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Attitude to RSV Vaccination Among a Cohort of Pregnant Women in Jordan: A Cross-Sectional Survey Study

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ABSTRACT

Background and Aims: The recently approved maternal vaccination against respiratory syncytial virus (RSV) can reduce its burden among infants. However, vaccine hesitancy/resistance can undermine the beneficial impact of RSV vaccination. The aim of this study was to assess the willingness of pregnant women in Jordan to receive RSV vaccination and its associated determinants.

Methods: Face-to-face interviews were conducted in obstetrics/gynecology clinics in the Central, Northern, and Southern regions of Jordan during January–February 2024, using a convenience sampling approach. Attitude to RSV vaccination was assessed using the previously validated ABCDEF scale.

Results: A total of 404 pregnant women participated in the study with a mean age of 30.1 ± 6.2 years. A majority of the participants showed willingness to receive RSV vaccination ($n = 313$, 77.5%), with hesitancy among 25 participants (6.2%), and resistance among 66 participants (16.3%). Variables that were significantly associated with a higher RSV vaccine acceptance in multivariate analysis were: age < 30 years (adjusted odds ratio (aOR): 2.45, $p = 0.010$), undergraduates (aOR: 3.27, $p = 0.026$), being a healthcare worker (aOR: 4.50, $p = 0.036$), and the history of previous COVID-19/influenza vaccine uptake (aOR: 2.47, $p = 0.045$). Two out of the six ABCDEF constructs were significantly associated with RSV vaccine acceptance, namely the "Advice" construct (aOR: 10.38, $p < 0.001$) and the "Fear" construct (aOR: 21.49, $p < 0.001$).

Conclusion: This study highlighted the complex nature of attitude towards maternal RSV vaccination among pregnant women. The study showed the role of demographic variables, prior vaccination experience, trust in credible health institutions and vaccine safety, and the fear of RSV disease consequences in infants in shaping maternal attitude to RSV vaccination. Addressing these factors can help to effectively promote RSV vaccine uptake among pregnant women, subsequently helping to protect infants from the significant RSV disease burden.

Abbreviations: ABCDEF scale, advice, burden, conspiracy, dangers, efficiency, and fear scale; aOR, adjusted odds ratio; CI, confidence interval; COVID-19, Coronavirus disease 2019; FDA, The United States Food and Drug Administration; GBS, group B streptococcus; HCW, healthcare worker; IQR, interquartile range; JOD, Jordanian dinar; LRTIs, lower respiratory tract infections; RSV, respiratory syncytial virus; VBS, vaccine behavior score; WHO, World Health Organization.

1 | Introduction

The respiratory syncytial virus (RSV) is the most common respiratory pathogen among infants contributing to a substantial global health burden [1, 2]. This RNA virus is considered a leading cause of lower respiratory tract infections (LRTIs) among infants with substantial morbidity and mortality rates [3–5]. Specifically, RSV is responsible for an estimated annual mortality rate of more than 100,000 among children under the age of 5 years [2]. Therefore, the RSV disease burden motivated the pursuit of effective preventive measures, particularly directed towards the most at-risk populations such as infants [6–8].

The recent breakthroughs in RSV preventive approaches were manifested in the development and approval of RSV vaccines for use in pregnant women and among the elderly [9–12]. Maternal immunization against RSV confers passive immunity to newborns; therefore, such a cost-effective approach helps in protecting infants against RSV when they are most susceptible to severe consequences of RSV disease [13–15].

Despite the promising potential of maternal RSV vaccination to protect their infants against RSV disease, the success of this strategy is dependent upon high RSV vaccine uptake among the target population, namely pregnant women [16]. A considerable challenge that needs further investigation is the potential for RSV vaccine hesitancy and resistance among pregnant women considering their heightened perceived risk for themselves and their fetuses [17, 18]. A recent narrative review reported that about a third of pregnant women remain unvaccinated despite recommendations from healthcare providers [19].

Vaccine hesitancy is defined as the delay in acceptance or outright refusal of vaccines despite the availability of vaccination services [20]. It is a complex and context-specific phenomenon that varies across time, place, culture, and vaccine type [21–23]. Attitude towards vaccination is influenced by factors such as complacency, convenience, confidence, calculation of benefits and risks, as well as socio-cultural beliefs including misconceptions about vaccine safety and efficacy, which can be of particular importance during pregnancy [19, 24–26].

Vaccine resistance or hesitancy among pregnant women can be related to several factors. Specifically, these factors include concerns about the potential adverse effects of vaccines on fetal health and development, perceived risks of vaccination during pregnancy, and the influence of misinformation [27–30]. Thus, elucidating the determinants of vaccine resistance/hesitancy among pregnant women is essential for targeted intervention measures [31]. Such an investigation can help to address the challenge of vaccine resistance/hesitancy through the development of targeted communication strategies specifically tailored to engage pregnant women [18, 32, 33].

The current study aimed to investigate the attitude of pregnant women towards the recently approved RSV vaccination. Additionally, this study sought to elucidate the underlying factors that would contribute to RSV vaccine resistance/hesitancy among pregnant women in Jordan utilizing a survey instrument specifically designed for this purpose [16]. In turn, the findings of this study can help to reveal valuable insights into the possible barriers and facilitators of RSV vaccine acceptance among pregnant women in Jordan with possible implications in the Arab region where vaccine hesitancy was a notable phenomenon during the coronavirus disease 2019 (COVID-19) pandemic [34].

