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A STUDY TO ASSESS THE VACCINATION COVERAGE OF UNIVERSITY STUDENTS IN MUMBAI, INDIA

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ABSTRACT: Background: Immunization is the most cost-effective intervention for infectious diseases which are the major cause of morbidity and mortality worldwide. There is a scarcity of information on the vaccination status of young adults and the role of socioeconomic conditions in India. **Objectives:** Present study explored the adult vaccination status and influence of income and education of parents on adult vaccination status in university students from Mumbai, India. **Methods:** On the basis of the eligibility criterion 149 students were selected for the present study. A total of 8 vaccines namely Tdap/DTP, Varicella, MMR, Influenza, Pneumococcal, Hepatitis A, Hepatitis B and Meningococcal were included in this study for all the respondents. In addition to these vaccines, Human Papilloma Virus vaccine was also included for female respondents. **Results:** There were total of 149 (75 male and 74 females) respondents with the mean age of 21.5 years. The top 3 immunizations were Td/Tdap (97.3%), MMR (66.4%) and Hepatitis B (55%) among the respondents. Only 4 (5.5%) female respondents have been immunized against the HPV. **Conclusions:** Td/Tdap (97.3%) and MMR (66.4%) coverage was in line with the recommendations. For all the other vaccines the coverage was low varying from 5.5% to 35.4%. The vaccination coverage was better in respondents with higher educated and higher income parents. We suggest that patient education, planning by government for the implementation of policy for adult vaccination and involvement of physicians are must for better adult vaccination coverage.

INTRODUCTION: "When meditating over a disease, I never think of finding a remedy for it, but instead a means of preventing it*"* Louis Pasteur. Immunization is the most cost-effective intervention for infectious diseases which are the major cause of morbidity and mortality worldwide. Vaccines not only protect the individual who is vaccinated but also reduce the burden of infectious vaccine preventable diseases for the entire community.[1]

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Vaccination of adults is very important given that >25% of mortality is due to infectious diseases. Vaccines are recommended for adults on the basis of age, prior vaccinations, health conditions, lifestyle, occupation, and travel. [2] There have been significant efforts to curb morbidity, mortality, and disability among adults particularly due to communicable diseases such as tetanus, diphtheria, pertussis, hepatitis A, hepatitis B, human papilloma virus, Japanese encephalitis, measles, mumps, rubella, meningococcus, pneumococcus, typhoid, influenza, and chickenpox. Nevertheless, in a developing country like India, communicable diseases contribute to a large burden morbidity, mortality, and disability. [3]

Immunization for infants worldwide has led to important long term effects on the traditional

epidemiological patterns of major infectious diseases. Countries have found that vaccine induced immunity may not have the same long term stability as disease induced immunity, raising the average age of incidence for various vaccine preventable diseases.[4] Many childhood vaccine preventable infections are now found among adults. A massive diphtheria epidemic occurred in the former Soviet Union with more than 1,57,000 cases and 5000 deaths. A majority of cases throughout this epidemic occurred in persons > 15 yrs old and adults from 40 to 49 yrs old had very high incidence and death rates. [4] Both in resource rich and resource poor countries, outbreaks of measles, mumps and rubella have caused major disruptions on college campuses, in the workplace and in institutions.[4]

The government of India as well as the WHO considers childhood vaccination as the leading priority. However, there is no focus on adult immunization, [5-7] which also is the most ignored part of healthcare services in India. A recently published 'National Vaccine Policy – 2011' by the India Ministry of Health and Family Welfare, Government[8] gives guidelines to policy makers and program managers regarding various strategies for strengthening the 'Universal Immunization Programme', but the main focus is on children not adults.

Vaccine-preventable diseases cause unnecessary morbidity and mortality among adults in the region.[9] Adult vaccination coverage in India is negligible; even in a developed country like US, the coverage is only 2% of the adult population. The economically productive adult populations have been denied the full benefit of personal protection owing to either non-availability of vaccines or those receiving vaccines not being protected to the fullest extent due to incomplete effectiveness of available vaccines. Protecting adults by vaccination has never been considered in India a preventive strategy likely to have a great impact on population health.[10] While inadequate immunization results in unnecessary costs, including those associated with hospitalization, treatment, and loss of income [9], studies have also shown that education status and socioeconomic profile is an important determinant associated with adult immunization.[11, 4, 12]

Rationale: There is a scarcity of information on the vaccination status of young adults and the role of socioeconomic conditions in India. We through our University research collaborations in Mumbai, India wish to explore the vaccination status of university students and probable role of socioeconomic factors in Mumbai, India.

