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Gaps in Knowledge, Receipt, and Acceptance of Measles, Mumps, Rubella Vaccines in a National Sample of Emergency Department

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ABSTRACT

Measles cases are increasing in the U.S., raising concern about gaps in adult measles, mumps, and rubella (MMR) vaccination, which is poorly captured by current surveillance. Emergency departments (EDs) often act as safety nets for underserved populations and can help identify gaps in adult MMR uptake. We assessed adult MMR up-to-date status, knowledge, and willingness to receive vaccination in the ED, nationally. We conducted a cross-sectional survey of adults aged 18-64 at ten U.S. EDs from April 2024 to December 2024. Participants completed a structured survey assessing MMR knowledge, self-reported vaccination status, reasons for non-receipt, and willingness to receive an MMR vaccine in the ED. Outcomes were summarized as proportions with 95% confidence intervals (CIs). Multivariable logistic regression identified factors associated with not being up to date and with willingness to accept vaccination. Among 2,456 participants, 25.0% (95% CI 23.3–26.7%) had not heard of the MMR vaccine, and 44.0% (42.5–46.4%) were not up to date. Factors associated with being unvaccinated included male sex (OR 2.21 [1.84–2.66]), African American (non-Hispanic) race (OR 2.27 [1.75–2.96]), Hispanic ethnicity (OR 1.98 [1.49–2.62]), non-English speaking (OR 1.53 [1.12–2.09]), and lack of primary care access (OR 1.25 [1.01–1.58]). Among those not up to date, 36.5% (33.6–39.4%) were willing to receive the MMR vaccine if offered in the ED. Substantial gaps in adult MMR vaccination persist, especially among underserved populations. This study aimed to identify the gaps in access to the vaccination by assessing the status, knowledge, and willingness to receive as well as the sociodemographic factors contributing to these access gaps, on a national level. ED-based strategies might support targeted vaccine education and delivery during periods of increased transmission.

KEYWORDS: Vaccine hesitancy; vaccine acceptance; disease resurgence; emergency departments; Measles, Mumps, and Rubella; MMR

FACULTY MENTOR - Dr. Robert Rodriguez, Department of Internal Medicine

Dr. Robert Rodriguez is a Professor of Medicine and Associate Dean of Clinical and Population Health Research at the University of California Riverside School of Medicine. After the University of Notre Dame and Harvard Medical School, he completed a combined Emergency Medicine/Internal Medicine residency at UCLA and a Critical Care Medicine fellowship at Stanford.

SAHITHI MALIREDDY

Sahithi Malireddy is a fourth-year Neuroscience student at UCR. Her research centers on public health, mental health, and healthcare equity, with a focus on improving access to care for marginalized communities. In addition to her work under the mentorship of Dr. Robert Rodriguez, she has also contributed to youth-centered behavioral health and intervention research through the CREER Laboratory under Dr. Lisa Fortuna. Outside of research, Sahithi is involved in mental health advocacy, street medicine, and crisis intervention counseling throughout the Inland Empire. She hopes to pursue a career as a physician focused on advancing equitable, trauma-informed, and community-centered care for historically underserved populations.

Gaps in Knowledge, Receipt, and Acceptance of Measles, Mumps, Rubella Vaccines in a National Sample of Emergency Department

BACKGROUND

The recent resurgence of measles in the United States underscores the need to increase and maintain high levels of Measles, Mumps, and Rubella (MMR) vaccination coverage across the population. Measles is a highly contagious viral illness that can lead to severe medical complications, including pneumonia, encephalitis, and death, particularly in unvaccinated populations. As of March 19, 2026, 1,487 confirmed measles cases have been reported across 32 jurisdictions. Of these cases, 94% (1,398 of 1,487) have been linked to outbreaks, indicating a significant increase in outbreak-associated transmission compared to 2024, when 69% (198 of 285) of cases were outbreak-related [1].

The MMR vaccine is highly effective, and pediatric vaccination rates are monitored throughout the U.S., with approximately 93% of kindergarteners vaccinated [2]. Adults born in or after 1957 are also recommended to receive one or two doses [3]. Despite this, surveys such as the National Health Interview Survey (NHIS) do not assess MMR vaccination, and adult coverage remains poorly described [4]. Additionally, NHIS sampling (in-person household interviews) likely misses medically vulnerable groups, including unhoused persons and immigrants.

