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## Conference report

**A summer school on vaccinology: Responding to identified gaps in pre-service immunisation training of future health care workers**

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## ABSTRACT

Immunisation is one of the corner stones of public health. Most health care consumers see the health care worker as their major source of information on immunisation and vaccine safety. Doctors, nurses and midwives should be appropriately and timely trained for that role. Within the Vaccine Safety, Attitudes, Training and Communication (VACSATC) EU-project a specific work package focused on the possible improvements of pre-service training of future health care workers.

Surveys to assess current pre-service training about knowledge, skills and competences towards immunisation were distributed to students and curriculum managers of medical schools, universities and nursing training institutions in seven EU countries. In all responding institutions training on vaccines and immunisation is disseminated over a wide range of courses over several academic years. Topics as immunology and vaccine-preventable diseases are well covered during the pre-service training but major gaps in knowledge and competences were identified towards vaccine safety, communication with parents, addressing anti-vaccine arguments and practical skills. This assessment underlined the rationale for adequate pre-service training and identified opportunities for improvement of pre-service training.

A prototype of an accurate pre-service immunisation curriculum was developed, implemented and evaluated in the summer of 2009 with a group of 36 students from 19 countries during a summer school on vaccinology at the Antwerp University, Belgium.

**1. Knowledge and perception towards vaccines**

Vaccination is one of the greatest public health achievements in history. Millions of early deaths have been prevented, and countless more children have been saved from life-long sequelae and severe illness. Though some risks are unavoidable when dealing with vaccines, the medical, social and economic benefits they confer have led countries in Europe to establish childhood vaccination programs to stop the spread of preventable diseases. Today, however, vaccines are becoming a victim of their own successes. Many individuals, including more and more health care workers, have never witnessed the devastating diseases against which vaccines protect, leading to complacency towards immunisation requirements.

Despite the proven safety and efficacy of vaccines, immunisation rates remain suboptimal in many European countries, and some common vaccine-preventable diseases are not controlled to the extent to which they could [1].

Some of the main barriers to vaccination in Europe are inconsistent vaccination systems, lack of political will, and poor understanding or false perceptions of vaccination by the public and by health care workers [2,3]. Fear of side-effects and false contra-indications have also been mentioned in some studies as the most frequent reason for not vaccinating. Elsewhere respondents expressed concerns about the safety of vaccine components, the adequacy of safety testing, and potential severe long-term consequences [4,5].

Multiple studies confirm the lack of knowledge about vaccines, especially safety issues, among the general public and among health care workers [6–9].

A vital part of achieving and maintaining high levels of vaccination uptake is the spread of accurate and reliable information on benefits and risks. This includes increasing awareness about the diseases that the vaccines prevent [10].

Research stresses the importance of information available for parents and health care workers who play a major role in immunisation coverage [3,10–12]. Parents and health care workers, and even children, have specific information needs, each of which needs to be addressed. Even within these groups, information requirements can often vary. Parents, for example, can be subdivided into those that 'trust', those that are 'compliant' and those that are 'resistant'. Health care workers inform the public about vaccines and immunisation programmes but this is often alongside conflicting information that comes from other communication channels in society [13].

Educating the general public can, and must, be done on a national and regional basis, but cannot be fully effective unless there is a corresponding provision, enthusiasm and commitment at local level by trained health care workers [1].

**2. Health care workers are in a key position for achieving and maintaining high vaccination coverage rates**

The attitude of health care workers and their skills to promote and communicate effectively and timely about vaccination is of great importance in achieving and maintaining high coverage rates. Health care workers serve as an important source of information for the general public and are the main drivers of vaccination programmes [1,14,15].

Gust et al. [16] identified the attitude of the health care workers as a determining factor in vaccine acceptance. The strong link between health care workers' perceptions of vaccination and vaccine uptake has been documented by studies from several countries, pointing out that next to family physicians and paediatricians, nurses, pharmacists and midwives also play an important role [1]. Also in Belgium, Italy, and Germany was shown that an important reason for non-vaccination was the physician not informing or recommending the vaccination [4,11,12,17]. Preventive medicine, including immunisation, asks for pro-active communication with people.

