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Immunization in Vietnam

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Abstract

Since the Expanded Program on Immunization was proposed by the World Health Organization in 1981, it has been promptly adopted by Vietnam as one of the country's national priority programs. In 1986, Vietnam achieved some remarkable goals, including polio-free status and the elimination of neonatal tetanus. At the same time, however, barriers and difficulties have also emerged. This article aims to provide an overview of both achievements and barriers to the implementation of the program and proposes some solutions.

1. Introduction

Vietnam is a country with an estimated population of 97 million in 2018, ranking 15th in the list of countries worldwide (1, 2). As of 2018, there is a large birth cohort (15.2 births/1,000 population, ranking 123rd in the world) and a high infant mortality rate (17.3 deaths/1,000 live births) as well as in children under the age of 5 (22 deaths/1,000 live births) (3). Only 35.9% of the population lives in urban areas, though the urbanization rate has increased due to migration and rapid urban development. Vietnam is divided into 6 geographical areas (northern mountain, Red River delta, central, central highland, south east and south west), 58 provinces and 5 central cities, approximately 713 districts and 11,145 municipalities. Health care administration is organized in a three-level system, which is mirrored in the division of healthcare facilities. At a central level is the Ministry of Health (MoH), which formulates and executes health policy and programs in the country) and Units under the MoH. At provincial level, there are 63 Health Bureaux (58 Provinces and 5 Central Cities) following MoH's policies; these are the core parts of the Provincial Local Governments under the Provincial People's Committees (PPCs); the Central Cities' and the Provincial Health Bureaux cover 1-2 million inhabitants each. At primary level, 2 different levels can be observed: a *District level,* which covers about 100,000–200,000 inhabitants, with a district health centre, and a *Municipal*

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level, covering around 5,000–10,000 users (4, 5), with one Municipal Health Centre (MHC) and several Village Health Care Workers (VHCWs) Groups. Over the past few years, Vietnam has achieved significant improvements and developments in the health care system and network. By 2011, there were 1,040 hospitals, 620 regional polyclinics, 59 rehabilitation hospitals and 11,047 MHCs with a total of 266,700 beds. Furthermore, the establishment of the private health sector and the completion of a grassroots health network with 80% of villages having HCWs and 100% of municipalities having health stations, of which nearly two-thirds met the national standards (6). The MHC is the first medical and technical unit to provide a range of basic services (mother and child health care, family planning, first aid, immunization and training for VHCWs) staffed by 4-6 workers (5). VHCWs are trained from 3 to 6 months on basic health care and primary health care by the MHCs and receive a small salary. These professional figures work hard and play an important role in immunization: from management and mobilization to monitoring and health program communication in their own villages (7).

2. The expanded program on immunization

The Expanded Program on Immunization (EPI) was initially established in 1974 by the World Health Organization (WHO) with the objective of providing universal immunization for children against diphtheria, pertussis, tetanus, poliomyelitis, measles and tuberculosis (8, 9). In 1999, the Global Alliance for Vaccines and Immunization (GAVI) was established with a grand coalition including various UN agencies and institutions (WHO, UNICEF, the World Bank), public health institutes, the vaccine industry and NGOs in order to extend the reach of the EPI by supporting the poorest countries in ensuring immunization for children aged under 1, thus trying to achieve a world free of poliomyelitis, reducing the incidence of tetanus and measles and developing and introducing new and improved vaccines and technologies (10). The WHO summary of 2011 showed that the global coverage of DPT3 vaccine (diphtheria–pertussis–tetanus) from 1980 to 2011 increased from 20% to 83% and the Measles-Containing Vaccine (MCV) shots from 16% to 85% (11).

In Vietnam, the EPI was first introduced in 1981 with the support of WHO and UNICEF and became one of six national targeted health programs in 1986. In Vietnam the EPI is organized and managed by the national EPI office and 4 regional EPI offices. Below, the provincial level is administered by Preventive Medicine Centers and followed by the District Medical Centers. MHCs are at the primary level and are the basic points of vaccine delivery. In a parallel manner, there are 2 surveillance systems which include epidemiology and post-injective response and 2 delivery systems including cold chain and immunization materials. The immunization services of each center were conducted actively and monthly on fixed consecutive days in almost all municipalities at one or several fixed immunization sites, with no more than 50 subjects/sessions/sites or 100 subjects when only 1 kind of vaccination was being administered. In some mountainous, remote or hard-to-reach areas, mobile teams must attempt to reach the target subjects in order to administer routine vaccines every 2 or 3 months with very low expenditure (around 0.5$ per shot or 1$ per shot in especially difficult areas) (12). The EPI includes vaccines against tetanus, diphtheria, hepatitis B, poliomyelitis, measles, pertussis, haemophilus influenzae, cholera, typhoid and tuberculosis according to the recommended national immunization schedule for 2015 shown in Table 1 **(**13**).**

Table 1 - Recommended national immunization schedule in 2015

Vaccine	Vaccination time	No. of doses	Location
BCG*	As soon as possible after birth	1	nationwide
HepB birth dose	As soon as possible after birth	1	nationwide
Quinvaxem*	2,3,4 months	3	nationwide
OPV*	2,3,4 months	3	nationwide
Measles	9, 18 months	2	nationwide
DPT booster dose	18 months	1	nationwide
Japanese Encephalitis	12 (2 doses), 24 months	3	nationwide
Cholera	2-5 years	2	high risk areas
Typhoid	3-10 years of age	1	high risk areas
TT*	WRCB 15-45 years	at least 2	high risk areas

*BCG: Tuberculosis vaccine, Quinvaxem (DTP-HepB-Hib): diphtheria, tetanus, pertussis, hepatitis B, and *Haemophilus influenzae* type b; OPV: Live Oral Poliomyelitis; TT: Tetanus Toxoid; WRCB 15-45: women reaching childbearing age from 15 through 45 years of age (*time that women are naturally able to become pregnant and give birth, or the time that women have menstrual periods*)

Since its adoption in 1981, the EPI in Vietnam was rapidly and successfully implemented in the target population with about 25 million children having been vaccinated from 1985 to 2004, which resulted in the evident improvement of their health as seen by the sharp drop in the under-five mortality rate: from 58 to 27 deaths/1,000 live births and the infant mortality rate went down from 44 to 22 deaths/1,000 live births between 1990 and 2006 (14). The goal of universal vaccination among children under 1 year of age was completed with 87% of children fully immunized against the six key diseases (diphtheria, pertussis, tetanus, polio, tuberculosis and hepatitis) in 1990 and 90% in 1993 (11). In 1991, Vietnam initiated the implementation of the national program for poliomyelitis eradication and maternal and neonatal tetanus elimination and achieved these goals by 2000 (Fig. 1) and 2005 (Fig. 2) respectively, thanks to the country's consistently high immunization coverage (15, 16). All immunization programs implemented in Vietnam are summarized in Table 2.

