Scientific Research and Essays Vol. 7(44), pp. 3809-3815, 12 November, 2012
Available online at http://www.academicjournals.org/SRE
DOI: 10.5897/SRE12.218
ISSN 1992-2248 ©2012 Academic Journals

Full Length Research Paper

Determining the knowledge levels of midwives about vaccines in Sivas, Turkey

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Accepted 9 September, 2012

This study aims to determine the knowledge levels and incorrect knowledge of midwives regarding vaccination and it increase the efficiency of vaccination through providing necessary training. This is a cross-sectional study. The material of the study included midwives (n = 93) from primary health care centres, state hospital and university hospital in a city center. A survey was conducted to obtain demographical data about the midwives and their knowledge on vaccination. The data obtained were analyzed using chi-square and percentage tables on computer. It was determined that 83.9% of the midwives were trained on vaccination practice. It was also found out that 33.3% of the midwives, 37 and over years old that were at the age of retirement felt they were inadequate. In addition, it was revealed that 91.4% of the midwives used upper arm as vaccination place in infants, 76.3% did not know how long vaccines needed storing in vaccine transportation container, and that 41.9 to 45.2% stored the vaccines on unsuitable shelves. At the end of the study, it was determined that the midwives' knowledge about vaccines was inadequate. It was concluded that health staff should be trained theoretically and practically to increase their efficiency.

Key words: Vaccine, vaccination, midwifery, knowledge level.

INTRODUCTION

Vaccination is the most effective, economical, rational and dependable method of preventing infectious diseases (Jenner, 1996; Salisbury et al., 2006). The aim of vaccination is to protect individuals from infectious diseases, prevent and, if possible, eradicate diseases (Armstrong, 2003; Arvas, 2004; Chiodini, 2000, 2001). Vaccination practice is part of midwives' daily tasks who work in primary health care centers (Chiodini, 2000, 2001). Early infant vaccination is among the duties of midwives and nurses who work in newborn units. Midwives and nurses are trained on injection techniques and vaccinations during their professional education (Chiodini, 2000). Yet, new theoretical insights bring about changes in the field of practice, as well. For this reason, midwives should follow the current scientific developments to accommodate these changes (Jodar et al., 2001). However, there are only a limited number of sources for midwives to improve themselves regarding vaccines and vaccination after graduation (Sağlik Bakanliği and UNICEF, 1993; TC.Sağlik Bakanliği Temel Sağlik Hizmetleri Genel Müdürlüğü-TSHGM, 2000, 2002, 2006). Nurses and midwives are responsible for the application and storage of vaccines in primary health care centers (TC.Sağlik Bakanliği Temel Sağlik Hizmetleri Genel Müdürlüğü-TSHGM, 2000, 2002). If a midwife is to make a mistake before the vaccination of an infant, this will cause vaccines to be ineffective or even unwanted effects to appear (American Academy of Pediatrics-AAP, 2003; Center for Disease Control and Prevention-CDC, 1994; Centers for Disease Control and Prevention-CDC, 2003). Effective and complication-free vaccination could be achieved through midwives equipped with necessary knowledge on vaccines and their uses (Chiodini, 2000, 2001; Chiodini et al., 2001).

This study aims to determine the knowledge levels of

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Table 1. Socio-demographic characteristics of midwives (n = 93).

Socio-demographic characteristic	Number	Percent
Institution		
Primary health care center	82	88.2
Hospital	11	11.8
Experience (Years)		
1 - 4	9	9.7
5 - 8	26	28.0
9 - 12	29	31.1
13 - 16	13	14.0
≥17	16	17.2
Education level		
Health high school	61	65.6
Health vocational school	26	27.9
Midwifery undergraduate	6	6.5
Age (Years)		
20 - 29	65	69.9
≥30	28	30.1

midwives and their incorrect knowledge in order to improve the efficiency of vaccines by providing them with necessary training.

