Adult Vaccination among Diabetic Patients: An Assessment of Awareness, Coverage and Acceptance in a Tertiary Care Hospital in Kolkata, India

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Abstract:

Introduction: Adult vaccination is widely recognized as a highly cost-effective public health measure, despite its benefits many diabetics may not grasp their importance or have misconceptions, affecting their acceptance. The purpose of the study was to assess the awareness and to estimate the coverage and find out the level of acceptance of adult vaccination. **Methods:** An observational study with cross-sectional design was conducted in Diabetes OPD of tertiary care hospital in Kolkata among 423 diabetics patients using consecutive sampling methods attending Diabetic OPD for a duration 6 months (September 2023-February 2024). A pre-designed, pre-tested, structured schedule comprising of socio demographic clinical profile, awareness, coverage and acceptance of vaccine was used for face-to-face interview. Data were analysed by Microsoft Excel 2019 and SPSS v25.0. **Results:** Out of 423 participants more than half (57%) were male, and mean age of them were 50.7 years (±11.2). Ninety one percent (91%) of study participants had type II Diabetes Mellitus, and more than two thirds (67.4 %) suffered from co-morbidities. Thirteen percent (13%) had adequate awareness about adult vaccination and very few (7%) had administered Hepatitis B vaccine. Seventy one percent (71%) of the study participants were ready to get Influenza vaccine after being aware. Fear of adverse effects and out of pocket expenditure were the major reason from non-acceptance of vaccines. **Conclusion:** Eighty-seven percent (87%) of the participants had inadequate awareness about adult vaccines and only seven percent (7%) of them had taken Hepatitis B vaccination.

Keywords: Awareness, Coverage, Diabetes Mellitus, Vaccination

Introduction:

Adult vaccination is widely recognized as a highly cost-effective public health measure with numerous benefits at various levels.[1] A population-based study from 2017-2018 revealed that coverage for vaccination among adult population in India is below 2% in which 1.5%, 0.6%, 1.9% were vaccinated against influenzae, pneumococcal vaccine and hepatitis B vaccine respectively.[2] Vaccination protects individuals from vaccine preventable diseases, reducing the risk of illness, disability, and death.[3] By preventing diseases such as influenza, pneumonia, and shingles, immunizations contribute to an individual's overall health and well-being, leading to improved quality of life.[4]

Diabetes is a chronic, metabolic disease characterized by elevated levels of blood glucose

(or blood sugar) which damages heart, vessels, eyes, kidneys, nerves.[5] Globally approximately 422 million people are suffering from diabetes, and majority were from low to middle-income nations.[6] From the estimates of 2019 reported that 77 million individuals in India were suffering from diabetes, and by 2045 it is expected to rise to over 134 million. Around 1.5 million diabetes cases are diagnosed annually, and its prevalence has been steadily rising in recent decades. Still around 57% of these individuals remain undiagnosed.[7]

Around sixty million population of India are living with diabetics, and they are susceptible to morbidity, mortality as well as increased hospitalizations due to infectious diseases like influenza and pneumococcal disease.[8] Centres for Disease Control and Prevention provide guidelines for those who are more than 19 years and immune-compromised. It recommended different vaccines for adult like pneumococcal vaccine, Tdap (Diphtheria, Pertussis, Tetanus), Herpes Zoster, Hepatitis B vaccine, Human Papilloma Vaccine etc. The burden of vaccine-preventable diseases (VPDs) in adults is a significant public health concern.[9] Narrative review analysed that India had a disproportionately high share of globally reported cases of diphtheria (60%), Japanese encephalitis (44%), and tetanus (40%) in 2017.[10]

Though vaccination is more acceptable among children, but it is also essential for adults to prevent serious illnesses and complications. In India childhood immunization is followed as per National Immunization Schedule, but adult immunization is much more far behind. Diabetics face higher infection risk due to weakened immunity. Promoting vaccination awareness is vital to prevent complications and enhance public health. Despite vaccination benefits, some diabetics may not grasp their importance or have misconceptions, impacting their vaccination choices. With this background the study was conducted to assess the awareness of adult vaccination, to estimate the coverage of adult vaccination and to find out the level of acceptance of adult vaccination among study participants.

Methods:

An observational study with cross sectional design, was conducted at Diabetes OPD of tertiary care hospital in Kolkata among patients attending Diabetes OPD for a duration of 6 months (September 2023-February 2024).

