



Short communication

Closing the gaps in adolescent vaccinations: Rhode Island's Vaccinate Before You Graduate program as a model for other jurisdictions

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ABSTRACT

Objective: The northeastern state of Rhode Island (RI) has a Vaccinate Before You Graduate (VBYG) program that supplements the traditional primary care infrastructure by providing vaccines to adolescents while they are in school, with no out-of-pocket expenses. We analyzed data from RI's immunization registry to evaluate whether VBYG also reduces disparities in adolescent immunization rates.

Methods: We identified adolescent and catch-up vaccines administered in RI to people who were aged 11–18 at any point during the 5-year study period of 2019–2023, and conducted bivariate and multivariate analyses of vaccine administration data by setting (VBYG clinics, community health centers [CHCs], all other primary care practices [oPCPs], other school-based clinics, and other sites) and adolescent demographics (racial and ethnic identity, insurance status, sex, and age at time of vaccine).

Results: Of over 387,000 routine vaccines administered during the study period, 3.3 % were administered by a VBYG clinic despite significant declines during school closures associated with the early COVID-19 pandemic. VBYG-administered doses went to slightly older youth, and a higher proportion were catch-up doses (25.7 % versus 14.1 % for CHC doses and 6.5 % for oPCP). Youths received an average of 2.71 vaccines in VBYG clinics compared to 1.77 from oPCPs and 2.08 from CHCs. A higher proportion of vaccines administered by VBYG went to adolescents of color and those without private insurance than those administered by oPCPs.

Conclusions: VBYG provides a model to other jurisdictions of a vaccine safety net for adolescents who may not otherwise receive recommended vaccines before exiting the school system.

1. Introduction

Despite its very small size, the New England state of Rhode Island (RI) leads the United States in immunization rates, particularly for adolescents (Pingali et al., 2021). RI benefits from rigorous school vaccination requirements; high insurance coverage rates and primary care density (Merritt et al., 2021); and a universal State-Supplied Vaccines (SSV) program which supplies no-cost vaccines for healthcare professional use, regardless of the insurance status of patients. Despite these strengths, many RI adolescents are missing school-required vaccines (Dumont et al., 2023), while healthcare professionals are experiencing high rates of burnout, workforce shortages, unsustainable payment models, and tremendous administrative burdens (Lin et al., 2020; Murthy, 2022). Clinical guidelines for routine preventive care have become so extensive that following them all appropriately requires unfeasible amounts of time (Porter et al., 2023; Privett and Guerrier, 2021).

Alongside efforts like primary care payment reform and team-based care, another solution may be to reinvigorate the historical connections between primary care and public health in the delivery of some services. In many states, the public health infrastructure already provides crucial support to preventive care services like cancer screening and testing for/treatment of sexually transmitted infections. Expanding public health/primary care partnerships may also reduce persistent inequities in preventive care by embedding services in a variety of trusted and accessible community sites alongside traditional healthcare settings.

Routine adolescent immunization is one obvious example. In RI as elsewhere, the COVID-19 pandemic exacerbated long-term patterns of lower adolescent immunization coverage compared to younger children (Dumont et al., 2023). School-based clinics (SBCs) have proved valuable partners in improving vaccination rates in some states, including RI (Ely et al., 2014; Feldstein et al., 2020; Rane et al., 2021; Shah et al., 2020), but SBCs can be challenging to fund and staff (Sprigg et al., 2017). For over 20 years, RI has built up an alternative school-based public health

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Table 1

Descriptive statistics of routine vaccines administered to 11–18 year-olds in Rhode Island, 2019–2023.

		VBYG clinics	SBCs	CHCs	Other PCPs	All other settings
Total doses administered ^a	N	12,900	4600	76,100	288,000	5700
2019–2023 pooled	%	3.3	1.2	19.6	74.4	1.5
2019	%	4.8	1.1	18.5	73.0	2.7
2020	%	2.3	0.4	16.4	80.1	0.8
2021	%	1.7	1.1	21.8	74.5	1.0
2022	%	3.5	1.5	21.8	72.1	1.2
2023	%	4.0	1.9	19.7	72.9	1.5
Catch-up doses ^b	%	25.7	30.7	14.1	6.5	12.1
Unique individuals ^{a,c}	N	5,000	1,800	26,100	102,500	14,100
Doses per person ^d	\bar{x} (SD)	2.71 (2.23)	2.59 (2.18)	2.08 (1.52)	1.78 (1.11)	1.41 (0.91)
<i>Racial and ethnic identity</i>						
Hispanic/Latino	%	44.2	61.8	55.1	20.0	21.4
Black (non-Hispanic)	%	10.2	12.0	11.5	6.6	10.4
White (non-Hispanic)	%	15.1	14.7	23.2	63.1	50.9
All other identities	%	20.5	7.7	8.4	7.5	11.5
Unknown	%	10.1	3.8	1.8	2.8	5.8
<i>Insurance type</i>						
Medicaid	%	41.9	58.5	75.3	36.7	39.4
Private	%	11.1	5.4	12.1	53.9	32.5
None/unknown	%	47.0	36.2	12.6	9.5	28.1
Age	\bar{x} (SD)	16.5 (1.8)	15.4 (2.1)	13.9 (2.4)	14.1 (2.6)	16 (2.7)
<i>Sex</i>						
Female	%	40.9	43.8	50.1	49.1	46.2
Male	%	59.1	56.2	49.9	50.9	53.8

