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REVIEW

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## Vaccinating healthcare workers: Level of implementation, barriers and proposal for evidence-based policies in Turkey

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### ABSTRACT

The role of healthcare workers in life-long vaccination is very important in the means of 2 sided infection, rising patient awareness and being a role model for the patients. Numerous organizations publish guidelines for vaccination of HCWs, while healthcare facilities develop vaccination policies according to the accreditation standards. Nevertheless, vaccination rates among HCWs are far below targets.

The obstacles to getting vaccinated or recommending vaccination may include rather universal factors such as the vaccine paradox, however in the case of HCWs, probably a different set of factors are included.

The aims of this article are to gain an overview of vaccination strategies for HCWs, to assess the coverage rates of HCWs and make in-depth analyses of the potential barriers to vaccination and potential factors to motivate HCWs for vaccination in Turkey and to compare them with the global picture to improve implementation of policies concerning vaccination of HCWs.

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adult vaccination; barriers; healthcare workers; immunization policies; vaccination

### Introduction

One of the risk groups for which administration of certain vaccines are recommended within the framework of adult vaccination is healthcare workers (HCWs). Numerous international organizations publish dedicated guidelines for vaccination of HCWs, while healthcare providers monitor vaccination rates and develop vaccination policies according to the accreditation standards concerning quality and patient safety. However, vaccination rates among HCWs are far below the targets.

Updating guidelines, developing recommendations for a specific country or institution, monitoring vaccination rates, and making vaccines accessible are necessary but not sufficient in terms of achieving the vaccination rate targets. The obstacles to getting vaccinated may include rather universal factors such as the vaccine paradox (as a result of the vaccine's success, the condition it was developed for would become a distant memory, leading to lower vaccination rates). However, in the case of HCWs, probably a different set of factors are included. That is why the endeavors to increase the vaccination rates among HCWs should be preceded by in-depth analyses of the potential barriers to vaccination and potential factors to motivate professionals for vaccination.

In this review we aimed to gain an overview of vaccination strategies for HCWs, to assess the coverage rates of HCWs and make in-depth analyses of the potential barriers to vaccination and potential factors to motivate HCWs for vaccination in Turkey and to compare them with the global picture to improve implementation of policies concerning vaccination of HCWs.

### Definition of healthcare professionals

The term 'Healthcare worker' refers to all personnel -regardless of training in medicine-, who have contact with the patients.<sup>1</sup> According to the United States Center for Disease Control and Prevention (CDC), this group includes a variety of professionals with various levels of exposure and patient contact, such as doctors, nurses, physiotherapists, dietitians, chaplains, cleaning, catering and laboratory personnel.<sup>2</sup> According to World Health Organization data, a conservative estimate of the size of the health workforce globally was just over 59 million workers as of year 2006.<sup>3</sup> The United States (US) alone uses more than 18 million HCWs.<sup>4</sup>

In Turkey, the term HCWs covers the professionals working in the field of medicine, and other professionals specified in the "Law on the Performance of Medicine and Medical Sciences."<sup>5</sup> According to the data for year 2013, by the General Directorate of Healthcare Services, the number of HCWs in Turkey reached 698,518. Approximately 150 thousand of these are physicians and dentists, while nurses, midwives, pharmacists and other auxiliary medical personnel make up the rest.<sup>6</sup> These figures are helpful in coming up with an idea about the number of HCWs who have to be vaccinated.

### Vaccination strategies and recommendations for healthcare professionals

Many organizations, which publish guidelines and standards regarding vaccination, review the vaccination of HCWs under a specific category. The guideline updated annually by the Advisory Committee on Immunization Practices (ACIP) in the

US provides the basis of nation-wide standard practices in this field. World Health Organization, in turn, recommends vaccination with reference to exposure risks in place.<sup>7</sup> Centers for Disease Control and Prevention's vaccination recommendations for HCWs run in parallel to those of ACIP (Table 1). The vaccines recommended for Australian HCWs are summarized in Table 1.<sup>8</sup> European policies regarding the vaccination of HCWs vary from country to country. In parallel to the vaccination guidelines, the national practices regarding the mandatory or just recommended vaccines vary across borders. For instance, some countries may require evidence of vaccination as a prerequisite of hiring healthcare staff.<sup>9</sup> In Europe, mandatory vaccination is discussed critically, with a preference for voluntary policies.<sup>10</sup> Another way to increase HCW's vaccination rate maybe requiring non-vaccinated HCWs to wear a mask while working, which is uncomfortable and stigmatizes unvaccinated HCWs.<sup>11</sup> Mandatory vaccination becomes the only option to protect the health of the public when voluntary vaccination programs have not reached to target rates of vaccination among HCWs. Mandatory vaccination policies raise several ethical issues concerning to keep a balance between arising benefits for patient safety and constraining HCWs' individual autonomy. In the literature, the prevention of harm to others, as mandated by the Hippocratic oath, is widely considered a legitimate cause for constraining individual autonomy.<sup>12</sup>

Seasonal influenza and hepatitis B vaccines are universally recommended for HCWs. The efforts, reports, and reviews on the vaccination of HCWs usually focus on the influenza vaccine. On 22 December 2009, the European Council called the member states through the Council Recommendation to increase the influenza vaccination rates to established targets by the season of 2014–15 at latest.<sup>13</sup> The vaccination target set in this recommendation at 75% can be considered as a good starting point for the HCWs as well.