Although the prevalence of hepatitis B is high in Vietnam (8.6 million hepatitis B-positive people), its vaccine is 95% effective in preventing infection and its chronic consequences. However, until 2003, the hepatitis B vaccine was not

Table 2 - National and International Immunization Programs implemented in Vietnam

Institution	Program	Year
WHO	Expanded Program on Immunization (EPI) was initially established	1974
WHO, UNICEF	EPI was first introduced in Vietnam	1981
National Government	National program for poliomyelitis eradication, maternal and neonatal tetanus elimination	1991
WHO, UNICEF, World Bank	Global Alliance for Vaccines and Immunization (GAVI)	1999

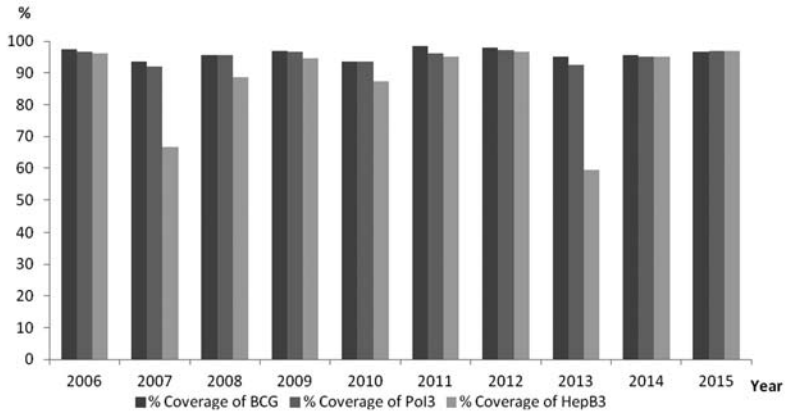

Fig. 1 - Percentage of coverage of BCG, PoI3 and HepB3 from 2006 to 2015 (children under 5 years

fully implemented nationwide since its introduction in the EPI in 1997, due to the limited production capacity of the local vaccine manufacturer and people's attitude towards vaccination (7, 17). Afterwards, with the support of GAVI, hepatitis B vaccine coverage rose consistently above 90% (Fig. 1) with an increase in birth dose coverage from 65% in 2006 to 75% in 2012 (16). Besides, Vietnam achieved WHO's goal of bringing the rate of children aged <5 infected with hepatitis B (1.89% in a national survey in 2012) under 2% (16).

Regarding measles, its incidence decreased 6-fold in 2000 compared to 1985 thanks to the EPI program. In 2002-2003, mass campaigns for a second dose of measles vaccine were implemented because of the increasing number of cases, especially in countries with only one dose of measles vaccine (like Vietnam at the time); a second dose of measles vaccine was administered to all children from 9 months to 10 years of age in some pilot sites in 1999 (18) and a national plan for Measles Elimination including a routine second vaccine dose at school entry was adopted in 2006 (7). From 2005 to 2009, the incidence of measles increased slightly because of the accumulation of infectious diseases among children that did not receive

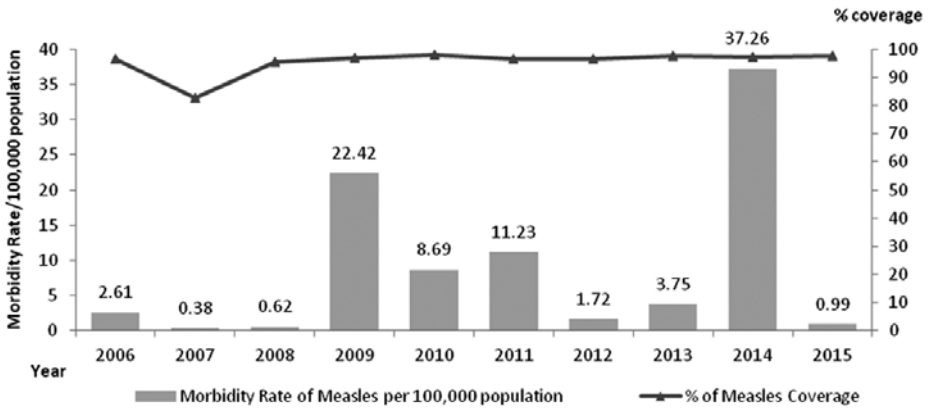

Fig. 2 - The rate of measles vaccination and the morbidity rate of measles between 2006-2015 (children under 5 years)

Table 3 - Situation of diphtheria, pertussis and neonatal tetanus between 2006 and 2015

Cases / Deaths	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Diphtheria	25/0	32/0	17/1	8/0	6/0	13/0	12/0	11/2	16/0	15/2
Pertussis	144/0	183/0	280/0	122/0	81/0	105/0	98/0	54/0	90/0	309/1
Neonatal Tetanus	27/18	36/26	34/25	33/27	35/24	32/17	39/19	46/32	34/28	47/17

the second shot of measles vaccine (under 6 years of age) and because of a vaccine shortage in 2007 (Fig. 2) (16).

Since 1984, the incidence of diphtheria and pertussis has also been continuously reduced, corresponding to an increase in routine coverage of the DPT vaccine and has been brought down to less than 0.01 and 0.1 per 100,000 population, respectively, since 2009 (Table 3) (16). New vaccines (Japanese encephalitis, Cholera and Typhoid) were also proposed in EPI and were officially approved in 1997. Despite its late introduction, immunization was implemented rapidly and successfully, as shown by the sharply declining rate of Japanese encephalitis, from 60% before 1997 to the current 10-15% (16). Due to a limited budget, typhoid and cholera vaccines are only administered in high-risk areas, but coverage in these areas has always remained at a high rate. In 2010, *H. Influenzae* B (Hib) vaccine as the combined component of Quinvaxem (DPT-VGB-Hib) was implemented nationwide, resulting in a total of 11 vaccines in the Vietnamese EPI being provided free of charge.