MATERIALS AND METHODS

Study setting, design and participants

The cross-sectional study was implemented between 1 and 30 June 2006 to determine the knowledge levels of midwives about vaccines in 19 different primary health care centres, aseptic unit of the state hospital and newborn unit of university hospital within the boundaries of Sivas Municipality. Study material composed of 107 midwives who administer vaccinations. However, 9 midwives were on vacation and 5 did not want to participate in the study; therefore, the study was carried out with 93 midwives.

Data collection

After reviewing related literature, a “Questionnaire Form” and an “Informed Consent Form” were developed by researchers with expert assistance to collect data about the midwives. A pilot study of the questionnaire form was implemented with 15 midwives who worked in the state hospital, and necessary corrections were made accordingly. Required permission was granted from Provincial Directorate of Health. Questionnaire forms were distributed to midwives in hospitals, and they were asked to fill out the questionnaires.

Data analysis

Data were entered into the computer, tabulated and analyzed by using statistical package for Social Sciences (SPSS) 16.0 software program. Descriptive statistics (mean ± standard deviation, the number and percentage) were used to report sample characteristics. A level of $P < 0.05$ was considered statistically significant.

RESULTS

The ages of 93 midwives participating in the study ranged between 20 and 49, and their mean age was 29.0 ± 7.3. 88.2% of the midwives participating in the study worked in the primary health care centres and 11.8% in hospitals. 9.7% of the midwives had a work experience of 1 to 4 years, 17.2% were close to their retirement or earned their retirement. 61 midwives were high school graduates, 26 had associate degree and 6 had bachelor’s degree (Table 1). The participating midwives were found to have training on various topics such as immunity, types of vaccines, injection techniques, principle of vaccination, storage of vaccines, cold-chain, vaccination calendar, infant vaccines and the requirements of vaccination.

Midwives (83.9%) had training on vaccination. 11.1% of those younger than 36 years of age felt they are inadequate in vaccination, while 33.3% of the midwives (37 years of age and over) felt they are inadequate.

Midwives (23.1%) less than 30 years of age and 46.4% of 30 years of age and over could not identify the dead vaccines ($P = 0.029$). 19.4% of the midwives gave wrong answers like radiotherapy when they were asked about the non-obstacle conditions for vaccination. 91.4% of the midwives stated upper arm as the region to be

vaccinated in infants, which was also incorrect (Table 2). The interesting point was that all undergraduate midwives gave wrong answers.

When the midwives were asked about the methods of vaccination, 95.7% were found to know the injection method of polio, but 12.9 and 33.3% did not know the application methods of different vaccines (Table 2). 41.7% of the midwives that were 37 years of age and over who reached their retirement and 12.3% of the midwives of less than 36 years of age did not know the application method of BCG (P = 0.022). When the midwives were asked about injection angles of vaccines, 17.2 and 23.7% could not give the right answer (Table 2).

When the midwives were asked about the storage place of vaccines, 11.8 and 45.2% of them gave wrong answers (Table 2). 46.5% of the trained and 72.7% of the untrained midwives were found to store Tuberculin Skin Testing (TST) solution in the wrong shelves (P = 0.049). Five undergraduate midwives out of the 6 stored TST solution on the wrong shelves. Midwives graduating from health vocational high schools were better at storage than undergraduates, even if they were not quite excellent. The difference between these two groups was found statistically significant [TST solution (P = 0.019), Hepatitis B (0.042), Td (0.042)]. 60.2 and 76.3% of the midwives did not know the factors leading to the spoilage of vaccines (Table 2). 52.3% of the midwives less than 30 years of age and 78.6% of 30 years of age and over did not know the factors spoiling BCG (P = 0.021). 39.8% of the midwives did not know the indications of spoiled vaccines, and 76.3% did not know how long a vaccine could be stored in transportation containers (Table 2).

DISCUSSION

Infection chain can be broken when 80% of the children less than 1 year of age are vaccinated. Therefore, prevalence of infections which lead to disability and death of children can be decreased (TC.Sağlik Bakanliği and UNICEF, 1993; Zuckerman, 2000). Vaccination rates range between 92 and 99% in the USA and 85 and 97% in England, while it is 99% in Iran and Syria and 60 to 91% in Iraq (World Health Organization-WHO, 2009a, b, c, d, e, f). According to the data of World Health Organization, general immunization rate in Turkey was determined to range between 92 and 97% in 2008; however, it was found as 41.5% in a study carried out in Istanbul, which was surprisingly lower (World Health Organization-WHO, 2009f, Seren et al., 2006).