Emergency departments (EDs) often serve as healthcare safety nets and access points for underserved populations and are uniquely positioned to examine public health issues, including vaccination coverage [5]. The purpose of this national survey of adult ED patients was to determine: 1) knowledge and uptake of the MMR vaccine; 2) reasons for non-receipt; 3) acceptability if offered in the ED; and 4) reasons for non-acceptance. These data will help identify plausible reasoning for gaps in access and inform healthcare systems with ED-based strategies to increase MMR coverage among underserved populations.

METHODS

We conducted a preplanned secondary analysis of self-reported survey data collected as part of our multicenter emergency department vaccination study published in the CDC Morbidity and Mortality Weekly Report (MMWR). The surveys were conducted across ten EDs in eight U.S. cities (Chicago, IL; Detroit, MI; Durham, NC; Fresno, CA; Los Angeles, CA; Philadelphia, PA; San Francisco, CA; and Sylmar, CA) from April 18, 2024, to December 31, 2024 [6]. Research staff approached non–critically ill adult ED patients (≥18 years) for participation and screened them for eligibility; exclusions included critical illness, altered mental status, incarceration, respiratory precautions, or psychiatric holds. Based on CDC recommendations at initiation (June 2024), patients ≥ 65 years were excluded [7].

After scripted consent, surveys were administered in English and Spanish. Two sites also administered surveys in Mandarin. Questions included: 1) "Have you heard about the MMR vaccine?" with the short plain-language descriptor: "vaccine to prevent measles, mumps, and rubella;" 2) If they responded "yes" or "unsure," they were asked, "Have you received the MMR vaccine?;" 3) if they answered no to question 2, they were asked "Why have you not received it?;" 4) if no to question 1 or 2, they were asked, "Would you accept the MMR vaccine if it were offered to you in the ED?;" and 5) if they answered "no" to question 4, they were asked, "Why would you not accept it?" Patients who stated that they had not heard of the MMR vaccine were only asked questions 4 and 5.

Participants were divided into age quartiles. Outcomes were summarized as percentages with 95% confidence intervals (CIs), excluding missing responses. For the outcome of receipt of the MMR vaccine, only participants who answered yes to both questions 1 and 2 were deemed to have received it, i.e., if they had not heard of the vaccine, they were considered to have not received it.

We used multivariable logistic regression models to assess factors associated with 1) lack of knowledge, 2) lack of receipt, and 3) willingness to receive the vaccine. Independent variables were included as fixed effects, including age (categorical quartiles), sex, city, and factors associated with low vaccination coverage (African American race, Hispanic ethnicity, non-English speaking, no primary care, no insurance) [6]. The study site (or city) was included as a fixed effect to account for geographic variation and healthcare access variation across diverse patient populations. Results are presented as adjusted odds ratios (aORs) with 95% CIs. We managed data using REDCap, a secure,

web-based platform designed for building online surveys [8] hosted by the University of California, San Francisco, and analyzed the data using RStudio (version 2023.12.1). A sample size of 2401 was required to estimate the prevalence of not being up to date on the MMR vaccination with a 95% confidence interval width of ±2 percentage points. Institutional review board approval was obtained at all sites through the University of California, San Francisco (UCSF) IRB, and STROBE guidelines were followed [9].

RESULTS

Of 4,325 patients approached, 3,275 (75.7%) agreed to participate. We excluded 816 participants who were 65 or older and three participants who had incomplete data, leaving 2,456 participants in this analysis. 1,343 (54.7%) were female, 876 (35.7%) were Latino/a, 695 (28.4%) were African American, and 566 (23.1%) were White non-Latino/a. 463 (18.9%) spoke Spanish primarily, and 622 (25.4%) lacked a primary care provider (Table 1).

Knowledge of the MMR vaccine

A total of 613 participants, or 25.0% (95% CI 23.3–26.7%), had not heard of the MMR vaccine. By age group, 29.1% (95% CI, 25.6–32.6) of those aged 18–30 years, 25.7% (95% CI, 22.3–29.1) of those aged 31–41 years, 21.9% (95% CI, 18.5-25.3%) of those aged 42-53 years, and 23.0% (19.6-26.3%) of those aged 54-64 years had not heard of the MMR vaccine (Table 2).

The following participant characteristics were associated with not having heard of the MMR vaccine: age 18-30 (aOR 1.89; 95% CI 1.39-2.57), male sex (aOR 2.21; 95% CI 1.78-2.71), African American (Non-Hispanic) race (aOR 1.91; 95% CI 1.38-2.62), and non-English as the participants' primary language (aOR 2.17; 95% CI 1.56-3.03). Participation in Sylmar, CA, or Philadelphia, PA, was associated with a greater likelihood of having heard of the vaccine. (Figure 1).

