could potentially reduce existing disparities. Based on updated efficacy and effectiveness data, the Center for Disease Control and Prevention (CDC) Advisory Committee on Immunization Practices (ACIP) altered the vaccination schedule recommendations for children ages 9-14, by recommending a two-dose vaccination series in late October 2016.[23] Individuals 15-26 years of age were still advised to complete the previously recommended three-dose series. Thus, those who initiate the vaccine at a younger age now have fewer vaccine doses to complete, and consequently could facilitate vaccine schedule adherence. However, the impact of this policy on vaccine initiation and completion has not been examined extensively.

This study examined how disparities in HPV vaccination manifest in the state of Virginia, which has lower HPV vaccination rates than most states,[24] in spite of being one of only three states or territories mandating the HPV vaccine for school attendance.[25] In particular, given the change in ACIP vaccine recommendations, we examined how patient and provider factors are associated with initiation, partial completion, and full completion of the vaccination series.

Methods

Data

Data for this study come from electronic medical records of patients from a large healthcare system located in Northern Virginia. Data represented 41 health system practices, including 21 Family Medicine, 8 Internal Medicine, 8 Obstetrics and Gynecology (OBGYN) and 4 Pediatric that served low-income communities. Records for patients who were ages 9-26 at any point between 1/1/2012 and 7/31/2017 and had an office visit were included. Patients with a diagnosis of HPV via DNA test, or history of an abnormal PAP smear were excluded. This represented a total of 103,664 patient visits made by 37,427 patients. Records were coded to include reason for visit and if the patient received an HPV vaccine during their visit. Data use for this study was approved by both the health system and the University of Virginia Institutional Review Boards. Because this study involved a secondary analysis of de-identified data, informed consent was not required.

Variables

There were four dependent variables of interest: initiation of vaccination (i.e. receiving at least 1 vaccine dose), completion of vaccination series in 6 months, completion of vaccination series in 12 months, and clinical completion (i.e. completion of vaccination series within 3 years).

Several patient characteristics were examined as independent variables in analyses. These were: gender, race/ethnicity (White, Asian, Black, Latino, Middle Eastern, Multiracial, other race or unknown race), average age across all visits (9-10, 11-12, 13-18 and 19+), insurance coverage (public, private, other or unknown) and years between first and last visit (measured as a continuous variable). Two primary care provider characteristics were also examined: gender and department (primary care, family medicine, internal medicine, OBGYN and other providers). The "other provider" category included pediatricians, nurse practitioners, dermatologists and subspecialists managing a variety of clinics where eligible patients were seen.

According to the ACIP recommendations for HPV vaccination, the following criteria were applied for vaccination completion within 6 months:
a) For age groups more than 15 years, 3 shots should be given within 6 months;
b) For age groups less than 15 years, adolescents who have received 1 shot before April 2016, 3 shots be given within 6 months; and
c) For age groups less than 15 years, adolescents who have received 1 shot after April 2016, 2 shots be given within 6 months.

The same criteria were applied to vaccination completion within 12 months and clinical completion (i.e. completion of vaccination within 3 years), respectively. These definitions allow for the concurrent examination of both the older three-dose and newer two-dose vaccination recommendations.

Analyses

Data were analyzed using SAS 9.4. Sample characteristics were tabulated by the dependent variables. Because the outcome of interest was binary, logistic regression models, limited to the 33,150 cases with complete data, were used to estimate odds of the 4 different outcomes. Marginally standardized probabilities were also calculated.[26] These probabilities were created by scoring the data with model-based predicted probabilities assuming all the patients received the level of a variable (regardless of observed level). The sample average of the predicted probabilities was then used to get the marginally standardized probabilities. The probabilities can then be compared after eliminating biases due to different confounder distributions between levels.[26]

Results

Table 1 shows the sample characteristics. In general, vaccination initiation (47.83%), 6 months completion (1.22%), 12 months completion (2.53%) and clinical completion rates (5.79%) were highest among those who were 11-12 years of age. Latinos demonstrated the highest initiation (27.99%), 6 months completion (0.35%), 12 months completion (1.04%) and completion rates (3.21%), when compared to other racial/ethnic minority groups. Males and females saw similar rates of vaccine series initiation, 6 months completion, 12 months completion and clinical completion rates. Those with public insurance coverage saw higher rates of HPV vaccination initiation (23.12%), 6 months completion (0.35%), 12 months completion (0.86%) and clinical completion rates (2.31%); relative to other insurance types. Patients whose primary care provider was a female had higher rates of vaccination initiation (11.29%), 6 months completion (0.19%), 12 months completion (0.45%) and clinical completion (0.85%) compared to those who had a male primary care provider. Patients who had a primary care provider in "other" departments had the highest rates of vaccination initiation (42.95%), 6 months completion (0.67%), 12 months completion (1.56%) and clinical completion (5.43%).

Table 2 shows the results of the binary logistic regression model for the four dependent variables. Asian (OR=1.56; 95% CI= 1.34, 1.81), Black (OR=1.51; 95% CI= 1.31, 1.73), Latino (OR=1.67; 95% CI= 1.44, 1.93), other race (OR=1.63; 95% CI= 1.40, 1.88) and multiracial (OR=1.70; 95% CI= 1.29, 2.21) patients had higher odds of initiating at least one dose of HPV vaccination, relative to white patients. Each additional year between the patient's first and last visit was associated with higher odds of initiating vaccination (OR=1.63; 95% CI= 1.58, 1.68), completing vaccinations in 6 months (OR=1.46; 95% CI= 1.20, 1.78), completing vaccinations in 12 months (OR=1.71; 95% CI= 1.51, 1.94), and clinical completion (OR=1.92; 95% CI= 1.76,

2.10). Those that were 11-12 years of age had almost ten times the odds of initiating vaccination (OR=9.17; 95% CI= 8.03, 10.48), 6 months completion (OR=22.62; 95% CI= 9.19, 62.62), 12 months completion (OR=14.16; 95% CI= 7.86, 26.41) and clinical completion (OR=11.81; 95% CI= 7.39, 19.27), relative to patients who were 19 years or older. Those that were 13-18 years of age had more than three times the odds of initiating vaccination (OR=3.39; 95% CI= 3.06, 3.76), 6 months completion (OR=4.14; 95% CI= 1.65, 11.49), 12 months completion (OR=3.83; 95% CI= 2.17, 7.01) and clinical completion (OR=4.02; 95% CI= 2.60, 6.40), relative to patients who were 19 years or older. Patients with female primary care providers had higher odds of initiating vaccination(OR=1.51; 95% CI= 1.37, 1.66) , 6 months completion (OR=2.27; 95% CI= 1.16, 4.83), 12 months completion (OR=1.95; 95% CI= 1.25, 3.14) and clinical completion (OR=1.35; 95% CI= 1.01, 1.81), relative to those with male primary care providers. Patients with primary care providers from other departments had higher odds of initiating vaccination (OR=2.99; 95% CI= 2.53, 3.54), and clinical completion (OR=2.06; 95% CI= 1.28, 3.35), relative to patients with providers in the primary care department.

Table 3 shows the results of binary logistic regression models in female patients. Asian (OR=1.72; 95% CI= 1.42, 2.07), Black (OR=1.70; 95% CI= 1.43, 2.01), Latino (OR=1.68; 95% CI= 1.39, 2.03), other race (OR=1.75; 95% CI= 1.46, 2.09), unknown race (OR=1.39; 95% CI=1.11, 1.72), and multiracial (OR=1.80; 95% CI=1.28, 2.47) female patients had higher odds of initiating HPV vaccination, relative to white female patients. Each additional year between the female patient's first and last visit was associated with higher odds of initiating vaccination (OR=1.59; 95% CI=1.53,1.65), completing vaccinations in 6 months (OR=1.44; 95% CI=1.10,1.87), completing vaccinations in 12 months (OR=1.74; 95% CI=1.48, 2.05), and clinical completion (OR=2.02; 95% CI=1.79, 2.28). Female patients that were 9-10 years of age had more than ten times the odds of completing vaccination in 6 months (OR=13.23; 95% CI=1.92, 92.39), and more than four times the odds of clinical completion (OR=4.35; 95% CI=1.77, 9.82), relative to female patients who were 19 years or older. Female patients that were 11-12 years of age had higher odds of initiating vaccination (OR=9.87; 95% CI=8.31, 11.72), 6 months completion (OR=45.88; 95% CI=12.26, 253.53), 12 months completion (OR=16.36; 95% CI=7.82, 35.89) and clinical completion (OR=13.15; 95% CI=7.44, 23.74), relative to female patients who were 19 years or older. Female patients that were 13-18 years of age had higher odds of initiating vaccination (OR=2.97; 95% CI=2.61, 3.36), 6 months completion (OR=8.83; 95% CI=3.37, 47.92), 12 months completion (OR=3.90; 95% CI=1.90, 8.39) and clinical completion (OR=3.20; 95% CI=1.86, 5.63), relative to female patients who were 19 years or older. Female patients visiting female primary care providers had higher odds of initiating vaccination (OR=1.54; 95% CI=1.35, 1.75), and clinical completion (OR=1.63; 95% CI=1.05, 2.61), relative to those visiting male primary care providers. Female patients with primary care providers from other departments (OR=2.30; 95% CI=1.84, 2.89) and obstetrician and gynecology department (OR=1.96; 95% CI=1.57, 2.43) had higher odds of initiating vaccination, relative to female patients with providers in the primary care department.

