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Maternal Vaccine Receipt, Intentions, and Refusal Among Pregnant Women Attending Antenatal Care in Panama City: A Cross-Sectional Study

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Abstract

Background/objectives

Maternal vaccination surveys often combine willingness and receipt, potentially obscuring differences between these measures. We quantified self-reported vaccine receipt, intention without receipt, complete reported receipt, and refusal in an urban Panamanian convenience sample and examined their relationship with vaccination recommendation.

Methods

We analyzed an anonymous cross-sectional survey completed from March 26 to July 25, 2026, by 204 pregnant women aged 18 years or older recruited in health-related settings in Panama City. Self-reported receipt meant reporting at least one maternal vaccine during the current pregnancy. Intention without receipt meant planning at least one vaccine without reporting receipt of any specific vaccine. Complete reported receipt was the independent response "already received all," rather than verified completion of a vaccination schedule. Modified Poisson regression with robust variance estimated prevalence ratios (PRs). A secondary, post hoc evaluation examined six rating items without claiming formal questionnaire validation.

Results

The number of women who chose self-reported receipt was 128/204 (62.7%; exact 95% confidence interval (CI), 55.7-69.4), while the composite of receipt or intention was 190/204 (93.1%). Intention without receipt was reported by 62/204 (30.4%), complete reported receipt by 41/204 (20.1%), and refusal with coexisting receipt or intention by 92/204 (45.1%). Four participants reporting complete receipt did not report any vaccine-specific receipt. Refusal was reported for COVID-19 by 96/204 (47.1%), influenza by 11/204 (5.4%), tetanus, diphtheria, and acellular pertussis (Tdap) by 8/204 (3.9%), and respiratory syncytial virus (RSV) by 7/204 (3.4%). Receipt was reported by 126/172 (73.3%) participants with a vaccination recommendation versus 2/32 (6.2%) without one (adjusted PR, 11.28; 95% CI, 2.95-43.17). Three-item standardized Cronbach's alpha values were 0.699 and 0.728, with substantial ceiling effects and an unstable two-factor solution.

Conclusions

In this convenience sample, stated acceptance coexisted with the absence of reported receipt and vaccine-specific refusal. Recommendation was associated with receipt, but the estimate was imprecise and noncausal. These findings are not population estimates and support reporting recommendation, intention, receipt, and refusal separately. Intention without receipt does not establish subsequent failure to vaccinate.

Categories: Obstetrics/Gynecology, Public Health, Epidemiology/Public Health
Keywords: intention-behavior gap, maternal immunization, panama, pregnancy, selective refusal, vaccination recommendation, vaccine receipt

Introduction

Vaccination during pregnancy protects the pregnant woman and, through transplacental antibody transfer, the infant during the first months of life. Influenza and tetanus, diphtheria and acellular pertussis (Tdap) vaccination has established maternal and infant benefits, while COVID-19 vaccination during pregnancy reduces the risk of severe COVID-19 in pregnant women. Furthermore, respiratory syncytial virus (RSV) prefusion F vaccination reduces severe medically attended RSV disease in early infancy [1-3]. Panama's 2026 national schedule recommends annual influenza vaccination at any stage of pregnancy, one Tdap dose in

each pregnancy from 27 weeks, and one COVID-19 dose regardless of gestational stage. RSV vaccination is recommended once per pregnancy at 30-36 weeks, at least 14 days before the expected delivery date; administration at 28 weeks is permitted on medical indication in a high-risk obstetric clinic [4].

Maternal vaccination behavior is not a single binary construct. Confidence, recommendation, willingness, access, vaccine availability and receipt are related, but none can be used as a substitute for the others. Systematic and narrative reviews consistently identify provider recommendation, perceived benefit, confidence regarding safety and convenient access as facilitators of uptake of vaccination by pregnant women [5-8]. A prior review specifically noted that there is little evidence on how maternal vaccination attitudes translate into uptake and coverage, and that vaccine-specific nuances are often lost in dichotomous acceptance measures [9].

The distinction is especially important in Latin America. In an online study of women with a child aged 12 months or younger in Panama, Peru and Colombia, 73%-80% reported receiving influenza vaccination but only 30%-39% reported Tdap receipt; recommendation, knowledge of where to obtain the vaccine and reminders were common correlates [10]. Qualitative research among urban pregnant women in Panama found generally favorable views alongside safety concerns, access barriers and demand for clearer information [11]. These studies establish the importance of maternal immunization in Panama, but do not resolve whether high stated acceptance among women currently receiving antenatal care corresponds to self-reported receipt across the four vaccines now discussed in practice.

Recent data further show that recommendation and delivery opportunity should be separated. In a survey in the United States, influenza receipt was 61.4% among women receiving a provider offer or referral, 22.7% among those receiving a recommendation without an offer or referral, and 10.8% among those receiving no recommendation [12]. Card-based data from a Brazilian public maternity hospital found documented complete receipt of all four program vaccines in only 11.2% despite high awareness of having been vaccinated [13]. Vaccine-specific reasons also vary: an Italian study found insufficient provider information prominent for Tdap nonreceipt, low disease-risk perception regarding influenza, and fetal safety concerns for COVID-19 vaccine refusal [14].

This study examined the difference between reported vaccination and stated intention, together with vaccine-specific refusal. The objectives were to: (a) estimate self-reported receipt of at least one vaccine as the primary behavioral outcome; (b) separately quantify intention without receipt, complete reported receipt, absence of receipt or intention, any refusal and selective refusal; (c) describe vaccine-specific recommendation, receipt, intention and refusal; (d) estimate the association between recommendation and self-reported receipt; and (e) provide a limited secondary measurement evaluation of the six rating items without claiming full questionnaire validation. We did not identify another Panamanian study that jointly reports these coexisting states across influenza, Tdap, COVID-19 and RSV vaccination among currently pregnant women; this context-specific measurement, rather than representing the entire population, is the study's intended contribution. The primary analysis concerns reported vaccination behavior; the secondary measurement analysis only describes the performance of six rating items and does not validate reported vaccination status.

