

## Vaccination campaign against meningococcal disease in army recruits in Italy

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### SUMMARY

A high attack rate (17·3/100 000) of meningococcal disease in army recruits in Italy, with 95% of the cases due to serogroup C, constituted the motivating factors to make bivalent serogroup A + C meningococcal vaccination compulsory by law for army recruits starting January 1987. Because the vaccine was given only to the new recruits entering the army, full coverage was not achieved until January 1988. Nearly 900 000 subjects (300 000 yearly) were vaccinated between January 1987 and December 1989. There were no reports of any untoward reactions to the vaccine. Of the 300 000 recruits in service each year, 52, 21, 15, 5 and 4 cases of the disease occurred in 1985, 1986, 1987, 1988 and 1989, respectively ( $P < 0\cdot001$ ).

Of the 24 cases occurring since the start of the vaccination, only two (due to serogroup C) were attributable to vaccine failure. The remaining cases were in unvaccinated recruits (15 cases) or were due to serogroups other than A or C (7 cases). The cumulative incidence of meningococcal serogroup C in the 600 000 vaccinated recruits during the period 1988–89 was 0·2/100 000 (1 case amongst 600 000 recruits), while the corresponding figure in the 600 000 unvaccinated recruits during the period 1985–6 was 11·3/100 000 (68 cases amongst 600 000 recruits) ( $P < 0\cdot001$ ). The protective efficacy of the vaccine in 1987 was 91·2% (12 cases of meningococcal serogroup A and C disease from an average of 150 000 unvaccinated recruits observed for 1 year, and 1 case from the corresponding average of 150 000 vaccinated ones). In 1988 and in 1989 this figure could not be calculated because all recruits were vaccinated.

The incidence of meningitis caused by other serogroups of meningococci remained low, both before and after the mass vaccination campaign.

### INTRODUCTION

Army recruits are generally a high risk group for meningococcal disease, with a reported incidence of four to ten times greater than that of the general population [1].

In Italy the results of the National Meningitis Surveillance Programme showed a high attack rate of the disease among recruits in 1985 as well as in 1986, with respectively 92% [2] and 95% [3] of the cases caused by serogroup C and thus

preventable. These findings constituted the motivating factors behind the authorities' decision to make vaccination against meningococcal disease compulsory by law for army recruits since January 1987.

Because the vaccine was given only to the new recruits entering the Army, full coverage was not achieved until January 1988. This paper describes the mass vaccination campaign and the possible effects that this might have had on the incidence of disease in recruits in Italy.

## MATERIALS AND METHODS

### *Recruits*

The military service in Italy is compulsory by law for young men when they reach 20 years old and lasts 1 year. New recruits enter or leave the Italian Army ten times a year, 1·2 months apart. The number of recruits entering or leaving the service differs month by month; however, the total number of recruits in service during 1 year is 300 000.

Since January 1987 new recruits have received meningococcal vaccine subcutaneously in the left arm 1 week after entry to service. At the same time vaccines against diphtheria and tetanus are administered in the right arm.

### *Vaccine*

The vaccine given was a single dose of 50 micrograms of a combined group A and group C meningococcal polysaccharide vaccine (Sclavo, Siena, Italy).

The medical staff of all garrisons report any serious side-effect immediately to the Medical Section of the Central Headquarters. All side-effects serious enough to cause relief from a day's duty were recorded in the diaries of the garrison clinics and in the vaccination reports.

### *Surveillance of meningococcal disease*

All recruits with suspected meningitis were referred to hospitals for evaluation and treatment. The strains of *Neisseria meningitidis* isolated from cases were serogrouped for the lipopolysaccharide using commercially prepared sera (groups A,B,C,D,X,Y,Z,W-135,29E) in the laboratories of the various hospitals to which recruits had been admitted.

Information about cases (vaccination status and meningococcal serogroup isolated) was compiled by means of a questionnaire prepared by the laboratory of Epidemiology of the Istituto Superiore Sanità.

The clinical cases reported included those from the entire population of army recruits.