Up to date status of the MMR vaccine

A total of 1,090 participants (44.4%; 95% CI, 42.4–46.4%) were not up to date on the MMR vaccine. By age group, 48.5% (95% CI, 44.6–52.3%) of participants aged 18–30 years, 47.4% (95% CI, 43.4–51.3%) of those aged 31–41 years, 40.4% (95% CI, 36.3-44.4%) aged 42-53 years, and 40.9% (95% CI, 37.0–44.9%) aged 54-64 years were not up to date (Table 2).

The following characteristics were associated with not having received the MMR vaccine: age 18-30 (aOR 1.64; 95% CI 1.26-2.13); age 31-41 (aOR 1.39; 95% CI 1.07-1.79); male sex (aOR 2.21; 95% CI 1.84-2.66); African American (non-Hispanic) (aOR 2.27; 95% CI 1.75-2.96); Hispanic (aOR 1.98; 95% CI 1.49-2.62), non-English as the primary language (aOR 1.53; 95% CI 1.12-2.09); and participation in the cities of Chicago, IL (aOR 1.41; 95% CI 1.02-1.95) or Fresno, CA (aOR 2.01; 95% CI 1.49-2.71). Participation in Sylmar, CA, or Philadelphia, PA, was associated with having received the vaccine (Figure 2).

The most commonly cited reasons for not being up to date on the MMR vaccine were "I didn't know about it/Didn't know I should get it" (29.7%); "I'm not worried about contracting measles, mumps or rubella" (18.2%); "I haven't gotten around to it" (18.2%); and "Other" (19.9%).

Willingness to receive the MMR vaccine in the ED

Among 1,079 participants who were not up to date and had complete data, 394 (36.5%; 95% CI, 34.6–39.4%) reported they would accept the MMR vaccine if offered in the ED. By age group, 31.6% (95% CI, 26.4–36.8%) of those aged 18–30 years, 32.0% (95% CI, 26.6–37.3%) of those aged 31–41 years, 39.0% (95% CI, 32.7–45.2%) of those aged 42-53 years, and 45.7% (95% CI 39.5-52.0%) aged 54-64 years were willing to receive the MMR vaccine (Table 2).

Characteristics associated with greater willingness to receive the MMR vaccine included Hispanic ethnicity (aOR 1.72; 95% CI 1.08-2.75), mixed race (aOR 2.12; 95% CI 1.11-4.07), and participation in the city of Sylmar, CA (aOR 7.45; 95 % CI 3.81-15.49). Characteristics that were associated with a lower willingness to accept the MMR vaccine were participation in Fresno, CA (aOR 0.62; 95% CI 0.41-0.96); Philadelphia, PA (aOR 0.47; 95% CI 0.25-0.85); and Chicago, IL (aOR 0.56; 95% 0.34-0.91) (Figure 3).

The most commonly cited reasons for not accepting the MMR vaccine in the ED were "I need more information about the vaccines and the disease" (39.4%), "I am worried

about side effects from vaccines" (15.2%), "I would rather get them from my doctor or at a pharmacy" (15.2%), and "Other" (36.4%).

DISCUSSION

In this national ED-based study of a diverse adult population, we found gaps in knowledge and receipt of the MMR vaccine. Approximately a quarter of participants had not heard of the vaccine, and nearly half (44.4%) were not up to date. Disparities in knowledge and uptake were especially evident in African Americans, Hispanics, non-English speakers, and participants who lacked primary care. The primary reasons for not having received the MMR vaccine were related to a lack of information and opportunity. Notably, over a third of participants stated they would accept MMR vaccination if offered; if administered to them, this would result in an additional 16% of coverage from 56% to 72% in this population.

While there is substantial data regarding uptake of the MMR in pediatric populations [2], there is no equivalent MMR vaccine surveillance data for U.S. adults. The reliance on in-person household interviews with low response rates limits the validity of other vaccination surveillance studies like those conducted by NHIS [4]. Our sampling of a highly diverse and medically underserved population suggests that there is value in ED-based research to evaluate populations missed by traditional surveillance. Nevertheless, with regard to subpopulation disparities, our study findings are similar to other vaccine surveillance work showing that the characteristics of African American race, Hispanic ethnicity, male sex, and lack of primary care are associated with incomplete vaccination uptake of other vaccines [10-12].