This article was previously posted to the Preprints.org preprint server on August 14, 2026 [15].

Materials And Methods

Design, setting, and participants

We conducted an exploratory cross-sectional study among pregnant women attending public or private health facilities or vaccination centers in Panama City and its metropolitan area. The first recorded response was on March 26, 2026 and the last was July 25, 2026. Eligible participants were pregnant, aged 18 years or older, able to understand Spanish and willing to participate. The analytic dataset contained no participant younger than 18 years.

Participants were recruited by convenience sampling in health-related settings. The protocol set an operational target of 200 completed questionnaires based on anticipated attendance and feasibility; it was not a precision- or power-based calculation. A prospective screening log and site-specific recruitment counts were not maintained, so the numbers eligible, approached and declining, the response rate and the contribution of each site cannot be reconstructed. The analytic sample comprised 204 completed anonymous questionnaires. No weighting, post-stratification or post hoc power calculation was applied because no probability sampling frame or external calibration margins were available.

The estimand throughout is the proportion or association within this care-engaged convenience sample. Exact confidence intervals quantify internal statistical precision only; they do not correct selection bias or support citywide or national generalization. Reporting was checked against Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) for cross-sectional studies [16].

Study-specific questionnaire and outcome definitions

A study-specific, anonymous, self-administered questionnaire was developed from the protocol objectives and maternal immunization literature. It contained closed multiple-choice, dichotomous and 1-10 rating items and took approximately 10 minutes to complete. The protocol described expert review, but archived item-rating matrices, content-validity indices, cognitive-interview records and a prespecified validation report were not available. We therefore describe the instrument as study-specific and expert-reviewed, not as a validated questionnaire. The analyzed content covered sociodemographic and obstetric characteristics, vaccination recommendations, receipt, intention and refusal for four maternal vaccines, one principal refusal reason, information sources and six rating items. The full Spanish questionnaire, including response options, is provided in the Appendices as Appendix A, and its English translation is provided in Appendix B. All 204 participants completed the same electronic questionnaire. The response option "I have already received all of them" was available from the start of data collection, and the question on preferred information sources allowed multiple selections.

For the present exploratory analysis, the primary outcome was reported receipt, defined as self-report of receiving at least one of influenza, Tdap, COVID-19 or RSV vaccine during the current pregnancy. Secondary states were: (i) stated acceptance, a composite of receipt or a plan to receive at least one vaccine; (ii) intention without receipt, defined as planning at least one vaccine among women reporting no vaccine-specific receipt; (iii) complete reported receipt, based on the independent response 'already received all'; (iv) neither receipt nor intention; (v) any vaccine-specific refusal; and (vi) selective refusal, defined as refusing at least one vaccine with coexisting receipt or intention. This definition identifies coexisting survey responses without establishing their timing. The stated-acceptance composite comprised two mutually exclusive groups: participants reporting vaccine-specific receipt and participants reporting intention without any vaccine-specific receipt; refusal could coexist with reported receipt or intention.

Four participants selected 'already received all' but reported no vaccine-specific receipt. These anonymous responses could not be checked against vaccination records or clarified with participants. Both responses were retained independently: the four participants remained classified as having no reported vaccine-specific receipt for the primary outcome and as reporting complete receipt for the separate item. The complete-receipt option did not override or impute any vaccine-specific response. The 41/204 complete-receipt responses therefore describe an independent self-assessment, not verified schedule completion or a logical subset of vaccine-specific receipt.

All vaccine-specific percentages use the full sample of 204 participants, irrespective of eligibility for a given vaccine at the time of the survey. Gestational age at survey was recorded, but vaccination dates, gestational age at vaccination, and the clinical circumstances determining eligibility were not. Eligibility-adjusted coverage could therefore not be estimated for any of the four vaccines. In particular, the RSV estimates do not measure coverage among women eligible within the recommended gestational window.

The questionnaire allowed participants to select one or more vaccines they did not want, followed by one principal reason. It did not link a separate reason to each refused vaccine. We therefore report vaccine-specific refusal frequencies, but do not compare refusal reasons across vaccines. Recommendation was defined by a yes response to item 20, which asked whether anyone had recommended vaccination during pregnancy; it was not restricted to healthcare professionals. Geographic variables present in the electronic export were not used in the analysis.

Secondary measurement evaluation

Six 1-10 items were examined in two conceptually defined three-item groups. The perception mean was calculated as the unweighted arithmetic mean of questionnaire items 17-19: willingness to receive any vaccine recommended by the participant's primary physician, the belief that vaccines are safe, and the belief that vaccines protect against serious diseases such as influenza or COVID-19. Each item was rated from 1 (strongly disagree) to 10 (strongly agree). The score was calculated as (item 17+item 18+item 19)/3 and had a possible range of 1-10, with higher values indicating more favorable vaccination perceptions. No items were reverse-scored. All three responses were required to calculate the score; missing responses were not imputed. The score was entered as a continuous predictor, and its adjusted prevalence ratio represents a one-point increase in the mean score. It was treated as an exploratory summary, not as a formally validated scale. The benefit/knowledge group covered the beliefs that vaccination helps prevent prematurity or low birthweight, protects the infant after birth against diseases such as pertussis or influenza, and protects the mother during pregnancy. This secondary, post hoc evaluation used the same 204 observations as the substantive analysis and was intended to characterize score behavior, not to establish criterion, predictive, cross-cultural, or external validity.

We calculated raw and standardized Cronbach's alpha, item means and standard deviations, floor and ceiling percentages, Spearman item-rest correlations and alpha if deleted. Factorability was examined using the Kaiser-Meyer-Olkin (KMO) statistic and Bartlett's test. Maximum-likelihood exploratory factor models with one and two promax-rotated factors were inspected, including minimum uniqueness and boundary solutions. Known-group comparisons assessed score distributions by self-reported receipt and

recommendation using Mann-Whitney tests and rank-biserial correlations. Because the factor solution was unstable and ceiling effects were marked, no cut points were created and the domain means were retained only as exploratory summaries.

