REVIEW

Immunization in health care workers

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ABSTRACT

Introduction: Vaccination of healthcare professionals is an essential part for the decrease of the infectious diseases transmitted within Healthcare settings, as well as for the reductions of the absenteeism due to illness. Because of their contact or infective materials, many healthcare professionals are at high risk for exposure to and possible transmission of vaccine preventable diseases.
Aim: The aim of thee present study was to review the literature regarding immunization and recommended vaccinations for healthcare professionals.
Materials and methods: Methodology included reviewing research studies mainly in the computerized database «pubmed» regarding recommended vaccinations and immunization of health professionals. Literature review: According to the literature, the main reasons of vaccination is the personal protection from disease and immunization due to work, as well as to prevent disease transmission by health professionals to and from patients, while reasons for lack of vaccinations included negligence, lack free vaccines, working night shifts, as well as concerns about side effects and misconceptions about the effectiveness of vaccines.
Conclusions: Education about the safety and effectiveness of vaccines is the key to the acceptance of vaccines by healthcare professionals .Immunization schedules should be planned by taking under consideration the specific needs existing in every healthcare setting. Emphasis should be placed on individual responsibility for maintaining immunization records and update vaccination status.

Keywords: Healthcare workers, recommended vaccinations, tuberculosis, vaccination, influenza, hepatitis B, measles, mumps, rubella, infectious diseases.

INTRODUCTION

Because of their contact with patients or infectious materials from patients, health care professionals are at risk of exposure and possible transmission of diseases that can be prevented by vaccination. For this reason, implementation and maintenance of immunity is an important part of prevention and infection control for health professionals. The excellent use of immunization factors protects health professionals while providing protection to patients from possible infection through exposure to healthcare professionals who have an infection. Continuous immunization programs could effectively reduce the number of susceptible health professionals working in hospitals, and the risk of transmission of diseases can be predicted through vaccination, other employees and patients. (American Hospital Association, 1992).

Any department that provides direct care to patients should be encouraged to implement a comprehensive immunization policy for all health professionals. The American Hospital Association has ratified the functioning immunization programs for hospital staff and patients (CDC, 1996). The immunization recommendations of the Advisory Committee on immunization (ACIP), for health care professionals should be taken into account when developing this policy. In Greece the National Immunization Schedule recommends vaccination of health professionals against hepatitis A and B, meningitidococcus (MnCV4), pneumoniococcal (PPSV), chickenpox, measles-mumps-rubella and seasonal flu, but the vaccine is not accepted in accordance with the principles of free choice and autonomy (Table 1). Education and awareness of new health professionals will help to improve levels of immunity to diseases preventable by vaccination.

The purpose of this study was to review the literature on immunization and recommended vaccinations for health professionals and to investigate newer international and Greek data on this issue.

Literature method

Extensive literature review of international and Greek databases (Pubmed, Chinahl, Scopus, Iatrotek, WHO, CDC). We reviewed articles of the last twenty years on the subject using keywords such as health professionals, tuberculosis, hepatitis B, measles, rubella, mumps, influenza, vaccination and infectious diseases.

Results

Based on the documented hospital transmission, health care professionals are at significant risk of infection with hepatitis B, influenza, measles, rubella, mumps, chickenpox, tetanus and diphtheria. All these diseases are preventable by vaccination (CDC, 1989). Health professionals are vulnerable to many diseases and several of them can be prevented by implementing immunization program. According to the WHO recommendations, vaccination of health professionals should be a major priority of a country in order to be able to protect its health system (Rachiotis G et al, 2010).

More recent studies from Greece, according to the national record of vaccination coverage in 2006, show that the vaccination protection for infectious diseases is high, and for diseases like influenza is very low around 20%. According to WHO, the general vaccination program over the last 30 years in Europe, eliminated polio cases in 2002 and reduced by 90% the incidence of measles The Greek Public Health agencies should implement coordinated and sustained efforts to broadly implement the vaccination course with firm policy, qualified staff and infrastructures in order to better inform health professionals and to prevent misinformation that may compromise the achievements of preventive medicine (Παπαγρηγορίου-Θεοδωρίδου Μ, 2011).