Table 4 shows the results of binary logistic regression models in male patients. Latino (OR=1.58; 95% CI= 1.25, 1.99) and other race (OR=1.44; 95% CI= 1.12, 1.83) male patients had higher odds of initiating HPV vaccination relative to white male patients. Each additional year between the male patient's first and last visit was associated with higher odds of initiating vaccination (OR=1.67; 95% CI=1.59, 1.75), completing vaccinations in 6 months (OR=1.48;

95% CI=1.10,1.95), completing vaccinations in 12 months (OR=1.65; 95% CI=1.36, 1.99), and clinical completion (OR=1.81; 95% CI=1.59, 2.07). Male patients that were 9-10 years of age had higher odds of clinical completion (OR=5.08; 95% CI=1.83, 14.78), relative to male patients who were 19 years or older. Male patients that were 11-12 years of age had almost ten times the odds of initiating vaccination (OR=9.36; 95% CI=7.51, 11.68), 6 months completion (OR=9.79; 95% CI=2.98, 36.08), 12 months completion (OR=10.32; 95% CI=4.04, 29.21) and clinical completion (OR=12.60; 95% CI=5.55, 32.35), relative to male patients who were 19 years or older. Male patients that were 13-18 years of age had higher odds of initiating vaccination (OR=4.46; 95% CI=3.72, 5.35), 12 months completion (OR=3.36; 95% CI=1.39, 9.17), and clinical completion (OR=5.81; 95% CI=2.69, 14.40), relative to male patients who were 19 years or older. Male patients visiting female primary care providers had higher odds of initiating vaccination (OR=1.46; 95% CI=1.27, 1.69), 6 months completion (OR=3.91; 95% CI=1.49, 12.68) and clinical completion (OR=1.74; 95% CI=1.48, 5.82), relative to those visiting male primary care providers. Male patients with primary care providers from other departments had higher odds of initiating vaccination (OR=3.94; 95% CI=3.05, 5.09) and clinical completion (OR=3.54; 95% CI=1.73, 7.36), relative to male patients with providers in the primary care department.

Discussion

Results showed that most non-white patients had higher odds of initiating or completing the HPV vaccine series in this study population. This differs from much of the existing literature showing that minority populations have lower rates of initiation and ultimate completion of the HPV vaccination schedule.[27-29] Racial minorities are also less likely to be insured or utilize preventive health care than non-Latino whites.[30, 31] Even though, the present study is limited to people who live in a racially diverse part of the United States, the higher income nature of the Northern Virginia area may help explain some of the disparities observed. Specifically, previous research has shown that parents with higher socio-economic status and parents who are white are less likely to hold pro-social views about the HPV vaccine (i.e. seeing the vaccine as beneficial to society and not just the recipient)[29] and that anti-vaccine attitudes are more common in more affluent areas.[32]

While two-dose HPV vaccination is now common practice for 9-14-year-olds in the United States, this study indicates that vaccine initiation is still a major hurdle in this population. Among the 9-10-year-olds that initiated HPV vaccination, they had more time to achieve clinical completion compared to the older cohort. It may also indicate more frequent health care visits and thus more opportunities to get educated about HPV vaccination schedule.[33] The geographic area of Northern Virginia served by the study health system is a highly affluent region that likely serves parents with higher educational levels compared to some of the rural parts of Virginia. It is possible that parents residing in the area are more informed about HPV vaccination, more likely to follow the Virginia mandate, and thus are proponents of its completion within the intended time period.[34]
However, this population had higher odds of achieving clinical completion compared to 19+-year-olds. We also found that 11-18-year-olds had higher odds of vaccine initiation, which is similar to previous research looking at the age duration of HPV vaccine initiation.[35] Furthermore, those previously eligible for the vaccine, who had not yet initiated the vaccination series, may

represent a “hard-to-reach” population whose likelihood to vaccinate is driven by factors that cannot be accounted for in medical record data. HPV vaccination is covered under public insurance programs such as Medicaid, vaccines for children program, children’s health insurance program, and immunization grant program.[36] Research also shows that parents are more accepting of HPV vaccination if they have public insurance or pay out-of-pocket.[37] This is in support with the findings of our study that shows higher odds of vaccine initiation among the overall study population whose parents were covered by public insurance.

The rates of vaccination initiation for patients seeing internal medicine providers were lower when compared to other primary care providers. This may be due to the age range of the study population. Also, internal medicine physicians generally cater to adults rather than children whereas family medicine physicians or pediatricians often cater to both children and adults. Previous research has shown that a majority of physicians that cater to vaccinated children and children that are exempt from vaccination are pediatricians (53.7%), followed by family medicine (44.4%) and internal medicine (7.4%).[38] Compared to family medicine physicians, internal medicine physicians also tend to stock less vaccinations [39] and do not perceive the need to stock vaccinations due to the age of their patient population.[21]

Also, our findings showed a significant relationship between patient and provider gender in HPV vaccinations. Our study suggests that regardless of patient gender, vaccination schedule adherence was higher when patients saw female primary care providers. In particular, female patients were more likely to achieve clinical completion whereas male patients were more likely to complete vaccination within 12 months. Generally, gender concordant care has shown limited benefit in most contexts.[40, 41] However, studies have also shown that compared to male primary care providers, female primary care providers tend to have longer visits, gather more information from patients, have higher information exchange with the patients and have a better rapport with both male and female patients. [42,43] While children prefer physicians of the same gender, parents tend to prefer female providers. [43] As such, patients and their guardians may benefit from having the option to choose the gender of their primary care providers, so as to provide gender-concordant care to those who desire it. Furthermore, findings suggest that efforts must be taken to both understand and improve the vaccine recommendation and administration practices of male primary care providers. Doing so may help increase HPV vaccination uptake and reduce gender disparities.

Several limitations must be considered when interpreting findings. First, data represent patients seen at one healthcare system in Northern Virginia and thus may not generalize to other populations. Second, the nature of the data only allows us to control for a limited set of confounders, thus ignoring factors like household income and education. Third, because patients can enter or exit the Inova healthcare system at any time (i.e. an open population), it is impossible to know if patients initiated or completed the vaccination series outside of the health care system. Thus, the number of doses completed within the Inova healthcare system can only be a proxy of the actual number of doses completed. However, accounting for years between first and last visit should mitigate some of this impact. Finally, among the study sample, there may be individuals who were outside of the population for whom HPV vaccination was recommended. In particular, during the study inclusion period, HPV vaccination was only recommended through age 26 for men who are gay, bisexual or who have sex with men. For all other men, the

HPV vaccine was only recommended through age 21. As a result, the results for men may be biased to the null.

Despite limitations, this study expands existing knowledge of disparities in HPV vaccination in the United States in important ways. We showed that provider characteristics can interact with patient characteristics to improve adherence to the HPV vaccination schedule. As a result, future work must improve the vaccination behaviors of male primary care providers.