Europe has still much way to go in terms of influenza vaccination rates, from the current level of approximately 30%.<sup>14</sup> In the US, setting influenza vaccination coverage rate (VCR) as a performance benchmark, as well as the mandatory vaccination policies helped to increase the reported influenza vaccination rates in 2013–14 season to 75.2%. The corresponding figure for HCWs used at hospitals is 89.6%, while among the physicians the vaccination rate is 92.2%.<sup>15</sup>

In 2007, World Health Assembly recommended vaccination of HCWs for hepatitis B<sup>16</sup> while in 2010, the same assembly called for rapid action by the states, for the development of vaccination strategies and infection control measures.<sup>17</sup>

Measles, mumps, rubella, chicken pox, diphtheria, tetanus, pertussis and meningococcus vaccines, as well as tuberculosis, polio and hepatitis A vaccines with reference to the risk levels of specific countries may be added to the list of vaccines recommended for HCWs.<sup>2,8,9</sup>

In Turkey there were no published vaccination recommendations, especially for HCWs, before but there is a specific category for HCWs at the very recently published National Immunization Guideline for Adults by Infectious Disease and Clinical Microbiology Specialty Society of Turkey. Hepatitis B, influenza, measles, mumps, rubella, chicken pox, diphtheria, tetanus and pertussis are the recommended vaccines for all HCWs. Polio, meningococcal, typhoid and rabies vaccines are recommended for only HCWs at high risk of infection as it is recommended by ACIP. In Turkey there is not any mandatory vaccination for HCWs.<sup>18</sup>

## Importance of vaccination for healthcare professionals

### Two-way infection

During influenza epidemics, particularly HCWs employed in high-risk areas such as Emergency Departments, Acute and Intensive Care Units, and HCWs in direct contact with high

**Table 1.** Vaccination recommendations for healthcare workers, in the light of current guidelines.

	ACIP <sup>2</sup> (2011)	WHO <sup>7</sup> (2015)	Australia <sup>8</sup> (2015)	Turkey <sup>18</sup>
<b>Influenza</b>	All	All	All	All
<b>Hepatitis B</b>	Those who work with blood or body fluids, post-contact	Those who work with blood or body fluids	All	All
<b>MMR</b>	If not immune	All (except mumps)	If not immune	If not immune
<b>Pertussis (Tdap)</b>	All	No recommendation	All	All
<b>Diphtheria</b>	No exclusive recommendation	All	No exclusive recommendation	No exclusive recommendation
<b>Tetanus</b>	No exclusive recommendation	No recommendation	No exclusive recommendation	No exclusive recommendation
<b>Pertussis</b>	No exclusive recommendation	Under review	No exclusive recommendation	No exclusive recommendation
<b>Varicella</b>	If not immune	If not immune	If not immune	If not immune
<b>Hepatitis A</b>	No recommendation	No recommendation	Personnel working with risk groups	No recommendation
<b>BCG</b>	No recommendation	No recommendation	Those under the risk of exposure to multidrug resistant TB	No recommendation
<b>Rabies</b>	No recommendation	No recommendation	Laboratory personnel	No recommendation
<b>Q Fever</b>	No recommendation	No recommendation	Laboratory personnel	No recommendation
<b>Anthrax</b>	No recommendation	No recommendation	Laboratory personnel	No recommendation
<b>Small pox</b>	No recommendation	No recommendation	Laboratory personnel	No recommendation
<b>Poliomyelitis (IPA)</b>	Laboratory personnel	All should receive primary vaccination	Laboratory personnel	Laboratory personnel
<b>Typhoid fever</b>	Laboratory personnel	No recommendation	Laboratory personnel	Laboratory personnel
<b>Yellow fever</b>	No recommendation	No recommendation	Laboratory personnel	No recommendation
<b>Quadruple Meningococcal conjugate</b>	Laboratory personnel	No recommendation	Laboratory personnel	Laboratory personnel
<b>Japanese encephalitis</b>	No recommendation	No recommendation	Laboratory personnel	No recommendation

ACIP, Advisory Committee on Immunization Practices; WHO, World Health Organization; MMR, measles-mumps-rubella; Tdap, tetanus-diphtheria-acellular pertussis; BCG, Bacillus Calmette Guerin; TB, tuberculosis; IPA, inactive polio

numbers of patients are under the risk of infectious diseases. The risk of a HCW getting influenza during the high-season of the disease is 25%.<sup>19</sup> Moreover HCWs may have asymptomatic attacks, which increase their risk of becoming an unrecognized source of infection for patients.

In addition to the often-pronounced influenza and hepatitis B vaccines, vaccination strategies regarding diseases such as measles and pertussis, which can be prevented through vaccination, should be discussed. The single most important reason for the recommendation of booster shots against pertussis for the adolescents and adults, despite the complete cover of vaccination during childhood, is the risk of infecting the infants who have not yet developed immunity. That is why, the vaccination of adults against pertussis is particularly crucial for HCWs and people who are in close contact with infants. Seroepidemiological data reveals that, in Turkey, adults constitute a potential reservoir for pertussis, and that particularly adults who are in close contact with infants need to be vaccinated.<sup>20</sup> This method called the “cocoon strategy” aims to vaccinate the mother right after birth, as well as all individuals who are in close contact with infants younger than 12 months (family members, HCWs etc.).<sup>21</sup> Yet, in a survey of 517 HCWs from 4 European countries, only 17% of the physicians noted their concern about pertussis as a medical problem of the adults, while 58% stated that they had never prescribed even a single pertussis vaccine.<sup>22</sup>

A measles epidemic which began in Eastern Europe, and which later on spread to Turkey as well, led to a resident from the Emergency Department suffering respiratory failure due to pneumonia caused by measles.<sup>23</sup> Two studies reported that 15–23% of medical students had no immunity for measles.<sup>24,25</sup> While Finland requires measles vaccine for HCWs, after a study by Maltezou et al.<sup>9,26</sup> Estonia, Greece, Norway and Holland also started to recommend measles vaccine.

