

## Research Article

# Greek nursing students' immunization coverage: Data from central continental Greece

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### Abstract

Nursing students are at risk of acquiring vaccine-preventable diseases. To estimate the vaccination rates for nursing students, a cross-sectional survey was conducted in a major district of central continental Greece with an anonymous and self-administered questionnaire in a sample of 432 nursing students (the response rate was 97%). The eligible nursing students completed the questionnaire after informed consent was obtained. The vaccination rates of the nursing students ranged from 65.2% for the oral polio (SABIN) vaccine and 65.7% for the hepatitis B virus vaccine to 74.6% for the diphtheria-tetanus-pertussis (DTP) vaccine. The parents' level of education did not correlate with the students' underimmunization. The *t*-test showed that the senior students were more knowledgeable about the compulsory vaccines. Almost half of the nursing students were somewhat satisfied with the available information on vaccination, while 9.5% were not at all satisfied and 38.5% were underimmunized. The proportion of male students who had completed the SABIN and DTP vaccination schedules was higher compared to the female students. More health education programs could increase the vaccination rates among nursing students.

### Key words

diphtheria-tetanus-pertussis vaccine, hepatitis B vaccine, immunization, measles, nursing students.

## INTRODUCTION

Immunization is a highly cost-effective and relatively inexpensive health intervention aiming to eradicate vaccine-preventable diseases (Trichopoulos & Petridou, 2000). The impressive decrease of infectious diseases prevalence and, especially, that of *Haemophilus influenzae* type b, diphtheria, pertussis, and measles are indicative of the effectiveness of vaccination (WHO, 1995; 2003; Gavana *et al.*, 2005). In response to immunization needs worldwide, global partnerships and shared strategies have been created in order to attain shared goals. Each country drafts its National Immunization Program according to the available epidemiological data in order to protect more people against vaccine-preventable diseases by expanding the reach of immunization to every eligible person in order to reduce the number of indigenous cases of vaccine-preventable diseases (WHO, 2003; Gavana *et al.*, 2005).

The surveillance of vaccine-preventable diseases is an important part of estimating the burden of diseases, identifying persons' susceptibility, deciding on appropriate measures to prevent and control outbreaks, and formulating policy recommendations to reduce the disease burden. In Greece, vaccine-preventable diseases are monitored through surveil-

lance and sentinel systems. According to the World Health Organization (WHO), between 2000 and 2001, four confirmed cases of tetanus, 106 cases of pertussis, 82 cases of mumps, and 11 cases of meningitis from *H. influenzae* type b have been reported (WHO, 2003). After the onset of a congenital measles outbreak in 1993, with 25 reported cases, no more cases have been reported in the last biennium (Panagiotopoulos *et al.*, 1999a).

In Greece, there is no formal and continuous documentation of immunization coverage for the vaccine-preventable infectious diseases and, thus, the available epidemiological data are based on sparse studies that provide only estimations of the real condition due to their sample and methodological limitations (Panagiotopoulos, 1999; Roupa *et al.*, 2005). The Greek Institute for the Health of Children has provided data from two Pan-Hellenic studies in 1998 and 2001 (Panagiotopoulos *et al.*, 1999b). Based on these data, the WHO and UNICEF estimated that the vaccination coverage for the Greek population for 2000 to 2001 ranged between 86% and 88% (WHO/UNICEF, 2002), while for 2005, it ranged between 87% and 96%. The vaccination coverage for the population of the European continent was estimated to range between 91% and 95% for 2005, with the exclusion of the hepatitis B virus (HBV) vaccine and that of *H. influenzae* type b, for which vaccination coverage was 74% and 41%, respectively (WHO, 2006).

The diphtheria-tetanus-pertussis (DTP) vaccine coverage data are used to reflect the proportion of children protected

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against diphtheria, pertussis, and tetanus, as well as to evaluate the performance of immunization services and of the health system in general. Hepatitis B3 coverage has steadily increased since 1990 due to the increasing number of countries introducing the HBV vaccine into their routine immunization services, as well as due to increasing coverage in these countries. Polio immunization coverage has resulted in polio eradication and, by the end of 2005, only six countries remained endemic for 2005: India (66 cases); Pakistan (28 cases); Afghanistan (nine cases); Nigeria (830 cases); and Niger (10 cases). In 2005, no wild viruses occurred in Egypt, but the disease remained endemic (WHO, 2007).

Nursing students in the course of their clinical work are at high risk of acquiring vaccine-preventable diseases, as well as transmitting them to their patients. The determination of the vaccination rates among nursing students is important to protect their health and to plan health education programs. The main goal of the current study was to estimate the vaccination coverage of nursing students attending the high technological educational institution (HTEI) of a large city in central continental Greece. Additionally, we explored the reasons for which students do not complete the National Immunization Schedule.

