

# Development of Vaccine Eligibility Prediction Algorithm for Potential Mobile Health Application

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### Introduction:

- Vaccines are highly effective at preventing disease and provide greater protection when vaccination rates are high within a community [1].
- Despite their effectiveness, vaccination coverage in the U.S. remains below recommended levels for many vaccines [2].
- Reminding patients to schedule vaccines increases immunization rates approximately 8% [3].
- Most existing health reminder apps focus on medication reminders or symptom tracking and few aid in long-term immunization scheduling.
- The development of a personalized vaccine prediction algorithm based on the Centers for Disease Control and Prevention Clinical Decision Support for Immunization (CDC CDSi) logic may support a mobile reminder app and improve adherence to vaccination schedules [4, 5].

### Methods:

- A synthetic adult patient dataset was generated to simulate various demographic and medical profiles relevant to vaccine eligibility.
- The CDC CDSi Logic and Supporting Data were used to define vaccine requirements and eligibility for the respiratory syncytial virus (RSV) vaccine [4, 5].
- An algorithm based on the CDC CDSi logic was applied to the synthetic dataset to generate vaccine eligibility outputs.
- Flowcharts were created to visualize vaccination eligibility logic and represent how the prediction algorithm determines vaccine eligibility.
- Predicted vaccination eligibility for the synthetic population will be compared to the CDC CDSi and established forecasting engines to assess algorithm implementation.

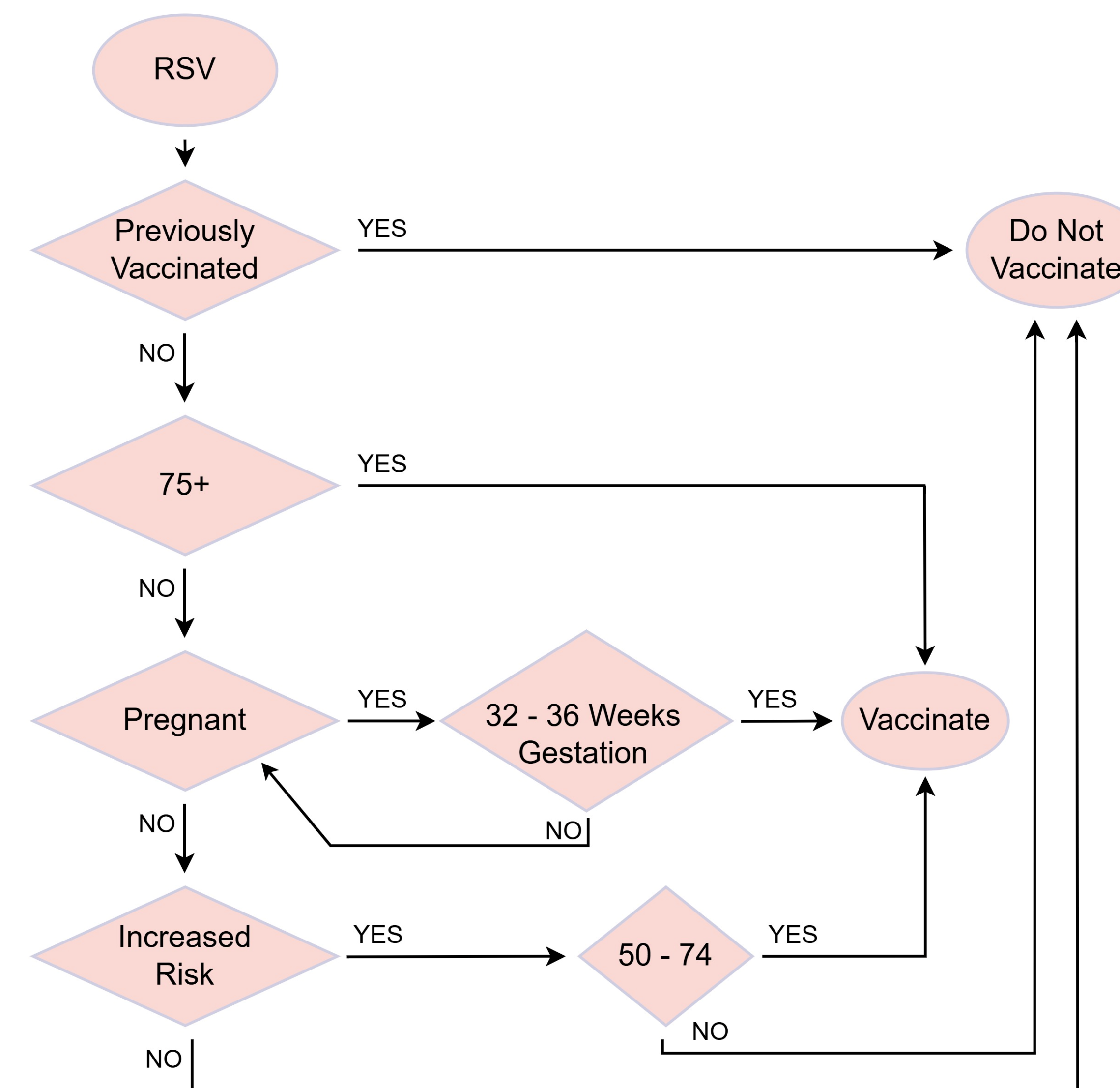


Figure 1. Decision-making flowchart illustrating the structured logic used to determine patient eligibility for the RSV vaccination based on CDC CDSi logic.

Patient ID	Sex	Age	DOB	Increased Risk (Y/N)	Currently Pregnant (Y/N)	Last Date RSV (Date, NR)
1	Female	48	10/18/1977	N	Y	5/9/2007
2	Female	78	7/30/1947	N	N	NR
3	Male	75	4/19/1950	N	N	NR
4	Female	27	7/2/1998	Y	N	NR
5	Male	83	7/17/1942	N	N	NR

Table 1. Example of the synthetic patient dataset.

Patient ID	Previously Vaccinated? Y/N	75+? Y/-	Pregnant? Y/N	32-36 weeks gestation? Y/N/-	Increased risk? Y/N	50-74? Y/-	Vaccinate/Reevaluate /Do Not Vaccinate
1	Y	-	Y	N	N	-	Do Not Vaccinate
2	N	Y	N	-	N	-	Vaccinate
3	N	Y	N	-	N	-	Vaccinate
4	N	-	N	-	Y	-	Do Not Vaccinate
5	N	Y	N	-	N	-	Vaccinate

Table 2. Example of the RSV algorithm based on the synthetic patient dataset.

### Results:

- CDC CDSi logic for the RSV vaccine was translated into a structured rule-based algorithm.
- The algorithm generated individualized vaccine eligibility outputs for all synthetic patients.
- The algorithm was validated manually until 100% accuracy for the RSV vaccine predictions was achieved.
- Ongoing validation of the algorithm will assess consistency with an established immunization forecasting engine through an online API and require structuring the synthetic dataset for the online API[6].

### Discussion:

- Preliminary findings demonstrate the feasibility of converting CDC CDSi guidance into an algorithm.
- The next steps include creating larger data frames, algorithm refinement, and integration of predicting future vaccination dates.
- Future work entails implementation of the refined algorithm into a digital vaccine prediction and reminder platform.

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