Hepatitis B

HBV infection is the most infectious hazard for health professionals. According to studies, in 1985 the health professionals who were infected were 90% fewer than in 1993, where it is estimated that 1,450 professionals were infected after exposure to blood and body fluids (CDC, 1989; Department of Labour 1991). Data show that 5% -10% of affected workers gradually developed chronic hepatitis B (Liang, 2009).

People with chronic hepatitis B are at risk of chronic liver diseases such as chronic active hepatitis, cirrhosis and primary hepatocellular carcinoma. An estimated 100 to 200 health professionals were dying every year in the 80's because of the prevalence of this chronic disease. The risk of HBV infection from occupational exposure depends on the frequency of transdermal and transmucosal exposure to blood or body fluids containing blood. Employees whose duties involve exposure to infected blood or body fluids should be vaccinated (CDC, 1989).

The standards were issued in December 1991 under the Occupational safety and health Act in the United States, which stated that the hepatitis B vaccine should be available for all healthcare personnel exposed to blood or other potentially infectious materials. 'Occupational exposure "was the logical expectation skin contact, eye, mucous membrane, or parenteral contact with blood or other potentially infectious materials as a result of the execution of one's official duties (Hadler, 1992).

The serology status before vaccination prior infection is not recommended for people who are vaccinated because of occupational risk. Control after vaccination for antibodies such as the surface antigen of hepatitis B, (anti-HBs) is indicated for healthcare professionals who have contact with blood or patient at risk of injury by needles or other sharp objects. Knowledge of antibody

response helps in determining the appropriate post-exposure protection. Antibodies developed due to vaccination tend to decrease gradually over time and a rate of less than or equal to 60% of people who initially respond to vaccination will lose detectable antibodies after 12 years (CDC, 1989).

Studies among adults have shown that despite the decline in antibody levels in serum immunity induced by the vaccine, it still protects against clinical disease or detectable viremia HBV infection and for this reason doses assistance is deemed necessary (Balkovic et al, 1980).

Flu- Influenza

An influenza epidemic in the community can cause hospital infections by infected patients admitted to the hospital (Van Voris et al, 1982; Potter et al, 1997) and it can be transmitted to staff. The transmission of influenza among the hospital staff causes absenteeism and disruption of health care (Williams et al, 1989, Braunstein et al, 1990). In addition, influenza epidemics cause morbidity and mortality in hospitalized patients. Research in long-term care and health care delivery settings where staff are vaccinated against the flu by more than 60%, has shown lower influenza and mortality rates in patients compared with patients who are hospitalized in settings where most staff were not vaccinated (Pachucki et al , 1990).

Measles

The transmission of hospital measles has been documented in private practices in the emergency department and other departments of hospitals. Although only 3.5% of cases of measles reported during 1985-1989 occurred in hospitals, the risk of measles infection in healthcare workers is estimated to be three times that of the general population. During 1990-1991, 1.788 (4.8%) out of 37.429 measles cases occurred in healthcare settings. Of these, 37% were healthcare professionals, 84% of whom were not vaccinated. 28% of these individuals were hospitalized with measles and three died. Although birth before 1957 is generally considered acceptable proof of immunity to measles, serologic studies on workers in hospitals showed that 5% - 9% of people born before 1957 were not immune to measles. Between 1985-1992 27% of all cases of measles in health professionals occurred in people born before 1957. (CDC, 1996).

Mumps

In recent years a significant proportion of reported cases of mumps occurred among unvaccinated adolescents and young adults. Mumps outbreaks in vaccinated populations have been attributed to vaccine failure (Briss et al 1994; CDC, 1989). Programs that ensure immunization of healthcare professionals to mumps are useful and can easily be combined with programs of measles and rubella control (CDC, 1984–1986; MMWR, 1987).