## METHODS

In general, estimates of immunization coverage are based on empirical data that derive from reports of vaccinations produced by health-services providers (administrative data) and from household surveys containing information on persons' vaccination history (coverage surveys). We conducted a retrospective cohort study of nursing students' vaccination coverage by using an anonymous questionnaire aimed at eliciting information on: (i) the social and demographic characteristics of the students; (ii) the students' immunization history; (iii) the reasons for not being vaccinated; and (iv) the students' satisfaction from the provided information about immunization. The research was conducted between January and April 2007.

The face validity of the questionnaire was explicitly assessed through feedback from a panel of experts (researchers, health-care professionals, and academics) who reviewed the questionnaire and confirmed it with minor wording changes. Content validity refers to the degree that the instrument covers the important aspects of what is being measured. Content validity ensures that the questionnaire includes an adequate and representative set of items that tap the concept. The more the questionnaire items represent the domain or universe of the concept being measured, the greater the content validity (Raftopoulos & Theodosopoulou, 2002). Expert validity is a form of content validity, which is demonstrated by asking experts to review the content of the instrument. According to Lynn (1986), the minimum number of experts required is five. Our expert review and the panel discussion were conducted at the Department of Nursing of the Lamia HTEI. The panel consisted of three nursing researchers, two specialized nurses, and one public health nurse. Initially, the experts were asked to respond independently to a questionnaire that was developed for the assess-

ment of the questionnaire. They were asked to rate the clarity, the concreteness, the centrality, and the importance of each item using a three-point rating scale (1 = "not clear", 2 = "clear", and 3 = "very clear"). The items were considered adequate if there was >80% agreement. The feedback offered tips and suggestions to improve the questionnaire.

The immunization coverage was defined by calculating the percentage of nursing students who had received four doses of the DTP vaccine, three or more doses of the poliovirus (SABIN) vaccine, one or more doses of the measles-containing vaccine, and three or more doses of the HBV vaccine. The participants who had received the previously mentioned vaccines were deemed to have a complete vaccination history. The fifth dose of the DTP vaccine was not included in the above definition criteria as it is used to enhance the corporate immunity of the population instead of the personal protection of the immunized person (Gavana *et al.*, 2005). The questionnaire was piloted to 15 students to evaluate the wording of the questions, the understanding of the questions, the language used, the scale's length, and the effectiveness of the response categories.

## Design and sample

The subjects who met the following inclusion criteria were selected to participate in the study: (i) a willingness to participate; (ii) being a nursing student at the HTEI; and (iii) the availability of their "personal health book" that is compulsory for every child living in Greece. The students were asked to copy from their personal health book or from their vaccination card the doses of vaccines and the date they were provided.

The potential participants were recruited from the HTEI on the basis of their availability. They were approached by the researchers and were given a brief explanation of the purpose and the aim of the study. Informed consent was obtained from those who agreed to participate and they were asked to fill in a structured questionnaire. Three of the researchers had a teacher-student relationship with the nursing students surveyed. To overcome potential coercion of the students to participate in the survey, the three researchers did not interfere in the collection of the questionnaires, which was performed by the other two researchers as they were external collaborators. The protocol of the study was approved by the Institutional Review Board of the HTEI of Lamia, Greece.

The convenience sample consisted of 432 students. Finally, 418 students gave their informed consent and participated in the study (a response rate of 97%). The vast majority was female (85.3%). The mean age of the sample was  $22.93 \pm 2.32$  years old and the median was 23 years old.

## Statistical analysis

All of the items were coded and scored, and the completed questionnaires were included in the data analysis set. SPSS-13 (SPSS, Chicago, IL, USA) was used to analyze the data. The  $\chi^2$  test was used to explore the existence of a statistically significant relationship between the categorical