2 | Methods

2.1 | Study Design and Ethics Statement

This cross-sectional study was based on adopting the previously validated "ABCDEF" scale specifically designed for the assessment of the determinants of RSV vaccine attitude in younger women at childbearing age [16]. The study adhered to the STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) guidelines for cross-sectional studies as outlined in (Supporting Information S1: Appendix S1) [35]. Data collection was based on conducting structured face-to-face interviews with potential participants recruited from various obstetrics/gynecology clinics across Jordan.

Before participation, all participants provided verbal informed consent, ensuring voluntary participation in the study. No identifying information or personal identifiers were collected during the interview process to protect the participants' privacy. The participants were not offered any incentives for participation. The interviews were conducted in Arabic language by five authors (T.K., A.A.-F., L.N., N.A., and R.F.) across multiple clinics located in the Capital Amman, Irbid in the Northern region, and Ma'an in the Southern region of Jordan, to ensure a diverse cross-section of the resident population in Jordan. To ensure the consistency and comparability of collected data across the different interviewers, a structured interview consensus was agreed upon before data collection. This consensus was achieved via training sessions for all interviewers to familiarize them with the interview process and how to handle potential queries by the participants.

Given the constraints of funding and the need to expedite the data collection, a convenience sampling strategy was employed. Inclusion criteria included (1) being pregnant female at any gestational age, (2) current residence in Jordan, and (3) good comprehension in Arabic.

The interviews were conducted between 17 January 2024 and 8 February 2024. The study was approved by the Institutional Review Board (IRB) at Jordan University Hospital (reference number 10/2024/1408), granted on 15 January 2024.

2.2 | Minimum Sample Size Calculation

To estimate the prevalence of maternal acceptance of the RSV vaccine, the Epitools - Epidemiological Calculators online tool was used [36]. The estimate was based on a presumed proportion of RSV vaccine acceptance at 0.5, with a precision level of ± 0.05 within a 95% confidence interval. The basis for estimating the annual number of pregnancies in Jordan was the total number of registered live births which was 197,397, according

to the Department of Statistics in Jordan 2021 Statistical Yearbook [37]. Thus, the calculated minimum sample size required for the study was determined to be 385 participants.

2.3 | Assessment of the Participants' Demographic Data

The data collection process started with a short introduction to the study objectives, with a short summary on RSV and its negative impact on infants' health. Additionally, a short overview was given to the participants regarding the recent US Food and Drug Administration (FDA) approval of the ABRYSVO vaccine for pregnant women in August 2023 [38]. This overview included a summary of the maternal RSV vaccine evaluation on 7300 pregnant women, highlighting its FDA-authorized administration between 32 and 36 weeks of gestational age and the reported safety and efficacy results [38].

Upon obtaining the verbal informed consent from the participant, a structured interview was conducted to collect demographic data and vaccination history information. The demographic data included age and gestational age at the time of the interview (categorized as up to 13 weeks and 6 days for the first trimester, 14 weeks to 27 weeks and 6 days for the second trimester, and 28 weeks to over 40 weeks for the third trimester). Additional demographic data included the number of offspring (categorized as none, 1, and 2 or more), the highest level of education attained (high school or less, undergraduate, postgraduate), employment status (unemployed, employed nonhealthcare worker (non-HCW, employed as HCW), monthly income of the household (1000 Jordanian dinar [JOD] or less vs. more than 1000 JOD), place of residence (the Capital [Amman] vs. outside the Capital), nationality (Jordanian vs. non-Jordanian), and vaccination history. The vaccination history specifically focused on the number of COVID-19 vaccine doses received (0, 1, 2, 3), influenza vaccine uptake during the last 2023 season (yes scored as "1" vs. no scored as "0"), and any prior influenza vaccine uptake before the 2023 season (yes scored as "1" vs. no scored as "0"). A vaccine behavior score (VBS) was calculated by summing the total doses of COVID-19 vaccine received and the scores for influenza vaccine uptake, subsequently categorizing the VBS as < 3 versus ≥ 3.

2.4 | Assessment of Attitude Towards RSV Vaccination

First, the participants were asked about their prior awareness of RSV using the item "Have you heard of RSV before this study?" with "yes" versus "no" as possible responses.

Second, the willingness to receive RSV vaccination during pregnancy was assessed using the following item "I am willing to receive RSV vaccination in pregnancy if it was safe, effective, and provided for free" with responses based on a 5-point Likert scale (agree, somewhat agree, neutral/no opinion, somewhat disagree, disagree). Subsequently, the responses were grouped into acceptance (agreement), versus hesitancy/resistance (neutral and disagreement) groups.

Finally, 21 items of the ABCDEF scale were introduced with responses based on a 5-point Likert scale (agree, somewhat agree, neutral/no opinion, somewhat disagree, disagree). These 21 items formed the six ABCDEF constructs as follows. First, the "Advice" construct comprising three items: (1) My previous experience with vaccinations has been generally positive; (2) I would feel confident if the RSV vaccine was recommended during pregnancy by international organizations; and (3) I would feel confident if the RSV vaccine was recommended during pregnancy by the Ministry of Health.

Second, the "Burden" construct comprising three items: (1) The cost of RSV vaccination is an important factor in my attitude toward its acceptance; (2) I consider my husband's support essential in shaping my decision to receive RSV vaccination during pregnancy; and (3) I consider the support of my family and social circle to be an important factor in shaping my decision to receive RSV vaccination during pregnancy.

Third, the "Conspiracy" construct comprising three items: (1) Pharmaceutical companies that manufacture vaccines care about their financial gains at the expense of public health; (2) The expansion of vaccine manufacturing could be part of a global conspiracy to increase infertility and reduce human population; and (3) The expansion of vaccine manufacturing could be part of a global conspiracy to increase abortions.