Statistical analysis

Categorical variables were summarized as n (%) and quantitative variables as mean±standard deviation or median (interquartile range), as appropriate. Exact Clopper-Pearson 95% confidence intervals (CIs) were calculated for principal outcome proportions. There were no missing responses among the 204 participants for modeled variables (0/204, 0.0%). The number of children and same-day vaccine willingness each had one missing response (1/204, 0.5%); no imputation was performed. For multiple-selection vaccination items, each named vaccine was coded as selected or not selected. A do-not-recall response or absence of a named selection was not treated as verified nonvaccination; it contributed no reported vaccine-specific receipt unless a named vaccine was also selected. No participant was excluded because of the four discordant complete-receipt responses, and neither these responses nor missing values were used to infer vaccination.

For the exposure of having received a vaccination recommendation, we tabulated outcome prevalence among recommended and non-recommended participants and estimated crude prevalence ratios (PRs) using modified Poisson regression with a log link and robust sandwich variance [17]. An adjusted model was fitted for self-reported receipt, not for the near-saturated stated-acceptance composite. Covariates were selected for epidemiologic relevance: age per five years, higher education, private antenatal care and the three-item perception mean. With 128 receipt events and 76 non-events, the model had 15.2 non-events per covariate and did not rely on automated selection. Variance inflation factors ranged from 1.01 to 1.12. Estimates remain exploratory because cross-sectional data cannot establish temporality and recommendation may mark broader care access, continuity and vaccination opportunity. Adjusted prevalence ratios and 95% confidence intervals were estimated using modified Poisson regression with a log link and robust sandwich variance (HC0). Two-sided P values were calculated using Wald z tests for each regression coefficient, dividing the coefficient by its robust standard error and comparing the resulting statistic with the standard normal distribution.

The protocol proposed logistic regression for acceptance. In the present exploratory analysis, modified Poisson regression was used to report prevalence ratios for the common receipt outcome. This analytic refinement and the selected adjustment set are not presented as a preregistered confirmatory analysis. Analyses were performed in R 4.6.1 (R Foundation for Statistical Computing, Vienna, Austria) using readxl, dplyr, sandwich, ggplot2 and base R functions. The analytic dataset was deidentified before analysis; the executable R code and data dictionary, including the questionnaire item map and coding rules, accompany this revision as Supplementary Files 1 and 2. The deidentified analytic dataset remains available from the corresponding author on reasonable request, subject to applicable ethical and institutional requirements. Two-sided p values below 0.05 were considered statistically significant; effect estimates and 95% confidence intervals were emphasized over p values.

Ethical considerations

The protocol was approved by the Research Bioethics Committee of The Panama Clinic on December 9, 2025 (EC-CBITPC-237; RESEGIS #4975), before data collection. Participation was voluntary, anonymous and confidential, and no direct identifiers were collected. Verbal informed consent was obtained before participation. The approved protocol permitted written or verbal consent according to the recruitment site.

Results

Participant characteristics

The mean age of the participants was 29.9 years (SD 5.0; range 18-43). Higher education was reported by 180/204 (88.2%). In the study population, 186/204 (91.2%) were married or cohabiting, 155/204 (76.0%) were expecting their first baby, and all 204/204 (100.0%) reported antenatal care. Median gestational age was 28 weeks (IQR 21.8-33.0), and 159/204 (77.9%) reported private care. These features define a care-engaged, highly educated, predominantly private-care sample (Table *1*).

Characteristic	n (%) or summary
Age, years	29.9±5.0
18-24	27 (13.2)
25-34	146 (71.6)
≥35	31 (15.2)
High school	24 (11.8)
University	149 (73.0)
Master's/doctoral degree	31 (15.2)
Married or cohabiting	186 (91.2)
Expecting first baby	155 (76.0)
Gestational age, weeks	28.0 (21.8-33.0)
First trimester	9 (4.4)
Second trimester	84 (41.2)
Third trimester	111 (54.4)
Receiving antenatal care	204 (100.0)
Private care	159 (77.9)
Public care	35 (17.2)
Both	10 (4.9)
Any comorbidity	43 (21.1)

TABLE 1: Sociodemographic, clinical and obstetric characteristics (N=204).

Continuous variables are presented as mean±standard deviation (SD) or median (interquartile range (IQR)), as appropriate. First baby reflects the survey response and does not establish first pregnancy.

Acceptance-action gap

Self-reported receipt of at least one maternal vaccine was reported by 128/204 (62.7%; exact 95% CI, 55.7-69.4). In contrast, stated acceptance based on either receipt or intention was reported by 190/204 (93.1%). Intention without receipt was reported by 62/204 (30.4%), and the independent complete-receipt response by 41/204 (20.1%). Four of these 41 participants did not report receipt of any named vaccine; the complete-receipt percentage should not be interpreted as verified vaccination completion. Any vaccine-specific refusal was reported by 101/204 (49.5%); 92/204 (45.1%) reported refusal of at least one vaccine with coexisting receipt or intention. Thus, stated acceptance exceeded self-reported receipt by 30.4 percentage points and did not exclude vaccine-selective refusal (Table *2*).

Definition	n/N	%	Exact 95% CI
Self-reported receipt of at least one vaccine (primary)	128/204	62.7	55.7-69.4
Stated acceptance: receipt or intention	190/204	93.1	88.8-96.2
Intention without receipt	62/204	30.4	24.2-37.2
Complete reported receipt	41/204	20.1	14.8-26.3
Neither receipt nor intention	14/204	6.9	3.8-11.2
Any vaccine-specific refusal	101/204	49.5	42.5-56.6
Selective refusal with receipt or intention	92/204	45.1	38.1-52.2

TABLE 2: Distinct maternal vaccination states in the study sample (N=204).