With over 155 million patient visits in 2022, EDs are high-volume healthcare settings [13]. Our findings highlight the potential of leveraging EDs to identify vaccination gaps and provide vaccine messaging in underserved populations who are missed in traditional public health surveillance systems. So as not to interfere with or delay critical ED operations, ED-based vaccination screening and messaging programs must consider workflow dynamics and overburdened staff.

The MMR vaccine is not routinely stocked in EDs. At sites where it is available from central hospital pharmacies, it can be ordered and administered before discharge. At other sites, patients missing the MMR vaccine would likely need referrals to clinics or other vaccination sites. These approaches offer a practical solution to address gaps in MMR coverage, especially for patients who might not engage with conventional healthcare systems.

Beyond routine surveillance, our work informs the development of ED-based programs to respond to measles outbreaks in adults, similar to pediatric efforts [14]. During the first two years of the COVID-19 pandemic, effective ED-centered vaccination programs provided vaccines to underserved adult populations [15–17]. Our data suggest that developing similar targeted programs in outbreak-affected regions is warranted; many adults would accept the MMR vaccine once asked, and others may do so after receiving information.

LIMITATIONS

The greatest limitation of this research is that the United States does not have a centralized adult vaccination registry for most vaccines. We could not verify uptake status through electronic medical records and instead relied on self-reported data. Although this method introduces potential inaccuracies, it is the standard procedure for vaccination surveillance, and previous studies have shown a high level of agreement between self-reported vaccination status and documentation in medical records [18]. Our assumption that participants who had not heard of the MMR vaccine had not received it likely leads to an underestimation of true MMR vaccine uptake rates; it is likely that many received it during childhood and no longer remember now that they are adults. Excluding the group who had not heard of the vaccine still results in uptake rates of 74%, substantially below the 95% uptake rate needed for measles herd immunity [19]. Additionally, all sites were in urban centers, which may limit the external validity of the findings to suburban or rural ED settings; rates of knowledge and uptake may not be representative of patients in these EDs. Finally, stated willingness to receive the vaccine could be influenced by contextual factors, such as social desirability bias.

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CONCLUSION

We found significant gaps in adult MMR vaccine knowledge and coverage, with almost a quarter of ED participants reporting they had never heard of the MMR vaccine, and almost half of them not being up to date. Many patients missing the MMR vaccine would accept it if offered. EDs may serve as effective vaccination surveillance settings to close immunity gaps in underserved populations and reduce the risk of future measles outbreaks. Future studies should focus on the feasibility, implementation strategies, and effectiveness of offering MMR vaccination programs, including specific data on the impact of vaccine uptake and health disparities.