### **Healthcare professional as a role model and mentor**

Healthcare workers play an important role in prompting a change in the behavior of the patients. Eppes and colleagues demonstrated that women who had specific discussion about influenza vaccine and its benefits were found to accept the vaccine at a significantly higher rate.<sup>27</sup> In a study performed in Denizli by the Turkish Society of Internal Medicine approximately 80 thousand persons were asked ‘why they did not get pneumococcal vaccine’, hence 28.5% responded by saying that ‘they never heard about it’.<sup>28</sup> A study performed in Europe reviewed the obstacles to influenza vaccination, and found that 32.7% of the patients stated their reason for not getting the shot was never having been recommended by the family physician. A glance at the vaccinated patients, on the other hand, reveals that the leading motivating factor for vaccination is a recommendation by the family physician/nurse (58.6%).<sup>29</sup>

The physicians themselves may suffer chronic diseases, and their performance as ‘patients’ are as crucial as their performance as ‘physicians’. Doctors, as role models, have an impact on the patient. On the other hand, the care the physicians have for their own health may reflect their level of awareness and information. The data from Turkish Physician Cohort Study that enrolled 7228 doctors graduated from 6 Medical Schools between 1975 and 2004, in Turkey reveals that, in a cohort of

physicians with an average age of 44, only 7.1% of the physicians older than 65 had pneumococcal vaccine (Turkish Society of Internal Medicine, Turkish Physicians Cohort 2009; unpublished).<sup>30</sup>

### **Loss of work force and economic losses**

Vaccine preventable diseases may lead to direct and indirect costs in addition to their medical consequences among HCWs:

- Direct costs include the expenses incurred for the examinations, consultations, inpatient admission and treatments required for the disease and its complications.
- Indirect costs, on the other hand, include the loss of work productivity and absenteeism.

When we look from the perspective of influenza even larger economic burdens given the highly contagious nature of the disease and its ability to transmit rapidly. Studies performed in the US, France, and Germany indicate that indirect costs associated with influenza may be more than in 5–10 times of its direct costs.<sup>31</sup> A retrospective observational study performed with HCWs in Taiwan found that vaccination of HCWs against influenza saved a cost of \$36 per lost work day.<sup>32</sup>

A substantial group among those who contract mumps (~20–40%) may be asymptomatic. Exposure to mumps at a healthcare facility may lead to losses concerning work force and even closing of the clinics. For instance, 2 mumps outbreaks at hospital settings in 2006 in the US led to costs of \$98,682, and \$262,788.<sup>2</sup> In a study from a hospital ward perspective taken into account all direct and indirect costs, estimates the nosocomial pertussis outbreak costs at around €48,682. Vaccination costs were estimated at €12,208, meaning preventively vaccinating HCWs to avert outbreaks against pertussis results in a positive return on investment presuming an outbreak occurs once in 10 y.<sup>33</sup> In this context, the vaccination of HCWs for pertussis becomes even more crucial, with medical benefits for the protection of infants.<sup>34</sup>

Yoldaşcan et al. estimated the average cost of an influenza pandemic including direct medical and indirect costs, which may hit Turkey, in a best-case scenario, to be in the 1.4B dollars (USD) and 2.7B dollars (USD) range.<sup>35</sup> The researchers note vaccination as the most effective and safest route of protection against influenza pandemics and outbreaks. Furthermore, the fear and social restrictions fed by the pandemics have almost immeasurable costs. Pandemics change social behavior patterns for all sections of the society, including but not limited to the HCWs; reduces consumption beyond fundamental needs, as well as travels, the financial cost of which have not been estimated by the study referred to above. The impact of such pandemics on HCWs would lead to breakdowns in all medical services.

### **Vaccination coverage rates of healthcare workers and reasons for not getting vaccinated**

#### **Turkey**

The studies revealing VCRs of HCWs in Turkey are quite limited. Studies indicating VCRs for influenza can be categorized in 2 groups: those predating the pandemic in 2009, and those performed after the pandemic. From the biggest cohort study

in Turkey that was held by Turkish Society of Internal Medicine with 12,235 participants, influenza VCR was 4.5% in general population, VCR among adults aged 65 y and older was 5.9% and it was 14.9% among participants with chronic obstructive pulmonary disease.<sup>36</sup>

A cross-sectional study performed with residents and specialists at Akdeniz University Hospital revealed that only 14.5% of the participants were vaccinated against influenza.<sup>37</sup> Another study performed in Turkey with a sample of 552 HCWs, 19.6% of which were physicians, with nurses, midwives, care providers, laboratory technicians, and imaging technicians, reported influenza VCR for 2006–2007 as 76.1%. Among the HCWs who had not been vaccinated, 47.7% believed that the vaccine was ineffective, 29.5% was worried about its side effects, and 22.7% referred to other methods for protection from influenza.<sup>38</sup>

In another study that was held in a university hospital and a state hospital after the 2009 pandemic with 300 participants of HCWs, it was found that only 12.3% of the participants were vaccinated with pandemic vaccine. The reasons for vaccine refusal were fear about the side effects, concerns about vaccine effectiveness, negative news about the vaccine and the perceived negative attitude of the government officials to the vaccine.<sup>39</sup>

Another study performed in Diyarbakır, with a participant count of 1658 found that only 35.3% of HCWs were vaccinated during the influenza pandemic. The major reasons for not getting vaccinated were thinking that ‘the vaccine was a new one, without sufficient studies, and having suspicions about the vaccine’ (36.4%).<sup>40</sup>