Some surveys conducted in 6 provinces randomly selected in 6 geographical areas, on 2,526 children aged 0-23 months, 1,800 children aged 16 months and 10 years and 1,260 mothers of children aged 0-11 months, indicated that vaccine coverage of key diseases in Vietnam in the period 2001–2008 reached the targets set by the Vietnamese EPI for fully immunized children by 1 year of age (90%) (Fig. 3), and for tetanus toxoid (TT2 Plus), for both pregnant woman (80%) and WRCB age (90%) (7).

A difficult and challenging task is to maintain the vaccination rate for under-1y children over 90% nationwide, especially in mountainous and remote areas. By 1994, there were still eight border municipalities in Muong Te district, Lai Chau province, which

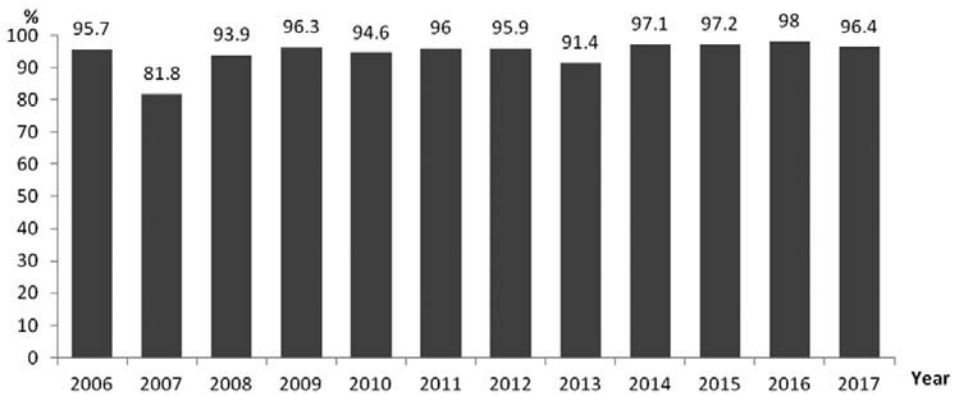

Fig. 3 - Percentage of coverage (fully vaccinated) nationwide from 2006 to 2017

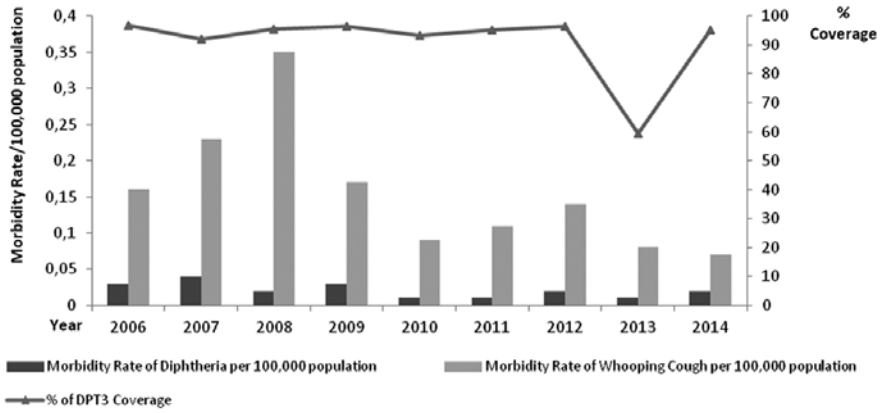

Fig. 4 - The rate of DPT3 vaccination and the morbidity rate of diphtheria and pertussis between 2006-2014

had not yet implemented EPI. In 1995, the efforts of the Muong Te district, for the last vaccination, have been implemented (15). Overall, the proportion of children under 1 year-old who were fully immunized has increased over the years and it has been consistently above 90% at the provincial level since 1995 and above 90% at the district level since 2004 (except in 2007 because of lack of measles vaccine) (16). Besides, an estimation of WHO and UNICEF about national immunization coverage from 2004 to 2015 showed that 96% and 94% of children less than 1 year old had received by 2009 the third-dose of diphtheria-tetanus-pertussis (DPT) and HepB, respectively (Fig. 4) (19, 20).

At present, the program is focused on maintaining the eradication of polio, the elimination of neonatal tetanus and of measles by 2018 as well as the incidence reduction of rubella and diphteria, keeping pertussis at a low level of 0.01 per 100,000 population and - last but not least - launching new vaccines. In the first phase of EPI starting in 1981, 4 types of basic high-quality vaccines were produced in Vietnam by the Institute of Vaccines and Medical Biologicals under the supervision of UNICEF. These included BCG, Typhoid, Diphtheria–Tetanus–Pertussis (DTP) and Tetanus Toxoid (TT). Through the supply of necessary equipment, technical assistance and vaccination supplies, Vietnam now produces 12 out of the 13 vaccines suggested by the EPI and will produce 14 types of vaccines by 2025 (15). The success of EPI lays in the fact that it cut down the burden of contagious diseases preventable by vaccination, which felt dramatically from 1990 to 2010 (21). This was also indicated in the research of Jit *et al* (20) that evaluated the impact of the Vietnamese EPI program based on national surveillance data. Results showed that up to 5.7 million cases and 26,000 deaths may have been prevented by EPI due to both improved vaccine coverage and increasing birth cohort size. More specifically, case-fatality risks for measles, pertussis, diphtheria and polio declined significantly between 1980–2010 (20). Besides, the eradication of poliomyelitis in 2000 also reflected an improved ascertainment of cause-of-death. Though temporary increases were observed in 1993 (measles), 2005 (pertussis) and 1990–1996 (polio) due to lower vaccine coverage in hardly accessible regions and a national stockpile problem, the coverage rate improved in the following years. In the research of Jit *et al* (20), analysis using LiST also suggested EPI has delivered

great benefits by preventing an increase of deaths in children aged under-five (370,000) thanks to measles and pertussis vaccination alone (20). An evaluation of the cost-effectiveness of EPI showed that its total cost from 1996 to 2010 (including the costs of the DPT, polio and measles vaccines and their campaigns) stood at $154.5 million and its cost-effectiveness was around $1000–$27,000 per death prevented. The EPI program could represent a net cost-saving for public health, in fact no analysis evaluates the savings on costs related to the reduction of treatment. This was more evident in a study by Dang TD *et al* (22) that evaluated some socio-economic benefits from EPI in Gia Lai province from 1997 to 2006. The results illustrated that the total costs of treatment for measles, pertussis and diphtheria during EPI (1997-2006) were 14.4, 83.9 and 4.3 lower respectively than in the pre-vaccination period (1979-1984). When Vietnam completes the transition to middle-income status, the benefits gained through Gavi's continued support to vaccine introduction and health systems strengthening will come to an end and Vietnam at that time should have become self-sufficient in the funding, production and supply of vaccines. There will be difficulties, challenges and competitive priorities for Vietnam's public investments both inside and outside its health sector. Therefore, understanding the impacts, values, and barriers of the EPI program is important and necessary to build appropriate policies and plans for the future.

