

Surveillance of infectious diseases in the Italian military as pre-requisite for tailored vaccination programme

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Abstract

Surveillance and control of infectious diseases in the Italian military include prompt reporting of all occurring cases and prophylaxis through compulsory vaccination practices. The last mandatory immunisation programme in the Italian military was launched in 1998 (more than 10 years after the previous programme was introduced in 1986–1987) and it was planned according to the epidemiological data herein reported. The incidence rates (number of cases \times 100 000 subjects) of infectious diseases notified during the period 1976–1980 were compared with the corresponding figures notified 15 years later (1991–1995). An increase of three airborne-transmitted viral diseases — varicella, rubella and measles — counterbalanced by a decrease of other infectious diseases, such as mumps, typhoid fever, tuberculosis, viral hepatitis, scabies, syphilis and gonorrhoea, was observed. This may be related to improvements in the general hygienic conditions and more responsible sexual behaviour among Italian military recruits. Moreover, incidence rates of cases notified in the military were compared with those notified in the general population of the same sex- and similar age-range (15–24 years) over a 12-year period (1986–1997), to monitor the epidemiological situation in relation to (a) potential risk factors specifically linked to military life and (b) protective effects induced by specific vaccinations. Airborne-transmitted viral diseases, such as varicella, rubella, measles and mumps — which are usually underreported among civilians — show higher incidence rates in the military. Meningococcal meningitis shows higher incidence rates in the military in 1986 and 1987 (before the introduction of mandatory specific vaccination) as well as in 1995–1997 (main etiologic agent *N. meningitidis* serogroup B); similar rates were instead observed in the other years. Incidence rates for typhoid fever are generally lower in the military, despite the community life, probably reflecting the protective efficacy of specific vaccine. Hepatitis A and B show similar rates between military and civilian population. Finally, pulmonary tuberculosis generally shows higher rates in the military. These data therefore allow the conclusion that the only infectious diseases, for which possible risk factors in the military life may be hypothesised, seem to be meningococcal meningitis and perhaps pulmonary tuberculosis. Epidemiological surveillance of infectious diseases in the military as a pre-requisite for appropriate public health intervention strategy represents a good model to be followed also in larger contexts. © 2001 Published by Elsevier Science Ltd.

Keywords: Infection; Vaccine; Military

1. Introduction

Infectious diseases pose a special threat to military personnel, among whom they occur more frequently for reasons such as community life, exposure to extreme

temperatures, high mobility, often hostile environmental conditions and risk behaviour regarding blood- and sexually-transmitted diseases. Infectious diseases, once spread, interfere heavily with operational activity, thus impairing readiness. Therefore, armies all around the world long ago implemented a means of prevention and control of infections. On the other hand, the military may provide interesting insights in the epidemiological trend of infectious diseases and preventive strategies in a given country.

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Incidence rates of some infectious diseases notified in the military in two 5-year periods, 15 years apart (1976–1980 vs. 1991–1995) were compared in order to identify current infectious emergencies. Moreover, comparison of the incidence rates of some vaccine-preventable infectious diseases in the Italian military with the corresponding figures in the general population of the same sex- and similar age-range (15–24 years) over a 12-year period (1986–1997), represents: (a) a suitable tool to check the effects of the mandatory vaccination programme for military recruits introduced in 1986–1987; and (b) a necessary pre-requisite for planning a new preventive vaccination strategy. Based on the data from the above-reported analysis, in fact, the new mandatory vaccination programme for the military has been tailored in Italy and launched in 1998. Moreover, this analysis may allow the identification of possible risk factors for infectious diseases specifically linked to the military life.

2. Materials and methods

Military service is compulsory in Italy. Each year $\approx 200\,000$ recruits are enrolled in the Army, Navy and Air Force. The incidence data, based on notification of cases of infectious diseases from the different peripheral military units, are directly collected at central level.

Diagnostic criteria for the infectious diseases in this study are as follows:

- varicella, measles, mumps and rubella: generally only clinical;
- meningococcal meningitis: clinical, microscopic and serological/cultural;
- pulmonary tuberculosis: clinical, radiographic and possibly microscopic;
- hepatitis A and B: clinical and serological;

- typhoid fever: clinical, serological and cultural.