In a study held with 941 participants of HCWs, in Istanbul after the influenza A/H1N1 pandemic, it is reported that 23.1% of the participants received the pandemic influenza A/H1N1 vaccine. The most common reason of refusing the pandemic influenza vaccine was fear about side effects (78.1%) followed by not convincing that the vaccine has an adequate protective effect (41.7%), the assumption that pandemic influenza is not a serious illness for a mass vaccination campaign (20.3%), believing that he/she is not at specific risk of influenza infection (16.3%).<sup>41</sup>

A cross-sectional survey was performed at the largest university hospital of the Aegean Region-Turkey during the H1N1 pandemic in 2009. Among 807 participants 30.0% received the H1N1 vaccine. Regarding H1N1 vaccination, 17.7% were willing to be vaccinated vs. 44.2% unwilling. The number of indecisive HCWs was 38.0% one week before vaccination. Only 82 (60%) of those willing, 108 (37%) of those indecisive and 38 (12%) of those unwilling were vaccinated. Doctors, HCWs working in medical departments rather than surgery departments, HCWs previously vaccinated against seasonal influenza, HCWs younger than 50 were more likely to accept vaccination. Fear of side effects and concerns about vaccine safety were the most common reasons underlying vaccine refusal.<sup>42</sup>

A study by Ciblak et al. in 2012 in İzmir and Istanbul, with the participation of 911 family physicians found, on the other hand, 45.7% of the family physicians received shots annually, on a regular basis. The reasons stated in the study for refusing vaccination include fear of the side effects, rarely getting flu, low number of high-risk patients, doubts about the

**Table 2.** Barriers to vaccination of healthcare workers for influenza, in light of the studies performed in Turkey.

Barriers to vaccination of healthcare workers for influenza
Doubts about the effectiveness/protection capabilities of the vaccine
Fears about the side effects of the vaccine/lack of trust in the vaccine
Negative news items about the vaccine
Ruling politicians' refusal to get vaccinated
Believing to have had and recovered from influenza
Believing to be safe from the risk of influenza / lack of contact with patients with high influenza risk
Opinion about influenza not being a serious illness / assuming to have resistance to influenza
Using other methods as protection against influenza
Failure to access to / forgetting getting the vaccine
Assuming contraindications due to existing health issues

effectiveness of the vaccine, forgetting to get vaccinated, and failure to procure vaccine, in the respective order.<sup>43</sup>

In a nutshell, VCRs among Turkish HCWs, against seasonal influenza is very low. Even though it was increased somewhat during the pandemic, they have not yet reached to target levels. In light of the studies from Turkey summarized above, barriers to influenza vaccination are listed in Table 2.

Even though no large-scale studies about Hepatitis B VCRs were performed in Turkey, a study with the students at a nursing school found that 85.3% were vaccinated.<sup>44</sup> In another study performed with Internal Medicine residents at a university hospital, on the other hand, the respondents reported a hepatitis B VCR of 90.5%.<sup>45</sup> According to the data from Turkish Physicians Cohort, the pneumococcal vaccine recipients among physicians older than 65 constituted 7.1% of the group, while hepatitis B vaccination rate was 79.2%, and influenza vaccination rate was 47.2%.<sup>30</sup> (Turkish Internal Medicine Specialist Association, Turkish Physicians Cohort 2009; unpublished).

Despite the data indicating very low seroprevalence of pertussis among adult population<sup>46</sup> there are no studies, which show the protective antibody levels of healthcare professionals or pertussis booster shot application rates among adults.

Even though there are no data on the VCRs of HCWs for measles, mumps, rubella, and chicken pox, the immunity rates were found to be in excess of 90%.<sup>47</sup> A study performed in Turkey found the rate of HCWs who have no immunity for measles as 6.3%, while non-immunity rates for rubella were 2.5%, for mumps were 9.2%, and for chicken pox were 1.8%.<sup>48</sup> A study performed with 1255 HCWs at a University Hospital in Turkey found the immunity rates for measles, rubella, mumps, and chicken pox at 94%, 97%, 90%, and 98% respectively. Screening before measles, rubella, mumps, and chicken pox vaccines was found to be a cost-effective method.<sup>49</sup>

### Global picture

In Europe, VCRs among the HCWs are quite low. From the latest report of ECDC, influenza VCRs for HCWs for the 2012–13 season provided by 13 Member States was reported in a wide range from 9.5% to 45.6%; the median VCR was 28.6%. The highest VCR was reported by the United Kingdom and the lowest by Poland. In the same season VCRs among adults aged 18–64 with high risk was 45.6% and among adults  $\geq 65$  y was



44.7%.<sup>50</sup> Even in the UK, which boasts the highest VCRs, seasonal influenza vaccination rates were reported to be 50.6% during the 2015–16 influenza season. The highest vaccine uptake by staff group was among GP practice nurses and the lowest uptake was among qualified nurses.<sup>51</sup>

According to the Venice II project report, hepatitis B vaccine uptake among HCWs presented by 4 countries varied from 75% to 100%.<sup>52</sup>

In the United States of America, influenza VCR among HCWs during the 2015–16 influenza season, was 79.0%. Coverage was highest among physicians, nurse practitioners/physician assistants, nurses, pharmacists, and health care personnel working in hospital settings. Coverage was lowest among assistants and aides and personnel working in long-term care settings.<sup>53</sup> In the same season VCRs among adults  $\geq 18$  y was 41.7%, among adults aged 18–64 with high risk was 46.0% and among adults  $\geq 65$  y was 63.4%.<sup>54</sup> Estimations show that overall, hepatitis B VCR among HCWs in the US was 60.7% in 2014. During 2010–2014, estimates of hepatitis B VCR among HCP have not improved, ranging from 61–65%, well below the Healthy People 2020 target of 90%.<sup>55</sup>