METHOD:

Study design and respondents: This descriptive study was performed in January – April 2015, among under graduate pharmacy students from Mumbai University, India way of a questionnaire. The study protocol was approved by V. V. research Independent Ethics Committee, Mumbai, India. Students were contacted by study team member in their classrooms and were given a brief introduction about the research project. Those who desired to participate were explained the purpose and objectives of the study. On the basis of the eligibility criterion (those who gave a written informed consent and are between the age group of 18-25 years) 149 students were selected for the present study.

Study instrument: The survey questionnaire was prepared in English after reviewing the literature for similar studies. The questionnaire was framed to gather information on age, gender, and vaccines taken by each participant after 18 years of age. Information on the monthly family income, and educational qualification of parents was also requested for each participant in the questionnaire. A total of 8 vaccines namely Tdap/DTP, Varicella, MMR, Influenza, Pneumococcal, Hepatitis A, Hepatitis B and Meningococcal were included in this survey for all the respondents. In addition to these vaccines, Human Papilloma Virus vaccine was included for female respondents.

The validity of the survey questionnaire was evaluated in the pilot study with a sample of 30 students. This was done to get the average time required for face to face interview for completing the questionnaire and to ensure that it is appropriate and understandable to students. Pilot population was not part of the final study.

Collection of data: Students were visited at their house with prior appointment by a study team of 5 trained master of pharmacy students. The purpose

of the research was explained to the respondents, anonymity and confidentiality were guaranteed and maintained. The researchers complied with the international ethical guidelines for research. The data was recorded into the predesigned case report form by interviewers. The vaccination status data was cross verified against the vaccination records of each participant.

Data entry and analysis: Collected data from individual CRF was entered into Microsoft excel and was verified by the authors other than interviewers. The data were analyzed by Microsoft excel for finding out relevant statistics (Mean, standard deviation, frequencies and percentage). Qualitative variables were presented as frequencies and percentages to observe their relationship with vaccination status.

RESULTS: Table 1 shows the socio-demographic parameters of study respondents from Mumbai. There were total of 149 (75 male and 74 females) respondents with the mean age of 21.5 years. 78 (52.7%) respondents belonged to the monthly family income group of 50,000 to 100,000 INR.

TABLE 1: SOCIO-DEMOGRAPHIC CHARACTERISTICS OF RESPONDENTS

n= 149, Cohort mean age = 21.5 years Male = 75; mean age = 22 years Females = 74; mean age = 21 years		
Family income (148 respondents)		
Monthly family income In Indian Rupee (INR)	Frequency (%)	
< 50,000	33 (22.3)	
50,000 to 100,000	78 (52.7)	
> 100,000	37 (25)	
Parent's education (139 respondents)		
Education score of parents	Frequency	(%)
0	0	0
0.5	2	1.3
1	9	6.5
1.5	7	5.1
2	11	7.9
2.5	8	5.7
3	10	7.2
3.5	4	2.9
4	54	38.9
4.5	21	15.1
5	13	9.4

For calculating education score following formula was used. Parent's education score = (Father's education score + Mother's education score) / 2. Scoring was as follows: education less that secondary school = 0, secondary school = 1, high school = 2, Diploma = 3, Bachelor's degree = 4, Master's degree and above = 5. In case data was available for only one parent, other parent's education score was considered zero. Maximum respondents 54 (38.9%) had parental education score of 4, followed by 21 (15.1%) respondents with parental education score of 4.5.

As seen from **Table 2**, the top 3 immunizations were Td/Tdap (97.3%), MMR (66.4%) and Hepatitis B (55%) among the respondents. Only 4 (5.5%) female respondents have been immunized against the HPV.