All notified cases were included in a file and number and type of diseases notified during 1976–1980 and those notified during 1991–1995 were compared. The methods used for diagnosing and reporting the infections in the two reporting periods were the same.

Another comparative study was conducted using homologous data reported for the Italian male population, age-range 15–24 years. This study covered the 12-year period 1986–1997 (1987–1997 for viral hepatitis A and B) and concerned notifications of infectious diseases occurring among civilians reported to the Ministry of Health, Department of Prevention, Bureau of Infectious Diseases and published in 'Bollettino Epidemiologico'. Methods used in the civilian and military sector to diagnose the infections were similar.

3. Results

Incidence rates (number of cases of infectious diseases notified in the military $\times 100\,000$ subjects during the 5-year period 1976–1980 as compared with the 5-year period 1991–1995) show a dramatic increase in three airborne-transmitted viral diseases: varicella, rubella and measles. Other infectious diseases, including mumps, typhoid fever, tuberculosis, viral hepatitis, but mainly scabies, syphilis and gonorrhea, showed a marked decrease (Fig. 1). In particular, varicella and rubella registered a fourfold increase, whereas measles a tenfold increase. By contrast, other infectious diseases showed nearly a threefold decrease.

The comparison of the incidence rates $\times 100\,000$ subjects of some vaccine-preventable diseases — namely varicella, rubella, measles, mumps, hepatitis A and B, pulmonary tuberculosis, meningococcal meningitis and typhoid fever — during 1986–1997 in the military,

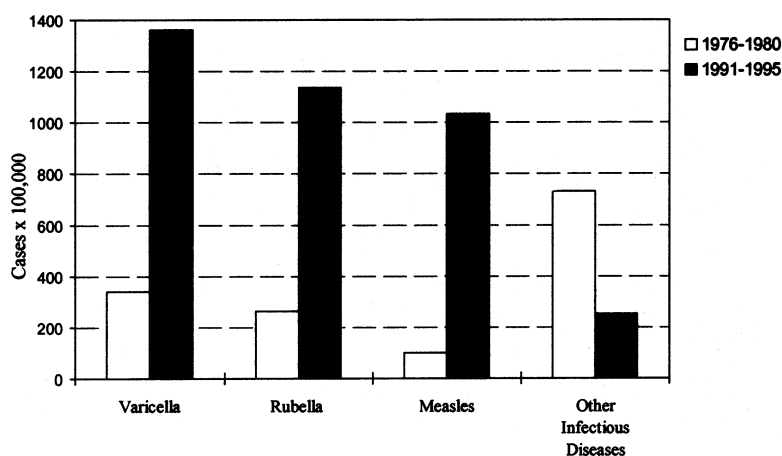


Fig. 1. Incidence rates (cases $\times 100\,000$) of varicella, rubella, measles and other (mumps, typhoid fever, tuberculosis, viral hepatitis, scabies, syphilis and gonorrhea) infectious diseases in Italian recruits from Army, Navy and Air Force in the period 1976–1980 compared to the period 1991–1995.