3. Barriers to EPI

3.1 Parental barriers

3.1.1. Knowledge and attitude of parents towards vaccination

Knowledge of EPI program by mothers was low, especially in mountainous or remote areas. In a cross-sectional descriptive study on the current status of knowledge and attitude of mothers with children at an appropriate age for vaccination in 2 bordering districts of Lang Son city, results showed that the on-time vaccination rate (according to the recommended immunization schedule) was as low as 13.5% (23). The municipality with the lowest on-time vaccination rate was 10.0% and the highest was only 15.6%. Subsequently, knowledge of EPI by mothers reached over 75.4%, but only 39.0% of them knew about the benefits of EPI. Only 27.65% of mothers thought that EPI could prevent disease (23). In another research conducted in a mountainous area of Vietnam (Dai Bac municipality), results indicated that the mothers' knowledge of vaccination schedules was limited, 80% knew inadequately the vaccination schedules, 60.3% did not know the effect of vaccination, 32.2% did not know when the child was to be vaccinated (24). It is necessary to strengthen education, information and communication for mothers with children of vaccination age and promote their initiative in taking children for specific vaccinations, thus reducing their dependence on the services of village HCWs. The Center for Health Education and Communication (T4G) conducted a survey of 2,160 parents who took those of their children who were under 36 months of age to be vaccinated at public health facilities in Ho Chi Minh City. The purposes of the survey were to identify reasons why parents do not vaccinate their children or do not allow shots to be administered adequately, as well as identifying communication channels accessible to parents about immunization issues. Results from the survey also showed that nearly half of the respondents said that free vaccines and service vaccines were equally good, 39% said that service vaccines were better than the free ones because they thought that service vaccines gave less side effects (44%), were of better quality (47%) and safer (39%) than free vaccines, but 92% agreed that their children should be vaccinated anyway (25).

3.1.2. Effects of media communication

Nowadays, the media have a significant impact on public attitudes and behaviors worldwide, and Vietnam is no exception (26,27). A study by Wakefield *et al* (28) showed that mass media campaigns could facilitate positive changes, promote awareness and/or prevent negative changes in health-related behaviors in large populations. For example, they can contribute to increasing awareness of HIV/AIDS among individuals in low-income countries (29) or, in the field of immunization, increasing the number of parents deciding to vaccinate their children. However, they can also drive people to distrust or even oppose the benefits of vaccines due to misinformation about their risks and benefits (30,31). Media channels are a critical source of health information for parents, whose attitude towards vaccination plays a crucial role in immunization of children. Consequently, the media have had a great influence and impact on the effectiveness of the EPI program. According to a research carried by T4G over the past year, 87% of parents were found to know about vaccination: HCWs were the most accessible source of information (62%), followed by the internet and the media (45%). Information on vaccination schedules was most sought by parents, followed by types of vaccines, immunization benefits, safety, etc. Notably, 859 out of 2,160 people mentioned difficulties that made them hesitate to vaccinate, with the most concern being for post-injection reactions (76%), then the safety of vaccines (39%) and misleading information on vaccines (14%) (25). This could be explained by the fact that, in the past, information on vaccines was mediocre, and some recent cases of post-injection reactions have led to confusion among parents and HCWs, causing a subsequent reduction in confidence towards medical staff. This was also the case in a cross-sectional study of Tran *et al* (29) carried in an urban vaccination clinic in Hanoi from November 2015 to March 2016. Face-to-face interviews were performed in order to identify the decisions of Vietnamese subjects after hearing about adverse effects of immunizations (AEFIs) on the media. Among the 429 participants with a mean age of 26.8 years (SD=6.2), most respondents began to worry more and 68.2% of them were hesitant about receiving vaccines after hearing about AEFIs, while 12.4% of respondents said they would refuse to be vaccinated. Results similar to T4G research were also observed. Though most respondents received information about vaccination via the media, 38.0% of them agreed that HCWs were the most trustworthy source and 90.6% of subjects were concerned about vaccine complications reported in the media. The results of multivariate logistic regression models indicated that wealthy subjects (OR=0.41; 95% CI=0.19–0.88), subjects with high trust in for-profit vaccines (OR=0.20; 95% CI=0.06–0.72) and EPI vaccines (OR=2.95; 95%CI=0.76-11.52) were less likely to display vaccine hesitancy. People with a secondary and tertiary education (OR=3.07; 95% CI=1.05–8.98) and/or with children under the age of 6 (OR=15.14; 95% CI=4.34–52.78) were highly concerned about AEFIs. Instead, those receiving information from HCWs (OR=0.44; 95% CI=0.20–0.99) or from their relatives, colleagues, and friends (OR=0.47; 95% CI=0.25–0.88) did not show vaccine hesitancy, but would refuse vaccines if learning about AEFIs via the media (OR=3.12; 95% CI=1.10–8.90 and OR=3.75; 95% CI=1.56–9.02, respectively) (32). The drop in vaccination after reading about AEFIs not only resulted in negative effects on the efforts of the population, organizations and the government to achieve EPI's goals, but also contained potential risks. Specifically, media reports of AEFIs led to substantial reductions in birth dose coverage of the hepatitis B vaccination in 2007 (from 64.3% to 26.9%, falling nearly