Stated acceptance was defined as self-reported receipt of at least one vaccine or intention to receive at least one vaccine. The 190 participants meeting this definition comprised 128 reporting vaccine-specific receipt and 62 reporting intention without any vaccine-specific receipt. Complete reported receipt refers to the independent response "I have already received all of them" to questionnaire item 28; it does not indicate verified completion of a vaccination schedule. Four participants selected this response without reporting receipt of any specific vaccine. These responses were retained without recoding, exclusion, or overriding the vaccine-specific receipt responses. Complete reported receipt is not a logical subset of vaccine-specific receipt. Refusal could coexist with receipt or intention. Percentages use the full sample (N=204). CI: confidence interval.

Vaccine-specific patterns and refusal

Influenza vaccine was most often reported as received, by 116/204 (56.9%), followed by Tdap, by 83/204 (40.7%), and RSV vaccine, by 50/204 (24.5%); COVID-19 vaccine receipt was reported by 11/204 (5.4%). RSV vaccine was most often planned by 105/204 (51.5%). COVID-19 vaccine was refused by 96/204 (47.1%), compared with 11/204 (5.4%) for influenza, 8/204 (3.9%) for Tdap, and 7/204 (3.4%) for RSV (Table *3*). The most frequently reported single principal reason for refusal was perceived lack of safety, reported by 46/204 (22.5%), followed by not knowing vaccination was recommended, reported by 26/204 (12.7%). These percentages use the full sample of 204 participants as the denominator, rather than only participants reporting refusal. These reasons cannot be validly compared across vaccines because the questionnaire did not link one reason to each refused vaccine. The vaccine-specific estimates above describe full-sample responses, not eligibility-adjusted vaccination coverage; participants who had not yet reached an indicated gestational window remain in the denominator.

Vaccine	Recommended	Received	Plans to receive	Refuses
Influenza	151 (74.0)	116 (56.9)	79 (38.7)	11 (5.4)
Tdap	140 (68.6)	83 (40.7)	91 (44.6)	8 (3.9)
RSV	102 (50.0)	50 (24.5)	105 (51.5)	7 (3.4)
COVID-19	31 (15.2)	11 (5.4)	22 (10.8)	96 (47.1)

TABLE 3: Full-sample vaccine-specific recommendation, receipt, intention and refusal (N = 204).

Values are n (%) using all 204 participants, without restriction to vaccine-specific eligibility. These are full-sample reported responses, not eligibility-adjusted coverage estimates for any vaccine. Multiple selections were allowed, so states within a row need not be mutually exclusive. The RSV receipt estimate (50/204, 24.5%) is not coverage among women eligible for RSV vaccination. Tdap, tetanus, diphtheria and acellular pertussis; RSV, respiratory syncytial virus.

Vaccination recommendation and reported receipt

Vaccination recommendation was reported by 172/204 (84.3%). Self-reported receipt was reported by 126/172 (73.3%) participants receiving a recommendation and 2/32 (6.2%) participants not receiving one (crude PR, 11.72; 95% CI, 3.05-44.98). Recommendation was inversely associated with remaining in the intention-only state and positively associated with the near-saturated stated-acceptance composite but was not associated with selective refusal (Table *4*). Only two receipt events occurred in the group without a recommendation, making the estimated magnitude uncertain.

Outcome	No recommendation	Recommendation	Crude PR (95% CI)	p
Self-reported receipt	2/32 (6.2)	126/172 (73.3)	11.72 (3.05-44.98)	<0.001
Intention without receipt	23/32 (71.9)	39/172 (22.7)	0.32 (0.22-0.45)	<0.001
Stated acceptance	25/32 (78.1)	165/172 (95.9)	1.23 (1.02-1.48)	0.03
Selective refusal	12/32 (37.5)	80/172 (46.5)	1.24 (0.77-1.99)	0.374

TABLE 4: Recommendation and distinct vaccination states.

Values are n/N (%) unless otherwise indicated. Crude prevalence ratios (PRs) and 95% confidence intervals (CIs) were estimated using separate modified Poisson regression models with a log link and robust sandwich variance (HC0). Two-sided P values were calculated using Wald z tests for the recommendation coefficient, with robust standard errors. Each PR compares participants reporting a vaccination recommendation with those reporting none. Only two of 32 participants without a recommendation reported receipt; the sparse comparison group produces substantial uncertainty in the estimated association.

After adjustment for age, higher education, private care, and the perception mean, recommendation was associated with self-reported receipt (adjusted PR, 11.28; 95% CI, 2.95-43.17). Higher perception scores were positively associated with receipt (adjusted PR per point, 1.13; 95% CI, 1.04-1.22), while private care was inversely associated (adjusted PR, 0.82; 95% CI, 0.70-0.96). These exploratory estimates may reflect selection, care pathways, access to public vaccination, and residual confounding rather than causal effects (Table *5*). Adjustment does not remove the uncertainty arising from only two receipt events in the group without a recommendation.

Term	Adjusted PR	95% CI	p
Vaccination recommendation (yes vs. no)	11.28	2.95-43.17	<0.001
Age (per 5 years)	0.93	0.85-1.01	0.092
Higher education (yes vs. no)	1.15	0.87-1.51	0.335
Private care (yes vs. public/both)	0.82	0.70-0.96	0.014
Perception mean (per 1 point)	1.13	1.04-1.22	0.003

TABLE 5: Adjusted prevalence ratios for self-reported receipt of at least one maternal vaccine (N = 204).

Adjusted prevalence ratios (PRs) and 95% confidence intervals (CIs) were estimated using modified Poisson regression with a log link and robust sandwich variance (HC0). The model included all five predictors shown. The perception mean was the unweighted arithmetic mean of questionnaire items 17-19, covering willingness to receive a physician-recommended vaccine, perceived vaccine safety, and protection against serious diseases. Each item ranged from 1 (strongly disagree) to 10 (strongly agree); the mean score therefore ranged from 1 to 10, with higher scores indicating more favorable perceptions. The PR for this variable is expressed per one-point increase. Two-sided P-values were calculated using Wald z-tests for each coefficient with robust standard errors. Variance inflation factors ranged from 1.01 to 1.12. Cross-sectional associations should not be interpreted causally. Only two participants without a recommendation reported receipt; the wide confidence interval limits precision despite adjustment.