**Table 1.** Characteristics of the students' parents

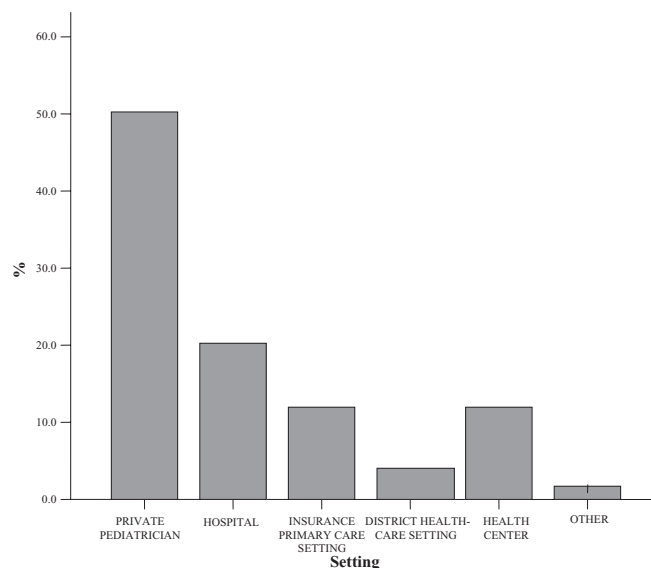
Variable	Father		Mother	
	N	%	N	%
<b>Education</b>				
Few elementary school classes	–	–	3	0.7
Elementary school	136	33.6	153	37.0
Gymnasium	61	15.1	76	18.4
High school	74	18.3	103	24.9
Technological	69	17.0	42	10.1
Higher	40	9.9	28	6.8
University	25	6.1	9	2.1
<b>Profession</b>				
Private employee	83	20.8	87	21.2
Civil servant	92	23.0	34	8.3
Household-keeping	–	–	226	55.0
Farmer	41	10.3	7	1.7
Freelancer	129	32.6	38	9.2
Unemployed	4	1.0	1	0.2
Businessman	49	12.3	18	4.4

variables. The *t*-test was used to assess whether the means of two groups were statistically different from each other. Values < 0.05 were considered to be statistically significant, unless otherwise stated.

## RESULTS

The *t*-test did not reveal a statistically significant difference ( $P = 0.695$ ) in the mean age of the male ( $22.79 \pm 2.54$ ) and female ( $22.93 \pm 2.31$ ) students. The mean age of the students' father was  $51.93 \pm 6.29$  years old and that of their mother was  $46.49 \pm 5.86$  years old. The characteristics of the students' parents are illustrated in Table 1. The majority of the students were indirectly insured (covered from their parents' insurance) in various Greek health-care funds. Only five (1.2%) students were not indirectly insured, while seven (1.5%) did not reply. The vast majority of the nursing students (92.3%) lived with their parents. Regarding marital status, 3.6% of the students' parents were widowed, 1% was separated, and 3.1% were divorced. Therefore, 90.6% of the students lived with both their parents, while 6.7% lived with their mother, 0.2% lived with their father, 0.5% lived with a relative, and 1.9% lived alone. One-hundred-and-fifty-six (39.7%) students were first-born children. The majority of the nursing students ( $n = 169$ , 41.1%) were third-year students, as opposed to 34.3% who were second-year students, and 14.8% and 9.7% who were fourth-year and first-year students, respectively.

Figure 1 gives information about the settings where the vaccinations were performed. The majority of the students were vaccinated by a private pediatrician, followed by those who were vaccinated in a hospital. To evaluate the students' knowledge on immunization, the students were directly asked to select the compulsory vaccines from a checklist of 11 vaccines that were provided in the questionnaire. The analysis showed that only 58 (13.9%) students gave a correct answer. The *t*-test revealed a statistically significant

**Figure 1.** Settings where the vaccinations were performed.**Table 2.** Frequency of nursing students' answers on vaccine-uptake barriers

Vaccine-uptake barrier	N	%
Negligence	128	90.8
Frequent diseases	5	3.6
Fear of side-effects	4	2.8
Past reactions to the vaccine	1	0.7
Allergic reaction	1	0.7
Not believed to be a measure of disease prevention	1	0.7
Failure to access the immunization center	1	0.7

difference ( $P < 0.001$ ) in the mean age of the students between those who gave the right answer ( $24.33 \pm 2.16$ ) and those who gave the wrong answer ( $22.70 \pm 2.72$ ).

Almost four out of 10 nursing students (38.5%) had not completed their vaccination schedule; 61.5% had all the doses of vaccines documented. As depicted in Table 2, the main reason for the students' incomplete vaccination was predominantly their negligence to get the vaccines (90.8%). A further exploration of the barriers for not being vaccinated showed that 48.2% of the students evaluated the information for vaccination as somewhat satisfactory, while 42.3% of the students evaluated it as very satisfactory and 9.5% evaluated it as not at all satisfactory. The students were asked to recommend measures to improve immunization coverage. They proposed the enhancement of information from television or radio (52, 22.0%), while 74 (31.4%) proposed the wide use of educational leaflets, 75 (31.8%) suggested the use of individualized health education programs from health-care professionals at home, and 35 (14.8%) proposed the provision of adequate information from private health-care providers.