The publications from USA and Europe showed that the most stated reason for refusal of influenza vaccination was fear of side effects. The other reasons stated for vaccine refusal were: lack of concern, inconvenient delivery, lack of perception of own risk, doubts about the vaccine efficacy, avoidance of medications, dislike of injections, self perceived contra-indications and lack of availability respectively. Furthermore it is found that self-protection was the most important stated reason of HCW to be vaccinated against influenza. Protection of patients, protection of family members or colleagues and convenient access were found to be the other stated reasons for getting vaccinated.<sup>56–58</sup>

A qualitative study conducted as a part of an ECDC Project to assess potential concerns among hesitant healthcare workers in Europe revealed that most of the HCWs had some concerns about the risks, vaccine efficacy; especially for influenza and they had mistrust toward the pharmaceutical industry as well as governments, health authorities and research. The study also showed that some HCWs were still against vaccination in general. As the most trusted source of information on vaccination, there is a risk that hesitant HCWs might spread concerns about vaccines to the general population, recommend vaccines less frequently to their patients, and reduce vaccine confidence and uptake by their patients.<sup>59</sup>

### **Potential strategies to increase vaccination rates among healthcare professionals**

#### **Motivation**

Different groups of HCWs tend to have different perceptions of adult vaccination, and hence, different motivations. There have been many attempts at increasing VCRs among HCWs. For instance, the most successful attempts, in the case of influenza, had been the ones which included free vaccines +/- training campaigns.<sup>58</sup> There are also certain ideas, which encourage vaccination:

- Motivation for self-protection
- Motivation for protecting the patient

- Free and accessible vaccine
- Previous vaccination
- Model colleagues

#### **Training**

To improve vaccination rates among HCWs as well as the public, HCWs should be provided education about adult vaccination, both at undergraduate and postgraduate level.

A study performed among the Internal Medicine residents at a university hospital in Turkey found that while 90.5% of the residents were vaccinated against hepatitis B, only 29.7% and 16.2% received flu vaccine in the years 2011–2012 and 2012–13 respectively.<sup>41</sup> The same study, was applied to a resident cohort from Europe, found VCR for hepatitis B as 97.4%, followed by 52.6% who received flu vaccine in year 2011–2012, and 47.4% who received flu vaccine in year 2012–2013 (Tanriover MD, European School of Internal Medicine; unpublished). It is possible that the difference between the results from Turkey and others lies in the fact that in Europe core competencies in Internal Medicine included adult vaccination practices but in Turkey Internal Medicine core competencies has just been defined.<sup>60</sup> The education of HCWs can help to increase VCRs by enhancing their level of knowledge and medical literacy, through theoretical classes on adult vaccination, as part of their education. In a study that was held among family physicians from Turkey 75.3% were found to have substantial knowledge of influenza vaccine, while 20.6% and 4.1% had medium or low levels of knowledge, respectively. A significant relationship was observed between the level of knowledge and vaccination rates, while physicians who received regular shots themselves were found to take more part in encouraging HCWs and patients to vaccination, and to have a conviction that flu vaccine should be covered by insurance firms. The physicians in this group have taken the lead in recommending flu vaccine to their patients, and monitoring the patients in terms of follow-up on the recommendation.<sup>43</sup> A study from Europe also revealed a correlation between the level of knowledge of HCWs about MMR vaccination and the actual vaccination rates in the community: in communities with a larger deficit of knowledge among HCWs, vaccination rates were found to be lower.<sup>61</sup>

#### **Improvement of health literacy**

Health literacy (HL) can be defined as the individual's ability to acquire, interpret, and understand basic medical information and services, with a view to protecting and improving, and regaining the health of the individual.<sup>62,63</sup> The individuals who embrace adult vaccination can have not only different views in terms of their perceptions of health, but also different levels of HL. The Health Literacy Survey of Turkey, based on the scales developed for Health Literacy Europe Survey (HLS-EU) found that 64.6% of the adult population of Turkey was in problematic or insufficient health literacy categories.<sup>64,65</sup> Indeed, even persons who hold graduate or post-graduate degrees fall short of the perfect level of HL.

In Europe, HLS-EU was conducted in 2011 across 8 countries. About 12% of respondents have inadequate general health literacy, and 35% have problematic health literacy, thus nearly

every second respondent shows limited health literacy, in the general sample higher levels than Turkey.<sup>64</sup>

In the United States. Health literacy was reported using 4 performance levels: Below Basic, Basic, Intermediate, and Proficient. The majority of adults (53%) had Intermediate health literacy. About 22% had Basic and 14% had Below Basic health literacy.<sup>66</sup>

Problematic HL is known to have a detrimental impact on the utilization rates of preventive medicine services. The Health Literacy Survey of Turkey found that flu vaccination rate in year 2013–14 was just 8.7%, while those older than 65 were vaccinated at a rate of 10.2%.<sup>65</sup> The results of this study representing whole Turkey, covering HCWs as well, lead to the conclusion that HL levels have an impact on vaccination behavior, regardless of the level of education one has. There are many studies in the literature showing that persons with low HL are less likely to be vaccinated.<sup>67–70</sup> Although there are some studies showing paradoxical relationship observed between higher socioeconomic and education status and lower vaccination rates.<sup>71,72</sup> HL may be problematic even in the persons who have a postgraduate education degree. Nevertheless the intervention studies aimed at improving skills of low health literacy population show that using simple educational interventions successfully increase the vaccination rates in populations with low health literacy.<sup>69,70</sup>

On the other hand, even a simple one-page information document written in plain language, to educate patients within the framework of HL, may increase pneumococcal vaccination rates by up to 5 times.<sup>69</sup> The implementation of similar strategies with a specific focus on HCWs can serve as steps to enhance health literacy levels in terms of achieving vaccination targets as well as with the defined different strategies specifically targeted at professional groups.