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Table 1: Patient and Characteristics, by HPV Vaccine Series Dose Completion (N=33,150)

	All		Vaccination Initiation		6 months completion		12 months completion		Clinical completion	
	N	%	N	%	N	%	N	%	N	%
Patient Race										
Asian	2818	8.5	273	9.69	3	0.11	9	0.32	16	0.57
Black	3699	11.16	366	9.89	5	0.14	8	0.22	25	0.68
Latino	3462	10.44	969	27.99	12	0.35	36	1.04	111	3.21
Middle Eastern	462	1.39	53	11.47	1	0.22	1	0.22	2	0.43
Multiracial	640	1.93	85	13.28	0	0	1	0.16	1	0.16
Other Race	3001	9.05	363	12.1	6	0.2	12	0.4	26	0.87
Unknown Race	2428	7.32	172	7.08	2	0.08	4	0.16	6	0.25
White	16640	50.2	1041	6.26	19	0.11	45	0.27	65	0.39
Patient Gender										
Female	20144	60.77	1946	9.66	26	0.13	68	0.34	132	0.66
Male	13006	39.23	1376	10.58	22	0.17	48	0.37	120	0.92
Patient Age										
9-10	2097	6.33	99	4.72	2	0.1	6	0.29	18	0.86
11-12	2210	6.67	1057	47.83	27	1.22	56	2.53	128	5.79
13 -18	7415	22.37	1304	17.59	13	0.18	37	0.5	77	1.04
19+	21428	64.64	862	4.02	6	0.03	17	0.08	29	0.14
Insurance Type										
Other	460	1.39	42	9.13	0	0	0	0	2	0.43
Private	26653	80.4	2004	7.52	29	0.11	70	0.26	125	0.47
Public	5368	16.19	1241	23.12	19	0.35	46	0.86	124	2.31
Unknown	669	2.02	35	5.23	0	0	0	0	1	0.15
Years Between First and Last Visit										
0	19847	59.87	895	4.51	6	0.03	10	0.05	10	0.05
1	6950	20.97	678	9.76	15	0.22	26	0.37	38	0.55
2	3189	9.62	590	18.5	8	0.25	19	0.6	39	1.22
3	1719	5.19	476	27.69	9	0.52	31	1.8	64	3.72

4	947	2.86	417	44.03	5	0.53	16	1.69	59	6.23
5	498	1.5	266	53.41	5	1	14	2.81	42	8.43
Primary Care Provider Gender										
Female	20182	60.88	2279	11.29	38	0.19	91	0.45	172	0.85
Male	12968	39.12	1043	8.04	10	0.08	25	0.19	80	0.62
Primary Care Provider Department										
Family Medicine	6417	19.36	743	11.58	8	0.12	29	0.45	48	0.75
Internal Medicine	5115	15.43	165	3.23	0	0	0	0	3	0.06
OBGYN	1597	4.82	115	7.2	1	0.06	1	0.06	2	0.13
Other	2375	7.16	1020	42.95	16	0.67	37	1.56	129	5.43
General medicine	17646	53.23	1279	7.25	23	0.13	49	0.28	70	0.4

Table 2: Odds of completing immunizations by different durations (N=33,150)

	Starting vaccination		**6 months completion**		**12 months completion**		**Clinical completion**	
	OR [95% CI]	Marginal Probability	OR [95% CI]	Marginal Probability	OR [95% CI]	Marginal Probability	OR [95% CI]	Marginal Probability
Patient Race								33,150
White								
Asian	**1.56 [1.34-1.81]**	11.47%	0.92 [0.24-2.58]	0.20%	1.10 [0.51-2.14]	0.46%	1.23 [0.68-2.10]	0.91%
Black	**1.51 [1.31-1.73]**	11.20%	1.05 [0.36-2.62]	0.23%	0.75 [0.33-1.51]	0.32%	1.38 [0.84-2.21]	1.00%
Latino	**1.67 [1.44-1.93]**	11.93%	0.48 [0.18-1.25]	0.11%	0.82 [0.44-1.49]	0.34%	1.02 [0.66-1.59]	0.77%
Middle Eastern	1.17 [0.82-1.63]	9.42%	1.48 [0.16-6.33]	0.32%	0.70 [0.08-2.76]	0.30%	0.54 [0.11-1.69]	0.43%
Multiracial	**1.70 [1.29-2.21]**	12.12%	0.37 [0.00-2.78]	0.08%	0.49 [0.06-1.86]	0.21%	0.27 [0.03-1.04]	0.22%
Other Race	**1.63 [1.40-1.88]**	11.79%	1.29 [0.46-3.16]	0.28%	1.28 [0.64-2.40]	0.53%	1.52 [0.91-2.47]	1.09%
Unknown Race	1.16 [0.97-1.39]	9.40%	0.79 [0.16-2.51]	0.17%	0.65 [0.21-1.56]	0.27%	0.69 [0.27-1.45]	0.53%
Estimated follow up in years	**1.63 [1.58-1.68]**	18.90%	**1.46 [1.20-1.78]**	0.31%	**1.71 [1.51-1.94]**	0.76%	**1.92 [1.76-2.10]**	1.52%
Patient Gender								
Male								
Female	1.07 [0.98-1.17]	10.21%	0.91 [0.51-1.63]	0.17%	1.13 [0.77-1.66]	0.40%	0.96 [0.74-1.26]	0.78%
Patient Age								

19+								
9-10	**0.51 [0.40-0.65]**	3.21%	3.53 [0.63-14.51]	0.15%	3.47 [1.27-8.44]	0.38%	**4.36 [2.28-8.14]**	0.88%
11-12	**9.17 [8.03-10.48]**	29.30%	**22.62 [9.19-62.62]**	0.95%	**14.16 [7.86-26.41]**	1.49%	**11.81 [7.39-19.27]**	2.25%
13-18	**3.39 [3.06-3.76]**	15.02%	**4.14 [1.65-11.49]**	0.18%	**3.83 [2.17-7.01]**	0.42%	**4.02 [2.60-6.40]**	0.82%
Insurance Type								
Private								
Other	**0.90 [0.62-1.27]**	9.17%	0.87 [0.01-6.43]	0.16%	0.35 [0.00-2.47]	0.14%	0.83 [0.17-2.46]	0.72%
Public	**1.15 [1.03-1.29]**	9.87%	0.96 [0.44-2.02]	0.18%	1.03 [0.63-1.68]	0.38%	0.85 [0.60-1.20]	0.85%
Unknown	**0.54 [0.37-0.78]**	6.51%	0.72 [0.01-5.67]	0.13%	0.44 [0.00-3.17]	0.17%	0.57 [0.06-2.16]	0.51%
Primary Care Provider Gender								
Male								
Female	**1.51 [1.37-1.66]**	10.80%	**2.27 [1.16-4.83]**	0.22%	**1.95 [1.25-3.14]**	0.44%	**1.35 [1.01-1.81]**	0.82%
Primary Care Provider Department								
General medicine								
Family Medicine	**1.34 [1.21-1.49]**	1.49%	0.72 [0.30-1.54]	0.13%	1.19 [0.73-1.89]	0.47%	1.41 [0.96-2.05]	0.79%
Internal Medicine	**0.69 [0.58-0.82]**	0.82%	0.17 [0.00-1.34]	0.03%	0.08 [0.00-0.54]	0.03%	0.38 [0.10-1.00]	0.23%
OBGYN	**2.01 [1.62-2.47]**	2.47%	2.14 [0.23-8.98]	0.38%	0.97 [0.11-3.72]	0.39%	1.22 [0.25-3.64]	0.69%
Other	**2.99 [2.53-3.54]**	3.54%	1.25 [0.43-3.60]	0.23%	0.87 [0.43-1.77]	0.35%	**2.06 [1.28-3.35]**	1.13%