Great variations in the level of knowledge about vaccines and vaccine-preventable diseases within and between different groups of health care workers were described earlier. Health care workers expressed a need for timely and accurate information to help them address parental concerns [7].

It is therefore very important to understand how health care workers acquire their own opinions and how they communicate with patients. Already in 2001 the Viral Hepatitis Prevention Board recommended the education of health care workers on communicating with parents as well as with the media to reduce the impact of unjustified allegations about vaccine safety on the public health [18].

Several studies recommend reviewing medical curricula in light of the important role of the health care workers [1,11,19].

Regarding the education of health care workers Schmitt et al. noticed that education on vaccination is poor or non-existing in the medical curricula in most western European countries and recommend to assess the current state of vaccine-related teaching in the formal education of health care workers [1,2].

Also Swennen et al. [11] asked for special attention to incorporate vaccine and vaccinology courses in the curricula at the universities and nurse schools.

In the UK an advisory group hosted by the Health Protection Agency produced National Minimum Standards for Immunisation Training to offer consistency in the training provided across the country and to aid those areas where training is not yet established. They observed that undergraduate courses rarely include much training about immunisation and that the provision of (postgraduate) immunisation courses for health care workers varies from locality to locality [20].

Within the framework of the Vaccine Safety, Attitudes, Training and Communication (VACSATC) EU project a specific work package focused on the possible improvements of pre-service training of future health care workers.

### 3. The vaccination landscape is very divers in Europe

To identify which health care workers are involved in informing and in immunising people the work package members (Belgium, Bulgaria, Italy, Romania, Slovenia, Spain, Sweden and Turkey) completed a detailed questionnaire on who vaccinates and who informs about vaccination, covering all age groups targeted and all vaccines provided.

Analysis of the completed questionnaires showed that the organisation of the vaccination services (newborn/infant/adolescent/adult) is very diverse in the covered European countries. The responsibility for the implementation of a vaccination program can be at national and/or regional level and involve one or several public institutes(s)/agency(ies)/department(s). An institute/agency/department can be responsible for all target groups or focus only on specific target groups. This also is reflected in the diversity of the settings for vaccination across countries. In Italy all persons regardless of their age are vaccinated at the vaccination centre. In Belgium most new-borns are vaccinated at baby-well-clinics, teenagers at school and elderly by their physician.

The diversity of the settings enhances the variation of tasks and responsibilities of nurses, midwives and doctors across countries. In some countries the doctors only inform and examine the persons, and nurses vaccinate. In other countries, such as Slovenia, nurses are mainly indirectly involved (storage, preparation and paperwork); and can only deliver the vaccine under the supervision of a doctor.

In a number of countries after childbirth a nurse or a paediatrician makes a home visit to inform parents, among other matters, about immunisation and to refer them to a public immunisation service. Although not a specific focus of the survey, major differences in the role and impact of the private sector exist.

The large spectrum of different profiles of health care workers, some very specific and unique to the local setting, complicates comparison between countries. Also the terminology used to designate the involved health care workers varies substantially; comparably trained health care workers might be named differently in the various countries, e.g. school doctor or youth health care doctor, or a family doctor and a general practitioner.

The third part of the questionnaire requested information about the educational programme followed by health care workers involved in immunisation. The duration of the basic training for medical doctors (bachelor and master years) is in most countries 6 years, only in Belgium it is 7 years. A high diversity of types and duration is found in the specialisations or postgraduate programmes (master after master). For nurses the duration for the basic training is also similar and is 3 years. However in some countries this training is at universities while for others it is done at other institutions of higher education.