Health literacy is also important for developing and delivering vaccination programmes, as both the information and the actions required to use the information are complex requiring sophisticated health literacy skills beyond the capacity of a significant proportion of the population. Addressing the levels of health literacy globally, simple steps can be taken to make the information in vaccination materials easier to understand and use.<sup>67</sup>

### ***Institutional leadership and implementation of policies***

It is clear that vaccination of HCWs require a culture of quality and leadership at the institution level. Policies to increase the vaccination rates among HCWs should be implemented through evidence-based, cost-effective, innovative, sustainable, multi-dimensional, traceable and assessable realist strategies with measurable objectives. Clear and authoritative messages on the vaccines and their effects, safety profiles, the burden of vaccine preventable diseases, and forgotten historical details should be relayed. Decreasing incidence of diseases such as polio and measles, which had historically caused substantial numbers of death and disability, with successful childhood vaccination, leads to a reduced level of perceived risk of such diseases. The embrace of adult vaccination by non-governmental organizations such as associations, as well as government agencies, with leadership at the very top, has an effect on not only the public, but also on HCWs.

The strategies to be developed to increase the vaccination rates among HCWs should focus on 2 fundamental objectives<sup>73</sup>: reverting the displaced risk perception regarding the disease and the side effects of the vaccine; increasing the HCWs' motivation levels for vaccination, while facilitating access to vaccines. Due to skewed perceptions and fear of vaccination human motivational forces of protecting against risk and caring for others may sometimes be in conflict with the risk they must face. Educational interventions should be taken to correct skewed risk perceptions and fear of side effects. In addition to educational interventions, potential strategies to increase vaccine uptake in healthcare workers maybe, mandatory vaccination or requiring non-vaccinated HCWs to wear a mask while working, making vaccines easily accessible and pro-social motivation of HCWs.<sup>73</sup> In this context, a model program which can be implemented at a healthcare facility may be developed on the following lines:

- The institution should embrace, at the leadership level, the necessity of vaccinating HCWs, and should set realistic and achievable targets.
- A person or team to assume responsibility for the vaccination programs should be named.
- Training and awareness programs to clearly explaining the effect, benefits, and side effects of vaccines, and to put forward evidence-based vaccination recommendations should be developed.
- The number of the HCWs used at the institution should be specified, and the required dosage of vaccines should be duly procured.
- The vaccination dates should be set and announced, or measures such as personal appointments or mobile vaccination units should be introduced.
- Vaccination rates should be monitored, reported, and presented to the staff as feedback.
- Measures should be taken to prevent any damage to be inflicted on public health, by HCWs who, on the basis of limited or inaccurate knowledge, or with a view to becoming popular, make statements against vaccination. Furthermore, measures to should be taken provide accurate, objective, and scientific evidence-based information to the public about the vaccines.

### ***Recommendations for Turkey***

- Development of a 'Healthcare Worker Vaccination Manual' applicable to Turkey, with specific priorities,
- Setting realistic objectives regarding the vaccination rates of HCWs, building on the existing state of affairs,
- Setting up a system to enable assessment and monitoring of vaccination rates,
- Inclusion of a quality benchmark concerning 'vaccination rates of HCWs' among the accreditation standards of the Ministry of Health (for starters, hepatitis B and influenza may be the required ones),
- Communication of social messages at the Government and Ministry of Health level, to encourage adult vaccination in general, and HCWs' vaccination in particular,
- Setting target rates and applying positive incentives for influenza, hepatitis B, and Tdap/Tdap-IPV cocoon.

- Development of systems to provide accurate, objective and scientific information to the public, and to check announcements playing on media attention, in a manner of giving communicate inaccurate information that can harm public health and to lead people to wrong conclusions.

## Abbreviations

HCWs	Healthcare workers
ACIP	Advisory Committee on Immunization Practices
HL	Health Literacy
VCR	Vaccination Coverage Rate.

