SHORT ARTICLE

Prevention of invasive diseases: strategies to increase vaccination coverage in children and adolescents

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Key words

Invasive bacterial diseases • Immunization policies • *Neisseria meningitidis*

Summary

Introduction. *Vaccines able to prevent invasive bacterial diseases have been introduced into national and/or regional immunization plans through different strategies. We evaluated Haemophilus influenzae type b, Pneumococcus and Meningococcus C vaccination coverage in the 5 Ligurian Local Health Agencies, in the Liguria Region, and in Italy in order to assess the efficacy of current immunisation policies concerning children at the 24th month and adolescents. Furthermore, we considered new strategies for increasing vaccination coverage.*
Materials and methods. *We estimated the vaccination coverage of Local Health Agency 4 by means of the "OASIS" software. The regional mean vaccination coverage was calculated from the data provided by the other four Local Health Agencies in Liguria. National data were obtained from the database of the Ministry of Health and from the last report of the ICONA Working Group.*
We used a questionnaire to evaluate the knowledge of Meningococcus C vaccination among the pediatricians and general practitioners operating in our Local Health Agency.
Results. *The regional vaccination coverage at the 24th month proved to be: > 95% for Haemophilus influenzae type b, 93% for Pneumococcus and 87% for Meningococcus C. The national mean is: >95% for Haemophilus influenza type b, 55% for Pneumococcus and 37% for Meningococcus C. Meningococcus C vaccination coverage among adolescents is 49% in Liguria, while the national mean is 16%.*
The questionnaire administered to the physicians was composed of 5 questions, which were answered by 81% of pediatricians and only 22% of general practitioners. Reducing the incidence of invasive meningococcal diseases through large-scale vaccination was deemed very important by 92% of pediatricians and 81% of general practitioners. About 92% of pediatricians and 85% of general practitioners considered the vaccine safe and effective. All (100%) physicians expressed their agreement with the Ligurian immunization strategy. However, while all the pediatricians reported recommending this vaccination, only 76% of general practitioners did so. Finally, all the physicians interviewed stated their willingness to collaborate with the Department of Prevention to increase vaccination coverage.
Discussion. *VC against Hib at the 24th month, in both Liguria and Italy, proved excellent. Compliance with vaccination against Pneumococcus has been very high since its introduction in 2003 in Liguria, while the national mean is suboptimal. The regional vaccination coverage against Meningococcus C at the 24th month is good; the national value, however, is low because some Italian Regions have not yet introduced this vaccination into their immunization plans. Vaccination coverage in adolescents varies widely among the Ligurian Local Health Agencies and needs to be increased; the national figure is very low because few Regions have introduced this vaccination. However, achieving compliance with vaccinations in adolescents is difficult.*
The questionnaire indicated that general practitioners place less emphasis on vaccinations than pediatricians. Nevertheless, both general practitioners and pediatricians expressed their willingness to collaborate with the Department of Prevention of Local Health Agency 4 in improving the immunization strategies aimed at adolescents.
Conclusions. *In conclusion, we consider it very important to create a network involving the Department of Prevention, pediatricians and general practitioners, in order to share the best immunization strategies.*

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Introduction

Many vaccines to prevent invasive bacterial diseases caused by *Haemophilus influenzae* type b (Hib), *Streptococcus pneumoniae* and *Neisseria meningitidis* have been introduced into national and/or regional immunization plans [1, 2]. In Italy, according to the 1999-2000 National Immunization Program (NIP) [3], vaccination against Hib is recommended for newborns during the 3rd month, followed by two further doses at the 5th and 11th months, respectively. A hexavalent combined vaccine against diphtheria, tetanus, pertussis, poliomyelitis, Hib and hepatitis B is now available. Vaccinations against Pneumococcus and *Neisseria meningitidis* were recommended at the national level in the NIP 2005-2007 [4] for at-risk groups. In accordance with the various regional vaccination policies, they are also offered to other targets. In the Ligurian schedule [5], vaccination against *Streptococcus pneumoniae* is recommended at the same age as Hib, and today we use a 13-valent conjugate vaccine (PCV13). Vaccination against *Neisseria meningitidis* is actively offered for 13-month-old infants and adolescents (15-16 years old); we usually offer a Meningococcal C conjugate (MenC) vaccine [6]. Only the National Immunization Prevention Plan 2012-2014, published in March 2012, recommends universal vaccination against Pneumococcus and Meningococcus C [7].