Parents were not informed about the normal reactions of vaccines; in addition, parents and midwives were not sufficiently knowledgeable, conscious and diligent, which were important factors affecting the success of vaccination (Arvas, 2004; TC.Sağlik Bakanliği and UNICEF, 1993; Chiodini et al., 2001). Some midwives that participated in the study were found inadequate regarding their knowledge on vaccines and vaccination.

Midwives who are equipped with up-to-date knowledge and skills increase the quality of services and the satisfaction levels of served groups by decreasing the frequency of unfavourable clinical events (Chiodini et al., 2001). The number of midwives who felt themselves incompetent was low; however, they should be trained and informed in order to increase service quality and decrease the frequency of complications and unfavourable events caused by health staff (National Health and Medical Research Council-NHMRC, 2003).

Established rules should be strictly followed in order to prevent malpractices that may occur during vaccination (Armstrong, 2003; Arvas, 2004; Chiodini et al., 2001; Turgut, 2004). Inappropriate storage, preparation and application of vaccines were mostly implemented by nurses, midwives and other health staff. In order to eradicate or minimize these errors, midwives/nurses should know the rules scientifically determined for each stage of vaccination (Arvas, 2004; Chiodini, 2001; Jodar et al., 2001; Turgut, 2004; Davis, 2001; Gardner et al., 2002). Training for injection techniques is given in the course of midwifery and nursing education; however, midwives encounter certain limitations when revising their knowledge and skills, and these problems vary by regions and institutions (Chiodini, 2001; Chiodini et al., 2001).

Spoilage of vaccines is caused by the cumulative effect of heat, which means that vaccines can be spoiled by being exposed to 10 to 30°C many times, while they can be spoiled by exposure to high temperatures like 30 to 35°C only once; therefore, cold chain requires continuity (TC.Sağlik Bakanliği Temel Sağlik Hizmetleri Genel Müdürlüğü-TSHGM, 2008). Live vaccines like Oral Polio Vaccine (OPV), Measles (M), Measles–Mumps-Rubella (MMR), Rubella (R), Chickenpox, Measles-Mumps-Rubella-Chickenpox and Bacillus Calmette Guerin (BCG) are sensitive to high temperatures, while inactive vaccines are affected by cold. Diluents of lyophilized vaccines and such vaccines as Diphtheria-tetanus and pertussis (DTaP/DTP), Diphtheria-Whooping Cough-Tetanus, Diphtheria-Tetanus-Acellular Pertussis, Tetanus Toxoid (TT), Diphtheria-Tetanus (Td) and Hepatitis B should not be frozen. In addition, BCG, measles, MMR, rubella are also sensitive to ultraviolet light like sunshine and should be protected from light (Centers for Disease Control and Prevention-CDC, 2003; American Academy of Pediatrics-AAP, 2006).

Similar studies reported that 17 to 37% of vaccines were exposed to unfavourable temperatures in the application process (American Academy of Pediatrics-AAP, 2006; Bell et al., 2001; Gazmararian et al., 2002; Techathawat et al., 2007; Matthias et al., 2007). In this study, it was determined that 11.8 to 45.2% of midwives did not know the storage places of different vaccines, 76.3% did not know the storage period of vaccines in transportation containers and 60.2 to 76.3% did not know

Table 2. Knowledge levels of midwives regarding vaccines (n = 93).