35% in 1 year) and in the birth dose and the 3-dose series coverage in 2013 (from 75.6% in the previous year to 56%), which impacted on hepatitis B infections and future mortality (33). A research adopting a widely-used mathematical model was carried to estimate the number of chronic infections and deaths expected to occur in the 2013 birth cohort attributable to the drop in hepatitis B vaccination in 2013 and the shortage of coverage in 2012. The results showed that an excess of 90,137 chronic infections and 17,456 future deaths would have occurred if catch-up immunization had not been conducted in this birth cohort. Simultaneously, sensitivity analysis also illustrated that the number of excessive deaths and excessive chronic infections would range from 15,151 to 19,279 and from 78,304 to 97,703 as the model input went from the lowest to the highest estimates (33,34). Results from the reduction in hepatitis B vaccination coverage in 2007 and 2013 indicate the media have a strong influence on public opinion, even though the hepatitis B vaccine was one of the safest vaccines available at the time. Though the National Institute of Hygiene and Epidemiology made great efforts to perform several investigations in order to find the causes of AEFIs and many meetings were held with major newspapers and journalists to communicate an accurate, easily understandable message to the public saying that the AEFIs were the result of human error, it was not possible to meet with all media sources. It also takes time to change awareness and build public trust. In separate and coincidental incidents in 2012 and 2013, 12 children died shortly after being vaccinated with Quinvaxem (DTP-HepB-Hib) (35). As a result, the Ministry of Health stopped using Quinvaxem until October 2013 and carried several investigations with international and WHO experts. The results found no causal link between the vaccine and the fatalities, but most of the parents delayed or refused Quinvaxem and switched to Pentaxim and were willing to wait for Pentaxim to be administered. A few months later, some unwanted vaccine incidents due to mistakes made by HCWs fed disenchantment with the government-run health system. This resulted in a refusal to vaccinate children until they were 18 or 24 months old and/or in a switch from public health cover to private health providers (36). This was one of the reasons which caused the Hanoi measles outbreak in 2014. These developments demonstrate the devastating consequences of a loss of public confidence in vaccination and highlights the importance of maintaining high vaccination coverage and swiftly responding to reported AEFIs in order to regain consumers' confidence in vaccinations. Vaccinations are an effective tool for the prevention of diseases both from a health and a socio-ethical perspective; from this point of view, it is of fundamental importance for a parent to understand medical terminology, especially in relation to the use of drugs (37,38) and medical therapies, including an exact awareness of risks to the health of the child associated with a wrong diet (39-41). Sometimes, decisions based on a lack of knowledge or on a presumed knowledge could, over time, determine the acquisition of wrong lifestyles and be detrimental to the health of the child.

3.1.3. Socioeconomic inequalities

The association between measles vaccine coverage rates and socioeconomic inequalities among children aged 12-23 months in Vietnam between 2000 and 2014 was described (42). Results indicate that children in ethnic minority groups (whose mothers have a lower education level) and in the poorest groups were less likely to receive the measles vaccine, though their vaccine coverage rates increased in time, compared to children of more-educated mothers living in urban areas and belonging to the

wealthiest socioeconomic group (42-47). This result was similar to a study by Minh An *et al* in 2016 (48) with timely immunization completion being less common among children whose mothers had relatively less household wealth, belonged to ethnic minorities, lived in rural areas and were less educated (48). Socioeconomic factors had different effects in different studies and, at times, had no clear explanation (49,50). As in the systematic review of Heidi *et al* (31), a high income is a barrier to vaccination in the USA, but a promoter in India and Burkina Faso. In Nigeria and Bangladesh, a low income was identified as both a barrier and promoter. This can be explained by the fact that a transition was occurring in these countries. In low-income countries, the rural population, the ethnic minorities and the poor were more hesitant about accepting vaccines, such as was observed in Vietnam at the start of the study, due to poor education and an incomplete knowledge of vaccines. However, at the end of the study, when the country was experiencing a transition to a high-income environment and the emerging of a wealthier population with higher levels of education and increasing urbanization, vaccine hesitancy was linked only to concern about incidents relating to vaccines or misinformation from the media (51, 52). Specifically, a measles outbreak in 2014 was concentrated in big cities, where wealthy and highly educated mothers were able to decide whether or not to vaccinate their children. This increased the likelihood of an outbreak. With 60,000 cases and 150 deaths, this outbreak was a result of a reduction of measles coverage from 85.6 to 82.4 % in urban areas (Fig. 5) (36). This provides obvious evidence of the importance of maintaining and strengthening vaccine coverage to prevent epidemics and losses of life in the future (42).

3.2 System barriers

A research was performed in 2004 using available documents, in-depth interviews of 15 advanced leaders at central level and from international organizations, questionnaire interviews of 80 leaders from 4 districts, 12 municipalities and from inter-provincial group discussions in 4 provinces in order to identify barriers to EPI on a large scale and suggest interventions and solutions. The study was carried out by 3 Vietnamese

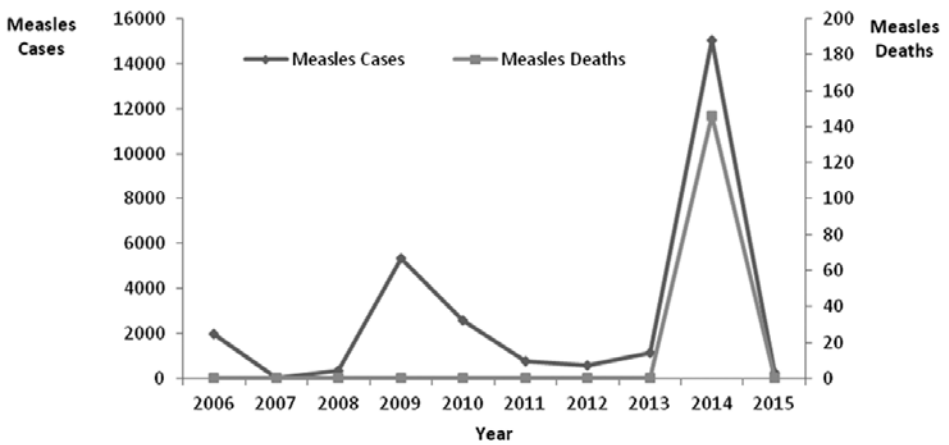

Fig. 5 - Number of cases and deaths of measles from 2006 to 2015

specialists, the WHO and members of Departments and Ministries under the supervision of the Ministry of Health and joined by representatives from stakeholders and Departments (53). Results showed that:

3.2.1. Budget and facilities

Considerable success has been achieved through EPI, contributing to feelings of satisfaction that have in turn led to a reduction in investment in the vaccination program. This is a mistake, as many countries (for example, China and some European countries) have experienced outbreaks of polio after a period during which the disease was successfully controlled. It must also be considered that diseases can spread very rapidly nowadays (25, 54). Moreover, the reduction in the national and local budget for the health sector, which has led to EPI being underfunded compared to actual needs, is the most important barrier to EPI (the EPI budget compared to the total health budget was less than 1% (0.93% in 2001 and 0.78% in 2004)) (53). This results in an extremely low immunization cost (the total cost for full immunization in facilties per child per year is VND 2,000 (US$ 0.13), including immunization allowance and other expenses) (53). Besides, the imbalance in revenue and expenditure and low disbursements in some provinces and districts have damaged the health sector, including EPI; consider also that health insurance currently only covers treatment and not prevention (53). Organizations tend to reduce their financial contribution because of EPI's high coverage, new health priorities such as SARS or HIV/AIDS and the fact that the country is undergoing an economic transition; at the same time, demand for high-quality vaccines, combined vaccines and new vaccines continues to increase. In addition, members of the EPI inter-agency coordination committee rarely attend meetings and propose more action plans through good communication (44, 53). Cold chain systems and vaccine transportation have been used for a long time to ensure vaccines maintain their effectiveness. At the municipality level, there are no refrigerators for preserving vaccines, with the exception of 4,000 municipalities in mountainous regions who have received a donation from the government of Luxembourg. A lack of computer systems at the provincial and district levels was also a problem for EPI management and supervision (53).