Fourth, the "Danger" construct comprising four items: (1) I am concerned about possible side effects of RSV vaccination; (2) I am afraid that vaccination against RSV during pregnancy may harm the fetus; (3) I am concerned about the safety of vaccination in general for pregnant women; and (4) I have concerns about the long-term side effects of RSV vaccination on the health of pregnant women or the health of the fetus.

Fifth, the "Efficiency" construct comprising four items: (1) The cost of the RSV vaccination must be covered by the pregnant woman's health insurance; (2) I consider the healthcare providers' recommendations important in shaping my opinion about RSV vaccination; (3) I would like more information about the benefits of RSV vaccination during pregnancy; and (4) I would like more information about the risks of RSV vaccination during pregnancy.

Sixth, the "Fear" construct comprising four items: (1) RSV infection is considered dangerous among children; (2) I believe that RSV vaccination for pregnant women will protect children from infection with the virus; (3) I think it is important for pregnant women to get RSV vaccination; and (4) I am confident in the safety and effectiveness of RSV vaccination for pregnant women.

Subsequently, a scoring system was employed to evaluate responses to each construct as follows: a response of "agree" was scored as 1, "somewhat agree" as 2, "neutral/no opinion" as 3, "somewhat disagree" as 4, and "disagree" was scored as 5. For each construct, individual scores were summed to derive a total construct score. These cumulative scores were then classified into three categories. For the first three constructs (ABC), scores ranging from 3 to 6 were classified as "agree", scores between 7 and 11 were classified as "neutral", and scores from

12 to 15 were classified as "disagree". For the last three constructs (DEF), the "agree" category comprised scores from 4 to 9, "neutral" comprised scores between 10 and 14, and "disagree" comprised scores from 15 to 20.

2.5 | Statistical Analysis

The statistical analysis was performed using IBM SPSS Statistics for Windows, Version 27.0. To test associations between categorical variables, the chi-squared (χ^2) test was employed. Following the preliminary univariate analysis, variables with p values of < 0.100 were included in subsequent multivariate analysis using the multinomial logistic regression analysis. For comparisons involving multiple groups, analysis of variance (ANOVA) was performed to assess differences in the dependent variable across factors. Effect sizes for the analysis of variance results were quantified using partial eta-squared (η^2), which were interpreted as follows: small effect (0.01), small-to-medium effect for values between 0.01 and 0.06, medium effect (0.06), medium-to-large effect for values between 0.06 and 0.14, and large effect (0.14) [39, 40]. The final threshold for statistical significance was established at $p < 0.050$ [41].

The reliability of the six ABCDEF constructs within the survey instrument was evaluated using the Cronbach's α. This assessment yielded Cronbach's α values indicating satisfactory to excellent internal consistency across the six constructs as follows. The "Advice" construct demonstrated a Cronbach's $\alpha = 0.810$, the "Burden" construct Cronbach's $\alpha = 0.615$, the "Conspiracy" construct Cronbach's $\alpha = 0.765$, the "Danger" construct Cronbach's $\alpha = 0.939$, the "Efficiency" construct Cronbach's $\alpha = 0.835$, and the "Fear" construct Cronbach's $\alpha = 0.822$.

3 | Results

3.1 | Description of the Study Sample

The final number of participating pregnant women in this study was 404, with a mean age of 30.1 ± 6.2 years (median = 30 years, interquartile range [IQR] = 25–35 years). The largest proportion of the study participants was in their first trimester, representing 46.8% ($n = 189$) of the participants, and 47.5% ($n = 192$) had two or more children. A majority of the participants had an undergraduate degree ($n = 262$, 64.9%), were unemployed ($n = 229$, 56.7%), had a monthly household income of ≤1000 JOD ($n = 263$, 65.1%), and were living in the Capital Amman ($n = 282$, 69.8%). Additionally, the vast majority of participants were Jordanians ($n = 377$, 93.3%). Moreover, the majority of participants had a vaccination behavior score of < 3 ($n = 304$, 75.2%). Finally, more than half of the study participants heard of RSV before the study ($n = 219$, 54.2%, Table 1).

TABLE 1 | General features of the participating pregnant women ($N = 404$).

Variable	Category	Count (%)
Age	< 30 years	200 (49.5)
	≥ 30 years	204 (50.5)
Pregnancy stage	First trimester	189 (46.8)
	Second trimester	107 (26.5)
	Third trimester	108 (26.7)
Number of children	None	103 (25.5)
	One	109 (27.0)
	Two or more	192 (47.5)
Educational level	High school or less	81 (20.0)
	Undergraduate	262 (64.9)
	Postgraduate	61 (15.1)
Occupation	Unemployed	229 (56.7)
	Employed (non-HCW)[3]	105 (26.0)
	HCW	70 (17.3)
Monthly income of household	≤ 1000 JOD[4]	263 (65.1)
	> 1000 JOD	141 (34.9)
Residence	Amman	282 (69.8)
	Outside the Capital	122 (30.2)
Nationality	Jordanian	377 (93.3)
	Non-Jordanian	27 (6.7)
Vaccine behavior score[1]	< 3	304 (75.2)
	≥ 3	100 (24.8)
Have you heard of RSV[2] before this study?	Yes	219 (54.2)
	No	185 (45.8)

[1]Vaccine behavior score: Calculated based on the number of COVID-19 vaccine doses received and previous uptake of influenza vaccination.
[2]RSV: Respiratory syncytial virus.
[3]HCW: Healthcare worker.
[4]JOD: Jordanian dinar.

3.2 | Attitude Towards RSV Vaccination in the Study Sample

A majority of the participating pregnant women showed willingness to receive RSV vaccination ($n = 313$, 77.5%), while 25 were hesitant (6.2%), and 66 were resistant (16.3%).