Knowledge	Informed		Uninformed	
	Number	Percent	Number	Percent
Vaccine type				
Dead vaccine	83	89.2	10	10.8
Live vaccine	65	69.9	28	30.1
More than one vaccine could be made at the same time	93	100.0	0	0.0
Date and time are given on vaccine vials	93	100.0	0	0.0
Situations hindering vaccination	75	80.6	18	19.4
Vaccination area in infants	8	8.6	85	91.4
Indications of spoiled vaccines	56	60.2	37	39.8
Maximum duration to keep vaccines in transportation containers	22	23.7	71	76.3
Vaccine-injection ways				
BCG*- Intradermal	78	83.9	15	16.1
Polio**-Oral	89	95.7	4	4.3
Measles-subcutaneous	62	66.7	31	33.3
DTP***-Intra muscle	80	86.0	13	14.0
Td****-Intra muscle	81	87.1	12	12.9
TT*****-Intra muscle	80	86.0	13	14.0
HepB******- Intra muscle	81	87.1	12	12.9
Vaccine-application angle				
BCG- 2 mm parallel to skin	77	82.8	16	17.2
Measles-45° angle	78	83.9	15	18.3
DTP-90° angle	71	76.3	22	23.7
Td-90° angle	73	78.5	20	21.5
TT-90° angle	73	78.5	20	21.5
HepB-90° angle	72	77.4	21	22.6
Vaccine-storage places				
BCG-mid shelf	54	58.1	39	41.9
OPV-top shelf	82	88.2	11	11.8
Measles-top shelf	80	86.0	13	14.0
DTP-bottom shelf	53	57.0	40	43.0
Td- bottom shelf	52	55.9	41	44.1
TT- bottom shelf	51	54.8	42	45.2
Hep B- bottom shelf	52	55.9	41	44.1
Vaccine-spoiling factors				
BCG- heat, sun light	37	39.8	56	60.2
OPV- heat, sun light	30	32.3	63	67.7
Measles- heat, sun light	41	44.1	52	55.9
DTP-freezing temperature	22	23.7	71	76.3
Td- freezing temperature	22	23.7	71	76.3
TT- freezing temperature	22	23.7	71	76.3
HepB- bottom shelf	22	23.7	71	76.3

*****BCG: Bacillus Calmette-Guérin,******OPV: Oral Polio Vaccine, *******DTP: Diphtheria-Tetanus-Pertussis, **-******Td: Tetanus-diphtheria,***** TT: Tetanus Toxoid, **********HepB: Hepatitis B.

the factors spoiling vaccines (Table 2). In order to provide cold chain condition for storing vaccines, it should be known that live vaccines are sensitive to light and temperature and, therefore, stored in frozen state; on the

other hand, inactive vaccines are stored unfrozen (Center for Disease Control and Prevention-CDC, 1994; TC.Sağlik Bakanliği Temel Sağlik Hizmetleri Genel Müdürlüğü-TSHGM, 2008). It is a significant problem not to conform freezing temperatures exactly in the cold chain (Bell et al., 2001; Alabaz, 2004). Frozen temperatures of vaccines were reported to be provided (14 to 35%) in refrigerators or transportation materials (Techathawat et al., 2007) in a study carried out in Bolivia. Temperatures below 0°C were recorded in 2 to 50% of the observation period (Alabaz, 2004; Center for Disease Control and Prevention-CDC, 2002).

International standards and national circular/books require that health staff should strictly adhere to storage and preparation rules (Arvas, 2004; Chiodini, 2000; Gardner et al., 2002; Matthias et al., 2007; Center for Disease Control and Prevention-CDC, 2002, 2007; Farren and Mc Even, 2004). In various studies, it was emphasized that health staff should pay attention to expiration date of vaccines, not use the same injector for different vaccines as long as the contrary was stated by producer (firm), and that they should also avoid applying wrong doses and dilution liquids (Chiodini, 2000; Kanra, 1998; World Health Organization-WHO, 2001).

People who administer vaccination should have a good knowledge of human anatomy and structure. Length and radius of needle should be adjusted according to patient's age, amount of vaccination and thickness of muscle tissue (Alabaz, 2004; Center for Disease Control and Prevention-CDC, 2003; Alparslan, 2008; Diggle and Deeks, 2001). This study demonstrated that upper arm (deltoid) was considered by 91.4% of midwives as the vaccination part of an infant's body.