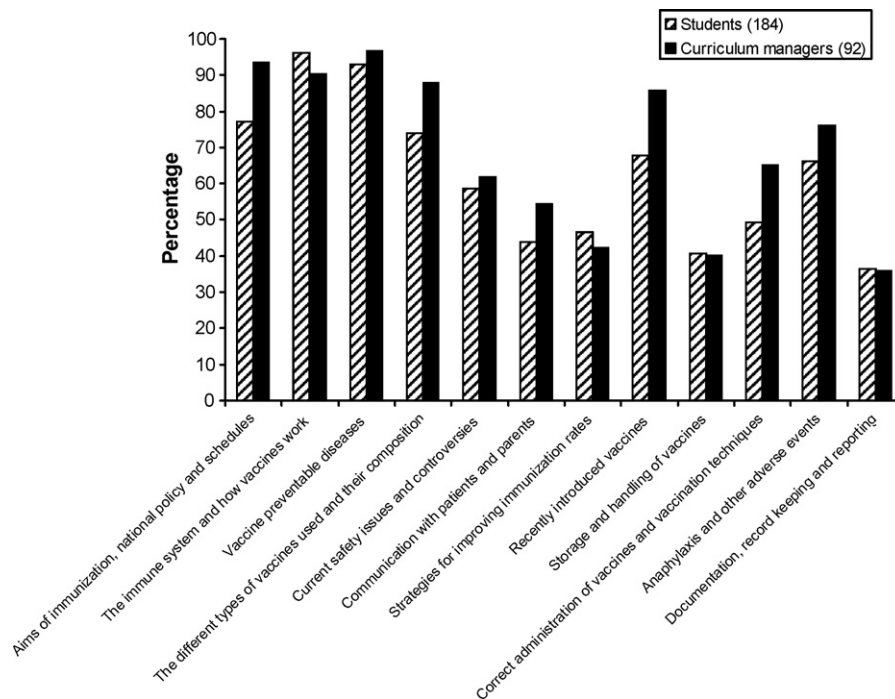
A comparison of the implementation of adolescent vaccination programmes in 16 European countries clearly confirmed the diversity in Europe [21].

Similar observations have been made in 2005 at the World Federation for Medical Education: "The European region displays differences in disease patterns, significant differences in health care delivery systems and in the composition of the health work force and consequently differences in the use of physicians and in the needed qualifications of medical graduates. Even larger differences can be observed in the governance of medical education, in medical curricula and the resources allocated to medical education – differences firmly embedded in cultural traditions, political realities and economic development [22]."

### 4. Assessment of the pre-service training on immunisation and vaccine safety

At European level several organisations or projects are involved with setting standards in education like for example the European Union of Medical Specialists (UEMS) or the Europe-wide European Healthcare Training and Accreditation Network (EHTAN) project that addresses issues regarding EU nursing qualifications and competence with the intention of facilitating nurse workforce mobility. These are in line with the Bologna Declaration aiming at standardising variations in qualifications, skill levels, methods, working practices, attitudes and culture of health care staff throughout the EU. The main objectives of the Bologna Declaration include: creation of comparable, uniform and easily readable degrees through a European Credit Transfer System (ECTS), promotion of EU-wide quality assurance based on comparable criteria and methodologies, promotion of life-long learning and the removal of obstacles to mobility in the EU [23].

The European Commission is still looking for solutions for assimilating different levels of education and different programmes with different outcomes [24].



**Fig. 1.** Different aspects of vaccinology training as perceived to have been taught by students ( $N=184$ ) (Medical (82), Midwifery (18) and Nursing (84)) and curriculum managers ( $N=92$ ) (Medical (36), Midwifery (9) and Nursing (47)).

To assess the immunisation knowledge, skills and competences provided in the pre-service curriculum the VACSATC work package conducted a survey among students and curriculum managers. The objectives were (1) to map where and when items of vaccinology are planned in the respective curricula, (2) to identify which items of vaccinology are taught, (3) to identify competences and (4) to identify training needs. The outline of this survey was based on the National Minimum Standards for Immunisation Training developed by the Health Protection Agency of the UK [20]. Curriculum managers and students finalizing their basic training were questioned in Belgium, Bulgaria, Italy, Romania, Slovenia, Spain, and Sweden.

The targeted curricula for the survey were that of nurses (3rd year), midwives (3rd year) and medical doctors (6th or 7th year).

Because all health care workers, regardless if they are professionally involved in immunisation or not, should be appropriately trained on these topics and because not all health care workers receive specialisation training we restricted the survey to the basic curricula.

Valid questionnaires of 184 students and 92 curriculum managers from six countries were further analysed. The response rate was lower than anticipated and in depth analysis of possible inter- or intra-group discrepancies was not justified. Only two countries provided valid data from midwife students or midwife curriculum managers. In Spain and Sweden no basic midwifery curricula exist so these curricula are not included in the study.