TABLE 2: VACCINATION STATUS OF RESPONDENTS

Vaccine (n = number of respondents)	Frequency (%)vaccinated
Td/T dap n=149	145 (97.3)
Varicella n=149	45 (30.2)
MMR n=149	99 (66.4)
Influenza n=147	52 (35.4)
Pneumococcal n=148	22 (14.9)
Hepatitis A n=149	76 (51)
Hepatitis B n=149	82 (55)
Meningococcal n=148	15 (10.1)
Human Papilloma Virus only for females n=73	4 (5.5)

Table 3 presents vaccination status categorized by monthly family income (INR). As seen in **Fig. 1**, income group (< 50,000 INR/month) had lowest vaccination percentages for all the vaccines, except for MMR and HPV. In case of MMR, vaccination percentages for all three income groups were almost similar. Only 1 (6.2%) respondent from income group of < 50,000 INR/month and 3 (8.1%) respondents from income group of > 100,000 INR/month had vaccinated against HPV.

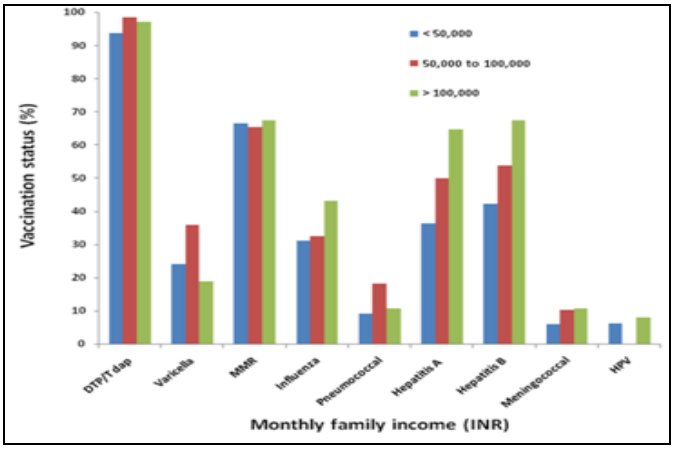

FIG. 1: MONTHLY FAMILY INCOME (INR) AND VACCINATION STATUS OF RESPONDENTS

TABLE 3: MONTHLY FAMILY INCOME (INR) AND VACCINATION STATUS OF RESPONDENTS

	< 50,000 INR n = 33		50,000 to 100,000 INR n = 78		> 100,000 INR n = 37	
	Frequency	%	Frequency	%	Frequency	%
Td/T dap	31	93.9	77	98.7	36	97.3
Varicella	8	24.2	28	35.9	7	18.9
MMR	22	66.7	51	65.4	25	67.6
Influenza	10	31.3	25	32.5	16	43.2
Pneumococcal	3	9.1	14	18.2	4	10.8
Hepatitis A	12	36.4	39	50	24	64.9
Hepatitis B	14	42.4	42	53.8	25	67.6
Meningococcal	2	6.1	8	10.4	4	10.8
Human Papilloma Virus vaccine (only for females)	1 n= 16	6.2	0 n= 38	0	3 n= 19	8.1

Table 4 shows parent's education and vaccination status of the respondents. Vaccination % is lesser for respondents with parent's education of < high school than those with parent's education score of graduate and above, except for Pneumococcal vaccine (**Fig. 2**). HPV vaccination has been taken only by respondents 4(8.5%) with parent's education of graduate and above.

TABLE 4: PARENTAL EDUCATION SCORE AND VACCINATION STATUS OF RESPONDENTS. (n=139)

Education Score of parents	Number of respondents Frequency (%)	Td/Tdap	Varicella	MMR	Influenza	Pneumococcal	HAV	HBV	Meningococcal	HPV
< High School	18(12.9)	15(83.3)	3(16.7)	8(44.4)	6(33.3)	4(22.2)	6(33.3)	6(33.3)	1(5.6)	0 n=10
High School to < Graduation	33(23.7)	33(100)	5(15.2)	24(72.7)	10(30.3)	5(15.2)	17(51.5)	19(57.6)	3(9.1)	0 n=17
Graduate and above	88(63.3)	88(100)	31(35.2)	60(68.1)	31(35.2)	14(15.9)	51(57.9)	51(57.9)	9(10.2)	4(8.5) n=47

Abbreviations: Td/Tdap (Tetanus, Diphtheria and Pertussis vaccine), MMR (Measles, Mumps and Rubella vaccine), HAV (Hepatitis A Virus vaccine), HBV (Hepatitis B Virus vaccine), HPV (Human Papilloma Virus vaccine).