Table 3: Odds of completing vaccinations by different durations for females (N=20,144)								
	Starting vaccination		6 months completion		12 months completion		Clinical completion	
	OR [95% CI]	Marginal Probability	OR [95% CI]	Marginal Probability	OR [95% CI]	Marginal Probability	OR [95% CI]	Marginal Probability
Patient Race								
White								
Asian	**1.72 [1.42-2.07]**	11.63%	1.40 [0.27-4.97]	0.20%	0.92 [0.29-2.32]	0.33%	1.52 [0.73-2.92]	0.93%
Black	**1.70 [1.43-2.01]**	11.51%	1.13 [0.21-4.05]	0.17%	0.91 [0.32-2.16]	0.33%	1.49 [0.77-2.74]	0.92%
Latino	**1.68 [1.39-2.03]**	11.44%	1.27 [0.36-4.25]	0.19%	1.16 [0.52-2.50]	0.41%	0.94 [0.51-1.72]	0.61%
Middle Eastern	1.10 [0.69-1.70]	8.43%	1.22 [0.01-10.52]	0.18%	0.43 [0.00-3.33]	0.16%	0.52 [0.06-2.25]	0.35%
Multiracial	**1.80 [1.28-2.47]**	11.98%	0.76 [0.01-6.11]	0.11%	0.87 [0.10-3.45]	0.31%	0.50 [0.05-1.99]	0.34%
Other Race	**1.75 [1.46-2.09]**	11.76%	2.83 [0.87-8.32]	0.41%	2.11 [0.95-4.38]	0.73%	**2.05 [1.09-3.72]**	1.21%
Unknown Race	**1.39 [1.11-1.72]**	9.98%	0.31 [0.00-2.45]	0.05%	0.62 [0.12-1.92]	0.22%	0.75 [0.24-1.84]	0.49%
Estimated follow up in years ǂ	**1.59 [1.53-1.65]**	18.60%	**1.44 [1.10-1.87]**	0.31%	**1.74 [1.48-2.05]**	0.80%	**2.02 [1.79-2.28]**	1.54%
Patient Age								
19+								
9-10	**0.67 [0.49-0.91]**	4.11%	**13.23 [1.92-92.39]**	0.36%	3.61 [0.89-11.36]	0.41%	**4.35 [1.77-9.82]**	0.95%
11-12	**9.87 [8.31-11.72]**	32.89%	**45.88 [12.26-253.53]**	1.23%	**16.36 [7.82-35.89]**	1.78%	**13.15 [7.44-23.74]**	2.67%
13-18	**2.97 [2.61-3.36]**	14.38%	**8.83 [2.37-47.92]**	0.24%	**3.90 [1.90-8.39]**	0.44%	**3.20 [1.86-5.63]**	0.71%
Insurance Type								
Private								
Other	1.17 [0.76-1.73]	10.67%	1.42 [0.01-11.50]	0.26%	0.58 [0.01-4.25]	0.22%	0.91 [0.10-3.50]	0.62%
Public	1.11 [0.95-1.28]	9.56%	0.91 [0.33-2.35]	0.18%	1.13 [0.06-2.08]	0.37%	1.10 [0.68-1.75]	0.68%
Unknown	**0.62 [0.38-0.97]**	6.76%	1.02 [0.01-8.66]	0.19%	0.68 [0.01-5.11]	0.26%	0.39 [0.00-2.85]	0.28%
Primary Care Provider Gender								
Male								
Female	**1.54 [1.35-1.75]**	10.33%	1.28 [0.53-3.50]	0.19%	1.41 [0.78-2.70]	0.40%	**1.63 [1.05-2.61]**	0.74%
Primary Care Provider Department								
General medicine								

Family Medicine	**1.35 [1.18-1.54]**	10.58%	1.23 [0.43-3.24]	0.23%	1.66 [0.91-2.99]	0.65%	1.48 [0.91-2.37]	0.89%
Internal Medicine	**0.76 [0.62-0.93]**	6.86%	0.50 [0.00-4.57]	0.09%	0.14 [0.00-1.01]	0.06%	0.36 [0.07-1.11]	0.23%
OBGYN	**1.96 [1.57-2.43]**	13.80%	2.48 [0.26-11.69]	0.45%	1.06 [0.12-4.31]	0.43%	1.31 [0.26-4.07]	0.80%
Other	**2.30 [1.84-2.89]**	15.44%	0.74 [0.19-2.88]	0.14%	0.68 [0.27-1.67]	0.28%	1.24 [0.65-2.40]	0.76%

ǂ Marginal probabilities are projected rates if patient is followed for 4 years.

Table 4: Odds of completing vaccinations by different durations for males (N=13,006)								
	Starting vaccination		**6 months completion**		**12 months completion**		**Clinical completion**	
	OR [95% CI]	Marginal Probability	OR [95% CI]	Marginal Probability	OR [95% CI]	Marginal Probability	OR [95% CI]	Marginal Probability
Patient Race								
White								
Asian	1.27 [0.97-1.65]	11.08%	0.66 [0.07-2.91]	0.31%	1.41 [0.49-3.46]	0.83%	0.92 [0.32-2.21]	0.93%
Black	1.20 [0.94-1.52]	10.67%	0.89 [0.19-3.14]	0.41%	0.60 [0.15-1.73]	0.36%	1.25 [0.57-2.58]	1.23%
Latino	**1.58 [1.25-1.99]**	12.61%	**0.15 [0.03-0.63]**	0.07%	0.48 [0.18-1.24]	0.29%	0.99 [0.51-1.91]	0.99%
Middle Eastern	1.37 [0.80-2.26]	11.60%	3.00 [0.30-14.54]	1.21%	1.74 [0.19-7.30]	1.01%	0.85 [0.09-3.65]	0.87%
Multiracial	1.57 [0.97-2.46]	12.56%	0.49 [0.00-4.87]	0.23%	0.34 [0.00-2.72]	0.21%	0.21 [0.00-1.66]	0.24%
Other Race	**1.44 [1.12-1.83]**	11.91%	0.40 [0.04-1.96]	0.19%	0.50 [0.10-1.66]	0.31%	0.97 [0.39-2.17]	0.98%
Unknown Race	0.83 [0.59-1.13]	8.49%	1.73 [0.33-6.19]	0.75	0.90 [0.18-2.87]	0.54%	0.69 [0.14-2.13]	0.72%
Estimated follow up in years	**1.67 [1.59-1.75]**	19.07%	**1.48 [1.10-1.95]**	0.42%	**1.65 [1.36-1.99]**	0.84%	**1.81 [1.59-2.07]**	1.67%
Patient Age								
19+								
9-10	**0.42 [0.28-0.61]**	2.62%	0.58 [0.00-5.79]	0.06%	3.04 [0.69-11.27]	0.41%	**5.08 [1.83-14.78]**	0.93%
11-12	**9.36 [7.51-11.68]**	25.37%	**9.79 [2.98-36.08]**	0.98%	**10.32 [4.04-29.21]**	1.34%	**12.60 [5.55-32.35]**	2.17%
13-18	**4.46 [3.72-5.35]**	15.86%	1.68 [0.46-6.42]	0.17%	**3.36 [1.39-9.17]**	0.45%	**5.81 [2.69-14.40]**	1.06%
Insurance Type								
Private								
Other	0.53 [0.24-1.04]	7.02%	2.51 [0.02-19.35]	0.57%	0.85 [0.01-6.54]	6.54%	1.27 [0.14-5.15]	1.47%
Public	**1.22 [1.01-1.45]**	10.38%	0.97 [0.27-3.19]	0.24%	0.89 [0.39-1.97]	1.97%	0.66 [0.40-1.10]	1.20%
Unknown	**0.46 [0.23-0.84]**	6.43%	1.59 [0.01-15.45]	0.37%	1.06 [0.01-8.41]	8.41%	1.05 [0.11-4.30]	1.25%
Primary Care Provider Gender								
Male								
Female	**1.46 [1.27-1.69]**	11.53%	**3.91 [1.49-12.68]**	0.37%	**2.83 [1.48-5.82]**	0.61%	1.18 [0.80-1.75]	1.02%
Primary Care Provider Department								
General medicine								
Family Medicine	**1.34**	10.67%	0.37	0.09%	0.72	0.32%	1.23	0.68%

	[1.13-1.59]		[0.07-1.27]		[0.30-1.55]		[0.63-2.28]	
Internal Medicine	**0.55 [0.38-0.77]**	5.61%	0.21 [0.00-1.85]	0.05%	0.17 [0.00-1.36]	0.08%	0.60 [0.06-2.51]	0.34%
Other	**3.94 [3.05-5.09]**	20.93%	2.53 [0.48-13.28]	0.62%	1.41 [0.45-4.42]	0.62%	**3.54 [1.73-7.36]**	1.83%

Knowledge of the Human Papillomavirus Vaccine: An Analysis using Together for Health Virginia Population Health Survey

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Abstract

Purpose: The purpose of this analysis was to identify key predictors which impact knowledge of the Human Papillomavirus vaccine in adults aged 21 to 45 in Virginia.

Methods: Data was collected from the Together for Health Virginia Population Surveys administered by Virginia Commonwealth University and the University of Virginia. Logistic regression was performed on data using the variables sex, age, rurality, race, education, income, occupation, and type of health insurance coverage.

Results: There was a statistically significant positive relationship between knowledge of the HPV vaccine and part-time occupation (OR: 4.288, CI: 1.492-13.325), younger age (OR: 2.31, CI: 1.088-4.905), and higher education (OR: 2.683, CI: 1.227-5.870). There was a statistically significant negative relationship between knowledge of the vaccine and being male (OR: 0.437, CI: 0.248-0.771), living in an urban area (OR: 0.511, CI: 0.267-0.977), and identifying in the lower income category (OR: 0.246, CI: 0.093-0.651).