Selection criteria: Those who were more than 18 years of age attending Diabetes OPD & has been treated for more than 1 year for diabetes were included in the study. Pregnant women and seriously ill patients & those who did not give informed written consent were excluded from the study.

Sample size: Proportion of awareness on adult vaccination (52%) was taken from a study conducted by Geneev *et al*[11] on knowledge of adult vaccination among type 2 Diabetes Mellitus. So, proportion of awareness of adult vaccination p=52%, q=1-p, Standard normal deviate (Z) = 1.96 at 95% Confidence Interval, Absolute error (d) = 5%; applying Cochranes formula sample size of 384 achieved, after taking 10% non-response, final sample size was 423.

Sampling technique: Consecutive sampling was done. Diabetes OPD is scheduled for three days a week; to attain the sample size data collected over 3 months and around twelve participants were interviewed each day.

Study tools: Study tool was prepared with socio-demographic variables and clinical (age, gender, marital status, religion, residence, highest level of education, occupation, their family income, type of family, addiction patterns, type of diabetes, family history of diabetes, blood glucose level, diabetes management, other co-morbidities etc), awareness of adult vaccination (Do you think adult vaccination is required for diabetes?, if yes reason and name of the vaccine, disease prevented from this vaccine etc), coverage of adult vaccination (name of the vaccine was taken by the individual, its dosage etc) and its acceptance (What are the vaccines you are ready to take after being aware- yes/no; if yes then which vaccine you want to take- flu vaccine/ pneumococcal/ Human Papilloma virus vaccine, Hepatitis B vaccine, Recombinant zoster, Tdap vaccine

etc. If no reason for non-acceptance). The study tool was a pre-designed, pre-tested, structured schedule which was designed by a team of two experts including one faculty of Community Medicine, and an Endocrinologist. The schedule was then pre-tested among 30 patients of the Diabetes OPD and necessary modifications were made. Those selected for pre-testing were not included in the final study population.

Study variables:

(a) **Dependent variable:** Awareness of adult vaccination, Coverage of adult vaccination, Acceptance of adult vaccination

(b) **Independent variables:** Socio-demographic & clinical profile- (Age, gender, religion, education, occupation, type of Diabetes, duration of diabetes, type of medication.)

Study technique and data collection: Diabetes OPD was visited, and consecutive eligible patients were selected. The informed consent was taken after ensuring anonymity and confidentiality and data were collected by face-to-face interview.

Operational definition & Data analysis:

Adult Vaccination: Adult Vaccination referred to the process of vaccinating individuals who have reached adulthood (typically 18 years and older) to protect them against various vaccine-preventable diseases.[12]

An awareness score was allocated to each study participant. For awareness of adult vaccination scoring the participants were asked the following questions- Do you think adult vaccination is required for diabetics? if the response is yes then next question was asked What is the name of vaccine? What is the dose of vaccine? The scoring is as follows: Do you think adult vaccination is required for diabetics? Yes - 1; No - 0; Dont know 0; If yes, name of the vaccine and number of doses taken, each vaccine/disease prevented - 1 point, correct dosage of each vaccine stated - 1 point, total score - 12 (since a total of 6 vaccines were recommended); thus Maximum score = 12 + 1 = 13 and those who scored more than equal to median (≥6.5) were considered to have adequate awareness. All the responses were scored. Vaccination coverage for a given vaccine was the percentage of study

participants who has been vaccinated by it and coverage was considered as whether they were vaccinated with any one of the vaccines (pneumococcal vaccine, Zoster vaccine, Flu vaccine, HPV vaccine, Tdap vaccine and Hepatitis B,). Acceptance was defined as the proportion of study participants who are willing to take the vaccines after making them aware.

Data were checked for correctness, completeness and tabulated in Microsoft Excel 2019 (Microsoft Corp, Redmond, WA, USA) and then imported to Statistical Package for the Social Sciences (SPSS for Windows, version 25.0, SPSS Inc., Chicago, USA) for interpretation and analysis. Descriptive Statistics were used to summarize the data. Multivariable binary logistic regression was performed to ascertain relationship between the dependent and the independent variables. All independent variables having p-value<0.20 were considered biologically plausible to be included in the multivariable model. Data was checked for multicollinearity (VIF<10) and variables with p-value<0.05 were considered statistically significant in the final model.

