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## RESEARCH ARTICLE

### A Cross-sectional Serological Study for Measles among Italian Medical Students in 2020

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#### Abstract:

##### Background:

Measles is an infectious disease and a major health concern worldwide. Among individuals with a higher risk of exposure to measles, there are the Health Care Workers (HCWs), who may transmit the virus to other people. According to the Italian National Plan for Immunization and Prevention, all HCWs should have presumptive evidence of immunity to measles (documented two doses of MMR vaccination) or serological evidence of protective antibodies.

##### Aim:

The study aims to evaluate the immunological status, the vaccine coverage, and the protective IgG antibody titre for measles in medical students of the teaching hospital PoliclinicoTor Vergata (PTV).

##### Methods:

IgG measles antibodies titre was evaluated in a sample of 461 medical students undergoing annual health surveillance visits from January 1<sup>st</sup> to May 31<sup>th</sup>, 2020.

##### Results:

73.7% of medical students showed protective measles IgG antibody levels. The immunization rate was higher among subjects aged less than 25 years with respect to students aged over 25 years (77.4% vs. 66.4%;  $P < 0,001$ ). Furthermore, average antibody titre showed a statistically significant association with the age group (124,2 AU/ml for the age group 18-25 and 133,2 AU/ml among subjects aged 25 or more;  $P < 0,001$ ).

##### Conclusion:

Our study shows a non-protective measles IgG antibody titre, especially among the older students. Therefore, it is essential to evaluate the serological levels, to vaccinate those subjects whose antibody level is not adequate, and promote the vaccination even in the general population.

**Keywords:** Occupational epidemiology, Infection, Health care workers, Measles, Medical students, Antibodies.

#### Article History

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## 1. INTRODUCTION

Measles is an infectious disease as it is a member of the genus morbillivirus in the Paramyxoviridae family. It is a major health concern globally, especially in the under-developed countries [1], but it is preventable with a specific vaccine. Although there are many measles infections, the vac-

cine is effective, and the World Health Organization (WHO) promoted a plan to eliminate measles and rubella infections worldwide [2 - 5]. According to WHO, vaccine coverage recommended to reach herd immunity and to prevent measles circulation among the target population is at least 95% [2].

In Italy, in 2017, the immunization coverage was 85%. The measles diagnoses were about 4000, so the Italian government decided a mandatory vaccination of new-born and pre scholar children with a trivalent vaccine (measles-mumps-rubella) [6].

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Among individuals with a higher risk of exposure to measles, there are the Health Care Workers (HCWs) that, as reported in many studies, have a risk 13 times higher than the general population [1]. For example, in Italy, between 2017 and 2019, a large percentage of measles cases occurred among unvaccinated or incompletely vaccinated subjects, including HCWs [7 - 10].

Since affected patients can transmit measles also during the incubation or prodromal phase of the virus, prompt identification and isolation of measles cases is crucial but could not be effective in preventing hospital outbreaks. In order to avoid the nosocomial transmission of the virus, it is necessary to reach optimal vaccination coverage among susceptible subjects. According to the Italian National Plan for Immunization and Prevention [6], all HCWs should have presumptive evidence of immunity to measles (documented two doses of MMR vaccination) or serological evidence of protective antibodies.

If, after the evaluation of the immunological status, those operators are not protected, the occupational medicine specialists have to recommend the vaccination.

MMR vaccination contemplates the administration of 2 doses, spaced a month, to provide an effectiveness of 99% [11] and long-lasting immunity, as well as for other vaccines preventable disease [12, 13]. Unfortunately, a large proportion of the HCWs have a non-protective antibody titre [14 - 19].

The aim of our study is to evaluate the immunological status, the vaccine coverage, and the protective IgG antibody titre for measles in medical students of the teaching hospital PoliclinicoTor Vergata (PTV).

**2. METHODS**

We evaluated age, gender and IgG measles antibodies titre in a sample of medical students undergoing annual health surveillance visits from January 1st to May 31th, 2020.

Measles-specific IgG antibodies were detected by means of the LIAISON® Measles IgG assay that uses Chemiluminescence Immunoassay (CLIA) technology: a semiquantitative evaluation of specific IgG antibodies was obtained. Serum IgG values higher than 16.5 AU/ml were considered protective according to the actual evidences [20]. All values of measles-specific IgG antibodies were collected in a Microsoft Excel worksheet.

We included in the study of medical students (both clinical and preclinical). We excluded from the study individuals with incomplete serological data or testing positive for measles-specific IgM antibodies.

Since the year of the introduction of the National Immunization Plan that extends the general vaccination for measles to the new-born population was 1995 in Italy, we divided the population into two groups: group 1 from 18 to 25 years old, and group 2 over 25 years old.

We compare the mean values of IgG specific antibodies of the protected students between the age group through multivariate analysis. Statistical analysis was performed using SPSS software (release 24). P values <0.01 were considered significant in our study.

The study was approved by the Ethical Committee for Research in Human Subjects of the Hospital (approval n.132/18).

**3. RESULTS**

We evaluated the clinical records of 461 medical students (171 males and 290 females). The median age was 24 years (range: 18-30); 306 students were in the 18-25 years old group (112 male, 194 female) and 155 were older than 25 years (59 male, 96 female).

We found that 340 students (73.7%) showed protective measles IgG antibody values. Immune subjects in the age group 18-25 years were 77.4% of the sample, whereas, among subjects aged over 25 years, 66.4% showed protective measles IgG levels (P <0,001). The main findings are reported in Table 1.