Characteristic	Total (N = 2456)	18–30 years old (N = 651)	31–41 years old (N = 624)	42–53 years old (N = 577)	54–64 years old (N = 604)
Median age. Years (IQR)	41 (30, 53)	25 (22, 28)	36 (33, 39)	47 (44, 51)	59 (56, 62)
Sex					
Female	1343 (54.7%)	405 (62.2%)	377 (60.4%)	289 (50.1%)	272 (45.0%)
Male	1087 (44.3%)	233 (35.8%)	243 (38.9%)	284 (49.2%)	327 (54.1%)
Other	26 (1.1%)	13 (2.0%)	4 (0.6%)	4 (0.7%)	5 (0.8%)
Housing status*					
Marginal	88 (3.6%)	18 (2.8%)	25 (4.0%)	18 (3.1%)	27 (4.5%)
Unstable	132 (5.4%)	18 (2.8%)	40 (6.4%)	33 (5.7%)	41 (6.8%)
Stable	2235 (91.0%)	615 (94.5%)	559 (89.6%)	525 (91.1%)	536 (88.7%)
Race and ethnicity¶					
Black or African American	695 (28.4%)	166 (25.7%)	158 (25.3%)	144 (25.0%)	227 (37.6%)
Asian	93 (3.8%)	44 (6.8%)	18 (2.9%)	18 (3.1%)	13 (2.2%)
Hispanic or Latino	876 (35.7%)	226 (35.0%)	252 (40.4%)	225 (39.0%)	173 (28.6%)
Native American	14 (0.6%)	4 (0.6%)	2 (0.3%)	5 (0.9%)	3 (0.5%)
Native Hawaiian or Pacific Islander	17 (0.7%)	2 (0.3%)	6 (1.0%)	6 (1.0%)	3 (0.5%)
Other	190 (7.8%)	57 (8.8%)	48 (7.7%)	44 (7.6%)	41 (6.8%)
White	566 (23.1%)	147 (22.8%)	140 (22.4%)	135 (23.4%)	144 (23.8%)
Health Insurance					
Affordable Care Act	51 (2.2%)	20 (3.1%)	19 (3.0%)	12 (2.2%)	0 (0.0%)
Community Health Plan	37 (1.6%)	6 (0.9%)	7 (1.1%)	13 (2.4%)	11 (2.1%)
Medi-Cal/ Medicaid	852 (36.3%)	223 (34.3%)	257 (41.2%)	191 (34.8%)	181 (34.5%)
Medicare	204 (8.7%)	25 (3.8%)	32 (5.1%)	56 (10.2%)	91 (17.3%)
Military and Veterans Administration	5 (0.2%)	2 (0.3%)	3 (0.5%)	0 (0.0%)	0 (0.0%)
No Insurance	235 (10.0%)	84 (12.9%)	85 (13.6%)	62 (11.3%)	4 (0.8%)
Other	146 (6.2%)	54 (8.3%)	32 (5.1%)	32 (5.8%)	28 (5.3%)
Private	819 (34.9%)	237 (36.4%)	189 (30.3%)	183 (33.3%)	210 (40.0%)
Primary Language					
English	1931 (78.6%)	553 (84.9%)	487 (78.0%)	422 (73.1%)	469 (77.6%)
Other	62 (2.5%)	20 (3.1%)	11 (1.8%)	15 (2.6%)	16 (2.6%)
Spanish	463 (18.9%)	78 (12.0%)	126 (20.2%)	140 (24.3%)	119 (19.7%)
Have a primary care provider or clinic					
Yes	1829 (74.6%)	460 (70.8%)	452 (72.6%)	440 (76.4%)	477 (79.2%)
No	622 (25.4%)	190 (29.2%)	171 (27.4%)	136 (23.6%)	125 (20.8%)
City of ED visit					
SF	495 (20.2%)	98 (15.1%)	146 (23.4%)	129 (22.4%)	122 (20.2%)
Sylmar	330 (13.4%)	51 (7.8%)	84 (13.5%)	102 (17.7%)	93 (15.4%)
Los Angeles	283 (11.5%)	98 (15.1%)	53 (8.5%)	60 (10.4%)	72 (11.9%)
Fresno	396 (16.1%)	122 (18.7%)	136 (21.8%)	76 (13.2%)	62 (10.3%)
Philadelphia	302 (12.3%)	121 (18.6%)	45 (7.2%)	51 (8.8%)	85 (14.1%)
Chicago	281 (11.4%)	58 (8.9%)	72 (11.5%)	67 (11.6%)	84 (13.9%)
Detroit	209 (8.5%)	57 (8.8%)	48 (7.7%)	56 (9.7%)	48 (7.9%)
Durham	160 (6.5%)	46 (7.1%)	40 (6.4%)	36 (6.2%)	38 (6.3%)

Table 1. Characteristics of 2456 study participants (age 18-64 years) at 10 emergency departments in eight U.S. cities, April 18 - December 31, 2024.

Note: primary care refers to access to a primary care provider (PCP).

	Total (N=2456)	18-30 (N=651)	31-41 (N=624)	42-53 (N=577)	54-64 (N=604)
Medicare	204 (8.7 %)	25 (3.8 %)	32 (5.1 %)	56 (10.2 %)	91 (17.3 %)
Military and Veterans Administrationt	5 (0.2 %)	2 (0.3 %)	3 (0.5 %)	0 (0.0 %)	0 (0.0 %)
No Insurance	235 (10.0 %)	84 (12.9 %)	85 (13.6 %)	62 (11.3 %)	4 (0.8 %)
Other	146 (6.2 %)	54 (8.3 %)	32 (5.1 %)	32 (5.8 %)	28 (5.3 %)
Private	819 (34.9 %)	237 (36.4 %)	189 (30.3 %)	183 (33.3 %)	210 (40.0 %)
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Spanish	463 (18.9 %)	78 (12.0 %)	126 (20.2 %)	140 (24.3 %)	119 (19.7 %)
Primary Care					
Yes	1829 (74.6 %)	460 (70.8 %)	452 (72.6 %)	440 (76.4 %)	477 (79.2 %)
No	622 (25.4 %)	190 (29.2 %)	171 (27.4 %)	136 (23.6 %)	125 (20.8 %)
City					
SF	495 (20.2 %)	98 (15.1 %)	146 (23.4 %)	129 (22.4 %)	122 (20.2 %)
Slymar	330 (13.4 %)	51 (7.8 %)	84 (13.5 %)	102 (17.7 %)	93 (15.4 %)
LA	283 (11.5 %)	98 (15.1 %)	53 (8.5 %)	60 (10.4 %)	72 (11.9 %)
Fresno	396 (16.1 %)	122 (18.7 %)	136 (21.8 %)	76 (13.2 %)	62 (10.3 %)
Plil.	302 (12.3 %)	121 (18.6 %)	45 (7.2 %)	51 (8.8 %)	85 (14.1 %)
Chicago	281 (11.4 %)	58 (8.9 %)	72 (11.5 %)	67 (11.6 %)	84 (13.9 %)
Detroit	209 (8.5 %)	57 (8.8 %)	48 (7.7 %)	56 (9.7 %)	48 (7.9 %)
Gurham	160 (6.5 %)	46 (7.1 %)	40 (6.4 %)	36 (6.2 %)	38 (6.3 %)