We evaluated the vaccination coverage (VC) against the pathogens that cause invasive diseases in the 5 Ligurian Local Health Agencies (LHA), in the Liguria Region and in Italy, in order to verify the effectiveness of current immunisation policies concerning children at the 24th month and adolescents (15-16 years old). We also calculated the VC against diphtheria, tetanus (and pertussis), a well-established vaccination in adolescents, to compare it with MenC vaccination. Furthermore, we considered new strategies for increasing vaccination coverage through the involvement of the pediatricians and general practitioners (GP) operating in the LHA 4 district.

Materials and methods

Immunization coverage in L.H.A. 4 was calculated by means of the "OASIS" software (version 9.0.0). The Departments of Prevention of the other four Ligurian Regional LHA provided their data, so that we could calculate the regional mean vaccination coverage. We then obtained national data from the database of the Ministry of Health and from the last report (dated 2008) of the ICONA Working Group, which conducted a national vaccination coverage survey among children and adolescents [8].

Furthermore we elaborated a specific questionnaire composed of 5 questions to evaluate the knowledge and opinions of the MenC vaccine among the pediatricians and GPs operating in our LHA.

Fig. 1. Haemophilus Influenzae, Pneumococcus and Meningococcus C vaccination coverage among children aged 24 months (cohort 2008) [8].

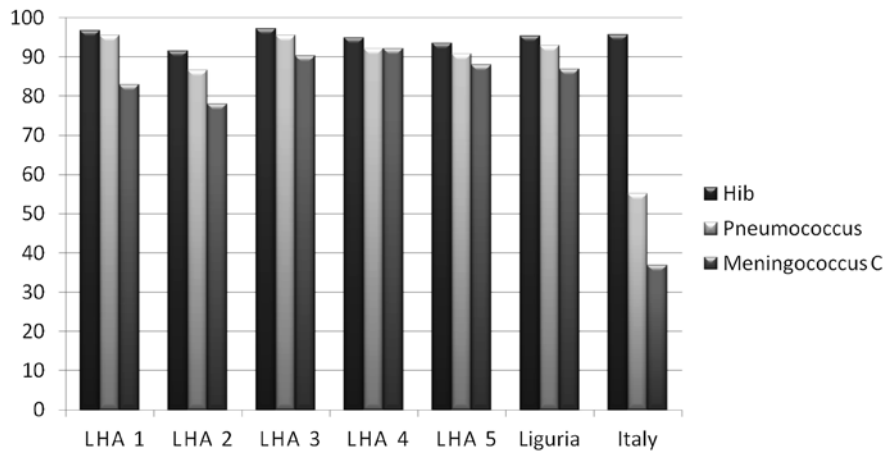
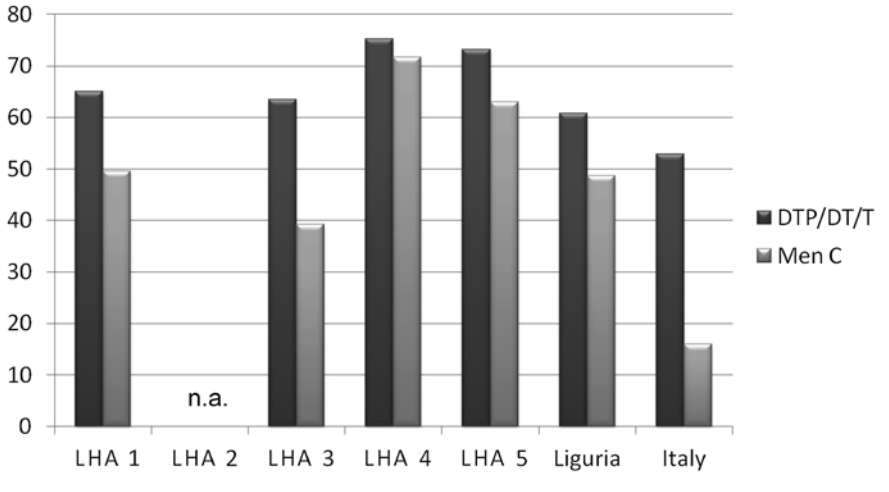


Fig. 2. MenC and DTP/DT/T vaccination coverage among adolescents (cohort 1994) [8].