## RESULTS

Nearly 900 000 recruits were vaccinated from January 1987 to December 1989 (300 000 yearly). However, because the vaccine was given only to the new recruits entering the service, the full coverage, with the accidental exception of a few hundred men, was not achieved until January 1988. During the first year of the campaign (1987) there was month by month an increasing number (from 0 on 1 January 1987 to 300 000 on 31 December 1987) of vaccinated recruits who entered

Table 1. Serogroups of meningococcal isolates from cases among the 300 000 Italian recruits yearly in service, by year, 1985-9

| Serogroup   | 1985 | 1986 | 1987 | 1988 | 1989 |
|-------------|------|------|------|------|------|
| A           | 0    | 0    | 1*   | 0    | 0    |
| B           | 2    | 1    | 2    | 1    | 2    |
| C           | 48   | 20   | 12†  | 2‡   | 1*   |
| Other       | 2    | 0    | 0    | 1    | 1    |
| Not grouped | 0    | 0    | 0    | 1*   | 0    |
| Total       | 52   | 21   | 15   | 5    | 4    |

\* Not vaccinated: 1987, because entered the army before the start of vaccination campaign; 1988, because of medical contraindication; 1989, for accidental reasons.

† 11 not vaccinated, because entered the army before the start of vaccination campaign.

‡ 1 not vaccinated, for medical contraindication.

Cases from 1985-9,  $P < 0.001$  by  $\chi^2$  for linear trend.

Cases in 1986 *v.* cases in 1989,  $P < 0.01$  by Fisher's exact test.

the service in that year and a decreasing one (from 300 000 on 1 January 1987 to 0 on 31 December 1987) of unvaccinated who had entered the service in 1986. Therefore it is estimated that during 1987 150 000 vaccinated recruits and 150 000 unvaccinated recruits were observed for an average of 1 year.

Of the 300 000 recruits in the service each year, 52, 21, 15, 5 and 4 cases of the disease occurred in 1985, 1986, 1987, 1988 and 1989 respectively ( $\chi^2$  for linear trend  $P < 0.001$ ) (Table 1). Clinical cases, both before and after the start of vaccination campaign, were reported from different barracks scattered throughout the country.

Only two (both serogroup C) of the 24 observed cases after the beginning of the vaccination campaign were attributable to vaccine failure. Both cases occurred nearly 2 months after immunization. Twelve cases (11 due to serogroup C and 1 due to serogroup A) occurred in unvaccinated recruits, because they had entered the Army in 1986, before the vaccination campaign started. Two cases (1 due to serogroup C and 1 culture negative) occurred in recruits not vaccinated for medical reasons (allergic diathesis). One case (serogroup C) was observed in a recruit who due to oversight had not been vaccinated. The remaining seven cases were not preventable because they were due to serogroups other than A or C (Table 1).

The cumulative incidence of meningococcal serogroup C in the 600 000 vaccinated recruits during the period 1988-9 was 0.2/100 000 (1 case out of 600 000 recruits), while the corresponding figure in the 600 000 unvaccinated recruits during the period 1985-6 was 11.3/100 000 (68 cases out of 600 000 recruits) ( $P < 0.001$ ).

The protective efficacy of the vaccine in 1987 was 91.2% (12 cases of meningococcal serogroup A and C from an average of 150 000 unvaccinated recruits during the year of observation, and 1 case of serogroup C from the corresponding average of 150 000 vaccinated ones) (Table 1). In 1988 and 1989, vaccine efficacy was not assessable because all recruits were vaccinated.

The incidence of meningitis caused by other serogroups of meningococci remained low, both before and after the start of the campaign (Table 1).

The attack rate of meningococcal disease in the Italian Armed Forces and in the general population from 1980-9 is shown in Fig. 1. The disease incidence in the

Table 2. *Protective efficacy of meningococcal (A + C) vaccine among Italian Army recruits in 1987*

| Vaccination status | Recruits years of observation | No. of A and C serogroup cases | Incidence/100 000 | Protective efficacy                   |
|--------------------|-------------------------------|--------------------------------|-------------------|---------------------------------------|
| Vaccinated         | 150 000                       | 1                              | 0.7               | $\frac{8-0.7}{8} \times 100 = 91.2\%$ |
| Unvaccinated       | 150 000                       | 12                             | 8                 |                                       |