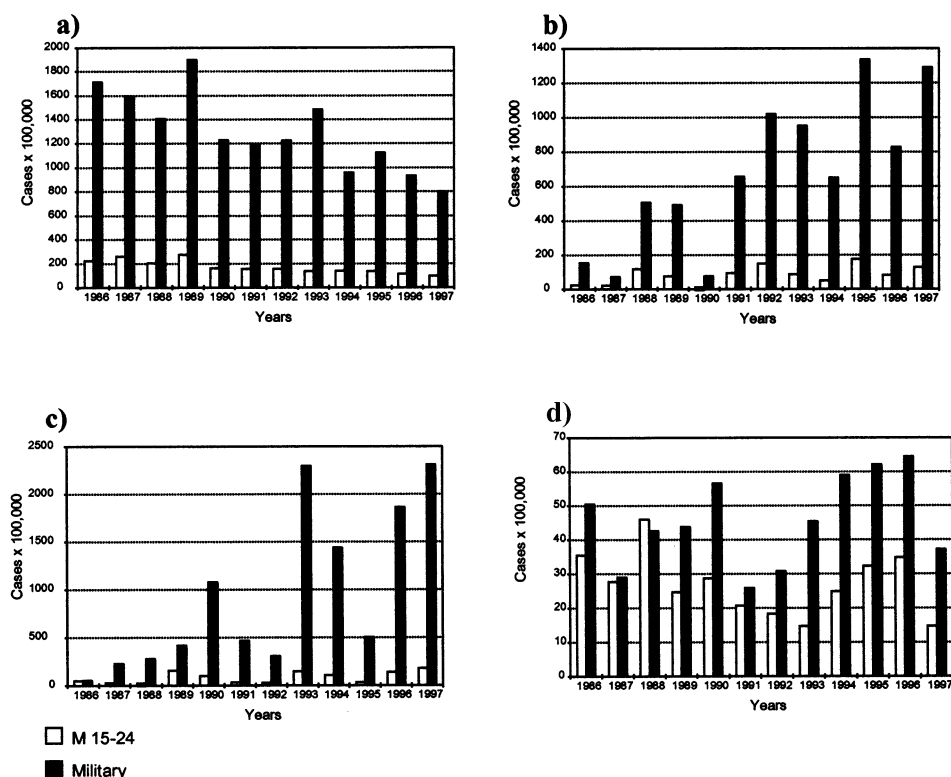


Fig. 2. Incidence rates (cases × 100 000) in Italian recruits from Army, Navy and Air Force (Military) compared to the Italian male population of 15–24 years (M 15–24) during the period 1986–1997. (a) Varicella; (b) measles; (c) rubella; and (d) mumps.

with the corresponding figures in the civilian population of male sex and similar age-range (15–24 years) yields interesting results. Varicella, rubella, measles and mumps (this last at lower level) have, in the large majority of the considered years, higher rates in the military (Fig. 2a–d). Pulmonary tuberculosis always shows higher rates in the military (Fig. 3). Hepatitis viral infections A and B show similar rates between the

two populations, even if to a lesser extent for hepatitis B (Fig. 4a,b). Meningococcal meningitis shows similar rates since 1988 (after the introduction in 1986–1987 of compulsory vaccination for recruits), whereas in 1986 and 1987 and 1995–1997, the rates are higher in the military (Fig. 5). Finally, the incidence rate of typhoid fever among civilians is much higher until 1988, but only slightly higher after this year (Fig. 6).

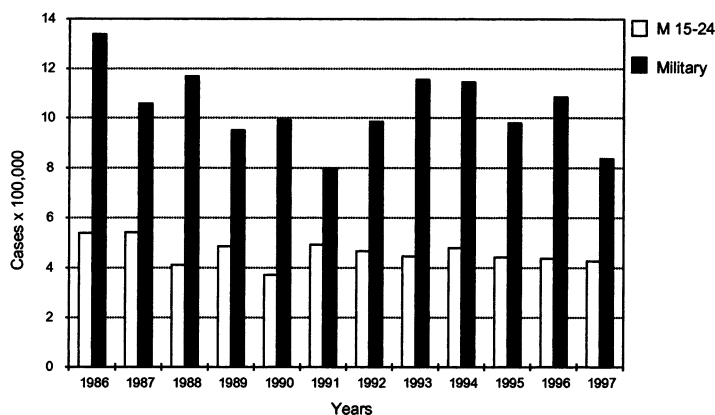


Fig. 3. Pulmonary tuberculosis. Incidence rates (cases × 100 000) in Italian recruits from Army, Navy and Air Force (Military) compared to the Italian male population of 15–24 years (M 15–24) during the period 1986–1997.