Statistically significant higher percentages of RSV vaccine acceptance were observed among participants < 30 years as opposed to those ≥ 30 years (84.0% vs. 71.1%, $p = 0.002$, $\chi^2 = 9.662$, partial $\eta^2 = 0.024$), participants with undergraduate education compared to postgraduates and participants with high school or less education (81.3% vs. 77.0% vs. 65.4%, and $p = 0.011$, $\chi^2 = 8.932$, partial $\eta^2 = 0.019$), and HCWs compared to unemployed participants and participants employed as non-HCWs (95.7% vs. 75.1% vs. 70.5%, $p < 0.001$, $\chi^2 = 17.026$, partial $\eta^2 = 0.042$). Additionally, higher RSV vaccine acceptance was reported among participants with monthly income of household > 1000 JOD compared to those with income ≤ 1000 JOD (87.9% vs. 71.9%, $p < 0.001$, $\chi^2 = 13.600$, partial $\eta^2 = 0.045$), and participants with vaccine behavior scores < 3 as opposed to those

TABLE 2 | Variables associated with RSV vaccine acceptance in the study sample.

Variable	Category	RSV[4] vaccine attitude		*p* value, χ^2
		Acceptance Count (%)	Hesitancy/resistance Count (%)	
Age	< 30 years	168 (84.0)	32 (16.0)	**0.002**, 9.662
	≥ 30 years	145 (71.1)	59 (28.9)	
Pregnancy stage	First trimester	142 (75.1)	47 (24.9)	0.255, 2.737
	Second trimester	89 (83.2)	18 (16.8)	
	Third trimester	82 (75.9)	26 (24.1)	
Number of children	None	82 (79.6)	21 (20.4)	0.159, 3.684
	One	90 (82.6)	19 (17.4)	
	Two or more	141 (73.4)	51 (26.6)	
Educational level	High school or less	53 (65.4)	28 (34.6)	**0.011**, 8.932
	Undergraduate	213 (81.3)	49 (18.7)	
	Postgraduate	47 (77.0)	14 (23.0)	
Occupation	Unemployed	172 (75.1)	57 (24.9)	**< 0.001**, 17.026
	Employed (non-HCW)[2]	74 (70.5)	31 (29.5)	
	HCW	67 (95.7)	3 (4.3)	
Monthly income of household	≤ 1000 JOD[3]	189 (71.9)	74 (28.1)	**< 0.001**, 13.600
	> 1000 JOD	124 (87.9)	17 (12.1)	
Residence	Amman	226 (80.1)	56 (19.9)	0.051, 3.805
	Outside the Capital	87 (71.3)	35 (28.7)	
Nationality	Jordanian	294 (78.0)	83 (22.0)	0.360, 837
	Non-Jordanian	19 (70.4)	8 (29.6)	
Vaccine behavior score[1]	< 3	226 (74.3)	78 (25.7)	**0.009**, 6.909
	≥ 3	87 (87.0)	13 (13.0)	

[1]Vaccine behavior score: Calculated based on the number of COVID-19 vaccine doses received and previous uptake of influenza vaccination.
[2]HCW: Healthcare worker.
[3]JOD: Jordanian dinar.
[4]RSV: respiratory syncytial virus. Statistically significant *p* values are highlighted in bold style.

with scores ≥ 3 (87.0% vs. 74.3%, $p = 0.009$, $\chi^2 = 6.909$, partial $\eta^2 = 0.015$ Table 2).

3.3 | Correlation of ABCDEF Constructs With RSV Vaccine Attitude

The full range of responses to the 21 ABCDEF items stratified based on the attitude to RSV vaccination divided into the acceptance versus hesitancy/resistance groups is shown in (Figure 1). Higher agreement levels were particularly pronounced for all items of the "Advice" and "Fear" constructs.

Analyzing the determinants of RSV vaccine attitude based on the ABCDEF constructs yielded statistically significant results for the six constructs. The agreement with the "Advice" construct was strongly associated with vaccine acceptance, with 82.7% ($n = 259$) of agreeing participants showing vaccine acceptance, compared to only 35.2% ($n = 32$) in the hesitancy/resistance group ($p < 0.001$, $\chi^2 = 101.666$, partial $\eta^2 = 0.303$). Similarly, agreement with the "Burden" construct items was significantly associated with a higher vaccine acceptance rate of 72.8% ($n = 228$) compared to 40.7% ($n = 37$) among the participants who were hesitant/resistant ($p < 0.001$, $\chi^2 = 32.865$, partial $\eta^2 = 0.095$).

The "Conspiracy" and "Danger" constructs showed less conspicuous patterns despite having statistical significance as follows. Higher agreement with the "Conspiracy" construct items was found in the RSV vaccine acceptance group at 46.0% ($n = 144$) compared to 30.8% ($n = 28$) in the hesitancy/resistance group ($p = 0.026$, $\chi^2 = 7.282$, partial $\eta^2 = 0.012$). Higher disagreement with the "Danger" construct items was observed among the RSV vaccine acceptance group ($n = 51$, 16.3%) compared to only four (4.4%) in the hesitancy/resistance group ($p = 0.009$, $\chi^2 = 9.523$, partial $\eta^2 = 0.020$).

For the "Efficiency" construct, a vast majority of the vaccine acceptance group ($n = 298$, 95.2%) showed agreement, as opposed to 73.6% ($n = 67$) in the hesitancy/resistance group ($p < 0.001$, $\chi^2 = 38.749$, partial $\eta^2 = 0.121$). Finally, 75.7% ($n = 237$) of the participants in the RSV vaccine acceptance group showed agreement with the "Fear" construct items in contrast to 22.0% ($n = 20$) in the hesitancy/resistance group ($p < 0.001$, $\chi^2 = 107.051$, partial $\eta^2 = 0.303$, Table 3).