The students who were satisfied with the available information on the compulsory vaccines (i.e. access to booklets

**Table 3.** Rates of fully vaccinated nursing students

Vaccine	Yes		No	
	N	%	N	%
DTP	285	74.6	97	25.4
MMR	247	64.7	135	35.3
SABIN	249	65.2	133	34.8
HBV	251	65.7	131	34.3

DTP, diphtheria-tetanus-pertussis vaccine; HBV, hepatitis B virus vaccine; MMR, measles, mumps, and rubella vaccine; SABIN, oral polio vaccine.

**Table 4.** Rates of vaccinated students as clustered by their gender

Vaccine	Women		Men		<i>P</i>
	Yes (%)	No (%)	Yes (%)	No (%)	
DTP	235 (77.3)	69 (22.7)	32 (59.3)	22 (40.7)	0.005
SABIN	204 (67.1)	100 (32.9)	28 (51.9)	26 (48.1)	0.024
HBV	202 (66.4)	102 (33.6)	35 (64.8)	19 (35.2)	0.464
MMR	197 (64.8)	107 (35.2)	35 (64.8)	19 (35.2)	0.565

DTP, diphtheria-tetanus-pertussis vaccine; HBV, hepatitis B virus vaccine; MMR, measles, mumps, and rubella vaccine; SABIN, oral polio vaccine.

and scientific research papers) were more likely to select successfully the compulsory vaccines ( $P = 0.002$ ) from the list provided. More precisely, of those who knew which were the compulsory vaccines, 63.8% were very satisfied with the available information for the vaccination, 31% were somewhat satisfied, and 5.2% were not at all satisfied. The percentages for the students who did not know which were the compulsory vaccines regarding satisfaction with the information were 38.8%, 51%, and 10.2%, respectively.

Two-hundred-and-ninety-four nursing students (70.3%) answered that they suffered from an infantile disease that is preventable through vaccination, as opposed to 17% ( $n = 71$ ) who did not, while 12.7% ( $n = 53$ ) did not give an answer. Of the 247 students who replied, 61 (24.7%) were tested for HBV antibodies after being vaccinated against hepatitis B, as opposed to 186 (75.3%) students who were not tested. Twenty-one (34.4%) students reported a positive result (anti-HBV) and 22 (36%) reported a negative result, while 18 (29.5%) students did not reply.

As displayed in Table 3, of the 382 nursing students who reported their vaccination history, the majority (74.6%) had completed the DTP vaccination schedule and 65.7% had completed the HBV vaccination schedule. There was a statistically significant difference in the percentages of the students who had completed the vaccination schedule in relation to gender for the DTP vaccine ( $P = 0.005$ ) and the SABIN vaccine ( $P = 0.024$ ). As seen in Table 4, the percentage of male students who had completed the vaccination schedule was higher compared to that of the female students.

The parents' level of education did not correlate with the completion of their children's vaccination schedule.

## DISCUSSION

This study demonstrated the vaccination coverage of nursing students in central continental Greece. To our knowledge, this is the first estimation of nursing students' vaccination coverage in Greece. The coverage levels for the DTP vaccine are considered to be one of the best indicators of health-system performance. Bacille Calmette-Guérin (BCG) (the vaccine against tuberculosis), measles, DTP, and polio immunization coverage increased during the 1980s due to the increased number of countries that introduced and established their national immunization services. Measles, BCG, DTP, and polio immunization coverage peaked in 1990 in order to achieve the goals of universal childhood immunization through routine immunization services and campaigns focusing on unreached children. The reported coverage remained high and steady throughout the 1990s. Bacille Calmette-Guérin coverage is often used to reflect the proportion of children who are protected against the severe forms of tuberculosis during the first year of life and also as an indicator of access to health services. Measles immunization coverage is one of the indicators of progress towards Millennium Development Goal 4: to reduce children's mortality. Although global measles immunization coverage exceeds 75%, several regions show much lower coverage (WHO, 2007).

From the present research, it is concluded that a large number of nursing students (38.5%) have not completed their vaccination schedule. The percentage of completed vaccination is very low and far away from the WHO's goals (90%), from UNICEF's estimates for 2005 (87–96%) (WHO, 2006), and from previous research (95%) performed in a rural and semirural Greek region (Roupa *et al.*, 2005). More precisely, there is a gap in the students' vaccination coverage as the rate of withdrawal for the DTP vaccine was 25.4%, and it was 35.3% for the measles, mumps and rubella vaccine (MMR) vaccine, 34.8% for the SABIN vaccine, 24.1% for the BCG vaccine, and 34.3% for the HBV vaccine. According to previous research, the relevant rates of withdrawal ranged from 6.4% for the third dose of the DTP vaccine to 16.3% for the fifth dose of the DTP vaccine, whereas for the fifth dose of the pertussis vaccine, it was 49.7%. The vaccination coverage for the MMR vaccine was higher (82–97.6%) in two previous studies in two samples of school and preschool children from urban and rural Greek regions (Gessouli *et al.*, 2004; Roupa *et al.*, 2005) compared to the results of the current research, which did not reach the goal of the WHO (90%).