Table 1 (cont). Characteristics of 2456 study participants (age 18-64 years) at 10 emergency departments in eight U.S. cities, April 18 - December 31, 2024.

Note: primary care refers to access to a primary care provider (PCP).

IQR = interquartile range; ED = emergency department

* Patients were asked, "What is your living situation today?" Stable was defined as a response of, "I have a steady place to live (home, apartment, or other)." Marginal was defined as a response of, "I have a place to live today, but I am worried about losing it in the future." Unstable was defined as a response of, "I do not have a steady place to live (I am temporarily staying with others, in a hotel, in a shelter, living outside on the street, on a beach, in a car, abandoned building, bus or train station, or in a park)."

¶ Persons of Hispanic or Latino origin might be of any race but are categorized as Hispanic

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Table 2
Percentages of 2456 ED patient participants (stratified by age group) who 1) had not heard of the MMR vaccine, 2) were not up to date on the MMR vaccine, and 3) If not up to date, would accept the MMR vaccine if offered in the emergency department.

Patient age (yrs) $N = 2456$	% of participants (95% CI) who had not heard of the MMR vaccine $N = 613$	% of participants (95% CI) who had missed the MMR vaccine (were not up to date) $N = 1090$	% of participants (95% CI) who were not up to date and would accept the MMR vaccine $N = 394$
All ages	25.0 (23.3–26.7)	44.4 (42.5–46.4)	36.5 (33.6–39.4)
18–30	29.1 (25.6–32.6)	48.5 (44.6–52.3)	31.6 (26.4–36.8)
31–41	25.7 (22.3–29.1)	47.4 (43.4–51.3)	32.0 (26.6–37.3)
42–53	21.9 (18.5–25.3)	40.4 (36.3–44.4)	39.0 (32.7–45.2)
54–64	23.0 (19.6–26.3)	40.9 (37.0–44.9)	45.7(39.5–52.0)

ED = emergency department; MMR = measles, mumps and rubella. Conducted in 10 EDs in the cities of Chicago, Illinois, Detroit, Michigan, Durham, North Carolina; Fresno, California; Los Angeles, California; Philadelphia, Pennsylvania; San Francisco, California; and Sylmar, California.

Table 2. Percentage of 2456 emergency department patient participants (stratified by age group) who 1) had not heard of the MMR vaccine, 2) were not up to date on the MMR vaccine, and 3) If not up to date, would accept the MMR vaccine if offered in the emergency department.
MMR = measles, mumps and rubella. Conducted in the cities of Chicago, Illinois; Detroit, Michigan; Durham, North Carolina; Fresno, California; Los Angeles, California; Philadelphia, Pennsylvania; San Francisco, California; and Sylmar, California.