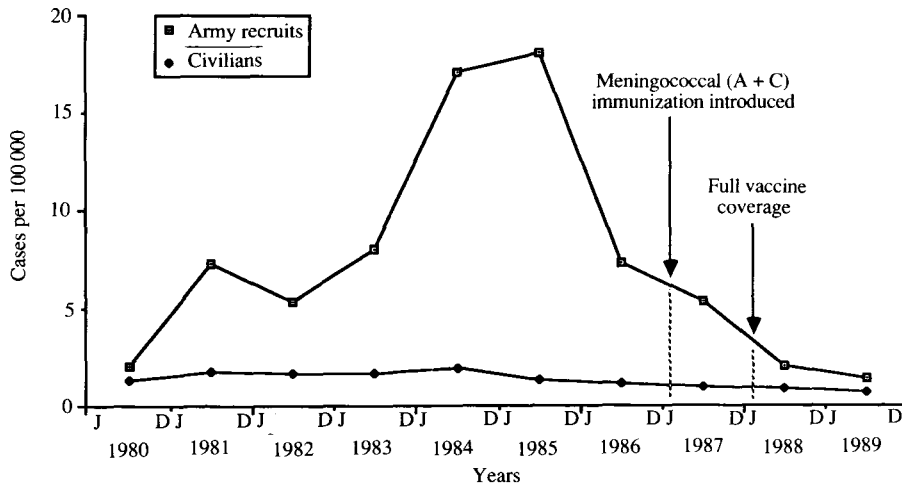


Fig. 1. Incidence (cases per 100 000 persons per year) of meningococcal disease in army recruits and in civilians in Italy, 1980–9.

civilians was low and stable by comparison with that in the armed forces. The major decline of meningococcal disease attack rate in recruits was observed during the period 1985–6 (from 17.3/100 000 to 7/100 000); however a further significant reduction was observed from 1986–9 (7/100 000 *v.* 1.3/100 000;  $P < 0.001$ ). Furthermore no statistically significant difference in the disease incidence between civilians and recruits was observed in 1989 (0.5/100 000 *v.* 1.3/100 000).

No untoward reactions to the vaccine were recorded.

#### DISCUSSION

It appears from the data given that there was an epidemic of serogroup C meningitis in army recruits in Italy over the period 1983–6. The epidemic was already declining in 1986, when vaccination was introduced, so it is difficult to assess the effect of the vaccination campaign.

Because of the cyclical pattern of epidemic of meningococcal meningitis it is too early to conclude that vaccination alone affected the further fall in the number of reported cases of the disease between 1987–9.

However, even with the limited data available so far, our field experience shows that, despite the major decline of disease incidence observed before the start of vaccination, there was a further significant ( $P < 0.001$ ) reduction after its

introduction. Furthermore in 1989 the disease incidence dropped to a level very close to that found in the general population, a situation similar to that in 1980, well before the introduction of vaccination. Finally, the protective efficacy of vaccine was very high (91.2%), with only two cases over the 3 years of the campaign attributable to the failure of the vaccine. It appears likely that fewer cases of meningococcal disease would have occurred in 1987 if the vaccine coverage had been as high as in 1988 and in 1989.

It has been suggested that vaccination with the present group-specific vaccines could result in epidemics caused by other groups of meningococci [4]. Such fears are unfounded; in fact vaccination with group A and C specific vaccines greatly reduced the incidence of meningococcal disease in the military in USA [5] and Finland [6], but nowhere has vaccination resulted in an increase in disease caused by other serogroups [7].

Our findings confirm these studies, however when the quadrivalent A,C,Y,W-135 vaccine becomes available, the broader spectrum of cover would be clearly advisable. We would emphasize that no firm conclusions can be drawn about the effects of vaccination at this stage. Final assessment will not be possible for several years. However, from the data provided, meningococcal vaccine appears to be a promising and very safe method to control the disease in Italian army recruits.

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#### REFERENCES

1. Peltola H. Meningococcal disease: Still With us. *Rev Infect Dis* 1983; **5**: 71–91.
2. Stroffolini T, Rosmini F, Curianò CM. A one year survey of meningococcal disease in Italy. *Eur J Epidemiol* 1987; **3**: 399–403.
3. Stroffolini T, Curianò CM, Congiu ME, Occhionero M, Mastrantonio P. Trends in meningococcal disease in Italy in 1986. *Public Health* 1988; **102**: 115–9.
4. Nikoskelaiven J, Leino A, Toivanen A. Is group specific meningococcal vaccination resulting in epidemics caused by other groups of virulent meningococci? *Lancet* 1978; ii: 403–5.
5. Artenstein NS, Winter PE, Gold R, Smith CD. Immunoprophylaxis of meningococcal infection. *Militar Med* 1974; **139**: 91–5.
6. Makela PH, Kayhty H, Weckstrom P, Sivonen A. Effect of Group A meningococcal vaccine in army recruits in Finland. *Lancet* 1985; ii: 883–6.
7. Makela PH, Peltola H. Group specific meningococcal vaccination and epidemics caused by other groups of meningococci. *Lancet* 1978; ii: 780–1.