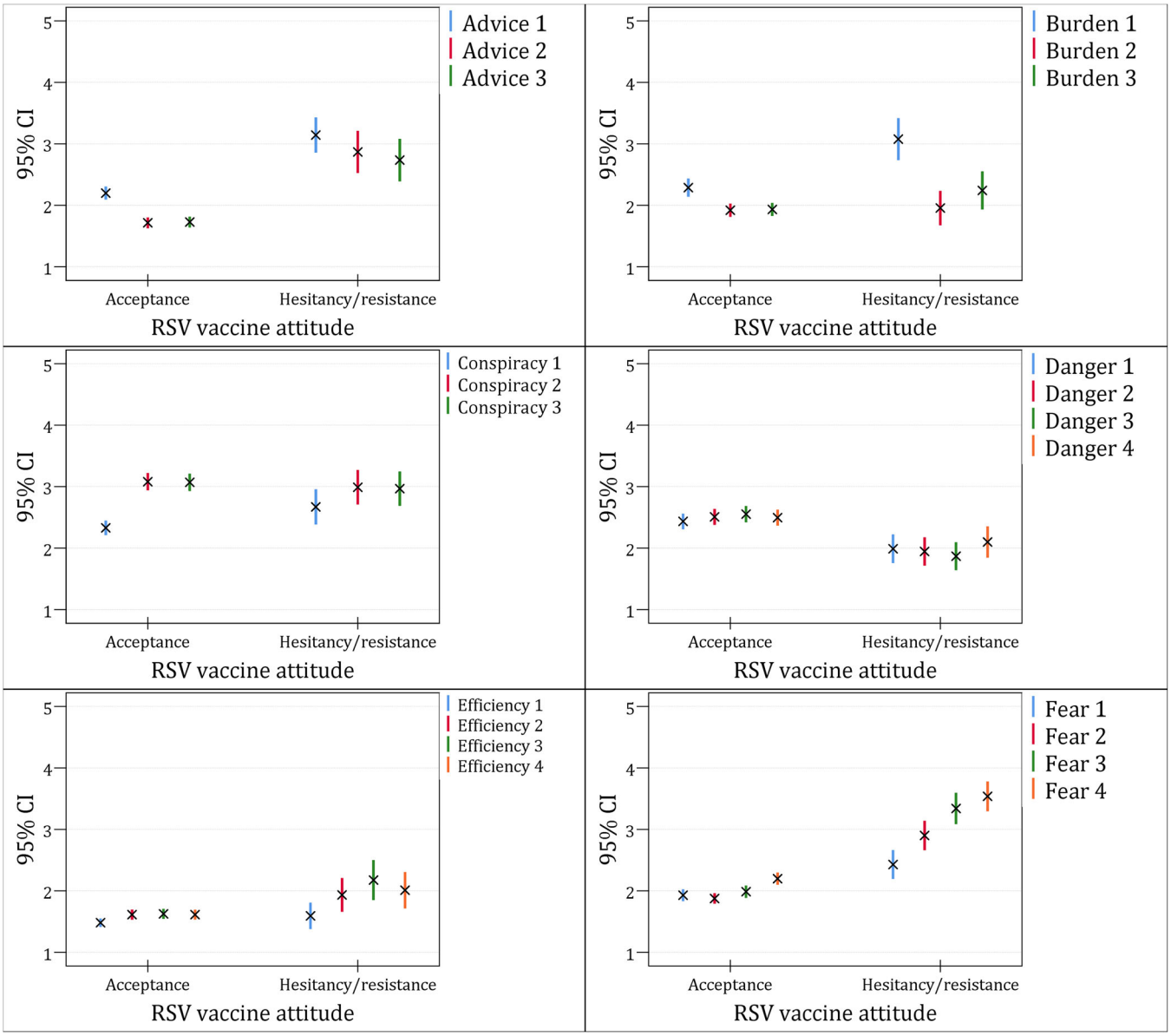

FIGURE 1 | Error bars representing the means and 95% confidence interval (CI) of the mean for the full ABCDEF items stratified based on attitude to RSV vaccination.

3.4 | Multivariate Analysis for the Factors Associated With RSV Vaccine Acceptance

Multinomial logistic regression analysis revealed the statistically significant determinants influencing RSV vaccine acceptance among the participating pregnant women, with a Nagelkerke R^2 of 0.529 indicating a moderately high explanatory power of the model.

Age showed a significant association with RSV vaccine acceptance, with women < 30 years being more likely to accept the vaccine (adjusted odds ratio (aOR): 2.45, 95% confidence interval (CI): 1.24–4.85, $p = 0.010$) compared to those ≥ 30 years. Educational level was also a significant determinant of RSV vaccine acceptance with undergraduates being more inclined to accept the RSV vaccine (aOR: 3.27, 95% CI: 1.15–9.27, $p = 0.026$) compared to postgraduates. Occupation was also a significant factor, with higher RSV vaccine acceptance among HCWs compared to employed non-HCWs (aOR: 4.50, 95% CI: 1.10–18.52, $p = 0.036$).

Additionally, the VBS was a significant determinant of RSV vaccine acceptance in the study sample with a higher RSV vaccine acceptance among the participants with VBS ≥ 3 compared to those with a VBS score of < 3 (aOR: 2.47, 95% CI: 1.02–5.99, $p = 0.045$).