Comparable trends were observed across countries, across medical, midwifery and nursing curricula and across curriculum managers and students. The fact that responding was fully voluntary may have selected for persons with a specific interest in this topic.

#### 4.1. Integration of vaccinology in the curricula

All curriculum managers indicated that vaccination/immunisation is a learning objective. Vaccinology was never

provided as a stand-alone course; often vaccine-related content is scattered over different courses and different years of the curricula.

In total 58 different courses were mentioned that covered aspects of vaccination: microbiology, infectious diseases, immunology, epidemiology and paediatrics were the most frequent ones. Some students and curriculum managers also mentioned that the vaccination topic is only part of an optional course or only addressed during traineeship.

#### 4.2. Aspects of vaccinology covered by the pre-service curricula

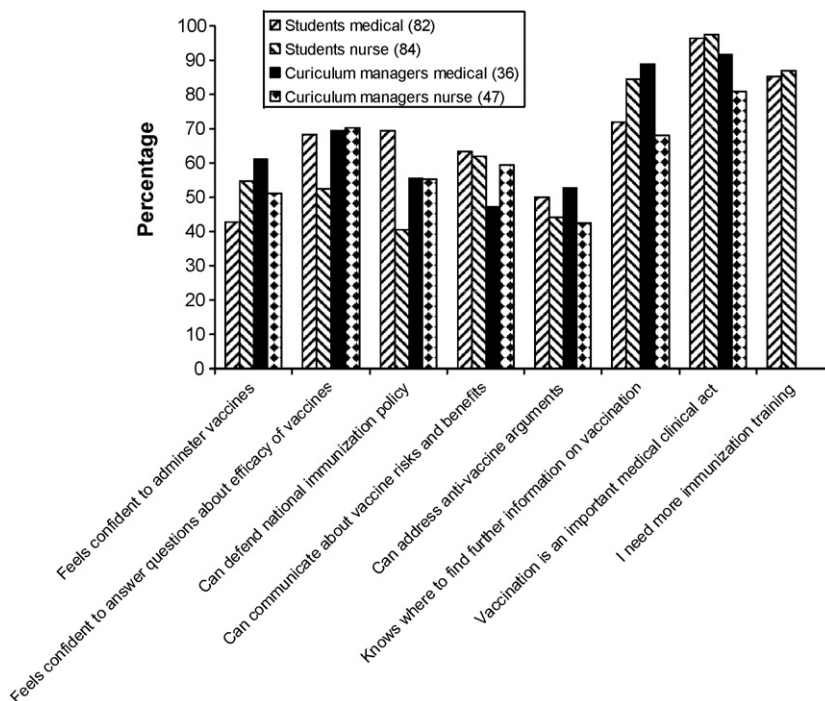
Fig. 1 shows that the immune system, how vaccines work and vaccine-preventable diseases are well covered according to most curriculum managers and students. The aims of immunisation, national policy and vaccination schedules and types of vaccines and their composition are respectively perceived to be taught by 77% and 74% of the students.

Less than 60% of students reported to have received training about safety issues and controversies and only 44% of the students indicated that they receive training on how to communicate with patients and parents about vaccination. Only half of the students reported receiving practical training on how to administer vaccines.

Also low coverage in the curricula regarding documentation, record keeping, and reporting and strategies for improving vaccination rates was observed.

In Italy only 4 out of 38 medical students indicated to have received communication training and only two students recalled classes about storage and handling of vaccines. This can be clarified by the fact that nurses who are actively involved in immunisation services in Italy are trained in a special public health nursing course. Due to this task distribution among health care workers those items are likely excluded from the basic medical and nursing curriculum.

For most aspects curriculum managers indicated much more often than students that a specific topic was taught.



**Fig. 2.** Competences of medical ( $N=82$ ) and nursing students ( $N=84$ ) as perceived by themselves and by medical curriculum managers ( $N=36$ ) and nursing curriculum managers ( $N=47$ ).

#### 4.3. Competences of students as perceived by themselves and by their curriculum managers

As shown in Fig. 2, only 42% of medical students and 54% of nursing students feel confident to administer vaccines. This corresponds to the missing practical training in several curricula and is influenced by the way local health care systems are organised and how tasks of health care workers are distributed.