Rubella

In the past two decades, rubella epidemics reported in hospital healthcare professionals and patients in USA (Crawford et al, 1981). Although vaccination reduced the overall risk of rubella transmission in all age groups in the United States, the possibility of transmission in hospitals remains, because 10% -15% of young adults are still susceptible (Greaves et al, 1982). Although rubella is less infectious than measles, however it can be transmitted easily by both sexes.

Vaccination of susceptible individuals, male and female, with the trivalent vaccine for measles, mumps, rubella (MMR), can reduce rubella transmission rates, like measles, (Weitekamp et al, 1985).

Varicella

Hospital transmission of varicella-zoster virus (VZV ratio) has been documented recently (Alter et al, 1986; Steele et al, 1982; CDC, 1996). Sources of hospital exposure of patients and personnel, including patients, staff, visitors (e.g. children of employees of hospitals) infected either varicella or zoster. Although all susceptible hospitalized people are at risk of serious infection with varicella or its complications, there are patients who are at increased risk, such as pregnant women, premature infants, and immunocompromised persons of all ages (including those undergoing chemotherapy, suffering from malignant diseases, or people with immunodeficiency).

A reliable history of varicella is a valid measure of immunity. Serological tests have been used to assess the accuracy of reported varicella in one's history (Steele et al, 1982; CDC, 1996; Bernstein et al, 1993). Among adults, 97% to 99% of individuals with a positive history of varicella are seropositive.

Control strategies of VZV infection in hospitals are listed in Table 2 (Anderson et al, 1985; McKinney et al, 1989). As regards disease protection, the varicella vaccine protects approximately 70% -90% against infection and 95% against severe disease for at least 7 - 10 years after vaccination. Long immunity is significant protection against the disease. Serious infections (e.g., varicella cases) have occurred among vaccinated individuals after exposure to natural varicella.

Immunobiological factors for which immunization of healthcare workers may be indicated

The following diseases included in this category can be transmitted in hospitals , but health professionals do not have an increased risk of becoming ill as a result of occupational exposure to them (e.g. hepatitis A), occupational risk may be high but protection via active or passive immunization is not available (e.g. pertussis) or vaccines are available but are not routinely recommended

for all health professionals or are recommended only in certain situations (e.g. smallpox vaccine and meningococcal).

Tuberculosis and vaccination with Bacillus Calmette-Guerin (BCG)

In the U.S., vaccination with BCG is not recommended for general use, because the risk of infection with mycobacterium tuberculosis in the general population is low, and the protective efficacy of the vaccine is uncertain. The immune response to the vaccine BCG also renders useless the tuberculin skin test for the detection of infection with Mycobacterium tuberculosis (Rosenblum et al., 1991). TB prevention and control efforts are focused on the interruption of transmission from patients with active TB, early diagnosis with tuberculosis skin test (mantoux) for those who are at high risk for tuberculosis, and providing preventive treatment when needed. In some cases, however, vaccination with BCG can contribute to the prevention and control of tuberculosis when other strategies are

Table 1.
Recommendations for Healthcare workers

Vaccines	*Recommendations in brief*
Hepatitis B	If there is not documented evidence of a complete hep. B vaccine series, or an up-to-date blood test that shows the immune status to hepatitis B (i.e., no serologic evidence of immunity or prior vaccination). • 3-dose series (the second in a month after the first dose and the third dose five months after the second) • An anti-HBs serologic test 1–2 months after the third dose.
Flu (Influenza)	A single dose of the vaccine annually.
MMR (Measles, Mumps, & Rubella)	The born before 1957 or later and the lack of evidence of MMR vaccine, or if you don't have an up-to-date blood test that shows you are immune to measles, mumps, and rubella (i.e., no serologic evidence of immunity or prior vaccination), get 2 doses of MMR, 4 weeks apart. For HCWs born before 1957, see the ACIP recommendations at bottom of this table.
Varicella (Chickenpox)	If you have not had chickenpox (varicella), if you haven't had varicella vaccine, or if you don't have an up-to-date blood test that shows you are immune to varicella (i.e., no serologic evidence of immunity or prior vaccination) get 2 doses of varicella vaccine, 4 weeks apart.
Tdap (Tetanus, Diphtheria, Pertussis)	Get a one-time dose of Tdap as soon as possible if you have not received Tdap previously (regardless of when previous dose of Td was received). Get Td boosters every 10 years thereafter. Pregnant HCWs need to get a dose of Tdap during each pregnancy.
Meningococcal	Those who are routinely exposed to isolates of N. meningitidis should get one dose.