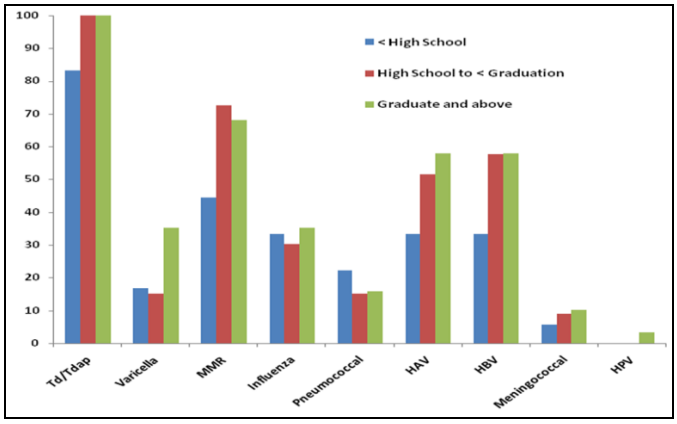

FIG. 2: PARENT'S EDUCATION AND VACCINATION STATUS OF RESPONDENTS

DISCUSSION: Although it is well known that disease prevention is the most cost-effective option to protect and promote health of populations and immunization is the key to achieve the same, adult vaccination has never been considered a preventive strategy likely to have a great impact on population health. Authors discuss below our findings in the light of recommendations by the expert group of API.

Vaccines' recommended by Expert group.

Td/Tdap

Diphtheria: In the 1990s, a large epidemic of diphtheria began in Russia and subsequently spread to the Newly Independent States (NIS) of the former Soviet Union. About two-thirds of the reported cases occurred among persons ≥15 years of age. In Ukraine too, at the peak of the epidemic in 1995, more than 80% cases were reported in the same age group [13-16]. In fact, serologic studies in the 1980s from these countries had suggested that >50% of adults were susceptible to diphtheria.[17, 18] Since then, diphtheria immunity among adults became an important issue.

Tetanus: Tetanus too remains an important public health problem in many parts of the world, particularly in the tropical developing countries. In 2008, the total number of deaths caused by tetanus worldwide was estimated to be more than 61,000. [19] In India, DTP vaccine was introduced in routine immunization in 1978, resulting in substantial decline in incidence in the pediatric populations. The effect was a shift of the infection to the older age groups. The age shift justified the need of booster diphtheria immunization. [20]

Pertussis: Pertussis is generally considered as a childhood disease but was well documented in adults during the twentieth century. [21-23] In the United States, there have been reports of pertussis among adolescents and adults. [24, 25] In India, there are no reports of pertussis in adults yet but chances are that these cases are not detected and the susceptibility is also not known.

There have been increasing reports of pertussis out breaks in adult's population in many western countries and vaccination of this group is being planned. [26] Like many other developing countries of the world, morbidity and mortality rate due to pertussis is likely to be high in South Asian countries such as Pakistan, India, Bangladesh and Sri Lanka as well as countries of African continent. [27-29] There is also a very high probability of occurrence of adult's pertussis case in this region.

Furthermore there is an overall lack of data related to laboratory confirmed cases of pertussis from these regions. The main reason behind this under reporting may be due to lack of adequate diagnostic facilities, poor surveillance systems and unawareness of physicians to the occurrence of these infections in adult population. Widespread use of DPT vaccination has resulted in the shifting of incidence of pertussis to adolescents and adults. [30] It is estimated that almost 20- 50% of all persistent cough cases in adults are caused by the *B. pertussis*. [31, 32] Adult pertussis is both a significant health problem as well as an economic burden in both developing as well as developed countries. [33]