68.3% of the medical students and 52.4% of the nurse students feel confident to answer questions about the efficacy of vaccines. 69.5% of the medical students and 40.5% of the nurse students indicate to be able to defend immunisation policy.

Student's perception of their own competences regarding communication with people and parents about risks, benefits or safety issues does not seem to be hampered by not receiving training. 64% of all students, including midwife students, feel competent to communicate about vaccine risks and benefits while only 44% indicate to have received communication training on this topic.

Most students are confident to find further information on immunisation.

Only 50% of the medical students in their last master year and 44% of the nurse students can address anti-vaccine arguments. Being able to address anti-vaccine arguments requires understanding of the underlying principles, aims and true risks and benefits of vaccines. With only 47% of all last year students feeling able to do so there is clearly room for improvement.

The responses from the curriculum managers are mostly in line with the answers we have received from the students. Curriculum managers are somewhat less convinced about the importance of vaccination as a medical act.

85% of medical students and 87% of nurse students expressed the need for more training on immunisation.

Finally the surveys analysed the perception of acquired competences and aspects being taught, it was not checked if the detailed learning objectives were reached.

#### 5. A prototype curriculum for pre-service immunisation training

Few resources and studies useful for teaching practices or core learning objectives related to vaccination in medical and paramedical pre-service curricula are available.

In 1994 a US Advisory Committee on Immunisation in Medical Education published Vaccine-Preventable Disease Core Curriculum objectives to provide a framework for delivery of appropriate information during all levels of medical education [25]. Also in the UK National Minimum Standards for Trainings and a Core Curriculum [20], indicating essential core topics to be incorporated into all immunisation training, were developed by the Health Protection Agency in 2005. Both curricula are rather country-specific and the UK curriculum is primarily written for immunisers and health professionals in primary care settings.

Based on those existing frameworks the training work package of the Vacsatc EU-project developed a more general prototype curriculum specific for pre-service training (bachelor, master) of all future health care workers and a training assessment tool for curriculum managers or heads of faculties to investigate which learning objectives are already included and which topics should be added to the curriculum to ensure that graduates are competent for their role as informers and for some also as immunisers. A set of generic training modules provides trainers also with guidance on content [26].

The developed prototype curriculum consists of 8 domains and 75 learning objectives and competences (see Table 1. The competences reflect the Dublin Descriptors [27] and include:

- knowledge and understanding
- applying the acquired knowledge and understanding
- formulation of judgements
- communication skills
- learning skills to continue to study and find information



**Table 1**  
Overview of the different domains of the pre-service vaccinology curriculum with their learning objectives and targeted competences.