Source: CDC Features, Immunization of HCW: Recommendations of ACIP. MMWR. 2011;60(RR07):1-45

TABLE 2.
Immunization of Health-Care Workers.

Generic name	Primary schedule and booster(s)	Indications	Major precautions and contra indications
Hepatitis B (HB) recombinant vaccine	Two doses IM 4 weeks apart; third dose 5 months after second; booster doses not necessary.	Preexposure: HCWs at risk for exposure to blood or body fluids.	On the basis of limited data, no risk of adverse effects to developing fetuses is apparent. Pregnancy should not be considered a contraindication to vaccination of women.
Hepatitis B immune globulin (HBIG)	0.06 mL/kg IM as soon as possible after exposure. A second dose of HBIG should be administered 1 month later if the HB vaccine series has not been started.	Postexposure prophylaxis: For persons exposed to blood or body fluids containing HBs Ag and who are not immune to HBV	
Influenza vaccine	Annual vaccination with current vaccine. Administered IM	HCWs who have contact with patients at high risk for influenza or its complications	History of anaphylactic hypersensitivity to egg ingestion
Measles live-virus vaccine	One dose SC; second dose at least 1 month later.	HCWs born during or after 1957 who do not have received 2 doses of live vaccine on of after the first birthday or a history of physician-diagnosed measles or serologic evidence of immunity. Vaccination should be considered for all HCWs who lack proof of immunity, including those born before 1957.	Pregnancy; immunocompromised persons, including HIV-infected persons who have evidence of severe immunosuppression; anaphylaxis after gelatin ingestion or administration of neomycin; recent administration of immune globulin
Mumps live-virus vaccine	One dose SC; no booster	HCWs believed to be susceptible can be vaccinated. Adults born before 1957 can be considered immune.	Pregnancy; immunocompromised persons; history of anaphylactic reaction after gelatin ingestion or administration of neomycin.
Rubella live-virus	One dose SC; No vaccine	Indicated for HCWs who do not have documentation of having received live vaccine on or after their first birthday or laboratory evidence of immunity. adults born before 1957 except women who can become pregnant can be considered immune	Pregnancy; immunocompromised persons; history of anaphylactic reaction after gelatin ingestion or administration of neomycin. Pregnancy, immunocompromised persons, history of anaphylactic reaction following receipt of neomycin or gelatin. Avoid salicylate use for 6 weeks after vaccination.

Generic name	Primary schedule and booster(s)	Indications	Major precautions and contra indications
Varicella zoster live-virus vaccine	Two 0.5 ml doses sc 4-8 weeks apart if ≥ 13 years of age	Indicated for HCWs who do not have either a reliable history of varicella or serological evidence of immunity	
Varicella-zoster immune globulin (VZIG)	Persons < 50 kgr 125 u /10 kg IM, persons > 50 kgr 625 u.	Persons known or likely to be susceptible (particularly those at high risk for complications, e.g., pregnant women) who have close and prolonged exposure to a contact case or to an infectious hospital staff worker or patient.	