Ethical considerations: Institutional Ethics Committee permission was obtained prior to start of the study (Institute Name/IEC/2023/1082 dated 12.12.2023). Informed written consent was obtained before each interview and all ethical principles were strictly adhered to throughout the course of the study.

Results:

Responses were collected from 423 participants; it was found that the mean age group of them were 50.7 years (±11.2) with a range of 19 years to 85 years. More than half (57.2%) of the participants were male, more than four fifths (88.4%) were married; nearly three fifth of the participants were Hindu (59.8%). Around half of them (50.8%) belonged to rural area and one fourth of them (24.3%) had educational qualification of primary school. More than one fourth (29.8%) belonged to the Lower Middle Class of Socioeconomic status as per Modified B G Prasad Scale 2023[13] and twenty six percent (26%) were substance user. (Table 1)

Table 1: Distribution of study participants as per their socio-demographic characteristics (N=423)

Variables	Number	Percentage (%)
Age (Years)		
18-36	36	8.5
36-59	292	69.0
>59	95	22.5
Gender		
Female	181	57.2
Male	242	42.8
Marital status		
Married	374	88.4
Unmarried/ Divorced/ Separated/Widowed	49	11.6
Religion		
Hindu	253	59.8
Muslim	170	40.2
Residence		
Rural	215	50.8
Urban	208	49.2
Education		
Illiterate & non formal	74	17.5
Primary school	103	24.3
Middle School	45	10.7
Secondary	76	18
Higher Secondary	50	11.9
Graduate& above	75	17.7
Occupation		
Unskilled	57	13.5
Semi-skilled	66	15.6
Skilled	93	21.9
Semi-professional	12	2.8
Professional	13	3
Others	182	43.1
Socioeconomic status (SES)		
Upper	54	12.8
Upper middle	61	14.4
Middle	107	25.3
Lower middle	126	29.8
Lower	75	17.7
Type of family		
Nuclear	268	63.4
Joint	155	36.6
Substance use		
Yes	108	26
No	315	74

Out of the study participants majority (91.3%) had type II Diabetes, nearly half (48.2%) had diabetes for less than 5 years and more than half (57.2%) didnt have a family history of Diabetes, more than two third (67.4%) had other comorbidities. Nearly half (48.5%) and more than half (53.4%) of them had controlled fasting blood sugar and post prandial blood sugar respectively. Nearly two fifth (43.3%) were on oral hypoglycaemic agent and around one third (35.9%) were on Insulin therapy. (Table 2)

It has been found that thirteen (13%) were aware of adult vaccination, only one tenth (11.1%) had coverage for one or more than one vaccine and maximum coverage was for Hepatitis B (7.6%), Pneumococcal vaccine (2.6%), flu vaccine (2.4%). Vaccination was accepted maximally by nearly three fourth (71.8%) after making them aware of it.

Table 2: Distribution of study participants as per their Clinical profile (N=423)

Variables	Number	Percentage (%)
Type of diabetes		
Type1	37	8.7
Type 2	385	91.3
Family history of diabetes		
Yes	181	42.8
No	242	57.2
Duration of Diabetes (years)		
1-5	204	48.2
6-10	111	26.3
> 10	108	25.5
Fasting Blood Glucose		
Controlled	205	48.5
Uncontrolled	218	51.5
Post Prandial Blood Glucose		
Controlled	226	53.4
Uncontrolled	197	46.6
Medication History		
Oral Hypoglycaemic agent	183	43.3
Insulin	152	35.9
Oral Hypoglycaemic agent and Insulin	88	20.8
Presence of co-morbidities		
Yes	285	67.4
No	138	32.6

Multivariable Binary Logistic Regression showed that those who had educational qualification of higher secondary and above [AOR 0.226 (0.062-0.819] had significantly lower odds of coverage of adult vaccination. Those who were skilled, semi-professional and professional worker [AOR 2.930 (1.873-10.837)], belonged to upper and upper middle [AOR 2. 570 (1.985-6.707)] had higher odds of association with coverage of adult vaccination. (Table 3)