Data source: Rhode Island Child and Adult Immunization Registry.

VBYG: Vaccinate Before You Graduate. SBCs: School-based clinics, CHCs: Community health centers. SD: Standard Deviation

^a Rounded to nearest 100.^b Hepatitis A, Hepatitis B, pneumococcal, polio, MMR or varicella.^c Not mutually exclusive (i.e. the same child may have received vaccines from multiple provider types over the study period).^d 2023 only.

program that serves as a safety net alongside community health centers and SBCs. The RI Department of Health (RIDOH)'s Vaccinate Before You Graduate (VBYG) program was initially established in 2001 and has expanded over the years to ensure that all school-required vaccines (in RI, these include all vaccines recommended by the Advisory Committee on Immunization Practices except influenza and COVID-19) are available to students attending public and private high schools and to all public middle school students, so that the vast majority of RI adolescents have access to vaccines at school, with no out-of-pocket expense regardless of insurance status. School nurses or parents can request a clinic at any time during the school year; there is no minimum number of students required for a clinic and schools can host multiple clinics during the school year (more details available by request).

To quantify the impact of VBYG on vaccination patterns in RI, we analyzed data from RI's immunization registry to compare the demographics of adolescents who received vaccinations in school settings versus those who received them in traditional primary care and other settings.

2. Methods

The Rhode Island Child and Adult Immunization Registry (RICAIR) is RI's immunization information system and captures vaccines administered or historical doses reported by vaccine administrators in RI. As of 2022, it also captures doses administered in Massachusetts, Connecticut, New York City, and New Jersey to RI residents. We identified vaccines administered in RI to people who were age 11–18 at any point during the 5-year study period of 2019–2023. For the purposes of this study, we excluded doses administered in other jurisdictions or reported as historical doses, as the type of setting where those vaccines were administered could not be confirmed. We further limited the data to include only school-required vaccines that were administered before age 19 during that 5-year period. Because youths could receive vaccines from multiple types of providers over time, we conducted the analysis by vaccines administered rather than by unique individual; we also

calculated the number of unique individuals served by each provider type and the mean number of vaccines per individual.

We created the following categories for vaccine administration settings: community health centers (CHCs), all other primary care practices (referred to here as oPCPs, which may be private or hospital-based), school-based clinics (SBCs) (excluding one at the state's juvenile detention center), VBYG clinics, and all other settings (pharmacies, urgent care settings, specialty practices, and mass immunizers). We classified Tdap, HPV, meningococcal B, and meningococcal conjugate as routine adolescent vaccines; hepatitis A, hepatitis B, pneumococcal, polio, MMR, and varicella are normally administered before age 11 and were considered "catch-up" vaccines.

Although we cannot address here the complex relationship between "race" and "class" and health in the United States (LaVeist, 2005; Nuru-Jeter et al., 2018), we looked at two fields in the registry which may approximate socioeconomic status and racial/ethnic identity in order to assess whether different vaccine administration settings served different youth populations. RICAIR receives insurance data from Medicaid and the larger private RI payers, while racial and ethnic identity are most often captured in RICAIR from birth certificates. We used insurance status as a broad measure of access to care and approximate socioeconomic status, using categories of public insurance, private insurance, and unknown or no insurance. (In RI, children under the age of 19 who live in a family earning up to 261 % of the Federal Poverty Level are eligible for Medicaid.) We used racial and ethnic identity to capture structural social and economic privilege or disadvantage (Howe et al., 2022; Mannor and Malcoe, 2022), applying the categories of Hispanic/Latino, non-Hispanic Black, non-Hispanic White, all other identities, and identity not captured in RICAIR, while recognizing that these categories imperfectly represent self-identity versus social constructs of race. Since adolescent vaccination patterns can vary by sex (Dumont et al., 2023) we also included this variable (we employ the term sex rather than gender since this data point is captured primarily from birth certificate data). A very small number of people were identified in RICAIR as "Other" or "Unknown" and were excluded from analyses by sex, though

Table 2

Crude and adjusted odds ratios of doses administered to 11–18 year-olds in VBYG clinics versus community health centers and other primary care providers, Rhode Island, 2019–2023.