Source: (Recommendations of the Advisory Committee on Immunization Practices (ACIP) and the Hospital Infection Control Practices Advisory Committee (HICPAC)December 26, 1997 / Vol. 46 / No. RR-18)

inadequate. Regarding health care professionals, the BCG vaccine should not be used as a primary control strategy because effectiveness is uncertain, exposure and infection with resistant strains of Mycobacterium tuberculosis is possible, and there is difficulty in distinguishing the effects of infection or immune response to vaccination, after the skin test.

Hepatitis A

The transmission of Hepatitis A Virus (HAV) from adult patients to health professionals is usually associated with faeces incontinence in these patients. However, most patients hospitalized with hepatitis A are recognized after the onset of jaundice, when the disease is beyond the point of maximum infectivity. Serological surveys among various health professionals showed no increased incidence of infection compared with other occupational groups. Two special precautionary measures are available to protect against hepatitis A: a)The administration of immune globulin (IG) and b) hepatitis A vaccination.

Meningococcal disease

Hospital transmission of Neisseria meningitis is rare. In rare cases, direct contact with respiratory secretions of infected individuals (e.g., during mouth-to-mouth resuscitation), results in transmission from patients with meningococcal meningitis or meningococcemia to health professionals. Health professionals can reduce the risk of infection by avoiding exposure to droplets (American Hospital Association, 1992; Bernstein et al, 1993). Post-exposure protection is recommended for individuals who had intensive unprotected contact (e.g. without using mask) with infected patients (e.g. respiratory resuscitation or examination of the patient's pharynx). Antimicrobial protection can eradicate the carriage of Neisseria meningitis. Meningitides and prevent infection in people who have unprotected exposure to patients with meningococcal infections.

Pertussis

Pertussis is highly contagious. Rates between episodes of secondary disease in susceptible family members due to contact exceed 80% (Mortimer et al, 1990; Linnemann et al, 1975). The transmission occurs through direct contact with respiratory secretions or aerosol droplets from the respiratory tract system of infected individuals. Vaccinated adolescents and adults whose immunity is impaired 5-10 years after the last dose of vaccine, are an important source of pertussis infection for susceptible infants. Hospital transmission of pertussis has been documented in several reports. Transmission can occur from visitors at hospitals, by hospital staff to

patients, but also by patients to the healthcare staff. With regard to passive immunization, a cellular pertussis vaccine provides immunity in adults, and it increases the risk of side effects when administered with the tetanus diphtheria vaccine (Td), in comparison with the single administration of Td.

Typhus

The S. Typhi and other enteric pathogens can be transmitted within hospital settings by the hands of infected staff. Generally, personal hygiene, especially hand washing before and after contact with the patients, reduces the risk of transmission of enteric pathogens in patients. If health professionals develop acute diarrhoea, accompanied by fever, cramps, or blood in the stool, it is more likely to secrete a large number of infectious organisms in their stool, so the exclusion of these workers from patient care until the disease be evaluated and treated, will help prevent the transmission of the disease (American Hospital Association, 1992).

Smallpox

The smallpox vaccine is a highly effective immunizing agent that has led to the global eradication of smallpox. In 1976, routine vaccination of healthcare professionals in the U.S. stopped. More recently, the ACIP recommended the use of the smallpox vaccine to protect laboratory workers from infection, handling other viruses of the same group (e.g. virus of monkeys) (Subbarao et al, 1991).

Conclusions

Many diseases cause significant morbidity worldwide. Vaccines are arguably one of the most significant achievements in the history of medical science, since it is an effective way to reduce infection risk. It is very important in every country to implement a comprehensive vaccination program for health professionals, thus significantly reducing the risk of disease transmission between workers and patients. But without the support of health professionals, the introduction of a vaccination program may fail. Nevertheless, the health policy addresses one of the major challenges, which is to achieve high immunization rates of healthcare professionals. However, fear of side effects and doubts regarding the usefulness of vaccines have led healthcare professionals to be very cautious. For this we must design strategies to enhance professional awareness regarding diseases that are preventable by vaccinations. The state should make evidence-based recommendations on the benefits and risks of vaccines.

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