3.2.2. Human resources

The major challenge was posed by the difficult access to vaccination in remote and mountainous areas. There are not enough resources to manage the trips and maintenance of HCWs at village level, especially in mountainous and island areas, where there are geographical, weather and language barriers and difficulties. As a result, the management of primary health and immunization services don't have registered many people, and then the coverage rate recorded results to be lower in these areas (53). Village and municipality HCWs, who are also the major responsible for the delivery of vaccines, are treated like volunteers. Their job is not easy, but they only receive VND 40,000 per month (equivalent to USD 2.6!), which easily leads them to feel depressed and abandoned (53). Moreover, knowledge of EPI as well as computer literacy levels of HCWs responsible for implementing EPI was very low (20.1% of HCWs knew about EPI goals, and only 58.7% of HCWs knew where and how to give injections) (23). Therefore, there is an urgent need to periodically train the staff (53).

4. Proposed interventions

4.1. System interventions

The government should increase the proportion of funds allocated to the health

budget with more focus on preventive medicine and, specifically, on the EPI program. The local government should have suitable revenue and expenditure as well as fast and timely disbursements for EPI and should also have supporting strategies for human resources at local level. The government and organizations should actively provide information and seek aid to obtain immunization equipment and systems as well as for the implementation of new vaccines. Computer systems and EPI software knowledge should be supported to improve management at all levels and quality of service (53). Nowadays, residents (who take their children to immunization) have shown they are very knowledgeable about vaccination. When visiting any facility - both the ones where people have to pay or not to pay - they observed injection techniques of medical staff, noting which was aseptic, safe or unsafe. Moreover, they compared facilities, techniques, consultants and costs so they were effectively able to evaluate and make choices.

Therefore, it is necessary to improve the quality of health facilities, improve skills and techniques of HCWs employed in vaccination. Besides, the consultancy before and after vaccination should be strengthen in order to increase the immunization knowledge of parents as well as their trust in HCWs. Above all, the quality of vaccines and distribution systems must be guaranteed even at the municipal level. High quality was an important factor and a source of legal evidence to enhance public trust in Vietnam's government-run health system and to lessens the impact of unofficial media channels.

4.2. Education

It is important to build and supplement policies on training, retraining and educating HCWs about vaccines as well as improve ways to effectively provide information to the vaccines and their families (53). Research by Tran *et al* (32) revealed that there was a higher proportion of respondents refusing vaccines among those with higher trust in HCWs at primary health care levels. These unusual findings might be associated with Vietnamese culture because the low quality of HCWs at MHCs as well as inadequate communication was perceived, leading to obstacles in building trust and providing knowledge about benefits, safety and post-injection care (32). It is also necessary to adopt supporting policies in order to effectively use health staff at a grassroots level and improve immunization coverage to ethnic minorities in mountainous and remote areas. Further researches should be carried out to identify strategic policies and key factors to improve vaccination coverage and reduce inequalities and misinformation, as well as unwanted incidents. These immunization strategies may be the key to prevent diseases and deaths in Vietnam. Municipality or village HCWs need to understand their role in EPI and need to actively seek children for treatment outside vaccination stations or even at home, because vaccination rates will be low if HCWs stay in their place of work, waiting for parents to bring their children in. Communication on the effectiveness of vaccines and their importance, clear communication on post-injection response, the safety of the vaccine and confidence in vaccine production and distribution through the EPI program should be strengthened. When accidents occur, it is important to provide timely and clear information, avoiding public confusion. Medical staff needs to deal efficiently with accidents and strengthen trust in parents. In addition, communication with parents about post-injection response, management, follow-up times after the first injection is essential. These factors influence the decision made by parents to immunize their children.

Conclusion

The EPI program has been implemented efficiently in Vietnam and has enjoyed considerable success, but there are still many barriers and difficulties to overcome in mountains, remote and island areas, including issues of hesitancy. These problems should be solved in a timely manner to increase benefits for children and women and avoid unwanted consequences. Building public confidence is one of the most important steps to maintain immunization success because it is an important factor for cultivating the desire to receive vaccines. To this end, using the media is one of the most influential ways of encouraging vaccine uptake and consolidating both trust and information on vaccination across Vietnam.

Riassunto

Vaccinazioni in Vietnam

Dall'introduzione nel 1981, da parte dell'Organizzazione Mondiale della Sanità, dell'Expanded Program on Immunization, prontamente diventato uno dei programmi nazionali prioritari nel 1986, il Vietnam ha raggiunto importanti obiettivi, in particolare l'eradicazione della polio e l'eliminazione del tetano neonatale. Nonostante questo, sono emerse difficoltà e ostacoli culturali. Questo articolo si propone di fornire una panoramica dei risultati e delle difficoltà nell'attuazione del programma, nonché di proporre alcune soluzioni.