Multivariable Binary Logistic Regression showed that those educational qualification was higher secondary and above [AOR 0.439 (1.171-1.075)], belonged to socioeconomic status of middle class [AOR 1.607 (1.889-2.904) and had type 1 diabetes mellitus [2.378 (1.085-5.212] had significantly higher odds of acceptance of adult vaccination. (Table 4)

Sperman correlation showed that those who had more duration of diabetes mellitus had positive correlation with awareness score for adult vaccination which was statistically significant. (Figure 1)

Fear of adverse effects (55.5%), out of pocket expenditure (47.9%), and over reliance on existing immunity (32.7%) were the main reason for non-acceptance of adult vaccination among the study participants. (Figure 2)

Present study was conducted in Diabetes OPD tertiary care hospital in Kolkata, India, where it was found that most of the study participants were male with mean age of 50.7 years, whereas a study conducted by Geneev et al.[11] in endocrinology department of a tertiary care hospital of Punjab concluded that mean age group of the study participants were 65 years; Kunnuru et al.[14] in their South Indian research revealed that majority of the study participants were males (55.6%) and mean age group was 54 years. There was a community-based study conducted in Vishakhapatnam by Yeluri et al.[15] among health care professionals on their attitude, beliefs and barriers on adult vaccination showed that majority of the study participants were male (66%) with mean age of 45.2 years.

Table 3: Association between socio-demographic profile and adult vaccination coverage (N=423)*

Variables	Coverage, n (%)	OR (95% CI)	AOR (95% CI)	p value
Education				
Illiterate & non formal	4 (5.4)	Ref	Ref	-
Upto secondary	10 (4.5)	1.061 (0.339-3.325)	1.014 (0.356-3.248)	0.982
Higher Secondary and above	22 (17.6)	0.181 (0.058-0.565)	0.226 (0.062-0.819)	0.024
Occupation				
Unskilled, semiskilled	9 (7.3)	Ref	Ref	-
Skilled, semi-professional, professional	9 (7.6)	1.145 (1.393-4.437)	2.930 (1.873-10.837)	0.038
Others**	18 (9.9)	1.597 (1.145-3.311)	2.209 (0.465-8.481)	0.319
Socio-economic status				
Upper, Upper Middle	9 (4.5)	4.491 (1.970-10.241)	2.570 (1.985-6.707)	0.049
Middle	7 (6.5)	3.008 (1.216-7.437)	2.265 (0.828-6.198)	0.111
Lower Middle, Lower	20 (17.4)	Ref	Ref	-
Type of family				
Nuclear	28 (10.5)	1.46 (1.20-1.05)	0.74 (0.31-1.77)	0.512
Joint	8 (5.2)	Ref	Ref	Ref
Substance use				
Yes	5 (4.6)	2.24 (1.85-5.93)	2.07 (0.74-5.72)	0.218
No	31 (9.8)	Ref	Ref	-

Model fit: Omnibus test- 0.001, Hosmer-Lemeshow-0.487; Nagelkerke R-0.167. *Binary Logistic Regression, **(Housewife, business, retired/at home)

Table 4: Association between socio-demographic profile with acceptance of adult vaccine (N=423)*

Variables	Acceptance, n (%)	OR (95% CI)	AOR (95% CI)	p value
Gender				
Female	99 (54.7)	Ref	Ref	-
Male	151 (62.4)	1.371(0.929-2.032)	1.345(0.891-2.073)	0.151
Education				
Illiterate & non formal education	39 (52.7)	Ref	Ref	-
Upto Secondary	137 (61.2)	1.355(0.736-2.482)	1.143(0.564-2.333)	0.711
Higher Secondary and above	51 (40.8)	1.545(2.235-3.247)	0.439(1.171-1.075)	0.040
Occupation				
Unskilled, semiskilled	71 (42.8)	Ref	Ref	-
Skilled	63 (67.8)	0.893(0.563-1.417)	0.764(0.420-1.389)	0.324
Semi-professional, professional	16 (64)	0.581(0.344-0.980)	0.873(0.339-2.245)	0.777
Others **	100 (54.9)	0.686(0.288-1.633)	1.035(0.591-1.813)	0.905
SES				
Upper, Upper Middle	30 (39.5)	1.079(0.672-1.734)	0.964(0.561-1.658)	0.896
Middle	47 (37.6)	1.771(1.036-3.028)	1.607(1.889-2.904)	0.049
Lower Middle, Lower	54 (50.5)	Ref	Ref	-
Type of diabetes				
Type1	28 (75.7)	2.301(1.061-5.022)	2.378(1.085-5.212)	0.031
Type 2	221 (57.4)	Ref	Ref	-