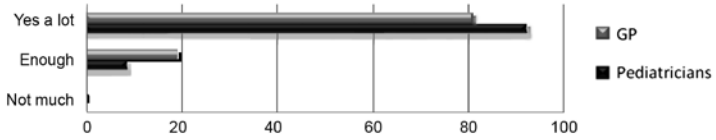
Results

Vaccination coverage

Vaccination coverage against Hib at the 24th month (cohort 2008) proved to be > 95% in all the LHA in Liguria, which is comparable to the national value (Fig. 1). VC against *Pneumococcus* at the 24th month (cohort 2008) ranged from 86% to 95% in the 5 L.H.A., the regional mean being 93%. The national mean is 55%. The values concerning MenC vaccination at the 24th month (cohort 2008) ranged from 78% to 92%, the regional and national means being 87% and 37%, respectively. Regarding VC against MenC in adolescents (cohort 1996), we obtained data only from 4 LHA; these ranged from 39% to 72% (Fig. 2). The regional and national means are 49% and 16%, respectively. The range of VC against diphtheria, tetanus (and pertussis) in Liguria is 65-75%, the mean being 61%; the national mean is 53%.

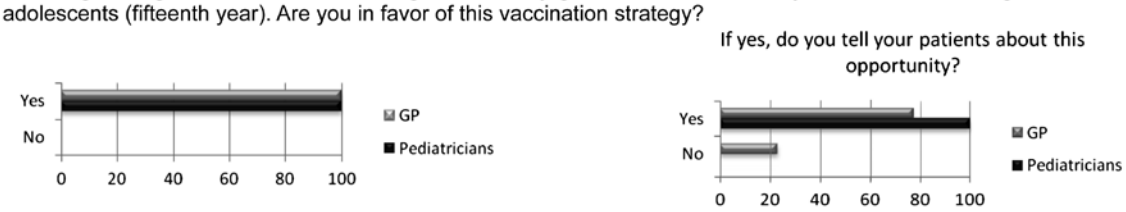
Fig. 3. Questionnaire.

1. Do you believe it's important to reduce the incidence of invasive Menigococcal disease through large-scale vaccination against Meningococcus C?

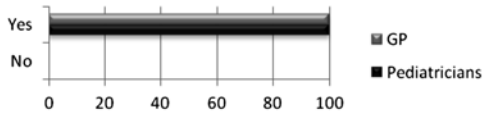


2. Do you think that the meningococcal conjugate C vaccine has sufficient safety and efficacy requirements?

3. In the Liguria region since 2006 the meningococcal conjugate C vaccine is actively offered to children aged 24 months and to adolescents (fifteenth year). Are you in favor of this vaccination strategy?



4. Would you be willing to actively cooperate with the Department of prevention of our L.H.A. to raise awareness of your patients who have not adhered to vaccination in different age-groups provided by the regional immunization plan?



Questionnaire

The questionnaire, which was administered to all the pediatricians and GPs operating in our LHA (Fig. 3). The questionnaire was completed by 81% of pediatricians and only 22% of GPs. The first question was about the importance of large-scale vaccination to reduce the incidence of invasive meningococcal diseases; 92% of pediatricians and 81% of GPs considered this very important. About 92% of pediatricians and 85% of GPs considered the vaccine to have excellent safety and efficacy profile. All physicians (100%) agree with the immunization strategy adopted by the Liguria Region, but only 76% of GPs tell their patients about this opportunity; by contrast, all the pediatricians recommend this vaccination. Finally, all the physicians interviewed stated that they were willing to collaborate with the Department of Prevention in raising awareness among subjects who do not adhere to vaccination.

Discussion

The objective of this survey was to evaluate the VC against the pathogens that cause invasive diseases in the 5 Ligurian LHA, in the Liguria Region and in Italy; infact immunization coverage is the best indicator in order to verify the efficacy of current immunisation policies [9] concerning children at the 24th month and adolescents (15-16 years old).