Secondary measurement findings

Standardized Cronbach's alpha was 0.699 for the three perception items, 0.728 for the three benefit/knowledge items, and 0.804 for all six items. Across the six items, the number of participants selecting the maximum score of 10 ranged from 83/204 (40.7%) to 135/204 (66.2%), limiting discrimination. Overall KMO was 0.793 and Bartlett's test was significant (chi-square, 369.26; 15 df; p<0.001), but a one-factor model fit poorly (chi-square, 39.10; 9 df; p<0.001) and the better-fitting two-factor model had a boundary solution (minimum uniqueness, 0.005; a loading greater than 1). Perception and benefit scores were modestly higher among recipients (rank-biserial correlations, 0.268 and 0.226), but perception did not differ by recommendation. These findings provide limited internal measurement evidence only and do not establish formal validation.

Information sources

Healthcare professionals were the most frequently consulted source, reported by 189/204 (92.6%), and were selected as a preferred source of vaccine information by 200/204 (98.0%). Artificial intelligence was

consulted by 64/204 (31.4%) and selected as a preferred source by 12/204 (5.9%). Social media were consulted by 14/204 (6.9%) and selected as a preferred source by 7/204 (3.4%). Both information-source questions allowed multiple selections.

Discussion

In this selected group of women attending antenatal care, the stated acceptance based on vaccine receipt or intention of vaccination was more common than reported vaccine receipt alone. The composite was 93.1%, whereas receipt was 62.7% and the independent complete-receipt response was 20.1%; 45.1% reported refusal alongside receipt or intention. These distinctions address the measurement gap identified by Lutz et al. [9]. A binary acceptance measure alone does not distinguish women who plan vaccination from those who report having received it, nor does it capture coexisting refusal. The independent complete-receipt response is a self-assessment with internal discordance and cannot be interpreted as documented completion of the recommended vaccine schedule.

Recommendation was associated with a higher prevalence of reported receipt: 73.3% of recommended participants reported receipt compared with 6.2% of non-recommended participants, while intention without receipt was lower among the recommended group. The adjusted PR of 11.28 had a wide 95% CI of 2.95-43.17 because only two women without a recommendation reported receipt. This sparse comparison group limits confidence in the magnitude; adjustment cannot establish that recommendation alone explains receipt or resolve residual confounding and uncertain temporal order. Recommendation may mark broader access to care that includes continuity of care, the strength and timing of counseling, knowledge of where to be vaccinated, a same-day offer or referral, availability and reminders. This interpretation is consistent with prior findings from Panama, Peru and Colombia [10] and the large differences between an offer/referral, recommendation alone and no recommendation in the US survey [12].

Almost half the sample reported refusing at least one vaccine, and 45.1% reported refusal alongside receipt or intention. COVID-19 refusal was common, whereas influenza and Tdap refusal was uncommon. Vaccine-specific differences have been observed elsewhere, with fetal safety concerns especially prominent for COVID-19 and information gaps or disease-risk perceptions varying for Tdap and influenza [14]. Our instrument cannot compare reasons by vaccine or establish the timing of refusal relative to receipt. The present evidence describes coexisting responses, not vaccine-specific causal mechanisms.

The secondary measurement evaluation improves transparency but does not overcome the questionnaire limitation. Internal consistency was borderline to acceptable for three-item domains, item-rest correlations were moderate and known-groups differences were small to modest. Marked ceiling effects and an unstable factor solution limit discriminative and structural interpretation. These findings do not establish questionnaire validation; domain scores were analyzed without categorical cut points and their associations remain exploratory. Future work should use cognitive interviews, prospective content-validity ratings, test-retest reliability and confirmatory evaluation in an independent, more diverse sample.

The inverse adjusted association between private care and receipt should be interpreted cautiously. In this selected sample, it may reflect public-sector vaccine availability, referral practices, residual differences in gestational timing or model suppression; it is not evidence that private antenatal care reduces vaccination in the wider population. Direct socioeconomic information was not collected, and education or care sector must not be used as a proxy for income. Card-based Brazilian data demonstrate the value of documented receipt and show that complete coverage can remain low even when women believe they were vaccinated [13]. Their record-verified completion outcome is not directly comparable to our independent complete-receipt survey response.

For practice, these observations suggest a pathway for prospective evaluation at antenatal visits: assess vaccine status and eligibility, provide a vaccine-specific recommendation, offer vaccination when indicated or arrange referral, and review documented receipt at the next contact. Monitoring could distinguish recommendation, offer or referral, intention, receipt and refusal for each vaccine and account for gestational eligibility and care sector. The present study did not test these service strategies or establish their effectiveness.

Limitations

The nonprobability sample is the principal limitation and cannot be repaired analytically. Recruitment through health-related settings, universal antenatal care, high educational attainment and predominantly private care probably selected women with greater access to information, recommendation and vaccination opportunity. The direction and magnitude of bias cannot be quantified without a sampling frame, recruitment denominators or data on nonparticipants. Exact confidence intervals describe precision within the sample only. The findings are not estimates for Panama City, Panama or pregnant women generally.