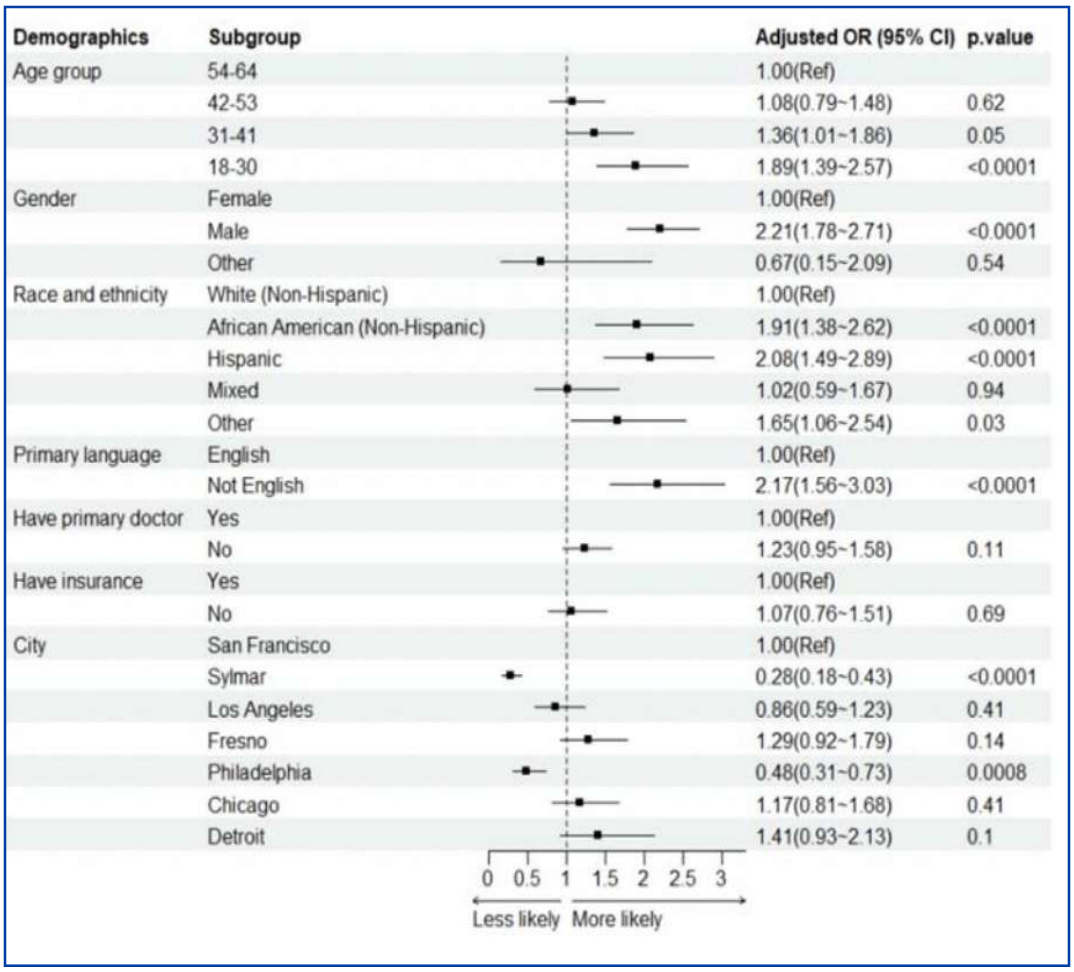


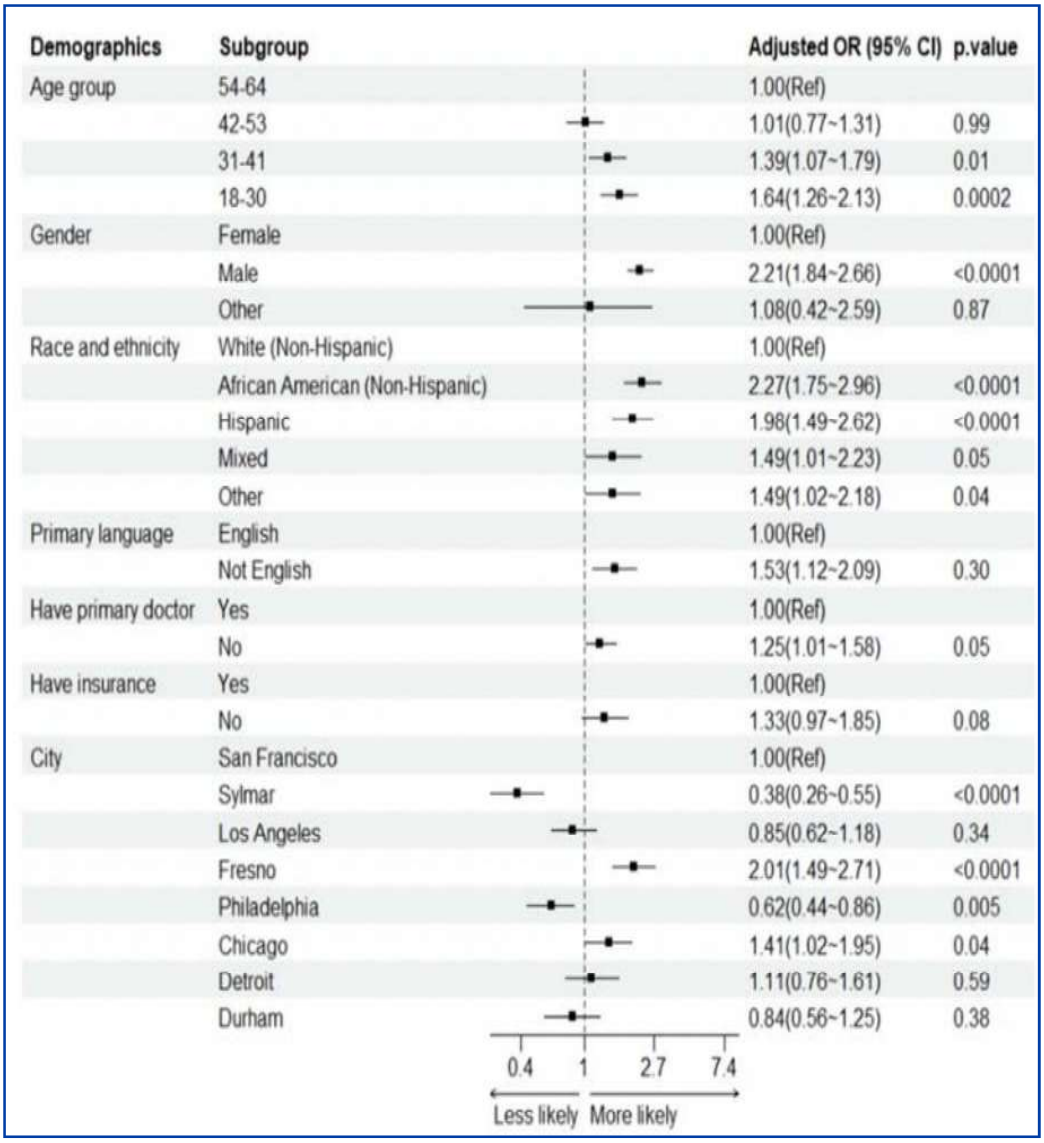
Figure 1: Forest plot of adjusted odds ratios and 95% confidence intervals for characteristics associated with not having heard of the MMR vaccination among adult patients in ten emergency departments in eight U.S. cities, April 18 - December 31, 2024.

Note: the first row is the comparison group to which all other groups were compared.

MMR = measles, mumps and rubella; OR = odds ratio; CI = confidence interval

Figure 2: Forest plot of adjusted odds ratios and 95% confidence intervals for characteristics associated with not being up to date with MMR vaccination among adult patients in ten emergency departments in eight U.S. cities, April 18 - December 31, 2024.

Note: the first row is the comparison group to which all other groups were compared.



Demographics	Subgroup	Adjusted OR (95% CI)	p.value
Age group	54-64	1.00(Ref)	