	Administration by VBYG vs. community health center		Administration by VBYG vs. other primary care providers	
	Crude OR (95 % CI)	Adjusted OR (95 % CI)*	Crude OR (95 % CI)	Adjusted OR (95 % CI)*
Racial/Ethnic Identity				
White, non-Hispanic	REF	REF	REF	REF
Black, non-Hispanic	1.4 (1.3–1.5)	1.3 (1.2–1.4)	6.5 (6.0–7.0)	4.5 (4.2–4.9)
Hispanic/Latino	1.2 (1.2–1.3)	1.1 (1.0–1.2)	9.2 (8.8–9.7)	4.8 (4.5–5.1)
All other identities	3.8 (3.5–4.0)	3.4 (3.2–3.7)	11.4 (10.7–12.1)	7.9 (7.4–8.4)
Unknown	8.8 (8.0–9.6)	5.6 (5.0–6.2)	15.3 (14.2–16.5)	6.7 (6.2–7.3)
Insurance Status				
Private	REF	REF	REF	REF
Medicaid	0.6 (0.6–0.6)	0.8 (0.7–0.8)	5.5 (5.2–5.9)	3.7 (3.4–3.9)
None/Unknown	4.0 (3.8–4.3)	2.6 (2.4–2.8)	24.0 (22.6–25.5)	10.3 (9.7–11)
Each additional year of age	1.6 (1.6–1.6)	1.3 (1.3–1.4)	1.5 (1.4–1.5)	1.5 (1.5–1.5)
Sex				
Female	REF	REF	REF	REF
Male	1.5 (1.4–1.5)	1.3 (1.3–1.4)	1.4 (1.3–1.4)	1.3 (1.2–1.3)

VBYG: Vaccinate Before You Graduate. OR: odds ratio. AOR: adjusted odds ratio. CI: confidence interval. Ref: reference group.

Data source: Rhode Island Child and Adult Immunization Registry.

* Adjusted for age, sex, insurance status (for AORs for racial and ethnic identity), and racial and ethnic identity (for AORs for insurance status).

included elsewhere.

Using SAS 9.4, we conducted bivariate and multivariate analyses of the number of vaccines administered by VBYG versus other vaccine administration settings to assess the relative odds of vaccines being administered to students of color and those without private insurance in those settings. Due to the small proportion of doses administered by SBCs, we included that setting in bivariate but not multivariate analyses. RIDOH's IRB committee deemed the project exempt from full review.

3. Results

Over 387,000 routine vaccines were administered in RI to adolescents ages 11–18 during 2019–2023. The vast majority (74.4 %) were administered by oPCPs, compared to 19.6 % administered by CHCs, 3.3 % by VBYG clinics, 1.2 % administered by SBCs, and 1.5 % administered in “other settings.” (Table 1). Those proportions varied during the pandemic closure of schools for key parts of the 2019–2020 and 2020–2021 school years; the proportion of doses administered by VBYG clinics was higher during the last full pre-pandemic calendar year (CY) (4.8 %) and dropped to 1.7 % in CY 2021 before recovering to 4.0 % for CY 2023. The mean age at administration was 16.5 years (standard deviation (SD) 1.8) for doses administered via VBYG, compared to 14.1 years (SD 2.6) for doses administered by oPCPs and 13.9 years (SD 2.4) for doses administered by CHCs. A significantly higher percent of doses administered by VBYG clinics and SBCs were catch-up doses (25.7 % and 30.7 % respectively) compared to the other provider types (6.5 %–14.1 %), and VBYG administered more doses per unique individual (2.71 compared to 2.59 for SBCs, 2.08 for CHCs, and 1.78 for oPCPs).

VBYG-administered doses were more likely to go to both male students and Black or Hispanic/Latino youth than doses administered by oPCPs: while 10.1 % of VBYG-administered doses went to adolescents whose racial/ethnic identity was not captured in RICAIR (a higher proportion than in other settings), 44.2 % of VBYG vaccinations went to Hispanic/Latino adolescents and 10.2 % to Black, non-Hispanic adolescents, compared to 20.0 % and 6.6 %, respectively, in oPCP settings (Table 1).