Conclusion: This study identified 6 key predictors in knowledge of the HPV vaccine among adults in Virginia. Future studies should explore, in particular, the category of students and residents of urban areas. Despite these results, knowledge of the HPV vaccine does not translate to intention to receive the vaccine. Therefore, future studies should additionally study attitudes, behaviors, and potential barriers.

Background:

Human Papillomavirus (HPV) infects about 14 million people in the United States each year, making it the most prevalent sexually transmitted disease in the country (Fueta & Chido-Amajuoyi, 2020). Although there are over 200 subtypes of the virus, 14 types are responsible for 5% to 10% of all cancers. Of these 14 subtypes, strains 16 and 18 are considered the most oncogenic (Lehtinen & Dillner, 2013). It is estimated that over 90% of cervical and anal cancers, 75% of vaginal cancers, and 70% of oropharyngeal and vulvar cancers are caused by HPV. Large percentages of penile (63%), oral (32%), and laryngeal (21%) cancers are also caused by the virus (Saraiya et al., 2015). It is estimated that in 2021 alone, over 4,000 women will die from cervical cancer in the United States (American Cancer Society, 2021). In addition to the high rates of morbidity and mortality due to HPV-derived cancers, are the staggering economic costs. According to the President's Cancer Panel Annual Report from 2012 to 2013, the annual economic burden stands at approximately $8 billion in the United States (Chesson et al., 2012). These human and financial costs can be reduced by preventing HPV infections.

The HPV vaccine is an extremely effective preventative measure against the most cancer-related strains. The most commonly heard of vaccine is Gardasil by Merck. Originally quadrivalent protecting against only HPV 6/11/16/18, the nonvalent Gardasil9 vaccine protects against HPV 6/11/16/18/31/33/45/52/58 (Gardasil, 2021). As of 2020, Gardasil9 is the only vaccine being used in the United States (Saslow et al., 2020). There are two doses given at various monthly intervals depending on if the vaccine recipient is younger or older than 15. The vaccine is aimed at those aged 9 to 14 because they are less effective after commencement of sexual intercourse and potential exposure to HPV. In trial, the nonvalent Gardasil9 vaccine was

found to be as effective at preventing HPV 6/11/16/18 when compared to the quadrivalent vaccine, but is also protective against HPV 31/33/45/52/58 (Joura et al., 2015).

Despite this convenient and effective vaccine, the United States is well below vaccinating the Healthy People 2020 target of 80% of females aged 13 to 15. Utilizing data from 2008-2018, only 48.9% and 47.1% of females and males, respectively, aged 13 to 15 had received 2 or 3 doses. When considering 13 to 17-year old's, only 53.7% and 48.7% of females and males, respectively, were vaccinated (HPV Vaccination, 2021). In the state of Virginia, rates for up to date HPV vaccines for females and males 13 to 17 in 2016 were 41.1% and 37.4%, respectively. 50.7% and 56.4% of females and males 13 to 17, respectively, received one or more doses (Walker, 2017). While higher than the national average for one or more doses, Virginia is still well below vaccination rates necessary for herd immunity. Interestingly, Virginia was the first state to mandate three doses of the HPV for adolescent girls entering middle school in 2008 (expanded to adolescent boys as of 2020) (*§ 32.1-46*). However, the bill included an opt-out option if parents read educational materials on HPV. The rates in the years following the new law indicate that the mandate was not effective. One difference-in-differences study found that controlling for demographic factors, females in Virginia were less likely to be vaccinated when compared to South Carolina and Tennessee, control states that did not have an HPV vaccine school mandate (Pierre-Victor et al., 2017).

Why are vaccination rates so low? Why do mandates prove to be ineffective? There are a multitude of factors that have been researched such as costs and access, scrutiny over an STD-preventing vaccine, and lack of education. The HPV vaccine requires three doses given months apart. The vaccine cost is usually not a problem as most children are covered through private insurance and public programs. Many childhood vaccine organizations cover uninsured,

Medicaid eligible, Native American and Alaskan Native children (North & Niccolai, 2016). However, there are other costs including transportation and taking time off work to accompany children to appointments, especially in rural regions. For example, one study found that in Kentucky, women in rural areas were 7 times less likely to receive their follow-up vaccine doses compared to women living in urban areas (Crosby et al., 2011). In Virginia, 46% of counties are rural and 72% are medically underserved, highlighting access due to geographic location as a potential predictor for low vaccination rates (HRSA, 2017).

A second major reason for low vaccination rates for HPV is because it is perceived as the "sex vaccine" and that vaccinating their children will increase risky sexual behaviors. However, it was found that HPV vaccination status is not associated with earlier sexual behavior nor an increased number of sexual partners (Brouwer et al., 2019). Further, by mandating vaccination in Virginia, parents distrusted the vaccine more due to "perceived political involvement" (Pitts & Tufts, 2013). Another study found that 23% of parents in the United States were hesitant due to concern about side effects and the novelty of the vaccine (Szilagyi, 2020). Ultimately, this barrier boils down to lack of knowledge. One study found that that 60.1% and 31.6% of men and women, respectively, aged 18 to 26 years old did not know that HPV causes cervical cancer. Of US adults, over 70% did not know HPV can cause anal, penile or oral cancers (Suk et al., 2019). Even among survivors of HPV-related cancers, it was found that only 33.2% knew that their cancer was caused by HPV and less than 60% felt that the HPV vaccine was safe (Shelal et al., 2019).

These numbers are alarming and more research is warranted in order to improve vaccination rates. While there are studies exploring HPV vaccination rates in Virginia, there is data lacking on predictors of HPV vaccine knowledge throughout the state. This paper explores

the role of sex, race, age, geographic setting (rural or metropolitan), education level, income, occupation status, and health insurance type on if one has heard of the HPV vaccine in Virginia.

Methods:

Data analyzed in this study are from the Together for Health Virginia Population Health Survey administered by the Virginia Commonwealth University (VCU) and the University of Virginia (UVA). The purpose of this survey was to obtain state-level data on cancer-related beliefs, attitudes, behaviors, and information sources. Virginia counties within the cancer center catchment boundaries of the two universities were targeted (Appendix A). Survey data collection was approved by the Institutional Review Board (IRB) at both universities. Sex, age, Black race indicator, rurality, and HPV vaccine knowledge are dichotomized variables. Existing education, income, occupation, and insurance categories from the survey were combined. The category "Other" in Occupation includes the smallest categories: those who are disabled (4.52%), students (2.02%), homemakers or stay-at-home parents (4.91%) and those categorized as "other" in the original survey (1.25%). The category "Other" in health insurance similarly combined the smallest categories: Alaska Native, Indian, and Tribal health services (0.29%), TRICARE (4.56%), purchased health coverage on one's own (4.06%), "some other source" (1.61%), and no coverage (1.56%). Multivariate analysis was performed using SAS. Univariate analysis can be found in Appendix B.

Results:

Table 1: Demographic Characteristics of Survey Participants

Characteristic	Percent	Confidence Interval
Sex (n=1496)		
Male	47.91%	43.49% - 52.34%
Female	52.09%	47.66% - 56.51%
Age (n=1496)		
21 to 45 years old	47.98%	43.49%-52.47%
45≤ years old	52.02%	47.53% - 56.51%
Black (n=1496)		
Yes	18.83%	14.95%-22.71%
No	81.17%	77.29%-85.05%
Rurality (n=1496)		
Urban	33.74%	29.66%-37.83%
Rural	66.26%	62.17%-70.34%
Education (n=1427)		
Not completed high school	7.72%	5.19%-10.25%
High school or some college	60.83%	56.58%-65.08%
College or Graduate School	31.45%	27.58%-35.32%
Individual Income (n=1193)		
Less than 35k	32.01%	27.00%-37.03%
35k to 49,999	12.64%	9.57%-15.71%
50k to 99,999	29.13%	24.70%-33.57%
100k+	26.21%	22.36%-30.06%
Occupation (n=900)		
Full-time	51.40%	45.72%-57.09%
Part-time	8.53%	5.13%-11.92%
Retired	22.21%	18.07%-26.36%
Other	17.86%	13.21%-22.50%
Health Insurance (n=1363)		
Employer	52.43%	47.79%-57.06%
Medicare	22.40%	18.84%-25.95%
Medicaid	13.09%	9.14%-17.04%
Other	12.08%	9.36%-14.82%
Heard of HPV Vaccine (n=1436)		
Yes	72.26%	68.26%-76.25%
No	27.74%	23.75%-31.73%

The distributions of sex and age were about even between men and women and those 21 to 45 and 45 and older. Most participants were not Black (81.17%), had completed high school or some college (60.83%), worked full time (51.40%), had employer sponsored health insurance (52.43%) and lived in a rural area (66.26%) (Table 1). Rurality in this survey was defined using the U.S. Department of Agriculture, Economic Research Service (ERS) rural-urban continuum codes. Metro or Urban Counties were coded 1 to 3. Nonmetro or Rural counties are coded 4 to 9 (USDA ERS, 2020). The income distribution was more evenly divided with a slight majority (31.01%) having an income less than $35,000 (Table 1).