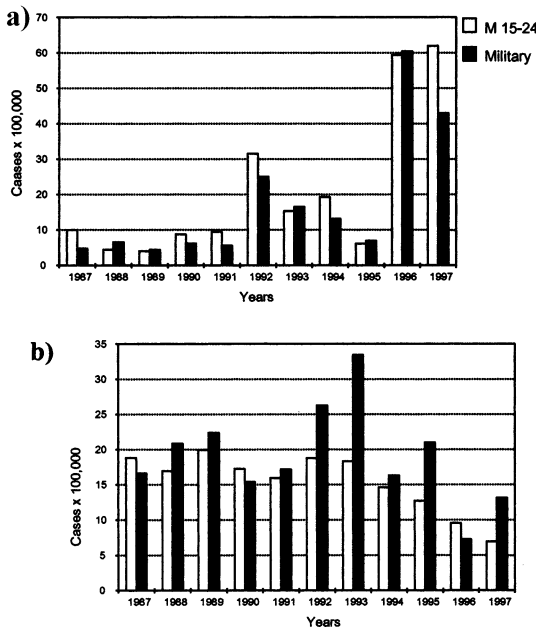


Fig. 4. Incidence rates (cases \times 100 000) in Italian recruits from Army, Navy and Air Force (Military) compared to the Italian male population of 15–24 years (M 15–24) during the period 1986–1997. (a) Viral hepatitis A; (b) viral hepatitis B.

4. Discussion

In the Italian military a new mandatory vaccination programme was launched on 1st April, 1998. This programme included trivalent anti-measles/mumps/rubella vaccine, a booster of tetanus (already present in the previous programme) and diphtheria toxoids, meningococcal polysaccharides A, C, Y, W135 (already present in the previous programme), oral typhoid vaccine (already present in the previous programme) and anti-hepatitis A and B, but only for permanent staff. Skin-unreactive applicants for military service should be vaccinated with BCG by national civilian health service. The analysis of infectious diseases notified until

the end of 1997 enabled the checking of the effects of the previous vaccination programme, which was introduced in 1986–1987. Moreover, it represents the framework on which the new mandatory immunisation programme has been tailored.

Retrospective analysis performed on the number and types of infectious diseases notified in the military during two time periods 15 years apart indicates a general reduction of all infections, with the exception of three exanthematous diseases — varicella, rubella and measles — which dramatically increased. The reduction of sexually transmitted diseases, e.g. syphilis and gonorrhea, is probably related to more responsible sexual behaviour of young Italian males. This is further supported by the low number of human immunodeficiency virus (HIV) infections notified in the military, the progressive reduction of hepatitis B virus (HBV)-positive recruits [1,2] and the low percentage of hepatitis C virus (HCV)-infected recruits [3]. The dramatic increase of varicella, rubella and measles is probably the result of a shift towards older ages, due to — at least for rubella and measles — incomplete vaccine coverage among children, which does not allow reaching herd immunity. Measles vaccine coverage in Italy for children aged 12–24 months ranged in fact $\approx 50\%$ in 1997–1998 [4]. The recent introduction in the new mandatory vaccination programme for the Italian military of the trivalent vaccination against measles, mumps and rubella has already heavily modified the epidemiological picture [5]. With regard to varicella, which currently still represents the most frequent infection in the Italian military recruits, even if with a declining pattern of incidence rates (Fig. 2a), the vaccine has been recently licensed, not only for the immunodepressed, but also for healthy people. The Italian military health authorities are therefore evaluating a cost–benefit analysis of introducing this vaccination into the compulsory vaccination programme.

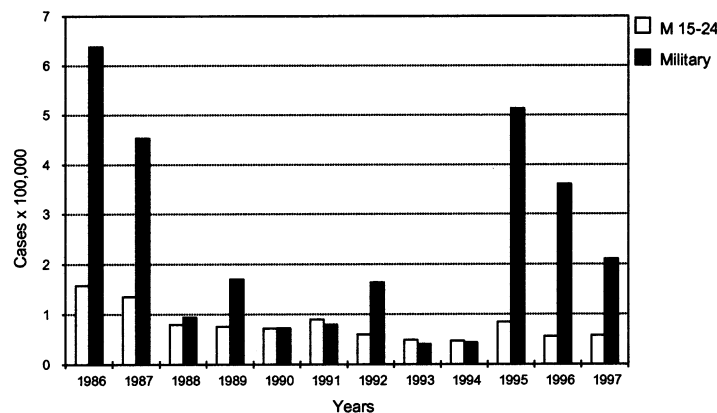


Fig. 5. Meningococcal meningitis. Incidence rates (cases \times 100 000) in Italian recruits from Army, Navy and Air Force (Military) compared to the Italian male population of 15–24 years (M 15–24) during the period 1986–1997.