	42-53	1.01(0.77~1.31)	0.99
	31-41	1.39(1.07~1.79)	0.01
	18-30	1.64(1.26~2.13)	0.0002
Gender	Female	1.00(Ref)	
	Male	2.21(1.84~2.66)	<0.0001
	Other	1.08(0.42~2.59)	0.87
Race and ethnicity	White (Non-Hispanic)	1.00(Ref)	
	African American (Non-Hispanic)	2.27(1.75~2.96)	<0.0001
	Hispanic	1.98(1.49~2.62)	<0.0001
	Mixed	1.49(1.01~2.23)	0.05
	Other	1.49(1.02~2.18)	0.04
Primary language	English	1.00(Ref)	
	Not English	1.53(1.12~2.09)	0.30
Have primary doctor	Yes	1.00(Ref)	
	No	1.25(1.01~1.58)	0.05
Have insurance	Yes	1.00(Ref)	
	No	1.33(0.97~1.85)	0.08
City	San Francisco	1.00(Ref)	
	Sylmar	0.38(0.26~0.55)	<0.0001
	Los Angeles	0.85(0.62~1.18)	0.34
	Fresno	2.01(1.49~2.71)	<0.0001
	Philadelphia	0.62(0.44~0.86)	0.005
	Chicago	1.41(1.02~1.95)	0.04
	Detroit	1.11(0.76~1.61)	0.59
	Durham	0.84(0.56~1.25)	0.38

MMR = measles, mumps and rubella; OR = odds ratio; CI = confidence interval

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