In spite of good immunization coverage, the developed countries have shown a shift in the epidemiology of the disease to the adolescent and the adult age group, leading to a revision of their vaccination policies. [34] The anticipation and early recognition of this change in the epidemiology is important because the affected adolescents and adults act as reservoirs of the disease to the vulnerable population of infants, for whom the disease can be life threatening. [35] Research in several countries had shown that pertussis is endemic among the adolescents and adults. It is suggested that a universal program of adolescent and adult boosters would decrease the circulation of *B. pertussis* in these age groups and possibly could lead to the elimination of the organism from the population. [36]

API [37] has recommended routine Tdap vaccination for all adults not immunized earlier. For all adults in the age group of 18 to 64 years who have completed their childhood vaccination schedule, a booster dose of Td vaccine is indicated once every 10 years till the age of 65 years; one dose of Tdap vaccine may be administered in place of Td vaccine. For adults aged over 18 years who have not received prior vaccination against diphtheria, pertussis and tetanus, three doses of Td vaccine are indicated.

Our results are encouraging in the light of API recommendation, wherein 145 (97.3%) of the respondents were immunized against DTP.

Varicella: Although VZV is an extremely common infection worldwide, its epidemiology is markedly different in tropical and temperate climates. While in temperate countries, the vast majority of the population have seroconverted by adolescence [38, 39] in tropical countries, seroconversion generally occurs in late adolescence and adulthood. [40] Several seroprevalence studies in Southeast Asia have indicated that a significant proportion of the population remain susceptible to VZV infection well into adulthood. In Singapore, serological surveys have revealed that only 41% of those aged 15-24 years have protective antibodies to VZV, while >90% seroprevalence is not reached until the age of 35 years and over. [41] Similar results have been obtained in Malaysia [42], the Philippines [43] and Thailand. [44] Incidence data reflect low seroprevalence among adolescents and adults in the region. [41, 45]

Reports from South India [46, 47] have revealed that close to 30% of adolescents above 15 years are susceptible to VZV infection. Multicentric study from India showed that Varicella susceptibility extended even into the 30-40 years of age group.[48]

The susceptibility to VZV of many adults in Southeast Asia due to late seroconversion, together with the heightened risk of complications, hospitalization and death, provide strong support for the vaccination of seronegative adults. Ideally, all adults and adolescents who did not have chickenpox as children should receive the vaccine.[9]

Persons aged over 13 years without evidence of varicella immunity should receive 2 doses of the vaccine 4-8 weeks apart. Those who have received one dose of vaccine in childhood are advised to get their second dose. [37]

Introduction of varicella vaccination in USA has resulted in a clinically and statistically significant reduction in varicella-related hospitalizations for adults and a corresponding significant decrease in hospital charges. [49]

Our results have shown that minimal 45(30.2%) respondents were immunized against varicella. There needs to be implement the API recommendations to prevent the varicella associated complications, hospitalizations and deaths.

MMR: Measles is an infectious disease caused by Morbillivirus, with a secondary attack rate in excess of 80%, that usually affects children.[50] However, multiple outbreaks of the disease have even been reported among adults in heterogeneous settings (urban areas, university campuses, disaster sites, during international travel, etc.). [51-54] Mumps, though historically a disease of childhood, present outbreaks of mumps predominantly involves young adults, nearly all of whom had been vaccinated, most with the two dose schedule.[55]

Rubella is an acute, usually mild, viral disease traditionally affecting susceptible children and young adults worldwide. Targeting rubella for elimination.[55]

Our study revealed that moderate number of respondents 99 (66.4%) received one dose of MMR vaccine. It is necessary to follow the expert group recommendations that all adults (except those who have medically documented history of having suffered from all the three disease; those who have received two doses of MMR vaccine in the childhood; and those with any contraindications for receiving this vaccine), should receive one dose of the MMR vaccine. [37]

Optional Vaccines by expert group:

Influenza: Our results showed that minimal number of respondents 52(35.4%) were immunized against influenza. Although, the burden of influenza-associated morbidity and mortality is now recognized in many developed countries, data on influenza in most developing countries remain sparse. A study conducted by Hirve [56] in northern (Ballabgarh) and western (Vadu) India to estimate and compare incidence of influenza-associated hospitalization showed that influenza-associated hospitalization rates were highest among infants and adults aged >60 years in Ballabgarh, whereas rates were higher among older children and young adults in Vadu. Peak detection of influenza viruses among hospitalized patients coincided with periods of peak rainfall in both communities. The markedly different influenza hospitalization rates by season and across communities in India highlight the need for sustained multi-site surveillance system for estimating national influenza disease burden. That would be the first step for initiating discussions around Influenza prevention and control strategies in the country.[56] In the absence of epidemiological surveillance regarding the influenza serotypes in India, the use of influenza vaccine in India is not recommended by API.[37]

Pneumoccocal: The scientific evidence for the efficacy of PPV has been a very controversial issue. This is attested by the fact that more than 15 meta-analyses with conflicting results have been published so far on the efficacy of PPV in adults. [37] The Expert Group observed that the available evidence is insufficient to recommend routine use of PPV in adults. Although PPV is efficacious in preventing invasive pneumococcal disease among adults, routine PPV administration to adults is not likely to be cost-effective in India. Given the lack of credible scientific evidence supporting the efficacy of PPV in high-risk populations and a complete lack of published data on the population

at risk of invasive pneumococcal disease and community acquired pneumonia among the adults in India, the Expert Group has endorsed the recent recommendations by the WHO against the use of PPV among adults. [37] This is in tune with our results showing that minimal number of respondents 22(14.9%) have taken Pneumococcal vaccine.

Hepatitis:

Hepatitis A: With improvement in economic and living conditions of the communities, the age of acquiring hepatitis A virus (HAV) infection is shifting from early childhood to adolescence and young adulthood. Data from India indicate that the population is no longer homogeneous for its HAV exposure profile. Occasional outbreaks of HAV and higher proportions of symptomatic cases are reported amongst older children and adults from different regions of the country. However, the heterogeneous exposure to HAV defies widespread use of the vaccine. The challenge is to recognize the susceptible pockets and take pre-emptive steps. In regions with rapid improvement in living standards and environmental hygiene, there is a need for regular surveillance through structured protocols that are able to identify early signs of epidemiological shift. [57]

The Expert Group conveys that universal immunization for hepatitis A is not recommended as yet. Not only is the vaccine costly, more epidemiological data are required to ascertain its benefits**.** [37] In the present study 76(51%) of the respondents have taken Hepatitis A vaccine.

Hepatitis B: 82(55%) of the respondents were immunized against Hepatitis B. API recommends that Hepatitis B vaccination is indicated for all unvaccinated adults at risk for HBV infection and all adults seeking protection from HBV infection including post-exposure prophylaxis. [37] Unvaccinated adults who are at risk for HBV infection include, for example patients with percutaneous or mucosal exposure to blood; patients with sexual exposure, persons at risk for occupational exposure to HBV patients who are HIV-seropositive, patients with CLD, chronic kidney disease (CKD) etc. [37] Hepatitis A and B move than 50% vaccination coverage can be in part explained by the recent Hepatitis awareness campaigns involving celebrities organized in various states of India.

Meningococcal: 15(10.1%) of the respondents had taken Meningococci vaccine. This is in tune with the recommendation of the expert group of the Association of Physicians of India [37] that routine vaccination of all adults is not recommended in view of the short lived protection provided by the currently available polysaccharide vaccines. The meningococcal vaccine can be used in selected populations in certain situations such as during an outbreak, during inter epidemic periods to persons living in dormitories and immunocompromised individuals, to travelers, pilgrims, people attending fairs and festivals in large numbers. [37]

HPV: Our results have shown that only 4(5.5%) of the female respondents have taken HPV vaccine. Expert group recommends that HPV vaccine has to be delivered prior to exposure to the HPV virus. Therefore, the immunization must precede the sexual debut. The Expert Group recommends the age for initiation for vaccination to be 10 - 12 years (Level Ib, Grade A). Catch-up vaccination can be advised up to the age of 26 years for Gardasil® vaccine and 45 years for Cervarix® vaccine (Level Ib, Grade A). The HPV vaccines can be given simultaneously with other vaccines *e.g*., Hepatitis B, Tdap (Level IIa, Grade B).[37] Currently available HPV vaccines do not protect against HPV types found in approximately 30% of cervical cancers. Although HPV vaccination is a promising control option, it will take several decades to establish its effect on cervical cancer burden and the vaccine costs are currently prohibitive. Timely implementation of an affordable and effective screening strategy in developing countries is thus crucial, while waiting for further improvements in HPV testing, vaccine technology, costs, and its widespread use. [58]