Model fit: Omnibus Test-0.05, Hosmer-Lemeshow-0.878; Nagelkerke R-0.084. *Binary Logistic Regression, **(Housewife, business, retired/at home)

Figure 1: Scatter plot showing relationship between awareness and duration of diabetes (N=423)

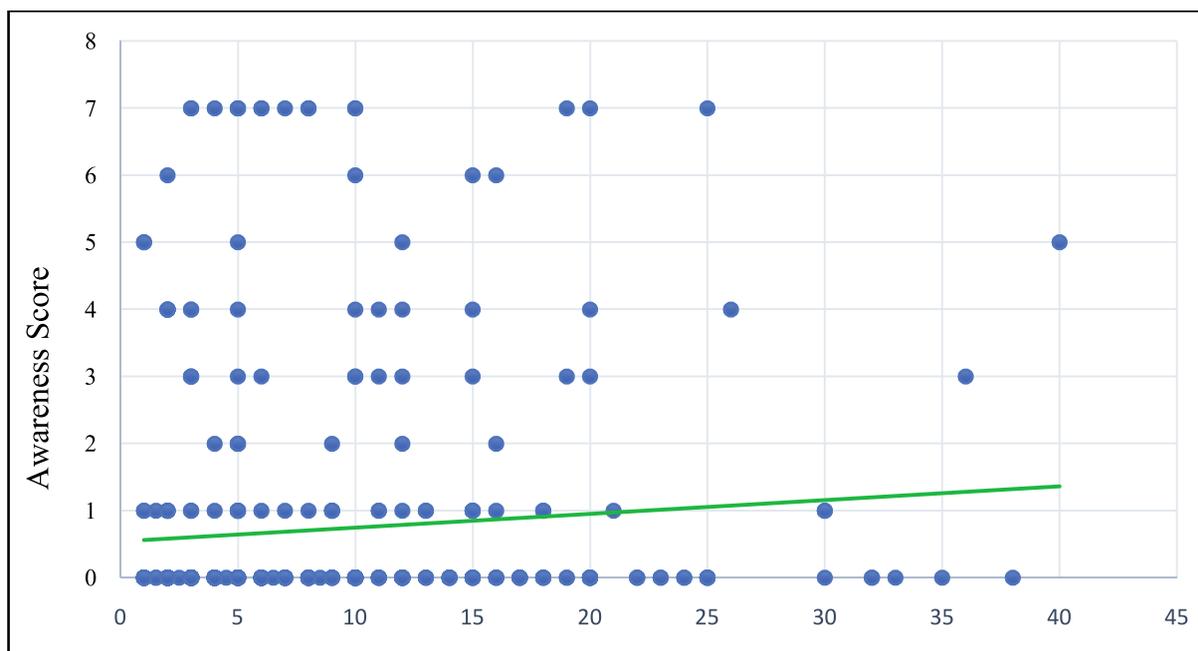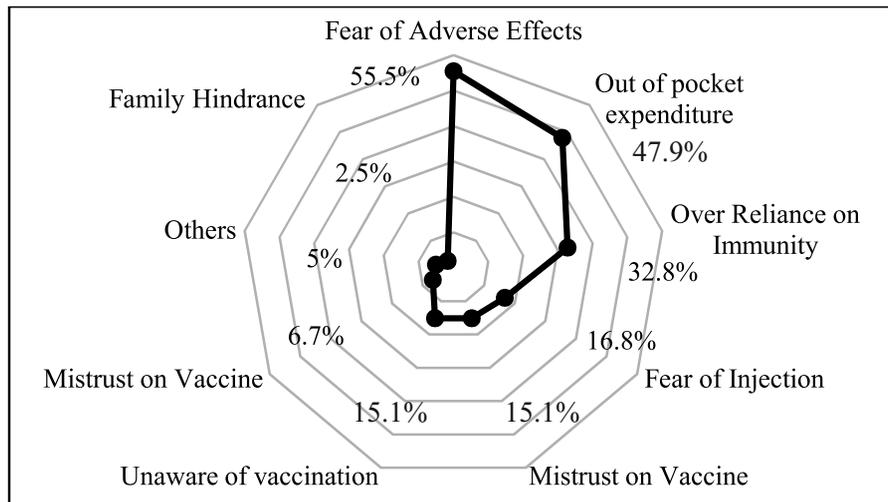**Figure 2: Rader diagram demonstrating distribution of adult vaccination among the study participants based on the reason for non-acceptance (N=119)**