References

1. The World Bank. Mortality rate, under-5 (per 1,000 live births). Available from: https://data.worldbank.org/indicator/SH.DYN.MORT (2017) [Last accessed: 2018, Nov 30].
2. Central Intelligence Agency. Vietnam. Available from: https://cia.gov. [Last accessed: 2018, Nov 30].
3. GAVI. The Vaccine Alliance. Vietnam country hub. Available from: http://www.gavialliance.org/country/vietnam (2018) [Last accessed: 2018, Dec 16].
4 World Health Organization (WHO). A health financing review of Vietnam with a focus on social health insurance, 2011 Available from: https://www.who.int/health_financing/documents/oasis_f_11-vietnam.pdf?ua=1 [Last accessed: 2018, Jan 6].
5. Takashima K, Wada K, Tra TT, Smith DR. A review of Vietnam's healthcare reform through the Direction of Healthcare Activities (DOHA). Environ Health Prev Med 2017; **22**(1):74. doi: 10.1186/s12199-017-0682-z.
6. General Statistics Office of Vietnam (G.S.O.o.). Statistic Data. Available from: http://www.gso.gov.vn/Default.aspx?tabid=706&ItemID=13412 (2018). [Last accessed: 2018, Dec 17].
7. Nguyen TD, Dang AD, Van Damme P, et al. Coverage of the expanded program on immunization in Vietnam: Results from 2 cluster surveys and routine reports. Hum Vaccin Immunother 2015; **11**(6): 1526-33. doi:10.1080/21645515.2015.1032487.
8. Siracusa M, Grappasonni I, Petrelli F. The pharmaceutical care and the rejected constitutional reform: what might have been and what is. Acta Biomed 2017; **88**(3): 352-9. doi: 10.23750/abm.v88i3.6376.
9. Signorelli C, Odone A, Gozzini A, et al. The missed Constitutional Reform and its possible impact on the sustainability of the Italian National Health Service. Acta Biomed 2017; **88**(1): 91-4. doi: 10.23750/abm.v88i1.6408.
10. GAVI. The Vaccine Alliance. Decade of Vaccines Collaboration. Available from: https://www.gavi.org/about/ghd/dov/ [Last accessed: 2018, Dec 17].
11. WHO, UNICEF. Immunization summary. A statistical reference containing data through 2013. 2014 Edition. Available from: https://www.who.int/immunization/monitoring_surveillance/Immunization_Summary_2013.pdf. [Last accessed: 2018, Nov 30].
12. National Expanded Program on Immunization. Immunization in moutinous areas [Vietnamese]. Available from: http://www.tiemchungmorong.vn/vi/content/cong-vac-xin-len-nui.html [Last accessed: 2018, Dec 17].
13. UNICEF, WHO. Recommended national immunization schedule for Viet Nam's children. Available from: http://www.wpro.who.int/vietnam/mediacentre/releases/2015/childhood_immunization_epi_schedule_march_2015_vietnam_v2.pdf (2015). [Last accessed: 2018, Dec 17].
14. UNICEF, WHO. National Expanded Program on Immunization. 25 years of co-operation between UNICEF and IVAC for National Expanded Program on Immunization. Available from: http://apps.who.int/iris/bitstream/handle/10665/170485/

EB89_17_eng.pdf?sequence=1&isAllowed=y [Last accessed: 2019, Jan 6].
15. Vietnam Economic Health Science Association. Some features of the effectiveness of vaccination against infectious diseases in children [Vietnamese]. Available from: http://vhea.org.vn/print-html.aspx?NewsID=197 (2011) [Last accessed: 2018, Dec 18].
16. National Expanded Program on Immunization. Achievement of the Expanded Program on Immunization in Vietnam [Vietnamese]. Available from: http://www.tiemchungmorong.vn/vi/content/thanh-qua.html (2011) [Last accessed: 2018, Dec 1].
17. World Health Organizatio (WHO). Western Pacific Region. Representative Office Viet Nam. Hepatitis B Fact sheet. Available from: http://www.wpro.who.int/vietnam/topics/hepatitis/factsheet/en/ [Last accessed: 2018, Dec 17].
18. McFarland JW, Mansoor OD, Yang B. Accelerated Measles Control in the Western Pacific Region. J Infect Dis 2003; **187**(Suppl 1): S246-51.
19. WHO, UNICEF. WHO and UNICEF estimates of immunization coverage: 2015 revision. Available from: https://data.unicef.org/wp-content/uploads/country_profiles/Viet%20Nam/immunization_country_profiles/immunization_vnm.pdf [Last accessed: 2018, Dec 1].
20. Jit M, Dang TT, Friberg I, et al. Thirty years of vaccination in Vietnam: Impact and cost-effectiveness of the national Expanded Programme on Immunization. Vaccine 2015; **33**(Suppl 1): A233-9. doi: 10.1016/j.vaccine.2014.12.017.
21. Vietnam Ministry of Health, Health Partnership Group. Joint Annual Health Review 2014. Strengthening prevention and control of non-communicable disease. Available from: http://jahr.org.vn/downloads/JAHR2014/Summary%20of%20JAHR%202014.pdf [Last accessed: 2019, Jan 18].
22. Vietnam EPI. Result of EPI activities in 2007, vaccine coverage. https://www.unicef.org/vietnam/immunization [Last accessed: 2019, February 13]
23. Duong AD, Pham QT, Hoang KL. Status of immunization activities, knowledge, attitude and practice in expanded program on immunization at 2 bordering districts in Lang Son province in 2015. Vietnam J Prev Med 2017; **27** (1): 77.
24. Duong TH. The status of quality of vaccination and evaluation of some interventions at the commune level in Da Bac district - Hoa Binh province, 2007 - 2009 [Vietnamese]. National Institute of Hygiene and Epidemiology, 2009.
25. The Center of Health Communication and Education (VietNam). Survey on information approach and barriers to vaccination in parents of children under 36 months old in HCMC (Vietnamese). Available from: http://www.t4ghcm.org.vn/tin-tuc-su-kien/tang-cuong-vai-tro-cua-nhan-vien-y-te-trong-truyen-2939/ (2016). [Last accessed: 2018, Dec 1].
26. Petrelli F, Contratti CM, Tanzi E, Grappasonni I. Vaccine hesitancy, a public health problem. Ann Ig 2018; **30**(2): 86-103. doi: 10.7416/ai.2018.2200.
27. Spacilova L, Petrelli F, Grappasonni I, Scuri S. Health care system in the Czech Republic. Ann Ig 2007; **19**(6):573-81.
28. Wakefield MA, Loken B, Hornik RC. Use of mass media campaigns to change health behaviour. Lancet 2010; **376**(9748): 1261-71. doi: 10.1016/S0140-6736(10)60809-4.
29. Bertrand JT, O'Reilly K, Denison J, Anhang R, Sweat M. Systematic review of the effectiveness of mass communication programs to change HIV/AIDS-related behaviors in developing countries. Health Educ Res 2006; **21**(4): 567-97. Epub 2006 Jul 17.
30. Jung M, Lin L, Viswanath K. Effect of media use on mothers' vaccination of their children in sub-Saharan Africa.Vaccine 2005; **33**(22): 2551-57. doi:10.1016/j.vaccine.2015.04.021.
31. Larson HJ, Jarrett C, Eckersberger E, Smith DM, Paterson P. Understanding vaccine hesitancy around vaccines and vaccination from a global perspective: a systematic review of published literature, 2007-2012. Vaccine 2014; **32**(19): 2150-9. doi: 10.1016/j.vaccine.2014.01.081.
32. Tran BX, Boggiano VL, Nguyen LH, et al. Media representation of vaccine side effects and its impact on utilization of vaccination services in Vietnam. Patient Prefer Adherence 2018; **12**: 1717-28. doi: 10.2147/PPA.S171362.
33. Li X, Wiesen E, Diorditsa S, Tet al. Impact of Adverse Events Following Immunization in Viet Nam in 2013 on chronic hepatitis B infection. Vaccine 2016; **34**(6): 869-73. doi: 10.1016/j.vaccine.2015.05.067.
34. Grappasonni I, Petrelli F, Amenta F. Deaths on board ships assisted by the Centro Internazionale Radio Medico in the last 25 years. Travel Med Infect Dis 2012; **10**(4): 186-91. doi: 10.1016/j.tmaid.2012.06.006.
35. Cioffi P, Laudadio L, Nuzzo A, Belfiglio M, Petrelli F, Grappasonni I. Gemcitabine-induced posterior reversible encephalopathy syndrome: a case report. J Oncol Pharm Pract 2012; **18**(2): 299-302. doi: 10.1177/1078155211424628. 36. Roberts L. In Vietnam, an anatomy of a measles outbreak. Science (New York, N.Y.) 2015; **348**(6238): 962 (2015). doi:10.1126/science.348.6238.962.