Domain	Learning objectives and targeted competences
Rationale, context and history of immunisation	<ul style="list-style-type: none"> <li>Outline the historical impact of vaccine-preventable diseases</li> <li>Discuss the rationale for implementing immunisation programmes</li> <li>Explain concepts of control, elimination and eradication related to vaccine-preventable diseases in historical perspective</li> </ul>
Key aspects of immunology	<ul style="list-style-type: none"> <li>Compare innate and adaptive immunity</li> <li>State the functions of B-cells and T-cells</li> <li>Describe the role of antibodies and antigens</li> <li>Explain how the immune system works</li> <li>Describe the difference between active and passive vaccination</li> <li>Outline the immune response to a vaccine</li> <li>List conditions that affect the immune response</li> <li>Assess the capacity of the immune system</li> <li>Describe how maternal antibodies work</li> </ul>
Key aspects of vaccines	<ul style="list-style-type: none"> <li>Define a vaccine</li> <li>State the components of vaccines and explain their function</li> <li>List and compare different types of vaccines</li> <li>Identify per type of vaccine the expected side-effects</li> <li>State the contraindications for each type of vaccine</li> <li>Clarify vaccination in pregnancy</li> <li>Outline the stages in vaccine development</li> <li>Describe procedures of safety control and monitoring of efficacy</li> </ul>
Vaccine-preventable diseases	<ul style="list-style-type: none"> <li>Describe for each disease the epidemiology and pathology (nature, frequency, infection, transmission, effects, incubation, symptoms, complications)</li> <li>State the current prevalence and/or incidence of each disease (in your country, in Europe and on a global scale)</li> <li>Name the population at risk for each disease</li> <li>List which preventive measures can be taken for each disease</li> <li>Show the historical impact of vaccination on the epidemiology of the relevant diseases</li> <li>Know where to find further information about the diseases and their vaccines</li> <li>Describe the vaccines in immunisation schedules (in your country)</li> </ul>
Immunisation policy and schedules	<ul style="list-style-type: none"> <li>Explain how infections spread</li> <li>Illustrate how herd immunity works and tell why it is important</li> <li>Explain how and why mathematical modelling of diseases is used</li> <li>Describe the role of economic evaluation of a vaccination programme</li> <li>Explain the different factors that inform policy decisions</li> <li>Describe the organisation and role of disease surveillance systems</li> <li>Discuss the role and importance of vaccination coverage data</li> <li>Name factors that influence immunisation coverage</li> <li>Understand why and how to document a vaccination correctly in all relevant records</li> <li>Outline how national schedules are defined</li> <li>Describe the history and possible future of vaccination programmes</li> <li>Describe how immunisation programmes are monitored and evaluated</li> <li>Access and use current vaccine schedules, deal with variations and find their updates</li> <li>Discuss catch-up campaigns, vaccine registration, outbreak response and vaccination policy towards special populations</li> </ul>
Future perspectives	<ul style="list-style-type: none"> <li>List new target diseases</li> <li>Describe processes of early clinical development</li> <li>Know which vaccines are in the pipeline</li> <li>Discuss new ways of administration</li> <li>Describe current research on components and techniques</li> <li>Discuss current developments for HIV, dengue, malaria, hepatitis C, . . .</li> </ul>
Communication	<ul style="list-style-type: none"> <li>Describe the myths and facts relating to (current) immunisation controversies</li> <li>Describe common misconceptions</li> <li>Critically evaluate media reporting of vaccine issues</li> <li>Understand issues that affect and influence potential vaccinees, parents and care givers in their decision making and acceptance of vaccination</li> <li>Understand the importance of public perception</li> <li>Understand physician-patient negotiation</li> <li>List key points for responding to parents' fear</li> <li>State key facts, advantages and risks that need to be communicated</li> <li>Respond to objections raised by anti-vaccine movements</li> <li>Respect differing views through listening</li> <li>Listen non-judgmentally to health beliefs about vaccination</li> <li>Be committed to offer the best professional advice on vaccination</li> <li>Respect patient's cultural beliefs</li> <li>Acknowledge the anxiety of individuals</li> <li>Direct others to reliable and appropriate sources of information</li> </ul>

Table 1 (Continued)

Domain	Learning objectives and targeted competences
Practical skills	Identify the correct immunisation site Understand and practice different immunisation techniques Describe the cold chain and the importance of its maintenance Specify minimum/maximum temperatures for vaccine storage Describe the effects of temperature on potency and efficacy of vaccine Identify vaccine sensitive to light, heat and freezing Identify the correct dose and site of administration of all vaccines for each age group Recognize true contraindications Assess if a patient is fit to receive safe and effective vaccination Reconstitute vaccines correctly Prepare and dispose vaccination equipment Distinguish between anaphylaxis and fainting Avoid needle stick injuries

The organisation of preventive health care is country-specific and inclusion of certain items, e.g. administration of vaccines can be related to legal aspects or organisational structure of health care services in each country or region. The training should therefore be adapted to local needs but it is important to cover at least a minimum of all aspects.

The outcomes of the survey and the criteria for good pre-service immunisation training, including the prototype curriculum, were disseminated among the curriculum managers and student organisations who were initially contacted to participate in the survey.

## 6. Summer school on vaccinology

Stemming from the identified gaps in the pre-service training of future health care workers an international summer school on vaccinology for students was organised in the summer 2009 at the University of Antwerp, Belgium. The newly developed prototype curriculum was implemented with the support of an international team of experts and attended by 36 students from 19 countries between their 2nd and 6th year of study. Student coaches from the European Medical Students Association Antwerp accompanied the delegates throughout the summer school.

Feedback from the students was systematically collected through anonymous daily evaluation forms and focus group discussions. Basic knowledge and training needs were assessed through a MCQ at the first day of the summer course. More than half of the students mentioned that communication training was not (yet) covered in their curriculum.