CONCLUSION: Our results in terms of vaccination coverage have varied from 30.2% (varicella) to 97.3% (Tdap) for recommended vaccines and 5.5% (HPV) to 55% (Hepatitis B) for optional vaccines. In the adult vaccination study done by Nacar [59] in Turkey vaccination rates were lesser compared to present study for Influenza (7.8% Turkey & 35.4% India) , Pneumonia (0.4% Turkey & 14.9% India), Hepatits B (25.6% Turkey

& 25.6% India) and HPV (1.1% Turkey & 5.5% India).

Undergraduate students in India are financially dependent on their parents not only for their education, but also for health care and all the other living costs. Hence we thought it is important to look at parent's education and family income as factors which might affect the vaccination status of students.

It is well documented that individuals who are more disadvantaged benefit less than those who are better off from preventive health interventions. [60, 61] Lower socioeconomic status, as measured by education or income, was associated with lower immunization rates for influenza. [62, 63] In the US, vaccination rates were lower among minority populations. [64, 65] Identifying and matching inequalities and barriers is therefore an important step in understanding and improving immunization rates. Uddin M [66] has shown that increasing parental educational attainment was significantly associated with a trend in higher vaccination uptake among students. The effect of parental educational status on vaccination rates can carry over to offspring, even among those who attain college student status.

Our results have also shown that vaccination percentages were lowest for the family income group of <50,000 INR/month. Also it was lower for respondents with parent's education of < high school than those with parent's education score of graduate and above, except for Pneumococcal vaccine (**Fig. 2**). HPV vaccination has been taken only by respondents with parent's education of graduate and above that also by very less number of females 4 (8.5%). This is in tune with the above mentioned finding from various studies relating vaccination coverage and socioeconomic conditions.

A number of factors are responsible for limited growth and penetration of vaccines in India. There is lack of epidemiological data on vaccination coverage of adults in India. As per author's knowledge this is the first study to assess the vaccination coverage in adults in India. This variation can be attributable to number of factors such as

1. Unclear process in introducing new vaccines – Government of India provides vaccines to public through UIP (Universal Immunization Program). But the process of inclusion of new vaccines in UIP is unclear, slow and is limited by funding. [67]

2. Lack of awareness – Physicians and patients have limited knowledge of vaccines. Vaccine sales teams do not cover general physicians. Other than successful polio vaccination program Indian government has not taken up any other major vaccination awareness campaigns. [67]

3. Physicians and patients preferences – Physicians do not prescribe options vaccines to avoid the liability in case of side effects. Patients prefer treating rather than preventing diseases. [67]

4. Affordability issues – Vaccines are provided free under UIP program but only for highly communicable and life threatening diseases. Obtaining vaccines through private system is expensive and medical insurance policies do not cover vaccines. [67]

5. Lack of data – A lack of quality data on disease burdens and vaccine efficacy is the biggest obstacle in vaccine coverage in India. Decision makers in India, need the safety and effectiveness of vaccines in the local population. [67]

6. Limitations in distribution and supply – distribution is hampered by inadequate cold chains and constrains to last mile distribution. Storage in the clinics is limited due to frequent electricity blackouts in India. [67]

Although immunization against infectious diseases is a lifelong process, it is not seen as a health issue for adults. Taking into consideration the benefits it brings to the individual and the community, and the costs that preventable diseases can bring to a society, adult vaccination is a very important issue. Taking into account the varied vaccination coverage rates observed in the present study, it can be said that there is a need for nation-wide regulations regarding vaccination.

Success in adult vaccination can be obtained by increasing knowledge in the community in general, by developing national policies, and by enabling doctors and health personnel to suggest vaccination to adults when necessary.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE: Taken.

CONFLICT OF INTEREST: The authors declare that they have no conflict of interest.

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