The feasibility-based target was not a formal sample-size calculation, and no site-level screening log was available. Direct socioeconomic status was not measured. Self-reported receipt was not checked against vaccination cards or registries, and cross-sectional timing prevents causal inference. The receipt item

included a do-not-recall option but no explicit none option. The absence of a named vaccine was coded as no reported vaccine-specific receipt and should not be equated with verified nonvaccination. Full-sample vaccine-specific percentages cannot establish coverage among eligible women. In particular, survey gestational age cannot reconstruct RSV eligibility at vaccination, and vaccination dates and relevant clinical circumstances were unavailable. Four participants reported complete receipt without naming any received vaccine. Retaining these responses preserves the observed data but does not resolve their inconsistency: the actual vaccination status of these participants is unknown, and the direction of any resulting misclassification cannot be determined. Reclassifying them as vaccine recipients or excluding them would require unsupported assumptions. The independent complete-receipt response should not be used to infer verified schedule completion.

Questionnaire measurement also has limitations. Expert review did not have archived quantitative ratings, and secondary psychometric analyses in the outcome sample cannot retroactively establish validation. Ceiling effects and the unstable factor solution further restrict score interpretation.

Finally, a single principal reason was recorded after participants could select multiple refused vaccines. Refusal reasons cannot be compared across vaccines. Recommendation source responses were internally inconsistent for 12 participants, so the analysis used whether any recommendation was reported, irrespective of source. Only two of 32 participants without a recommendation reported receipt. This sparse comparison group produced wide crude and adjusted PR confidence intervals; the point estimates should not be taken as precise measures of the association. Recommendation may also reflect unmeasured access, counseling, availability or vaccination opportunities. Residual confounding, selection bias and uncertain temporal order prevent attributing receipt to recommendation alone.

Conclusions

Among pregnant women attending antenatal care in this convenience sample, stated acceptance coexisted with the absence of reported vaccine-specific receipt and vaccine-specific refusal. Vaccination recommendation was associated with receipt, but the estimate was imprecise and does not establish a causal effect.

Antenatal services and future studies should distinguish reported receipt from intention, independent perceptions of completion, and vaccine-specific refusal. Linking counseling to vaccination opportunities and verifying receipt are strategies for prospective evaluation, not interventions whose effectiveness was established by this study. The findings require confirmation in more diverse samples and should not be generalized to all pregnant women in Panama.

Appendices

Appendix A: Study-specific questionnaire

The questionnaire was administered in Spanish. Question wording, response options and selection instructions are transcribed below; layout is adapted for publication. An asterisk identifies a required question. Open response fields have no listed options. Study eligibility was restricted to pregnant participants aged 18 years or older.

Este estudio tiene como objetivo conocer la percepción y las opiniones de las mujeres en Panamá sobre la vacunación durante el embarazo. A través de esta encuesta recopilamos información sobre conocimientos, actitudes, fuentes de información y factores que pueden influir en la decisión de vacunarse o no durante esta etapa. Se trata de un estudio observacional, lo que significa que únicamente recogemos información sobre opiniones y experiencias, sin realizar ninguna intervención. Tu participación es voluntaria y contribuirá a ampliar el conocimiento sobre la vacunación durante el embarazo en nuestro país. ¡Gracias por contribuir a esta investigación!

Item 1. País *

Open response field.

Item 2. Provincia *

Open response field.

Item 3. Distrito *

Open response field.

Item 4. Corregimiento *

Open response field.

Item 5. ¿Cuántos años tienes? *

Open response field.

Item 6. Nivel de estudios *

Marca solo una opción. Primaria ; Secundaria ; Universidad ; Maestría o doctorado ; Ninguno

Item 7. Estado civil *

Marca solo una opción. Casada ; Soltera ; Estoy en pareja, pero no estamos casados ; Viuda

Item 8. ¿Tienes alguna de estas condiciones de salud? *

Marca todas las opciones que correspondan. Presión alta ; Diabetes ; Bajo peso ; Sobrepeso ; Obesidad ; Ninguna ; Otra: _____

Item 9. ¿Es este tu primer bebé? *

Marca solo una opción. Sí ; No

Item 10. ¿Tienes otros hijos? *

Marca solo una opción. Sí ; No

Item 11. ¿Cuántos niños son? (Si no tienes más hijos, no responder)

Open response field.

Item 12. ¿Qué edades tienen? (Si no tienes más hijos, no responder)

Open response field.

Item 13. ¿Cuántas semanas de embarazo tienes? *

Open response field.

Item 14. ¿Has tenido controles durante este embarazo? *

Marca solo una opción. Sí ; No

Item 15. ¿Dónde realizas los controles de tu embarazo? *

Marca solo una opción. Centros de atención públicos (policlínicas, hospital público) ; Centros de atención privados ; Ambos ; No me he realizado controles

Item 16. ¿Por qué motivos o razones no has recibido controles de salud durante el embarazo? *

Marca solo una opción. No sabía que estaba embarazada ; No he logrado sacar una cita ; Se me dificulta transportarme a un centro de salud ; No he buscado atención médica ; No confío en los servicios de salud ; Sí recibí controles de salud ; Otro: _____

Item 17. Me pondría cualquier vacuna recomendada por mi médico de cabecera *

Marca solo una opción. 1 = «Totalmente en desacuerdo»; 10 = «Totalmente de acuerdo». Opciones: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10.

Item 18. Las vacunas son seguras *

Marca solo una opción. 1 = «Totalmente en desacuerdo»; 10 = «Totalmente de acuerdo». Opciones: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10.

Item 19. Las vacunas protegen de enfermedades graves como la influenza o la COVID-19 *

Marca solo una opción. 1 = «Totalmente en desacuerdo»; 10 = «Totalmente de acuerdo». Opciones: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10.

Item 20. ¿Durante este embarazo alguien te recomendó vacunarte? *

Marca solo una opción. Sí ; No

Item 21. ¿Qué vacunas te recomendaron?

Marca todas las opciones que correspondan. Influenza (gripe) ; COVID-19 ; Tdap (tétanos, difteria y tos ferina) ; VRS (virus sincitial respiratorio) ; No recuerdo

Item 22. ¿Quién te las recomendó?