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## References

- [1] Dash GP, Fauerbach L, Pfeiffer J, Soule B, Bartley J, Barnard BM, Lundstrom T, Andrus M. Association for Professionals in Infection C, Epidemiology. APIC position paper: Improving health care worker influenza immunization rates. *Am J Infect Control* 2004; 32:123-5; PMID:15153921; <http://dx.doi.org/10.1016/j.ajic.2004.03.001>
- [2] Immunization of health-care personnel: recommendations of the Advisory Committee on Immunization Practices (ACIP). *MMWR Recomm Rep* 2011; 60:1-45.
- [3] WHO. The world health report 2006: working together for health. Geneva: World Health Organisation; 2006. Available from: <http://www.who.int/whr/2006/en/index.html>. [Accessed on 4 04 13].
- [4] CDC. <http://www.cdc.gov/niosh/topics/healthcare/> [Accessed on 4 05 15].
- [5] Sağlık Meslek Mensupları ile Sağlık Hizmetlerinde Çalışan Diğer Meslek Mensuplarının İş ve Görev Tanımlarına Dair Yönetmelik. <http://www.resmigazete.gov.tr/eskiler/2014/05/20140522-14.htm>.
- [6] T.C. Sağlık Bakanlığı Sağlık İstatistikleri Yıllığı; 2012. Türkiye Cumhuriyeti Sağlık Bakanlığı Sağlık Araştırmaları Genel Müdürlüğü, 2013, 2013:129.
- [7] WHO Position Papers - Immunization of Health Care Workers, 2015 [http://www.who.int/immunization/policy/Immunization\\_routine\\_table4.pdf?ua=1](http://www.who.int/immunization/policy/Immunization_routine_table4.pdf?ua=1).
- [8] Australian Government Department of Health. The Australian Immunisation Handbook 10th edition (updated June 2015) Recommended Vaccines for Healthcare Workers, [http://www.immunise.health.gov.au/internet/immunise/publishing.nsf/Content/7B28E8751E08905CA257D4D001DB1F8/\\$File/Aus-Imm-Handbook.pdf](http://www.immunise.health.gov.au/internet/immunise/publishing.nsf/Content/7B28E8751E08905CA257D4D001DB1F8/$File/Aus-Imm-Handbook.pdf) [Accessed on 29 11 2016].
- [9] Maltezos HC, Wicker S, Borg M, Heining U, Puro V, Theodoridou M, Poland GA. Vaccination policies for health-care workers in acute health-care facilities in Europe. *Vaccine* 2011; 29:9557-62; PMID:21964058; <http://dx.doi.org/10.1016/j.vaccine.2011.09.076>
- [10] Galanakis E, Jansen A, Lopalco PL, Giesecke J. Ethics of mandatory vaccination for healthcare workers. *Euro Surveill* 2013; 18:20627; PMID:24229791; <http://dx.doi.org/10.2807/1560-7917.ES2013.18.45.20627>
- [11] Wicker S. Unvaccinated health care workers must wear masks during flu season-a possibility to improve influenza vaccination rates? *Vaccine* 2009; 27:2631-2; PMID:19428870; <http://dx.doi.org/10.1016/j.vaccine.2009.02.013>
- [12] Theodoridou M. Professional and ethical responsibilities of health-care workers in regard to vaccinations. *Vaccine* 2014; 32:4866-8; PMID:24951862; <http://dx.doi.org/10.1016/j.vaccine.2014.05.068>
- [13] European Commission. Proposal for a Council recommendation on seasonal influenza vaccination. [http://ec.europa.eu/health/ph\\_threats/com/Influenza/docs/seasonflu\\_rec2009\\_en.pdf](http://ec.europa.eu/health/ph_threats/com/Influenza/docs/seasonflu_rec2009_en.pdf).13.7.2009].
- [14] Talbot TR, Babcock H, Caplan AL, Cotton D, Maragakis LL, Poland GA, Septimus EJ, Tapper ML, Weber DJ. Revised SHEA position paper: influenza vaccination of healthcare personnel. *Infect Control Hosp Epidemiol* 2010; 31:987-95; PMID:20807037; <http://dx.doi.org/10.1086/656558>
- [15] Black CL, Yue X, Ball SW, Donahue SM, Izrael D, de Perio MA, Laney AS, Lindley MC, Graitcer SB, Lu PJ, et al. Influenza vaccination coverage among health care personnel—United States, 2013–14 influenza season. *Morb Mortal Wkly Rep* 2014; 63:805-11; PMID:25233281.
- [16] WHO. Resolution WHA 60.26, Global plan of action on workers' health. Available from: [http://www.who.int/occupational\\_health/WHO\\_health\\_assembly\\_en\\_web.pdf?ua=1](http://www.who.int/occupational_health/WHO_health_assembly_en_web.pdf?ua=1) [Accessed on 29 11 16].
- [17] WHO. The Sixty-third World Health Assembly Geneva, 17–21 May 2010 Resolution WHA 63.18. Available from: [http://apps.who.int/gb/ebwha/pdf\\_files/WHA63-REC1/WHA63\\_REC1-en.pdf](http://apps.who.int/gb/ebwha/pdf_files/WHA63-REC1/WHA63_REC1-en.pdf) [Accessed on 29 11 16].
- [18] Erişkin Bağışıklama Rehberi. Türkiye Enfeksiyon Hastalıkları ve Klinik Mikrobiyoloji Uzmanlık Derneği, <http://ekmud.org.tr/wp-content/uploads/EriskinBagisiklamaRehberi-web.pdf>. Istanbul, 2016.
- [19] Odelin MF, Pozzetto B, Aymard M, Defayolle M, Jolly-Million J. Role of influenza vaccination in the elderly during an epidemic of A/H1N1 virus in 1988–1989: clinical and serological data. *Gerontology* 1993; 39:109-16; PMID:8514200; <http://dx.doi.org/10.1159/000213520>
- [20] Kurtoglu D, Gozalan A, Coplu N, Miyamura K, Ishida S, Morita M, Akin L, Esen B. [Pertussis seroprevalence and vaccination status in 3 selected provinces of Turkey]. *Mikrobiyol Bul* 2008; 42:389-98; PMID:18822881.
- [21] Kretsinger K, Broder KR, Cortese MM, Joyce MP, Ortega-Sanchez I, Lee GM, Tiwari T, Cohn AC, Slade BA, Iskander JK, et al. Preventing tetanus, diphtheria, and pertussis among adults: use of tetanus toxoid, reduced diphtheria toxoid and acellular pertussis vaccine recommendations of the Advisory Committee on Immunization Practices (ACIP) and recommendation of ACIP, supported by the Healthcare Infection Control Practices Advisory Committee (HICPAC), for use of Tdap among health-care personnel. *MMWR Recomm Rep* 2006; 55:1-37.
- [22] Hoffait M, Hanlon D, Benninghoff B, Calcoen S. Pertussis knowledge, attitude and practices among European health care professionals in charge of adult vaccination. *Hum Vaccin* 2011; 7:197-201; PMID:21368583; <http://dx.doi.org/10.4161/hv.7.2.13918>
- [23] Ortac Ersoy E, Tanriover MD, Ocal S, Ozisik L, Inkaya C, Topeli A. Severe measles pneumonia in adults with respiratory failure: role of ribavirin and high-dose vitamin A. *Clin Respir J* 2016; 10:673-5; PMID:25619709; <http://dx.doi.org/10.1111/crj.12269>
- [24] Baer G, Bonhoeffer J, Schaad UB, Heining U. Seroprevalence and immunization history of selected vaccine preventable diseases in medical students. *Vaccine* 2005; 23:2016-20; PMID:15734076; <http://dx.doi.org/10.1016/j.vaccine.2004.03.073>
- [25] Wicker S, Rabenau HF, Pfeilschifter JM, Gottschalk R. [Measles in 2010. Knowledge and vaccination status of medical students]. *Bundesgesundheitsblatt Gesundheitsforschung Gesundheitsschutz* 2011; 54:238-42; PMID:21290279; <http://dx.doi.org/10.1007/s00103-010-1198-5>
- [26] Maltezos HC, Poland GA. Vaccination policies for healthcare workers in Europe. *Vaccine* 2014; 32:4876-80; PMID:24161573; <http://dx.doi.org/10.1016/j.vaccine.2013.10.046>
- [27] Eppes C, Wu A, You W, Cameron KA, Garcia P, Grobman W. Barriers to influenza vaccination among pregnant women. *Vaccine* 2013; 31:2874-8; PMID:23623863; <http://dx.doi.org/10.1016/j.vaccine.2013.04.031>
- [28] Unal S, Durusu Tanrıöver M, Taş E, Güner İ, Çetin ÖY, Sayar İ. "Aile hekimlerine eğitim verilmesi ve aşılama hedeflerinin