However, the coverage rates for the DTP vaccine were higher in the present research (74.6%) compared to the findings of another study, where the relevant rate was 44.6% (Iordanou *et al.*, 2006). The rate for the HBV vaccine was moderate (65.7%) despite that it is highly recommended for nursing students, as hepatitis B is a well-recognized work-related risk. In similar research, 90.8% of senior dental students from Brazil (de Souza *et al.*, 2006), 69.6% of Thai

medical students (Tchassathit *et al.*, 2005), 42.2% of Lahore medical students (Nasir *et al.*, 2000), and 19.1% of university students have been vaccinated for hepatitis B (Ganguly & Banerji, 2000). According to the findings of a recent study that was conducted in six big Greek hospitals (Noula *et al.*, 2001; 2002a,b), HBV vaccination coverage in nursing personnel was low (56.2%). There is an urgent need to promote immunization against hepatitis B among nursing personnel, as well as to inform nursing students about the benefits of the HBV vaccine. Recently, the HBV vaccine has been introduced to the National Immunization Program and has resulted in the increase of HBV vaccination coverage, reaching 74% according to a recent study (Gavana *et al.*, 2005). This is evidence of parents' awareness of the HBV vaccine's benefits, which could be attributed to the mass media campaign. Vaccination coverage must be continuously monitored to allow further evaluation of preventive services and interventions and to overcome the barriers of vaccination uptake (Bonu *et al.*, 2003). The immunization coverage level for polio was 59.6%, failing to reach the WHO goal.

A leading reason for the lack of vaccination reported from the participants was their negligence. It has to be stressed that the majority of vaccines are performed prior to the age of 6 years old and, thus, the parents are responsible for the follow-up of the immunization schedule. In a relevant study, 45.9% of the parents claimed that they had neglected to proceed with their children's vaccination schedule (Gessouli *et al.*, 2003). Focused health education programs incorporated in a national campaign to sensitize and educate nursing students and parents towards vaccination are needed to increase the uptake of vaccination. As 40.2% of the nursing students rated the information on vaccination as insufficient, they recommended more information by using leaflets and home visits (Smith *et al.*, 1994; Gessouli *et al.*, 2003). The students in their senior years were more knowledgeable about the primary prevention of vaccine-preventable diseases (Bedford & Elliman, 2000; Gavana *et al.*, 2005).

In summary, the vaccination coverage of the nursing students is low, as it is below the 90% WHO goal. There is growing concern that progress on expanding immunization coverage has leveled off. In recent years, an antivaccination movement has started in developed countries because people believe that vaccination not only is no longer necessary, but it is also dangerous (Raftopoulos, 2007). These barriers need to be overcome and the benefits of vaccination need to be promoted, as vaccination is linked with a low prevalence of vaccine-preventable diseases (Valasi-Adam *et al.*, 1995; Antona *et al.*, 2003; Muscat *et al.*, 2003; Gavana *et al.*, 2005).

The new immunization strategy should focus on: (i) the empowerment of parents to keep their children vaccinated; (ii) the expansion of primary health-care services; (iii) the ongoing education of health-care workers in order to promote the new vaccination strategy; (iv) the systematic surveillance of vaccine-preventable diseases; and (v) the evaluation of current and future interventions. Nursing students are in a position to promote universal vaccination and to deliver effective, preventive health care through intervention at many levels, under the assumption that they are convinced of the effectiveness of vaccines. Nursing students need

to be offered more sensitization and support regarding the prevention of hepatitis B infection, including vaccination and the use of universal precautions for infection control.

### Limitations of the study

There are some limitations in the study's design. The students were asked to report their vaccination history by copying their health book. Furthermore, we did not examine the students' immunoglobulin G antibody titers to the measles, rubella, varicella, mumps, and hepatitis B viruses to determine whether vaccination was required. An implication for further research could be the voluntary screening of nursing students for antibodies to investigate their immune response to the vaccination and more focused research on the motives and barriers regarding students' vaccination.

### CONCLUSION

Routine screening of nursing students is recommended as a preventive measure, combined with appropriate educational programs to upgrade the level of their knowledge of immunization, for nursing students and their future patients.

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