Marca todas las opciones que correspondan. Médico general ; Ginecólogo(a) ; Pediatra ; Enfermero(a) ; Familiar ; Amigo/a ; Líder comunitario (sacerdote, maestra, pastor, etc.) ; Red social o influencer ; Inteligencia artificial (IA) ; Político

Item 23. ¿Cuántas vacunas estarías dispuesta a recibir el mismo día?

Marca solo una opción. Solo 1 vacuna ; 2 vacunas juntas ; 3 vacunas en el mismo día ; No tengo problema con las 4 juntas ; No estoy dispuesta a vacunarme

Item 24. Las vacunas ayudan a que mi bebé no tenga problemas como parto prematuro o bajo peso *

Marca solo una opción. 1 = «Totalmente en desacuerdo»; 10 = «Totalmente de acuerdo». Opciones: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10.

Item 25. Las vacunas protegen a mi bebé cuando nace, contra enfermedades como la tos ferina o la influenza *

Marca solo una opción. 1 = «Totalmente en desacuerdo»; 10 = «Totalmente de acuerdo». Opciones: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10.

Item 26. Las vacunas también me protegen a mí durante el embarazo *

Marca solo una opción. 1 = «Totalmente en desacuerdo»; 10 = «Totalmente de acuerdo». Opciones: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10.

Item 27. ¿Recibiste alguna vacuna durante este embarazo? *

Marca todas las opciones que correspondan. Influenza ; COVID-19 ; Tdap ; VRS ; No recuerdo

Item 28. ¿Planeas aplicarte alguna de estas vacunas durante el embarazo? *

Marca todas las opciones que correspondan. Influenza ; COVID-19 ; Tdap ; VRS ; No voy a recibir ninguna vacuna durante el embarazo ; Ya recibí todas

Item 29. ¿Dónde las recibiste o piensas recibirlas? *

Marca solo una opción. Centro de salud o policlínica ; Consultorio privado del ginecólogo(a) ; Consultorio del pediatra de mis otros hijos ; Vacunatorio privado ; No voy a recibir ninguna vacuna durante el embarazo

Item 30. Si no te vacunaste y no piensas hacerlo, ¿cuál es la razón principal?

Marca solo una opción. No sabía que debía hacerlo ; Fui, pero no había vacunas o no podían atenderme ; Son muy caras ; No creo que sean seguras ; No creo que sirvan para protegerme a mí o a mi bebé ; Sí quiero vacunarme

Item 31. ¿Hay alguna vacuna que no quieras ponerte durante el embarazo? *

Marca todas las opciones que correspondan. Influenza ; COVID-19 ; Tdap ; VRS ; Quiero aplicarme todas las vacunas que me recomienden y estén disponibles en los centros donde me atiendo

Item 32. Si no piensas aplicarte una vacuna en específico, ¿cuál es la razón principal?

Marca solo una opción. No sabía que debía hacerlo ; Fui, pero no había vacunas o no podían atenderme ; Son muy caras ; No creo que sean seguras ; No creo que sirvan para protegerme a mí o a mi bebé

Item 33. Cuando tienes dudas sobre tu salud, ¿de dónde buscas información? *

Marca todas las opciones que correspondan. Médico general ; Ginecólogo(a) ; Pediatra ; Enfermero(a) ; Redes sociales (Instagram, TikTok, etc.) ; Influencer ; Familiares ; Amigos/as ; Inteligencia artificial (IA) ; Líderes comunitarios

Item 34. ¿A quién escuchas más cuando se trata de informarte sobre vacunas durante el embarazo? *

Marca todas las opciones que correspondan. Médico general ; Ginecólogo(a) ; Pediatra ; Enfermero(a) ; Familiares ; Amigos/as ; Influencer ; Redes sociales ; Inteligencia artificial (IA) ; Líderes comunitarios o religiosos

Interpretive note. Item 31 permits multiple refused vaccines, whereas item 32 records one principal reason. Therefore, refusal reasons cannot be compared validly across vaccines.

Appendix B: English translation of the study-specific questionnaire

This English translation is provided for publication. The questionnaire was administered in Spanish; the Spanish version is provided in Appendix A. This translation preserves the item order, response options, selection instructions, and required-question indicators of the Spanish questionnaire. It is not a separately validated English-language instrument. An asterisk (*) indicates a required question. Open response fields have no listed options. Study eligibility was restricted to pregnant participants aged 18 years or older.

Participant Introduction

This study aims to understand women's perceptions and opinions about vaccination during pregnancy in Panama. Through this survey, we collect information about knowledge, attitudes, sources of information, and factors that may influence the decision to receive or not receive vaccines during this period. This is an observational study, which means that we only collect information about opinions and experiences, without carrying out any intervention. Your participation is voluntary and will help expand knowledge about vaccination during pregnancy in our country. Thank you for contributing to this research!

Item 1. Country *

Open response field.

Item 2. Province *

Open response field.

Item 3. District *

Open response field.

Item 4. Corregimiento (local administrative subdivision) *

Open response field.

Item 5. How old are you? *

Open response field.

Item 6. Level of education *

Select one option only. Primary school; Secondary school; University; Master's or doctoral degree; None.

Item 7. Marital status *

Select one option only. Married; Single; In a relationship, but not married; Widowed.

Item 8. Do you have any of these health conditions? *

Select all that apply. High blood pressure; Diabetes; Underweight; Overweight; Obesity; None; Other: _____.

Item 9. Is this your first baby? *

Select one option only. Yes; No.

Item 10. Do you have other children? *

Select one option only. Yes; No.

Item 11. How many children do you have? (If you have no other children, do not answer.)

Open response field.

Item 12. How old are they? (If you have no other children, do not answer.)

Open response field.

Item 13. How many weeks pregnant are you? *

Open response field.

Item 14. Have you received antenatal care during this pregnancy? *

Select one option only. Yes; No.

Item 15. Where do you receive antenatal care? *

Select one option only. Public healthcare facilities (polyclinics, public hospital); Private healthcare facilities; Both; I have not received antenatal care.