Reflecting historical inequities in the US, non-Hispanic Black and Hispanic/Latino adolescents both had over four times the odds of receiving vaccines through VBYG versus oPCPs compared to non-Hispanic White youth (Table 2); adjusted odds for receiving vaccines through VBYG versus CHCs were lower (1.3 and 1.1 respectively for non-Hispanic Black and Hispanic/Latino youth) but still statistically significant. Doses to adolescents covered by Medicaid had an adjusted

odds ratio (AOR) of 3.7 (95 % CI 3.4–3.9) of being administered by VBYG versus oPCPs but were less likely to be administered by VBYG when compared to CHCs (AOR 0.8 [95 % CI 0.7–0.8]).

4. Discussion

The nearly 13,000 vaccines administered through the VBYG program accounted for a relatively small percentage of all adolescent vaccines in RI from 2019 to 2023. However, a large proportion of them went to adolescents of different demographics from those receiving vaccines at CHCs and oPCPs: they were less likely to be white and privately insured, indicating that the program may be helping to fill gaps in access to primary care for less historically privileged populations. In addition, given both the higher proportion of catch-up doses and higher average age at administration for VBYG-administered vaccine recipients, VBYG appears to be serving as a safety net for adolescents in catching up on vaccines before they exit the school system; this trend may signify that vaccination at a VBYG clinic is a marker of missed or delayed adolescent primary and preventive care, especially for adolescent males. Our results indicate that despite RI's strong primary care and public health infrastructure, public-sector school-based services can help fill gaps in access to primary care, gaps into which adolescents of color and those without private insurance are more likely to fall.

Of course, VBYG is specific to immunizations: the program does not provide other critical preventive services recommended for adolescents, such as sexual and reproductive healthcare. Even if up to date on vaccinations, adolescents still need routine care, ideally with a trusted primary care clinician. However, if some adolescents do fall out of regular contact with primary care, VBYG can at least offer protection from vaccine-preventable diseases, and provides an additional model for the broader delivery of certain preventive services to young people (Griffin et al., 2016; Storey et al., 2023).

RI benefits from factors that facilitate the VBYG program that other states should take into account when considering the development of similar programs. RI is very small, allowing for a single longstanding partner agency to conduct vaccination clinics statewide. Its status as a universal SSV state facilitates the provision of vaccines to all RI residents, regardless of ability to pay. (VBYG's consent form requests insurance information and, if missing, the program attempts to identify a payer in order to bill health insurers, but families have no out-of-pocket cost whether or not a payer can be verified). The school nurses at the heart of any school-based health programs (Ambrosino et al., 2023) collaborate with RIDOH via a statewide network. Like other healthcare

professionals, demands on their time sometimes limit their ability to work with VBYG; even so, nearly every school district and about 50 % of all eligible schools hosted at least one clinic in the 2022–2023 school year. Finally, given RI's high rates of both adolescent insurance and vaccine coverage (Pingali et al., 2021), the gaps VBYG was designed to address are of manageable proportions.

Limitations to our analysis largely relate to how youth attributes are captured in RICAIR. Youth who were not born in RI are likely to be missing information on racial/ethnic identity. Almost half of VBYG doses went to adolescents with missing insurance information, a much higher proportion than in other settings. These adolescents possibly had payers that did not participate in enrollment data sharing with RICAIR, but given the very low estimates of uninsured youth in RI overall and the timing of the study period, which fell under Medicaid's cessation of annual eligibility reaffirmation, this is more likely an indicator of having less stable insurance status.

Despite these limitations, our analysis shows that RI's VBYG program is an important option for adolescents who, for whatever reason, are not receiving vaccines within the traditional primary care setting. Given the increasing awareness and attention to the structural inequities built into the United States healthcare system, and recognizing the "Swiss cheese" model of public health (Roberts, 2020) that calls for a variety of solutions to any problem, we see the VBYG program as a valuable partner in providing basic preventive care to all adolescents.

Disclosures

The authors all confirm they are unaware of any real or potential conflicts of interest, and no funding or commercial interests played any role in this study. The VBYG program is funded by the RI Department of Health's Office of Immunization.

CRediT authorship contribution statement

Dora M. Dumont: Writing – review & editing, Writing – original draft, Methodology, Formal analysis, Conceptualization. **Jennifer S. Levy:** Writing – review & editing, Writing – original draft. **Lisa Gargano:** Writing – review & editing, Writing – original draft, Conceptualization. **Jordan Catherine White:** Writing – review & editing, Writing – original draft, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

The data that has been used is confidential.

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