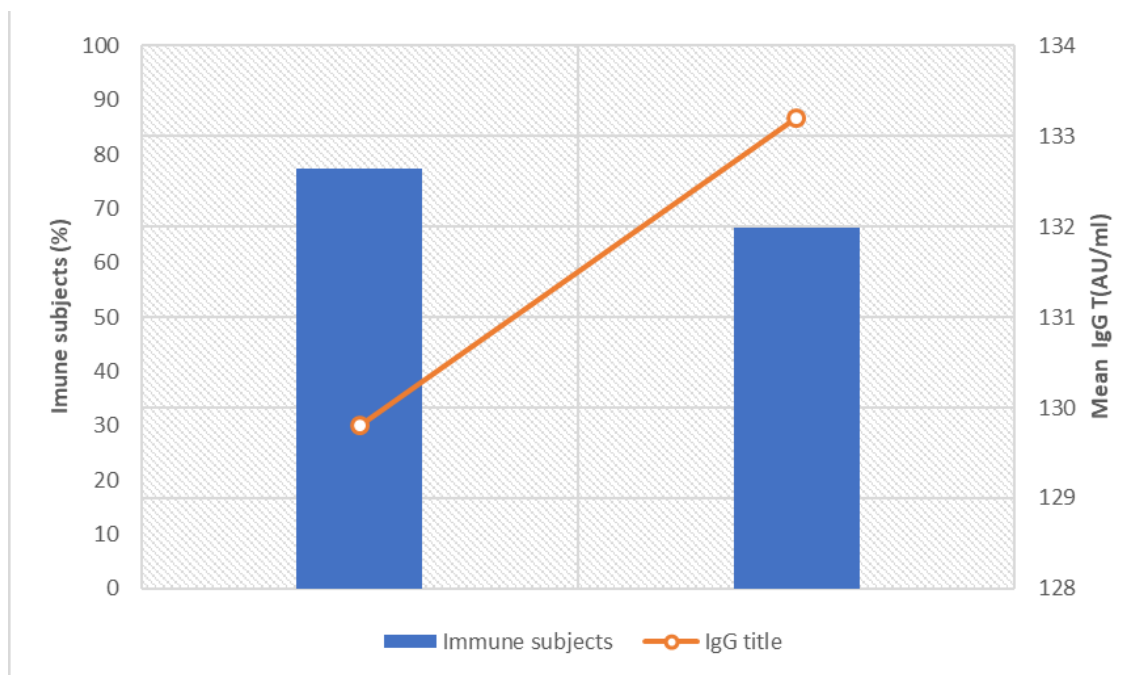
Average antibody titre was 129.8 AU/ml, and we found no significant difference between male and female gender (133,8 vs. 127,4 AU/ml respectively; p=N.S.), whereas a statistically significant association between measles IgG level and age was detected (mean titre was 124,2 AU/ml for the age group 18-25 and 133,2 AU/ml among subjects aged 25 or more; P<0.001) (Fig. 1).

**4. DISCUSSION**

Our study aimed to evaluate the percentage of protection against measles in medical students of the University of Rome Tor Vergata, after the introduction of the national immunization plan in Italy.

**Table 1. Immunization rate in HCWs age class according to sex, year 2019.**

		Age group					
		18-25 years			>25 years		
		Total	Number immune	Percentage immune (95% C.I.)	Total	Number immune	Percentage immune (95% C.I.)
Sex	Female	194	151	77,8 (71,3 – 83,5)	96	64	66,6 (56,3 – 76,0)
	Male	112	86	76,7 (67,9 – 84,2)	59	39	66,1 (52,6 – 77,9)
Total		306	237	77,4 (72,3 – 82,0)	155	103	66,4 (58,4 – 73,8)



**Fig. (1).** Immune subjects (%) and IgG titre (AU/ml) per age group.

We found a high proportion of unprotected employed among young health-care operators, mainly in subjects aged 25 years or more: about 1/3 of these operators showed non-protective measles IgG titre. The WHO asserts that 95% is the rate necessary to prevent the measles spread among susceptible people, but in Italy, the vaccination coverage was under 50% when those subjects were born [21, 22].

Due to their kind of job, susceptible HCWs carries an increased risk of exposure to measles, and they can transmit the infection to their parents and patients.

Due to the Italian historical vaccine coverage, we can suppose that younger operators were more frequently vaccinated than the older ones. In previous studies, a similar rate of serological protection and a paradoxical higher risk of infection among young adults in comparison to other age groups were found [14, 17, 19, 23].

Our data raise a question about the need for a compulsory vaccination among Italian HCWs, mostly in those aged 25-30 years.

Given the inadequate vaccination coverage in Italy and the circulation of the measles virus [7, 8], we recommend the vaccination in childhood, according to the vaccine schedule, the serological evaluation and possible vaccination for HCWs who do not report this kind of vaccination or have non-protective antibody titre [23, 24]. This strategy resulted in highly cost-effective and cost-saving in previous studies [14, 25, 26].

The limitations of our study were that we did not consider the different exposure risks according to the various hospital wards, and we do not have records of the previous vaccinations.

## CONCLUSION

As our study points out a non-protective measles IgG antibody titre especially among the older operators, it is highly important to evaluate the serological levels, vaccinate subjects whose antibody level is not adequate and promote the vaccination even in the general population, and increase the vaccine coverage and reduce complications of measles (like pneumomonia, laryngitis, bronchitis, otitis media, conjunctivitis, diarrhea and vomiting).

## ETHICS APPROVAL AND CONSENT TO PARTICIPATE

The study was approved by the Ethical Committee for Research in Human Subjects of the Hospital, Italy (approval no. 132/18).

## HUMAN AND ANIMAL RIGHTS

Not applicable.

## CONSENT FOR PUBLICATION

All patients participated on a voluntary basis and gave their informed consent.

## AVAILABILITY OF DATA AND MATERIALS

Not applicable.

## FUNDING

None.

## CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

## ACKNOWLEDGEMENTS

Declared none.

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