The summer school was evaluated as very successful by the students and teachers. The communication training and practical skills training on vaccination techniques were highly appreciated. The interactive teaching methods were also very well received. For some students this approach was new and very different from what they are used to.

The students indicated that even topics already covered in their curriculum, e.g. measles, mumps, rubella or the changing epidemiology of hepatitis A & B, contained a lot of new and clarifying information.

The curriculum was implemented during 4 days and concluded with 1 day student assessment of acquired knowledge and practical skills.

Further information on this summer school and the programme is available at: [www.ua.ac.be/cev/summerschool](http://www.ua.ac.be/cev/summerschool).

## 7. Challenges and lessons learnt

The organisation of immunisation in Europe is country/region specific with differences in health care delivery systems and different profiles of health care workers involved in different settings.

This diversity is also reflected in the pre-service training of health care workers, hampering possible future standardisation.

The majority of students responding to the survey agreed that vaccination is an important medical act. Unfortunately not only the opinion and attitude of health care workers but also their skills to promote and communicate effectively and timely about vaccination is of great importance in achieving and maintaining high vaccination coverage rates. The results of our survey indicate that the medical and nurse pre-service training in Europe is not sufficiently equipped to ensure all future health care workers being able to take such responsibility.

Knowing that many students will be involved in informing people about vaccination, more attention should be paid to communication with parents or vaccinees on vaccine safety, national immunisation policy and arguments addressing anti-vaccine stories. This communication training should also stress the important role health care worker plays in initiating conversations with vaccinees and parents.

Further studies need to be conducted to clarify shortcomings in the European curricula and to determine which improvements are desirable and possible. Educational institutes need to review if the practical training regarding vaccination offered is sufficient for the future role of their students. The impact of vaccination items being spread over several courses and academic study years needs also to be further investigated. This scattering of the content will not simplify the implementation of possible improvements.

Pre-service immunisation training should not replace specialisation courses or in-service training but it should ensure that every health care worker, after his basic training, can and will effectively communicate about vaccination, based on knowledge and competence and skills.

A prototype curriculum for pre-service immunisation training, covering 75 relevant learning objectives and competences, was developed and implemented during a summer school on vaccinology. The training was very well perceived by the attending students who appreciated especially the communication training, practical skills training and the interactive teaching methods applied. The training covered 4 days followed by a student assessment day.

Wide acceptance of the prototype curriculum and incorporation into the standard curricula could contribute to the standardisation of European higher education and be beneficial for European workforce mobility.

Implementing changes to the curricula requires policy makers, deans of faculties and curriculum managers to be convinced of the need and importance to provide updated and consistent vaccination/immunisation pre-service training. Support from stakeholders, further dissemination of these findings as well as further research are therefore indispensable.

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A. Vorsters\*

S. Tack

G. Hendrickx

*Vaccine and Infectious Disease Institute, University of Antwerp, Universiteitsplein 1, 2610 Antwerp, Belgium*

N. Vladimirova

*National Centre of Infectious and Parasitic Diseases, Sofia, Bulgaria*

P. Bonanni

*Department of Public Health, University of Florence, Florence, Italy*

A. Pistol

*Centre for Communicable Diseases Prevention and Control, Bucharest, Romania*

T. Metličar

*National Institute of Public Health, Ljubljana, Slovenia*

M.J. Alvarez Pasquin

*Sociedad Espanola de Medicina y Comunitaria, Madrid, Spain*

M.A. Mayer

*Medical Association of Barcelona, Barcelona, Spain*

B. Aronsson

*Sachs' Children's Hospital, Södersjukhuset, Stockholm, Sweden*

H. Heijbel

*Swedish Institute for Infectious Disease Control, Stockholm, Sweden*

P. Van Damme

*Vaccine and Infectious Disease Institute, University of Antwerp, Universiteitsplein 1, 2610 Antwerp, Belgium*

\* Corresponding author. Tel.: +32 3 265 26 64; fax: +32 3 265 26 40.

E-mail address: [alex.vorsters@ua.ac.be](mailto:alex.vorsters@ua.ac.be) (A. Vorsters)

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