Because the predictors included in our model are conceptually related, correlations were run between each variable to examine the possibility of multicollinearity. All correlations had Pearson Correlation Coefficients below 0.36679 except for education and income which had a value of 0.50511 (Appendix C). For this reason, regression was run twice, including and excluding income as a predictor.

Knowledge of the HPV vaccine was the primary dependent variable in this model. The survey read: “A vaccine to prevent HPV prevention is available and is called the HPV shot, cervical cancer vaccine, GARDASIL, or Ceravix. Before today, have you ever heard of the HPV vaccine?” The answer choices were “Yes” or “No.”

Table 2: Logistic Regression: Modeling knowledge of the HPV vaccine based on sex, age, education level, income, rurality, insurance type

	Model 1: Including Income		Model 2: Excluding Income	
Parameter	**Estimate**	**Odds Ratio**	**Estimate**	**Odds Ratio**
Intercept	**1.4932***** (0.3784)		**1.0441**** (0.3356)	
Male	**-0.8273**** (0.2886)	**0.437** (0.248-0.771)	**-0.6214*** (0.2565)	**0.537** (0.325-0.889)
21-45 years old	**0.8373*** (0.3835)	**2.310** (1.088-4.905)	**0.8126*** (0.3263)	**2.254** (1.188-4.276)
Black	**-0.4867** (0.6378)	**0.615** (0.176-2.150)	**-0.4705** (0.4282)	**0.625** (0.270-1.448)
Urban	**-0.6712*** (0.3299)	**0.511** (0.267-0.977)	**-0.3928** (0.2816)	**0.675** (0.389-1.173)
Education <high school College or Graduate School ref= completed high school/some college	 **-0.7512** (0.5892) **0.9871*** (0.3987)	 **0.472** (0.148-1.500) **2.683** (1.227-5.870)	 **-1.0698** (0.6024) **0.7488*** (0.2985)	 **0.343** (0.105-1.119) **2.115** (1.177-3.799)
Income Less than 35k 35k to 49,999 100k+ ref= 50k to 99,999	 **-0.5285** (0.4911) **-1.4009**** (0.4947) **-0.0805** (0.4948)	 **0.589** (0.225-1.546) **0.246** (0.093-0.651) **0.923** (0.349-2.438)	 - - -	 - - -
Occupation Part-Time Retired Other ref=Full-Time	 **1.4559**** (0.5377) **0.6770** (0.4069) **0.5489** (0.5549)	 **4.288** (1.492-13.325) **1.968** (0.885-4.375) **1.731** (0.582-5.147)	 **1.4262*** (0.4964) **0.5093** (0.3586) **0.6373** (0.4555)	 **4.163** (1.571-11.028) **1.664** (0.823-3.364) **1.891** (0.774-4.624)
Health Insurance Medicare Medicaid Other	 **-0.6317** (0.4321) **0.2497** (0.5571) **-0.1826**	 **0.532** (0.228-1.242) **1.284** (0.430-3.833) **0.833**	 **-1.0616*** (0.3850) **-0.2684** (0.4850)	 **0.346** (0.162-0.736) **0.765** (0.295-1.981) **0.480**

Ref=Employer	(0.4593)	(0.338-2.053)	**-0.7333** (0.4550)	(0.198-1.163)

SE for Estimate and 95% Confidence Interval for Odds Ratio in Parentheses; *p<0.05; **p<0.01; ***p<0.0001

Given the large sample size, relatively low correlation coefficient (0.50511), and similarities between models, analysis in this paper will consider the model which includes income as a predictor for knowledge of the HPV vaccine (Table 2). There are 6 significant predictors in this model. Being male, living in an urban area, or having an income from $35,000 to $49,999 relative to an income of $50,000 to $99,999 substantially decreased the odds that an individual has knowledge of the HPV vaccine. Compared to females, the odds that males have knowledge of the HPV vaccine are 0.437 times less (CI: 0.248-0.771). Similarly, those living in an urban area are 0.511 times (CI: 0.267-0.977) less likely to have heard of the HPV vaccine. Compared, to those who make $50,000 to $99,9999, those who fall into the bracket of $35,000 to $49,999 were almost 0.246 times (CI: 0.093-0.651) less likely to have heard of the vaccine. On the other hand, increased education – those with a college or graduate school degree were 2.683 times (CI: 1.227-5.870) more likely to have reported that they had knowledge of the HPV vaccine compared to someone with, at minimum, a high school degree. Those who self-identified as “Part-Time” were over 4 times as likely to have knowledge of the HPV vaccine compared to “Full-Time” workers (OR: 4.288, CI: 1.492-13.325).

Discussion:

While there is evidence that rurality is associated with decreased HPV vaccination rates, this study found that there was less knowledge of the HPV vaccine in urban areas (Crosby et al., 2011). Given that this analysis did not control for cost of living in addition to income, this study is limited in understanding the real-life financial situations of survey participants**.** According to

the US Census Bureau, 42 out of 50 states have higher poverty rates in urban versus rural areas. Poverty, which is tied to health literacy, could explain the lower rates of HPV vaccine knowledge in urban areas. Additionally, 2010 census data indicates that rural communities are, on average, comprised of 78% white, non-Hispanic individuals. Urban areas are nearly 15% more racially diverse. Studies have consistently found disparities in health knowledge by race. For example, one study found Hispanic and Black women were significantly less likely to have heard of HPV compared to white women (Gelman et al, 2011). Given this existing literature, the result of having less HPV vaccine knowledge in urban areas can be understood.

Interestingly those who were part of the $35,000 to $49,999 income range, but not those who make less than $35,000, had significantly lower odds of having heard of the vaccine compared to the $50,000 to $99,999 range. This could potentially be explained by the "Part-Time" occupation being a significant predictor for having heard of the HPV vaccine. One possible explanation is that, while the "Other" category contained an option for students, there is a possibility that a disproportionate number of students in higher education self-identified as "Part-Time." As previously shown, increased education was associated with 3-fold higher odds of having heard of the vaccine and would translate to part-time working students also having a greater knowledge.

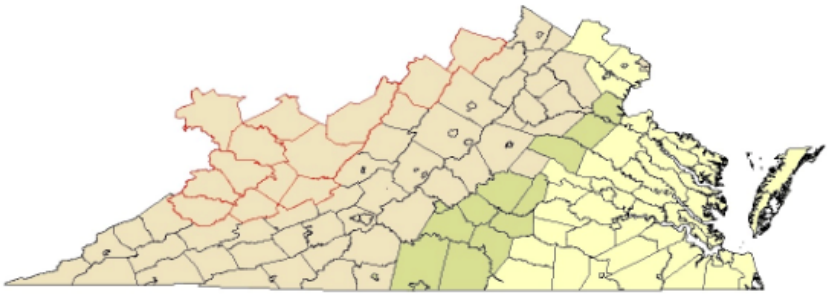
There are some limitations with this data. The survey was completed by a disproportionate number of younger, affluent, and well-educated volunteers, limiting the generalizability of the survey results. Additionally, many survey answers that are normally continuous were binned into categories, limiting this study's statistical ability to evaluate variables such as age and income.

Conclusion:

This study examined the relationship between knowledge of the HPV vaccine with race, sex, age, rurality, education, income, occupation, and insurance coverage in the state of Virginia. Knowledge is only the first step to increasing HPV vaccination rates. Although this survey indicated that 72.26% of participants have heard of the HPV vaccine, this does not translate to intention to receive it or to vaccinate their children and family members (Table 1).

Results indicated particular knowledge disparities by sex, age, rurality, income, and education. Future studies focusing on these factors should be conducted to elucidate barriers to knowledge to inform new policy. Increased knowledge and use of the HPV vaccine is crucial in reducing the spread of the virus and associated cancer risk.