36. Roberts L. In Vietnam, an anatomy of a measles outbreak. Science (New York, N.Y) 2015; **348**(6238):962 (2015). doi:10.1126/science.348.6238.962
37. Grappasonni I, Petrelli F, Klusonová H, Kracmarová L. Level of understanding of medical terms among italian students. Ceska Slov Farm 2016; **65**(6): 216-20.
38. Spacilova L, Klusonová H, Petrelli F, Signorelli C, Visnovsky P, Grappasonni I. Substance use and knowledge among Italian high school students. Biomed Pap Med Fac Univ Palacky Olomouc Czech Repub 2009; **153**(2): 163-8.
39. Grappasonni I, Petrelli F, Scuri S, Mahdi SS, Sibilio F, Amenta F. Knowledge and Attitudes on Food Hygiene among Food Services Staff on Board Ships. Ann Ig 2018; **30**(2): 162-72. doi: 10.7416/ai.2018.2207.
40. Grappasonni I, Marconi D, Mazzucchi F, Petrelli F, Scuri S, Amenta F. Survey on food hygiene knowledge on board ships. Int Marit Health 2013; **64**(3): 160-7.
41. Siracusa M, Petrelli F. Trade of food supplement: food or drug supplement?. Recenti Prog Med 2016; **107**(9): 465-71. doi: 10.1701/2354.25224.
42. Kien VD, Van Minh H, Giang KB, Mai VQ, Tuan NT, Quam MB. Trends in childhood measles vaccination highlight socioeconomic inequalities in Vietnam. Int J Public Health 2017; **62**(Suppl 1): 41-9. doi:10.1007/s00038-016-0899-4.
43. Scuri S, Petrelli F, Tesauro M, Carrozzo F, Kracmarova L, Grappasonni I. Energy drink consumption: a survey in high school students and associated psychological effects. J Prev Med Hyg 2018; **59**(1): E75-E79. doi: 10.15167/2421-4248/jpmh2018.59.1.898.
44. Grappasonni I, Paci P, Mazzucchi F, De Longis S, Amenta F. Awareness of health risks at the workplace and of risks of contracting communicable diseases including those related to food hygiene, among seafarers. Int Marit Health 2012; **63**(1):24-31.
45. Petrelli F, Grappasonni I, Evangelista D, et al. Mental and physical effects of energy drinks consumption in an Italian young people group: a pilot study. J Prev Med Hyg 2018; **59**(1): E80-E87. doi: 10.15167/2421-4248/jpmh2018.59.1.900.
46. Grappasonni I, Petrelli F, Traini E, Grifantini G, Mari M, Signorelli C. Psychological symptoms and quality of life among the population of L'Aquila's "new towns" after the 2009 earthquake. Epidemiol Biostat Public Health 2017; **14**(2): e11690-1-13. doi: 10.2427/11690.
47. Priebe S, Grappasonni I, Mari M, Dewey M, Petrelli F, Costa A. Posttraumatic stress disorder six months after an earthquake: findings from a community sample in a rural region in Italy. Soc Psychiatry Psychiatr Epidemiol 2009; **44**(5): 393-7. doi: 10.1007/s00127-008-0441-y.
48. Minh An DT, Lee JK, Van Minh H, et al. Timely immunization completion among children in Vietnam from 2000 to 2011: a multilevel analysis of individual and contextual factors. Glob Health Action 2016; **9**: 29189. https://doi.org/10.3402/gha.v9.29189.
49. Scuri S, Tesauro M, Petrelli F, Peroni A, Kracmarova L, Grappasonni I. Implications of modified food choices and food-related lifestyles following the economic crisis in the Marche Region of Italy. Ann Ig 2018; **30**(2): 173-9. doi: 10.7416/ai.2018.2208.
50. Grappasonni I, Scuri S, Tanzi E, Kracmarova L, Petrelli F. The economic crisis and lifestyle changes: a survey on frequency of use of medications and of preventive and specialistic medical care, in the Marche Region (Italy). Acta Biomed 2018; **89**(1): 87-92. doi: 10.23750/abm.v89i1.7068.
51. Cobos Muñoz D, Monzón Llamas L, Bosch-Capblanch X. Exposing concerns about vaccination in low- and middle-income countries: a systematic review. Int J Public Health 2015; **60**(7): 767-80. doi: 10.1007/s00038-015-0715-6.
52. Dubé E, Gagnon D, MacDonald NE; SAGE Working Group on Vaccine Hesitancy. Strategies intended to address vaccine hesitancy: Review of published reviews. Vaccine 2015; **33**(34): 4191-203. doi: 10.1016/j.vaccine.2015.04.041.
53. Dang VK, Pham HT, Nguyen MT. Rapid assessment of systemic barriers to vaccination in Viet Nam in 2004. Vietnam J Public Health 2005; **3**(3): 8-13.

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