Finally, only two out of the six ABCDEF constructs were significantly associated with RSV vaccine acceptance as follows. The agreement with the "Advice" construct strongly predicted RSV vaccine acceptance as opposed to disagreement (aOR: 10.38, 95% CI: 3.20–33.72, $p < 0.001$). A similar pattern was observed for the agreement with the "Fear" construct as opposed to disagreement (aOR: 21.49, 95% CI: 5.00–92.45, $p < 0.001$, Table 4).

TABLE 3 | Association of the ABCDEF constructs with RSV vaccine attitude.

Construct	Category	RSV[1] vaccine attitude		p value, χ^2
		Acceptance Count (%)	Hesitancy/resistance Count (%)	
Advice	Agree	259 (82.7)	32 (35.2)	**< 0.001**, 101.666
	Neutral	47 (15.0)	31 (34.1)	
	Disagree	7 (2.2)	28 (30.8)	
Burden	Agree	228 (72.8)	37 (40.7)	**< 0.001**, 32.865
	Neutral	74 (23.6)	45 (49.5)	
	Disagree	11 (3.5)	9 (9.9)	
Conspiracy	Agree	144 (46.0)	28 (30.8)	**0.026**, 7.282
	Neutral	104 (33.2)	42 (46.2)	
	Disagree	65 (20.8)	21 (23.1)	
Danger	Agree	192 (61.3)	59 (64.8)	**0.009**, 9.523
	Neutral	70 (22.4)	28 (30.8)	
	Disagree	51 (16.3)	4 (4.4)	
Efficiency	Agree	298 (95.2)	67 (73.6)	**< 0.001**, 38.749
	Neutral	12 (3.8)	16 (17.6)	
	Disagree	3 (1.0)	8 (8.8)	
Fear	Agree	237 (75.7)	20 (22.0)	**< 0.001**, 107.051
	Neutral	71 (22.7)	50 (54.9)	
	Disagree	5 (1.6)	21 (23.1)	

[1]RSV: respiratory syncytial virus. Statistically significant p values are highlighted in bold style.

4 | Discussion

The current study utilized a previously validated survey instrument designed for the analysis of the potential factors influencing RSV vaccine acceptance among pregnant women [16]. This approach helped to reach detailed insights regarding the attitudes towards the newly approved maternal RSV vaccine in a cohort of pregnant women residing in Jordan. Notably, the results of this study pointed to a pronounced willingness to receive RSV vaccination in the study sample, with 77.5% indicating acceptance to receive the vaccine if provided free-of-charge and if the RSV vaccine was deemed safe and efficacious.

Placing the observed prevalence of RSV acceptance in this study within a broader context was challenging, given the recent introduction and approval of the maternal RSV vaccination [38, 42]. Nevertheless, we identified a few studies with similar objectives that reported findings comparable to our major results as follows. In Nepal, Adhikari et al. reported that 72% of mothers showed willingness to receive an RSV vaccine during pregnancy if available [43]. In the largest antenatal RSV awareness survey to date in Ireland by McCormack et al., 49% of participating pregnant women were willing to accept RSV vaccination despite 76% having no prior awareness of RSV [44]. On the other hand, comparison of the RSV vaccine acceptance rate in our study with vaccine acceptance rates among pregnant women for other vaccine types such as influenza and COVID-19 could provide helpful clues into the perspectives of pregnant women to vaccination [45–47]. Lower acceptance rates were reported in the context of COVID-19, where a systematic review and meta-analysis by Milad Azami et al., covering 19,219 pregnant women across 16 articles, found COVID-19 vaccine acceptance to be 53.5% [48]. In an earlier review, Januszek et al. showed that in various studies, the percentage of pregnant women accepting the COVID-19 vaccine was between 29.7% and 77.4% [49].

In a Turkish study by Daşıkan et al., and using a comparative approach, the COVID-19 vaccine acceptance rates among nonpregnant women of reproductive age were substantially higher at 91.7%, compared to lactating women at 77%, and 59% among pregnant women [50]. In Jordan, COVID-19 vaccine acceptance among pregnant women was much lower at a rate of merely 35.4% [51]. Another Jordanian study by Masa'deh et al. showed that women planning for pregnancy, pregnant women, or breastfeeding women had significantly higher rates of COVID-19 vaccine hesitancy, compared to other women [52].

Studies on influenza vaccine acceptance among pregnant women further reflected this trend of relatively high levels of vaccination hesitancy [45, 53–55]. An early comprehensive systematic review from 2014 which involved 45 records, found that influenza vaccination uptake among pregnant women varied significantly, from as low as 1.7% to as high as 88.4% for seasonal influenza, and from 6.2% to 85.7% for A/H1N1 pandemic influenza [53]. Additionally, the aforementioned review showed that many pregnant women were not aware of their increased risk for influenza or its potential complications

TABLE 4 | Factors associated with RSV vaccine acceptance using multinomial logistic regression.