Appendix A: Catchment Area Counties by University



UVA catchment area counties*

VCU catchment area counties

Overlap counties: *Appomattox, Buckingham, Campbell, Charlotte, Cumberland, Halifax, Louisa, Pittsylvania, Prince Edward, Spotsylvania, Stafford, Danville City, Fredericksburg City, Lynchburg City, and Martinsville City.*

*Red border indicates the counties are a part of WV

Appendix B: Regression coefficients of Univariate Analysis for each predictor variable on outcome

Male	Age 21-45	Black	Urban	Education	Income	Occupation	Health Insurance
-0.7042*** (0.2066)	0.7393** (0.2257)	-0.4937 (0.2725)	-0.1566 (0.2091)	Less than high school: -1.3559*** (0.3748) College or Graduate school: 0.5701** (0.2193)	<$35k: -0.6157* (0.3069) $35k-$49: -1.0047** (0.3507) $100k+: 0.3925 (0.3167)	Part-Time: 0.6915 (0.4657) Other: -0.0635 (0.3609) Retired: -0.6059* (0.2973)	Medicare: -0.8645*** (0.2471) Medicaid: -0.4263 (0.3975) Other: -0.9278** (0.3111)

SE in parentheses; *p<0.05, **p<0.01, ***p<0.001

Appendix C: Correlation Matrix

	Sex	Age 21-45	Black	Urban	Education	Income	Occupation	Health Insurance
Sex		-0.04610	0.06804	0.0662	-0.01559	-0.17531	0.01318	-0.05291
Age 21-45	-0.04610		-0.01902	0.02853	-0.09072	-0.05601	0.34023	0.14513
Black	0.06804	-0.01902		-0.14817	-0.13600	-0.20502	-0.05393	0.03168
Urban	0.06662	0.02853	-0.14817		0.05322	0.03548	0.05226	-0.01109
Education	-0.01559	-0.09072	-0.13600	0.05322		0.50511	-0.20327	-0.23243
Income	-0.17531	-0.05601	-0.20502	0.03548	0.50511		-0.32420	-0.37107
Occupation	0.01318	0.34023	-0.05393	0.05226	-0.20327	-0.32420		0.36679
Health Insurance	-0.05291	0.14513	0.03168	-0.01109	-0.23243	-0.37107	0.36679	

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Predictors of Refugees' Ability to Pass the United States Citizenship Exam

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Abstract

Background: Passing the United States citizenship exam can be challenging for refugee populations for several reasons, including affordability of English classes, time restraints, medical stressors, and limited formal education. The purpose of this study was to examine factors that may influence a refugees' ability to pass the citizenship exam, including English proficiency, education, employment, and completion of English as a Second Language (ESL) classes.

Methods: Refugee patients at the International Family Medicine Clinic (IFMC) in Central Virginia participated in a survey that assessed their levels of English proficiency and whether or not they had passed the citizenship exam. The survey included questions about gender, employment, country of origin, years of education, participation in English classes and barriers to attendance.

Results: Refugees who had a higher level of self-reported English proficiency and more years of formal education were more likely to pass the citizenship exam. Other factors such as age, employment, English classes, and gender did not affect participants' ability to pass the exam.

Conclusion: Further research needs to identify successful models to help refugees obtain English fluency and assist them in passing the U.S. citizenship exam.

Key Words: Refugees, citizenship, English literacy, naturalization

Background

Throughout U.S. history, laws concerning immigration and naturalization have changed numerous times, often with the intent of limiting immigration. The first official Naturalization Law was passed in 1790 and stated that any white person 21 years and older could petition for citizenship; in 1795 it was amended to require residence of at least 5 years and affidavits from two U.S. citizens affirming that the applicant was of good moral character (Bolger, 2013). The applicant was then required to take an oath of allegiance to the U.S. In 1906, Congress passed legislation to establish a Bureau of Immigration and Naturalization, and knowledge of English was required for the first time, followed by literacy testing in 1917 (*USCIS*, 2019). The Immigration and Naturalization Act of 1952 established a new requirement of knowledge of U.S. history and civics for naturalization. The Immigration and Naturalization Service (INS) was established in 1933 to oversee naturalization of immigrants. This responsibility transitioned in 2003 to the U.S. Citizenship and Immigration Services (USCIS), which in 2008 created the currently used 4-part citizenship exam: demonstrate the ability to read, write, and speak basic English and respond to questions about American government and history (*USCIS*, 2021, Chapter 2).

Between FY 2016 and FY 2021, Virginia has resettled close to 13,000 refugees including asylees, Central American Minors, Cuban/Haitian Entrants, refugees and Special Immigrant Visa Holders (Virginia Department of Social Services, 2021). One in eight residents in Virginia is foreign-born; Northern Virginia has the highest concentration of foreign-born residents, one in four (Institute for Immigration Research, 2019).There are six major resettlement agencies in Virginia which include Catholic Charities Diocese of Arlington-Migration and Refugee Services, Commonwealth Catholic Charities, Church World Service, Ethiopian Community Development

Council, International Rescue Committee, and Lutheran Social Services (Virginia Department of Social Services, 2021).

The International Family Medicine Clinic (IFMC) provides comprehensive primary care to refugee families residing in central Virginia and is located less than two miles from the International Rescue Committee (IRC) in Charlottesville. The IRC offers resettlement, education, and employment support for newly arriving refugees, thus, Charlottesville, Virginia is a home to many refugees from around the world. At the IFMC, staff observed that some refugee patients struggle to learn English, which can serve as a barrier to obtaining U.S. citizenship and integrating within society.

Inability to become American citizens within 7 years of arrival in the U.S. can result in the loss of federal means-tested public benefits (such as Medicaid and Supplemental Security Income), placing refugees in a financially and medically vulnerable position. Refugee adults have higher prevalence of chronic medical conditions such as heart disease, arthritis, and chronic pain when compared to non-refugee immigrant adults based on studies conducted during the post-arrival period for refugees (Yun et al., 2012).The prevalence of mental disorders is also higher among refugee compared with non-refugee adults, including posttraumatic stress disorder, depression, anxiety and somatization (Jongedijk et al., 2020). Refugee children and children of refugee parents face higher rates of anemia, elevated blood lead levels, malnutrition, growth abnormalities, mental health disorders, and poorer oral health than the general population (Hodes & Vostanis, 2018; Reza et al. 2016; Sandell et al. 2017; Seifu et al. 2020; Smock et al. 2010; Yun et al. 2006).

Although data specific to refugee non-citizens is not available for the state of Virginia, in general 25% of lawfully present immigrants, which includes legal permanent residents, are

uninsured compared to 9% of the general population (*Health Coverage of Immigrants, 2021)*. Some of these refugee non-citizens will often ask their physician to complete an N-648 form, a medical waiver that allows the refugee to be granted an exception to the English and civics requirements (this process was defined by the Immigration and National Technical Corrections Act of 1994) (*USCIS,* 2020, Chapter 3). However, if there is no proven medical reason, such as physical or developmental disability or mental impairment, to account for why a patient cannot complete the educational requirements of naturalization, USCIS will reject the application, thus requiring the refugee to take the exam and put them at risk of failing due to their lack of English competency.

The purpose of this study was to examine potential factors influencing refugees' ability to pass the citizenship exam, including English proficiency, education, employment, and completion of English as a Second Language (ESL) classes. Prior studies suggest that female refugees, refugees with higher education, and adults who arrive at 50-60 years of age, relative to younger and older age groups, have higher naturalization rates (Mossaad et al., 2018). Our study explores additional factors that could help inform providers to better advocate for resources for refugee patients, thus enabling them to retain federal benefits essential to support their health and wellbeing.

Methods

The IFMC keeps a database of all patients seen; the database was queried to identify patients who met the eligibility criteria. Eligibility criteria included having resettled in Charlottesville or surrounding counties, age 25 years or older, residence of at least 5 years in the U.S. from the time of query, and ability to provide consent. The survey consisted of 30 items to assess English proficiency, barriers to learning English, and whether or not they passed the U.S.

citizenship exam. Participants were offered an interpreter and the interview was conducted either on the phone or in person, depending on the interviewee's preference. A $25 gift card to a local grocery store was provided after completion of the survey.

Participants answered questions about English fluency currently and upon first arrival (operationalized as "poor," "good" or "excellent"), the citizenship exam, ESL classes and demographics (age, gender, education, years in the U.S.). Current citizenship status was dichotomous (yes/no). Years of education and years in the U.S. were treated as continuous variables.

Frequencies and descriptive statistics were applied to demographic measures. Chi-squared tests assessed the relationship between measures of English fluency (current and upon first arrival) and current citizenship status. To further examine the effect of demographic factors beyond English fluency on citizenship status, binary logistic regression was conducted with gender, marital status, completion of ESL classes, employment status, years lived in U.S. and years of education as covariates. Analyses were conducted using SPSS 27.0. The study was approved by the University of Virginia Institutional Review Board for Health Sciences Research.