The levels of VC against Hib at the 24th month, in both Liguria and Italy, are excellent; the objective set in the 2005-2007 NIP has therefore been achieved. With regard to vaccination against *Streptococcus pneumoniae*, which was first introduced in Italy by the Liguria Region in 2003 as a pilot study, adhesion has been very high since its introduction, mainly because parents perceive the seriousness of this invasive disease. This result is also due to the co-administration with the hexavalent vaccine and to the collaboration of pediatricians. The national mean is suboptimal because the various Italian Regions have adopted different immunization strategies.

In Liguria, VC against MenC at the 24th month is good, while the ICONA 2008 report indicates that the national value is low [8]; this unsatisfactory national result stems from the fact that this vaccination has only been partially introduced into regional immunization plans. VC levels among adolescents vary widely among the Ligurian LHA, and should certainly be raised. The national figure is very low according to the ICONA 2008 report; this can be ascribed to the small number of Regions that have introduced this vaccination into their immunization

plan so far. In addition, the available data on VC against diphtheria, tetanus (and pertussis) in adolescents indicate that adhesion to vaccination is suboptimal in this age-group. This could be due to the lower perception among young people of the seriousness of infectious diseases and to the reduction in parents' authority with regard to the healthcare choices of their children. Furthermore, adolescents are treated by GPs, and no longer by pediatricians, who proved to be more sensitive to vaccination-related issues. Indeed, the responses to the questionnaires indicate that GPs place less emphasis on vaccinations, and therefore provide their patients with less information about the vaccination against MenC than pediatricians do. Nevertheless, both GPs and pediatricians declared their willingness to cooperate with the Department of Prevention of LHA 4 in implementing immunization strategies addressed to adolescents.

On analyzing VC data, we can conclude that the national strategies which have proved helpful in achieving good results at the 24th month are:

- the introduction of vaccinations that prevent invasive diseases into regional immunization programs (active offer and free of charge);
- active calls to vaccinate all newborns against Hib and *Streptococcus pneumoniae*; reminders for the following vaccinations;
- the inclusion of anti-Hib vaccine in the hexavalent vaccine;
- co-administration of the vaccine against *Streptococcus pneumoniae* with the hexavalent vaccine;
- co-administration of the vaccine against MenC with the trivalent vaccine against measles, mumps and rubella (MMR): high VC against MMR yields high VC against MenC [7];
- increasing the awareness of pediatric vaccinations among parents and vaccination services staff;
- communication of the benefits of vaccinations by pediatricians to the parents of newborns.

Effective strategies addressed to adolescents could be:

- active calls to vaccination;
- co-administration of the vaccine against MenC with the diphtheria, tetanus (and pertussis) vaccine.

We also identified some critical points in the immunization strategies specific for children up to the 24th month:

- lack of vaccinations able to prevent invasive diseases in some regional immunization program [10-14];
- low VC against MMR determines low VC against MenC;
- the presence of anti-vaccination movements.

Other critical points in the vaccination policies addressed to adolescents are:

- suboptimal use of the active call strategy;
- indifference to vaccinations and infectious diseases at this age;
- insufficient awareness of vaccinations aimed at adolescents and adults on the part of healthcare workers;
- less contact of adolescents with physicians.

Conclusions

This analysis indicates that various strategies could be adopted to improve vaccination strategies:

- the application, in all Regions, of the National Immunization Prevention Plan 2012-2014, that recommends universal vaccinations against Hib, Meningococcus C and Pneumococcus to prevent invasive diseases;
- complete computerized information on vaccination services by LHA [15];
- systematic use of the active-call strategy, particularly with regard to adolescents;
- communication of VC data to healthcare workers, pediatricians and GPs;
- raising the awareness of vaccinations aimed at adolescents among healthcare workers;
- planning and promoting vaccination campaigns aimed at adolescents through the media, schools, brochures, posters;
- urging pediatricians and GPs to check their patients' vaccinations certificates regularly and to actively recommend vaccination to those patients who have not been vaccinated.

Immunization strategies need to be shared with all healthcare workers in order to improve VC, especially among adolescents. We consider it very important to create a network linking the Department of Prevention, pediatricians and GPs through regular meetings that highlight scientific aspects of the vaccines available and the epidemiology of invasive diseases.

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