RSV[1] vaccine acceptance versus hesitancy/resistance; Nagelkerke $R^2 = 0.529$	aOR[5] (95% CI)[6]	*p* value
Age		
< 30 years	2.454 (1.242–4.851)	**0.010**
≥ 30 years	Ref.	
Educational level		
High school or less	0.978 (0.284–3.361)	0.971
Undergraduate	3.266 (1.150–9.270)	**0.026**
Postgraduate	Ref.	
Occupation		
Unemployed	0.307 (0.074–1.281)	0.105
Employed (non-HCW)[2]	0.222 (0.054–0.906)	**0.036**
HCW	Ref.	
Monthly income of household		
≤ 1000 JOD[3]	1.425 (0.582–3.488)	0.438
> 1000 JOD	Ref.	
Residence		
Amman	1.675 (0.84–3.339)	0.143
Outside the Capital	Ref.	
Vaccine behavior score[4]		
< 3	0.405 (0.167–0.978)	**0.045**
≥ 3	Ref.	
Advice construct		
Agree	10.379 (3.195–33.719)	**< 0.001**
Neutral	3.172 (0.933–10.784)	0.065
Disagree	Ref.	
Burden construct		
Agree	0.852 (0.150–4.840)	0.857
Neutral	0.877 (0.155–4.946)	0.882
Disagree	Ref.	
Conspiracy construct		
Agree	2.408 (0.867–6.687)	0.092
Neutral	1.431 (0.592–3.464)	0.426
Disagree	Ref.	
Danger construct		
Agree	0.258 (0.043–1.553)	0.139
Neutral	0.224 (0.036–1.388)	0.108
Disagree	Ref.	
Efficiency construct		
Agree	0.866 (0.098–7.622)	0.897
Neutral	0.563 (0.052–6.049)	0.636
Disagree	Ref.	
Fear construct		
Agree	21.489 (4.995–92.446)	**< 0.001**
Neutral	3.696 (0.953–14.331)	0.059
Disagree	Ref.	

[1]RSV: Respiratory syncytial virus.
[2]HCW: Healthcare worker.
[3]JOD: Jordanian dinar.
[4]Vaccine behavior score: Calculated based on the number of COVID-19 vaccine doses received and previous uptake of influenza vaccination.
[5]aOR: Adjusted odds ratio.
[6]CI: Confidence interval.

during pregnancy, often underestimating the personal and fetal risks associated with the disease [53].

The relatively high acceptance rate for the newly approved RSV vaccine observed in our study sample can be attributed to several methodological and contextual factors intrinsic to the current study. These factors may have shaped the participants' perception of the newly approved RSV vaccine. For example, the use of face-to-face interviews could have led to establishment of rapport and trust between the interviewer and the participant, potentially leading to more favorable views on RSV vaccination [56].

In addition, the decision to participate in the study was informed by an overview detailing the efficacy and safety aspects of maternal RSV vaccination as shown by the results of clinical trials and FDA approval [57–60]. Moreover, the introductory

part of the interview highlighted the significant health risks associated with RSV disease in terms of LRTI with considerable morbidity in infants [3, 61]. Importantly, the phrasing of the survey item assessing the major outcome in this study, namely RSV vaccine acceptance might have influenced the results. Specifically, this survey item was conceived to emphasize the key positive features of the recently approved RSV vaccine in terms of its safety and efficacy [57–60]. These positive feature were associated with high confidence in vaccine safety and trust in vaccine effectiveness as recently reported among a sample of 400 pregnant or lactating females in a study that investigated attitude to RSV vaccination in Kenya [62].

Furthermore, the phrasing of our survey item assessing the willingness to get maternal RSV vaccination involved the precondition that the RSV vaccine could be free of charge. Consequently, this proposition likely served as an additional motivator towards RSV vaccine acceptance since the financial constraint can be a significant barrier to accepting a vaccine [63].

When vaccines are presented as effective in preventing disease and safe for both mother and child, and further enhanced by being offered free of charge, this approach can motivate positive attitude to vaccination [64, 65]. Such an approach can significantly diminish vaccine hesitancy/resistance by reducing the perceived barriers and amplifying the perceived benefits of vaccination [66]. Future campaigns can benefit from these insights to promote RSV vaccine uptake. Thus, it is recommended to develop communication strategies that specifically address maternal concerns regarding RSV vaccine safety, improve the awareness of RSV vaccine benefits, and proactively address potential financial constraints that could hinder maternal RSV vaccination. A previous study by Simas et al., highlighted the importance of effectively tailored messaging that addresses specific concerns and needs among pregnant women, thereby strengthening trust in vaccine programs [67].

Regarding the significant determinants of RSV vaccine in this study, the use of multinomial logistic regression analysis demonstrated a substantial explanatory power. Specifically, younger participants showed significantly higher likelihood of RSV vaccine acceptance with aOR of 2.45 as opposed to their older counterparts. This finding might be attributed to fear of poor fetal or maternal outcomes among older pregnant women. Higher level of reluctance to get vaccinated among older women could stem from a heightened sense of caution about vaccination during pregnancy as well as the documented high risks of pregnancy at an advanced maternal age [68–70].

The educational level also emerged as another important determinant of RSV vaccine acceptance among pregnant women in this study with undergraduates being more likely to accept the RSV vaccine compared to postgraduates. The lower RSV vaccine acceptance among postgraduates may relate to their more critical approach to health interventions. This reflects calculation of the risks versus benefits of vaccination as demonstrated by the 5C model [25]. Another significant finding in this study was the higher likelihood to accept the RSV vaccine among pregnant HCWs compared to non-HCWs. This result can be attributed to HCWs' professional experience of the severe consequences of RSV in infants.

Another interesting finding in this study was the association of RSV vaccine acceptance with a previous history of vaccine uptake. This result suggests that trust and satisfaction from previous vaccination experience might enhance willingness to receive novel vaccines. In line with this finding, a study among HCWs in Jordan reported that prior vaccine uptake was a significant determinant of monkeypox vaccine acceptance [71].