However, in many countries (Center for Disease Control and Prevention-CDC, 2002; World Health Organization-WHO, 2001, 1998) as well as in Turkey since 2006, vaccine injection into upper arm muscles (deltoid) of infants (0 to 1 years of age) has been banned as these muscles are not developed well enough at this period of age (TC.Sağlik Bakanliği Temel Sağlik Hizmetleri Genel Müdürlüğü-TSHGM, 2006). Vastus lateralis muscles were suggested to be used for injection until 1 year and even 3 years of age in some studies (Chiodini, 2001; American Academy of Pediatrics-AAP, 2003; Center for Disease Control and Prevention-CDC, 1994; National Health and Medical Research Council-NHMRC, 2003). In addition, certain vaccines are more effective when they are injected into muscles. The possibility of adverse effects was reduced in a study carried out by Cockshott et al., (1982). About 5% of the male patients and 15% of female patients were found to be vaccinated correctly.

The same study carried out on 58 patients of a hospital in Belgium reported that an injection made by stretching skin with thumb and forefinger and injecting vaccine with a 5/8 inch (16 mm) needle at 90° angle was a perfect intra muscular (IM) application. This study demonstrated the importance of using right technique and material in vaccination (Cockshott et al., 1982). In a study carried out by Altiok et al. (2000), 73.8% of the midwives and nurses were determined to use vastus lateralis muscle for intra cellular injection, as it is distant from sciatic nerve, and the vessels and muscles are well developed. Knowledge levels of midwives and nurses were found higher than those who participated in this study.

It is important that midwives and nurses know the application procedures and adhere to these rules firmly, so that they can obtain maximum efficiency from vaccines and minimize discomfort (Arvas, 2004; Chiodini, 2001; Orhon and Gülnar, 2007). In a study carried out in England, 5% of the nurses complained about the absence of a comprehensive source covering all stages of vaccination techniques (Chiodini, 2001).

In this study, reference books for midwives composed of the publications they had during their educations which were issued by Ministry of Health. No other book or journal was mentioned. This situation may have been caused by the fact that there are only a limited number of sources and midwives are not informed about them.

Injection of vaccines into deltoid muscle, an old vaccination method probably dating back to education years of midwives, is still common at present, which implies that midwives have not been informed on the issue or trained through in-service training, or the sources on this issue have not been adequately updated. Ministry of health should follow the current developments in the world, deliver the necessary information to health staff, organize in-service training and implement the regulations and controls regarding the issue.

Midwives should know every rule in the procedure of vaccination (Alabaz, 2004; American Academy of Pediatrics-AAP, 2002; Alabaz, 2004; Cockshott et al., 1982). Vaccines should be used before their predetermined expiration date. If the vaccines (DTP, Td, TT and Hepatitis B) that should be injected into muscles are to be injected in subcutaneous tissue, they can cause local irritation, granuloma, sterile abscess, tissue necrosis and fibrosis. These vaccines should be injected into deep muscle tissue in gluteal area (Alabaz, 2004; .Arvas, 2004; World Health Organization- WHO, 2009c; Center for Disease Control and Prevention-CDC, 2002).

However, in this study, 4.3 to 33.3% of midwives were found to administer vaccines incorrectly, and 17.2 to 23.7% of the injections were administered at a wrong angle. Altiok et al. (2000) reported that midwives and nurses applied hepatitis B and DTP vaccines incorrectly in subcutaneous and intradermic layers in 29.1% of the cases. This rate was found higher in the study and it should not be disregarded as incorrect applications as wrong angles could cause damages to the health of the vaccinated individuals. Arbitrary and incorrect vaccinations could cause low immunization levels, and also loss of public confidence in vaccination (Alabaz, 2004).

Conclusion

This study revealed midwives were determined to have insufficient knowledge regarding vaccines and vaccination; in addition, especially their applications were faulty and they did not update their knowledge sufficiently. They need to revise their practices by renewing their knowledge. Health staff should be trained theoretically and practically to increase their efficiency.

There have been decreases in lack of knowledge and faulty vaccine applications recently, as a result of the serious efforts of the Ministry of Health and Provincial Directorate of Health. This study should be reiterated to determine the situation.

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