The recent study revealed that only 13% had adequate awareness towards vaccination and 7.6%, 2.6% and 2.4% had coverage towards Hepatitis B, PCV and flu vaccine coverage respectively; but Genev et al.[11] concluded that 53% of the study participants were aware of adult vaccination and the coverage for influenzae vaccine and pneumococcus vaccine were 2% and 0.7% respectively whereas Kunnuru et al[14] showed that only 2.5% had coverage towards PCV vaccine and 0.5% had coverage for influenzae vaccine.

Current study showed that 71.8% had acceptance towards vaccination after making them aware of adult vaccination, though Genev et al.[11] and Kunnuru et al.[14] had 72.4% and 76.2% acceptance towards adult vaccination.

Kwan Chan et al[16] conducted research in Hong Kong showed that those aged 65 years, with educational level of secondary school with household income above HKD 50000 were associated with low vaccination coverage but in this study those who had educational qualification of higher secondary and above [AOR 0.226 (0.062-0.819] had significantly lower odds of coverage of adult vaccination; and belonged to Upper class [AOR 11.95 (2.50-57.10)], skilled, semi-professional and professional worker [AOR 2.930 (1.873-10.837)], belonged to upper and upper middle [AOR 2.570 (1.985-6.707)] had higher odds of association with coverage of

adult vaccination Also, in previous study[16] those who had coronary artery disease and older willing to take flu vaccination but with a secondary educational level and with income of HKD 15000-30000 or HKD 30000-50000 were less inclined towards vaccination but in this study those who had type 1 diabetes mellitus and socioeconomic status of middle class showed significantly higher odds of low acceptance of adult vaccination.

Current study revealed that fear of adverse effects, out of pocket expenditure and overreliance of immunity were the main reason for non-acceptance of adult vaccination; in Genev et al[11] and Kannur et al[14] it was identified that main reason for rejection were financial reasons and fear of complications respectively.

Healthcare professionals sometimes miss opportunities to assess and recommend vaccines during routine healthcare visits, it's important to continue efforts to improve adult vaccination rates to protect individuals and communities from vaccine-preventable diseases.[16] Public health organizations, healthcare providers, and individuals all have a role to play in achieving higher vaccination coverage among adults.[17-18] A study by Riccio et al[19] regarding knowledge, attitude, practices, and behaviour of healthcare professionals (HCPs) about vaccinations against pneumococcal, influenza, and hepatitis B in

patients with type 2 diabetes mellitus (DM) revealed that it is important to improve the vaccination coverage among the high-risk population.

American diabetes association proposed a standard comprehensive medical care to treat diabetic patients and to make them aware regarding different comorbidities, early assessment.[20]

People failed to realize the importance of vaccinations in adults for being unaware of the vaccines they need as they grew older.[20] Patients are more likely to get vaccinated when their healthcare provider recommends specific vaccines based on their age, health status, and other factors.[21-22]

Limitation:

A Mixed Method Study design (with a Qualitative component) would have explored the reasons of non-acceptance more comprehensively.

Conclusion & Recommendations:

Among the study participants, majority belonged to the age group of 50-60 years and nearly half of them were female and most of them were suffering from Type II Diabetes Mellitus. Eighty seven percent of study participants had inadequate awareness about adult vaccines. Only seven percent of study participants had some form of adult vaccination coverage. While most participants were willing to receive adult vaccines after being informed, few remained hesitant, primarily due to fears of adverse effects, out of pocket expenditure, reliance on existing immunity as their main reasons for rejection.

IEC (Information, education and communication) is required to be displayed in front of diabetes clinic as well as other outdoors, pharmacy of hospital to aware patients regarding adult vaccination. Doctor or counsellor present in Diabetes clinic should inform patient regarding vaccination benefits. Different public health campaigns need to be organized at community level at a regular interval. Adult vaccination should get incorporated into the adult immunization policies, should be available and affordable to diabetic patients.

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