In this study, the analysis of the determinants influencing RSV vaccine acceptance among pregnant women highlighted the profound impact of psychological constructs modeled through the ABCDEF scale, particularly the "Advice" and "Fear" constructs. The "Advice" construct involved items assessing the influence of vaccine endorsement by credible health authorities and organizations and the influence of positive past vaccination experiences. This finding emphasized the importance of credibility and trust in health communication, pointing to the need for clear and consistent messaging about the efficacy and safety of vaccines during pregnancy. A recent qualitative study from Kenya highlighted the importance of this particular concern, since the key questions among pregnant and lactating women regarding maternal RSV vaccination revolved around vaccine safety and potential side effects [72].

Moreover, the "Fear" construct, which included items assessing the perceptions of RSV morbidity in children, the belief in the protective benefits of maternal vaccination, and confidence in vaccine safety and effectiveness, showed an even stronger correlation with vaccine acceptance with aOR of 21.49. This result appeared fathomable considering the pregnant women concerns regarding children's health. Consequently, this fear appears as a critical factor in maternal decision to receive vaccinations, indicating that emotional engagement and perceived personal relevance of the vaccine benefits are highly effective in influencing positive vaccine behavior [73].

4.1 | Strengths and Future Implications

Given the insights provided by the findings of this study, public health strategies to promote RSV vaccine uptake should focus on enhancing both the trust and emotional support provided to pregnant women. Endorsements of the RSV vaccine from respected entities such as the World Health Organization (WHO) and the local health ministries can enhance the perceived credibility of vaccine recommendations based on being reliable sources [74–76]. Additionally, the public health messages should clearly address common fears regarding RSV vaccine safety and effectiveness, particularly through sharing compelling evidence and real-world data on the benefits of preventing RSV in newborns with emphasis on the disease burden [77]. A recent study showed the potential role of HCWs in advocating the vaccine through raising community awareness of RSV risk and the benefits of maternal RSV vaccination [78]. The role of awareness was also highlighted in a recent study by Limaye et al. in the context of group B *Streptococcus* (GBS) vaccines, which showed that a multifactorial approach is needed to appreciate the benefits of a future maternal GBS vaccine by raising awareness of GBS-related harms [79]. Ultimately, using the aforementioned insights can help health campaigns to effectively encourage widespread acceptance of RSV vaccination

among pregnant women, thereby enhancing positive infantile health outcomes.

4.2 | Study Limitations

Finally, the findings of this study should be interpreted in light of the following limitations. First, the use of convenience sampling, driven by funding constraints and the need to expedite results could have introduced an element of selection bias in the sample [80]. Although participants were recruited from geographically diverse regions in the Central, Northern, and Southern regions of Jordan, the sample may not fully represent the broader population of pregnant women in Jordan, particularly those in rural areas. This limitation could result in an over-representation of women with easier access to healthcare services, potentially skewing the findings. Future studies should consider employing probability sampling to ensure greater generalizability. Second, the approach of face-to-face interviews to collect data may have led to social desirability bias, where participants might provide responses they perceive as socially acceptable rather than their true attitudes. Third, the involvement of five different authors in conducting interviews could have introduced a slight variability in how questions were presented and interpreted by participants. Fourth, the cross-sectional nature of the study captures attitudes at a single point in time, limiting the ability to assess changes in RSV vaccine attitudes over the course of pregnancy or in response to evolving public health information and vaccine recommendations. Fifth, the reliance on self-reported data regarding previous vaccination behavior was a subject to recall bias and may not accurately reflect actual vaccine uptake among the participants. Sixth, while the study provided valuable insights into the attitudes of pregnant women in Jordan, its findings may not be directly generalizable to pregnant women in other countries or cultural contexts. Finally, it is important to emphasize that the high RSV vaccine acceptance rate observed in this study should be interpreted in light of the possibility of a favorable perception of the vaccine. This favorable perception could have been introduced by emphasizing the maternal RSV vaccine efficacy and safety, and the hypothetical cost-free availability of the vaccine.

5 | Conclusions

The current study highlighted the multifaceted nature of RSV vaccine acceptance among pregnant women. The attitude towards the newly approved RSV vaccine could be influenced by a complex interplay of demographic and psychological factors. Emphasizing the importance of targeted communication that highlights the safety and efficacy of maternal RSV vaccination with support from credible healthcare institutions appears essential in promoting this new vaccine [81].

Considering the specific demographic, psychological, and emotional factors as well as past vaccine uptake can help to make public health strategies to reduce RSV disease burden more effective through maternal vaccination. These strategies are recommended to rely on targeted interventions. In turn, these measures can significantly contribute to promote maternal RSV vaccination with subsequent beneficial impact in reducing the burden of RSV among infants which are the most vulnerable population.

Author Contributions

Malik Sallam: conceptualization, investigation, writing–original draft, methodology, validation, visualization, writing–review and editing, software, formal analysis, project administration, data curation, supervision, resources. **Tleen Kherfan:** investigation, validation, data curation, methodology, writing–review and editing. **Amwaj Al-Farajat:** investigation, methodology, validation, writing–review and editing; data curation. **Leen Nemrawi:** investigation, methodology, validation, writing–review and editing; data curation. **Nada Atawneh:** investigation, methodology, validation, writing–review and editing, data curation. **Rand Fram:** investigation, methodology, validation, writing–review and editing, data curation. **Ala'a B. Al-Tammemi:** investigation, methodology, validation, writing–review and editing, data curation. **Muna Barakat:** investigation, methodology, validation, writing–review and editing, data curation. **Kamil Fram:** investigation, writing–review and editing, methodology, validation, supervision, data curation, resources.

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The authors have nothing to report.

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

The data presented in this study are available on request from the corresponding author (Malik Sallam).

Transparency Statement

The lead author Malik Sallam affirms that this manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as planned (and, if relevant, registered) have been explained.

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Supporting Information

Additional supporting information can be found online in the Supporting Information section.