Results

Fifty eligible participants completed the study and were included: 32 (64%) were female and the mean age was 48.5 (SD = 12.8) years. Participants lived in the U.S. for an average of 16 (SD = 8.9) years and had a mean of 9.2 (SD = 5.6) years of formal education. See Table 1 for bivariate statistics. The most common countries of birth were Afghanistan (n = 12, 24%), Iraq (n = 9, 18%), Burma, (n = 9, 18%), Bhutan (n = 8, 16%), and Uzbekistan (n = 7, 14%). The most common languages were Arabic (n = 9, 18%) followed by Nepali (n = 8, 16%) and Burmese, Dari, Farsi and Turkish (n = 5, 10%, for each).

Two measures of English fluency were significantly related to citizenship: writing ability upon first arrival, χ^2 (2) = 5.61, $p < .05$ and current speaking ability, χ^2 (2) = 21.1, $p < .001$). Of people who obtained citizenship, a higher proportion indicated their English writing skills upon arrival to the US were "good" compared to non-citizens (Table 1). Of people who obtained citizenship, a higher proportion indicated their current English speaking was "good" compared to non-citizens (Table 1).

Table 1

Citizenship Status by Demographic Characteristics

Variable		**U.S. Citizen**		**Total**	χ^2
		No	Yes		
Gender	Female	12	20	32	
	Male	8	10	18	0.23
Took ESL Classes	No	4	6	10	
	Yes	16	24	40	0
Marital Status	Single/Separated/Widowed	1	14	15	
	Married	19	16	35	9.92*
Employment Status	Employed	13	18		
	Not employed	7	12		0.13
Speaking ability FA[a]	Poor	19	24	43	2.24
	Good	1	6	7	
	Excellent	0	0	0	
Writing ability FA	Poor	19	20	39	5.61*
	Good	1	10	11	
	Excellent	0	0	0	
Reading ability FA	Poor	19	21	40	4.73
	Good	1	8	9	
	Excellent	0	1	1	
Speaking ability C[b]	Poor	13	2	15	21.14***
	Good	5	26	31	
	Excellent	2	2	4	
Writing ability C	Poor	13	10	23	4.93
	Good	6	16	22	
	Excellent	1	4	5	
Reading ability C	Poor	12	9	21	4.48
	Good	7	19	26	
	Excellent	1	2	3	
Total		**20**	**30**		
		M(SD)	M(SD)	Overall Mean (SD)	***t* statistic**

Education	5.5 (5.3)	11.7 (4.4)	9.2 (5.6)	-4.53***
Years in the US	8.0 (2.4)	9.6 2.5)	8.9 (2.5)	-2.02*

*p< 05; ***p< .001; [a]FA= first arrived in US; [b]C= current ability

The logistic regression model examining the impact of demographic factors on citizenship was statistically significant, χ^2 (6) = 22.5, p < .001 and explained 49.7% of the variance (Nagelkere R^2). More years of education was associated with greater odds of citizenship (1.22, 95% CI, 1.03, 1.45) (Table 2).

Table 2

Demographic Predictors of Citizenship Status

				95% CI for aOR	
	B	SE	aOR	Lower	Upper
Gender (Male)	-0.49	0.88	0.61	0.11	3.40
Marital Status (Married)	-2.26	1.23	0.11	0.01	1.16
Took ESL Class (Yes)	-0.63	0.98	0.53	0.08	3.62
Years lived in U.S.	0.09	0.18	1.10	0.78	1.54
Years of formal schooling:	0.20	0.09	1.22*	1.04	1.45
Employed (Yes)	-0.70	0.93	0.50	0.08	3.09

Discussion

Formal education prior to coming to the United States was the strongest predictive factor of U.S. citizenship status, supporting other studies examining refugee integration (Mossaad et al., 2018; Puma et al., 2020). It was surprising that although English proficiency itself was a positive predictive factor for acquiring citizenship, taking English classes did not increase the likelihood of becoming a U.S. citizen. Employment was not a significant factor, however, many of the refugee participants noted they learned English by speaking English at work. A study by McHugh et al. found that approximately 103 hours of English language study per year for six years is necessary for lawful permanent residents to integrate into U.S society and begin

postsecondary education (McHugh et al.,2007). This implies that learning English as an adult learner may take more time than many refugees can afford to allocate. Based on these findings, promoting refugee education, and specifically English classes in refugee camps or other settings prior to moving to the U.S. may assist refugees in obtaining citizenship.

Unfortunately, fewer than 1% of refugees have access to higher education prior to migration (United Nations High Commissioner for Refugees, 2018). In a case study of the Dadaab refugee camps in Kenya, Burkardt and colleagues concluded that promoting education in refugee camps requires a multifactorial approach including adequate extra-curricular support, better access to digital education, and creating a safe environment in the camp that will allow students to attend study sessions (Burkardt et al.,2019). Several obstacles made it difficult for students to learn, including missing classes due to security concerns. Students felt that peer-to-peer support in technology and computer skills was the most helpful for them to be successful in their coursework.

Although improving education in refugee camps seems to be essential, there is a lot that can be done to improve access to classes and education for refugees upon arrival. For example, refugees can access ESL classes at no cost for two years after arrival. According to this study, there were barriers that may have prevented them from attending classes (e.g., time constraints due to work or caring for family members) or making the most of the classes they were able to attend. Although 80% of participants had taken ESL classes, this did not increase the likelihood of passing the U.S. citizenship exam. Additional research is needed to examine why attendance was not beneficial—did the student attend enough classes/what would be an optimal number of class hours?; can the quality and content of classes be improved?; or does poor literacy in one's

native language and lack of prior formal education hinder English learning and exam preparation?

This study did not explore other factors that could have also played a role in language acquisition such as mental health, social support, finances, and motivation. In addition to English classes, there are other important interventions that can be taken to help improve English proficiency within the refugee population. One model implemented to help increase access to community resources and education for refugees included four components: increasing individual and group learning opportunities, improving refugee access to resources through advocacy, reducing social isolation, and creating meaningful social roles that take refugee culture into account (Goodkind et al., 2014). Implementation of such a model requires a large team of paid or volunteer staff representing a number of disciplines (i.e., psychologists, educators, medical providers, social workers). Goodkind et al. (2014) found that increases in English proficiency also improved quality of life measures and decreased rates of depression. Specifically, some of the educational interventions included learning circles that were primarily led by volunteers. The key to attaining English proficiency appears to be adequate follow-up in the community, mindfulness of the psychological stressors within the refugee population, making meaningful social roles for refugees that take culture into account, and addressing social inequities. Organizations that support refugee health and resettlement include the Virginia Refugee Healing Partnership, Virginia Refugee Resettlement Program, Virginia Services to Older Adult Refugees, and the Virginia Refugee Student Achievement Project. These projects involve working closely with one of the six resettlement agencies in Virginia and provide resources to help with social adjustment, finding permanent housing, translation services, and finding employment (Virginia Department of Social Services, 2021). Most communities

throughout Virginia have separate programs and organizations offering both language and instrumental support to refugees.

The primary limitations of this study are the small sample size, limited generalizability as only patients from the IFMC were interviewed, and possible bias due to self-reporting. However, this is one of few studies examining factors that influence refugees' ability to pass the U.S. citizenship exam. This is critical for refugees to retain federal benefits essential to supporting health as they transition to living in the United States.

Conclusion

This study found that the positive predictive factors for obtaining U.S. citizenship were higher education prior to arrival and English proficiency. Education and advocacy are crucial for successful adjustment to the United States for the refugee population; both facilitate the process of obtaining citizenship and help ensure refugees can maintain their federal benefits to reduce inequities in access to healthcare. In addition to educators and social workers, healthcare providers can make a powerful impact on a refugee patient's adjustment into the United States, as they are an essential part of this transition. Healthcare providers can encourage their patients to take ESL classes and give them information regarding community resources as early as their initial health department screening. Although ESL classes did not appear to increase rates of citizenship in this study, other studies have found that gaining English proficiency improved mental health outcomes and overall quality of life (Goodkind et al., 2014). Finally, it may also be time to re-evaluate the current testing requirements to attain citizenship in the US. For example, in Canada, individuals 55 and older at the time of application are not required to take a language or civics exam. Is it really necessary to have an exam at all? This question deserves greater consideration.

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