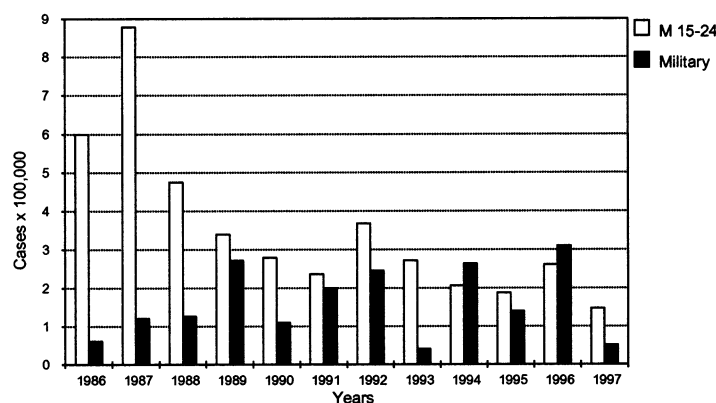


Fig. 6. Typhoid fever. Incidence rates (cases \times 100 000) in Italian recruits from Army, Navy and Air Force (Military) compared to the Italian male population of 15–24 years (M 15–24) during the period 1986–1997.

The incidence rates of varicella, rubella and measles were much higher in the military than in the age- and sex-matched general population. This is probably due to the fact that these three diseases are largely underreported among civilians [6,7].

Pulmonary tuberculosis has higher rates in the military than in the civilian population. Since undernotification may be excluded for this severe disease, the higher levels observed in the military may be interpreted as a consequence of community life, sometimes with overcrowding. However, since $\approx 50\%$ of cases in the military are diagnosed within the first 30 days after enrolment, many cases may be due to exposure that occurred during civil life, if the long incubation period of tuberculosis is considered. The protein-purified-derivative (PPD) skin unreactive Italian military recruits should be vaccinated with *Bacillus Calmette–Guérin* (BCG), but the World Health Organization (WHO) data on the vaccine efficacy, ranging from 0 to 80% [8], together with the demonstrated vaccine efficacy in children but not in adults, cast some doubts on the protective effect of such a measure. Pending the development of a new, more effective and safe vaccine, the only preventive strategy is based on a careful screening at the time of recruitment and on periodical checks, together with the constant improvement of environmental hygienic conditions. However, PPD-skin-reactivity in the Italian military recruits is currently low, $\approx 5\%$ [9].

Hepatitis A and B incidence rates are very similar to those observed in the civilian population. Noteworthy is the dramatic increase of notified cases of hepatitis A in 1996 and 1997 (Fig. 4a). Because the rate of notification among the two population groups is similar, hepatitis cases in the military can indeed be considered as the expression of virus circulation in the general population. The military, in fact, has been periodically analysed in cross-sectional and incidence studies as

sentinel population to extrapolate data to the general population [1–3,10,11], or to identify risk factors for infectious diseases [12].

Recruits from all over the world are particularly prone to developing meningococcal meningitis. In Italy, the epidemiological situation in the first half of the 1980's was very disturbing, with incidence rates in the military ten times higher than in age- and sex-matched civilians [13]. After the introduction of the compulsory vaccination for recruits in 1986–1987 (formerly the bivalent, since 1991 the tetravalent polysaccharide vaccine) a dramatic decrease in cases has been observed, with incidence rates similar to the figures observed in the civilian population [13]. In 1995–1997 again a significantly higher rate was observed in the military, with the majority of cases due to meningococcal serogroup B, against which no effective vaccine is available. The increase of meningococcal meningitis due to serogroup B in the military tends to abolish the protective effect of specific vaccination and confirms the military life as a specific risk factor for the onset of this disease.

Typhoid fever presents incidence rates comparable, but generally lower, to those observed in civilians. The military, in fact, has been systematically vaccinated since World War I, formerly with a killed polyvalent parenteral vaccine, but since 1986/1987, with a safe and effective live oral vaccine [14].

In conclusion, as far as meningococcal meningitis and perhaps pulmonary tuberculosis are concerned, risk factors specifically linked to the military life may be hypothesised. Epidemiological surveillance of infectious diseases represents a suitable tool for checking and planning public health intervention strategies. This model, currently present in the majority of military health services, may significantly contribute to the fight against infectious diseases at global level, as recently recognised and shown by the WHO [15].

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