Item 16. What are the reasons why you have not received antenatal care during pregnancy? *

Select one option only. I did not know I was pregnant; I have not been able to get an appointment; I have difficulty traveling to a healthcare facility; I have not sought medical care; I do not trust healthcare services; I have received antenatal care; Other: _____.

Item 17. I would receive any vaccine recommended by my primary physician. *

Select one option only. 1 = "Strongly disagree"; 10 = "Strongly agree." Options: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10.

Item 18. Vaccines are safe. *

Select one option only. 1 = "Strongly disagree"; 10 = "Strongly agree." Options: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10.

Item 19. Vaccines protect against serious diseases such as influenza or COVID-19. *

Select one option only. 1 = "Strongly disagree"; 10 = "Strongly agree." Options: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10.

Item 20. During this pregnancy, has anyone recommended that you get vaccinated? *

Select one option only. Yes; No.

Item 21. Which vaccines were recommended to you?

Select all that apply. Influenza (flu); COVID-19; Tdap (tetanus, diphtheria, and whooping cough); RSV (respiratory syncytial virus); I do not remember.

Item 22. Who recommended them to you?

Select all that apply. General practitioner; Gynecologist; Pediatrician; Nurse; Family member; Friend; Community leader (priest, teacher, pastor, etc.); Social media or an influencer; Artificial intelligence (AI); Politician.

Item 23. How many vaccines would you be willing to receive on the same day?

Select one option only. Only 1 vaccine; 2 vaccines together; 3 vaccines on the same day; I have no problem receiving all 4 together; I am not willing to get vaccinated.

Item 24. Vaccines help prevent problems such as premature birth or low birthweight in my baby. *

Select one option only. 1 = "Strongly disagree"; 10 = "Strongly agree." Options: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10.

Item 25. Vaccines protect my baby after birth against diseases such as whooping cough or influenza. *

Select one option only. 1 = "Strongly disagree"; 10 = "Strongly agree." Options: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10.

Item 26. Vaccines also protect me during pregnancy. *

Select one option only. 1 = "Strongly disagree"; 10 = "Strongly agree." Options: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10.

Item 27. Have you received any vaccines during this pregnancy? *

Select all that apply. Influenza; COVID-19; Tdap; RSV; I do not remember.

Item 28. Do you plan to receive any of these vaccines during pregnancy? *

Select all that apply. Influenza; COVID-19; Tdap; RSV; I will not receive any vaccines during pregnancy; I have already received all of them.

Item 29. Where did you receive them, or where do you plan to receive them? *

Select one option only. Health center or polyclinic; Private gynecologist's office; My other children's pediatrician's office; Private vaccination clinic; I will not receive any vaccines during pregnancy.

Item 30. If you have not been vaccinated and do not plan to get vaccinated, what is the main reason?

Select one option only. I did not know I should get vaccinated; I went, but no vaccines were available or they could not see me; They are too expensive; I do not think they are safe; I do not think they protect me or my baby; I do want to get vaccinated.

Item 31. Are there any vaccines you do not want to receive during pregnancy? *

Select all that apply. Influenza; COVID-19; Tdap; RSV; I want to receive all vaccines that are recommended to me and available at the facilities where I receive care.

Item 32. If you do not plan to receive a particular vaccine, what is the main reason?

Select one option only. I did not know I should get vaccinated; I went, but no vaccines were available or they could not see me; They are too expensive; I do not think they are safe; I do not think they protect me or my baby.

Item 33. When you have questions about your health, where do you look for information? *

Select all that apply. General practitioner; Gynecologist; Pediatrician; Nurse; Social media (Instagram, TikTok, etc.); Influencer; Family members; Friends; Artificial intelligence (AI); Community leaders.

Item 34. Who do you listen to most when seeking information about vaccines during pregnancy? *

Select all that apply. General practitioner; Gynecologist; Pediatrician; Nurse; Family members; Friends; Influencer; Social media; Artificial intelligence (AI); Community or religious leaders.

Interpretive note (not part of the administered questionnaire). Item 31 permits selection of multiple vaccines that the participant does not want to receive, whereas item 32 records one principal reason. Therefore, refusal reasons cannot be validly compared across vaccines.

Additional Information

Author Contributions

All authors have reviewed the final version to be published and agreed to be accountable for all aspects of the work.

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Disclosures

Human subjects: Informed consent for treatment and open access publication was obtained or waived by all participants in this study. The Panama Clinic Ethics Committee issued approval EC CBITPC 237. This study was reviewed and approved by the Research Bioethics Committee of The Panama Clinic, Panama City, Panama (approval number: EC-CBITPC-237; approval date: December 9, 2025). **Animal subjects:** All authors have confirmed that this study did not involve animal subjects or tissue. **Conflicts of interest:** In compliance with the ICMJE uniform disclosure form, all authors declare the following: **Payment/services info:** CEVAXIN Panama was the study sponsor but provided no funding, in-kind resources, or other support for the study. No study-specific remuneration or financial incentives were provided to the investigators. Endpoints Latam Panama paid the ethics committee review fees and will cover the article publication charges upon acceptance. Endpoints Latam Panama's institutional involvement was limited to this financial support. Vacunar Panama provided no funding or other resources. None of these institutions participated in study design, participant recruitment, data collection, data analysis, interpretation of the findings, or manuscript preparation. The investigators performed these activities in their personal capacities, independently of their institutional affiliations. . **Financial relationships:** Belén Ricci Pérez declare(s) employment from Vacunar Panama. No additional remuneration specifically for this study. . Jaime Ricardo Sevillano Giraldez declare(s) employment from Endpoints Latam Panama. No additional remuneration specifically for this study. . Rodrigo DeAntonio declare(s) employment from Endpoints Latam Panama. No additional remuneration specifically for this study. . Abigail De Ávila declare(s) employment from CEVAXIN. No additional remuneration specifically for this study. . Ana Lucas Quintero declare(s) employment from Vacunar Panama. No additional remuneration specifically for this study. . **Other relationships:** All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

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