- belirlenmesinin pnömokok aşılama oranları üzerine etkileri,” *Flora*, 20, baskıda (2015).
- [29] Blank PR, Schwenkglens M, Szucs TD. Disparities in influenza vaccination coverage rates by target group in 5 European countries: trends over 7 consecutive seasons. *Infection* 2009; 37:390-400; PMID:19768382; <http://dx.doi.org/10.1007/s15010-009-8467-y>
- [30] Turkish Society of Internal Medicine. Turkish Physicians Cohort 2009 <http://213.232.33.34/index.html> [Accessed on 29 11 16].
- [31] Szucs T. The socio-economic burden of influenza. *J Antimicrob Chemother* 1999; 44 Suppl B:11-5.
- [32] Chan AL, Shie HJ, Lee YJ, Lin SJ. The evaluation of free influenza vaccination in health care workers in a medical center in Taiwan. *Pharm World Sci* 2008; 30:39-43; PMID:17602309; <http://dx.doi.org/10.1007/s11096-007-9137-8>
- [33] Tariq L, Mangen MJ, Hovels A, Frijstein G, de Boer H. Modelling the return on investment of preventively vaccinating healthcare workers against pertussis. *BMC Infect Dis* 2015; 15:75; PMID:25879422; <http://dx.doi.org/10.1186/s12879-015-0800-8>
- [34] The Joint Commission on Accreditation of Healthcare Organizations. 2011 Tdap Vaccination Strategies for Adolescents and Adults, Including Health Care Personnel. [http://www.jointcommission.org/assets/1/6/Tdap\\_Monograph.pdf](http://www.jointcommission.org/assets/1/6/Tdap_Monograph.pdf).
- [35] Yoldascan E, Kurtaran B, Koyuncu M, Koyuncu E. Modeling the economic impact of pandemic influenza: a case study in Turkey. *J Med Syst* 2010; 34:139-45; PMID:20433052; <http://dx.doi.org/10.1007/s10916-008-9225-x>
- [36] Kadir Biberoglu SB ÖM, Bilgir O, Aslan L, Bolaman Z, Yüksel B, et al. Türk İç Hastalıkları Uzmanlık Derneği Ege Çalışma Grubu. Erişkin İmmünizasyonu <http://www.tihud.org.tr/main/content?ref=2&child=179>. 2006.
- [37] Donmez L, Polat HH, Yalcin AN, Oncel S, Turhan O. Influenza Vaccination; Rates, Knowledge and the Attitudes of Physicians in A University Hospital. *Turk Klin Tip Bilim* 2010; 30:48-53.
- [38] Mistik S, Balci E, Elmali F. Primary healthcare professionals' knowledge, attitude and behavior regarding influenza immunization; 2006-2007 season adverse effect profile. *Bratislavské lekárske listy* 2012; 113:384-8; PMID:22693979
- [39] Savas E, Tanriverdi D. Knowledge, attitudes and anxiety towards influenza A/H1N1 vaccination of healthcare workers in Turkey. *BMC Infect Dis* 2010; 10:281; PMID:20863386; <http://dx.doi.org/10.1186/1471-2334-10-281>
- [40] Sevencan F, Ertem M, Ozcullu N, Dorman V, Kubat NK. The evaluation of the opinions and attitudes of healthcare personnel of the province Diyarbakir against influenza A (H1N1) and the vaccination. *Hum Vaccin* 2011; 7:945-51; PMID:21892007; <http://dx.doi.org/10.4161/hv.7.9.16368>
- [41] Torun SD, Torun F. Vaccination against pandemic influenza A/H1N1 among healthcare workers and reasons for refusing vaccination in Istanbul in last pandemic alert phase. *Vaccine* 2010; 28:5703-10; PMID:20600497; <http://dx.doi.org/10.1016/j.vaccine.2010.06.049>
- [42] Arda B, Durusoy R, Yamazhan T, Sipahi OR, Tasbakan M, Pullukcu H, Erdem E, Ulusoy S. Did the pandemic have an impact on influenza vaccination attitude? A survey among health care workers. *BMC Infect Dis* 2011; 11:87; PMID:21473763; <http://dx.doi.org/10.1186/1471-2334-11-87>
- [43] Meral Akçay Ciblak NN, İlhan Gurbuz, Selim Badur, Dilek Guldal. Aile hekimliğinde grip ve grip aşısı: Bilmek uygulama için yeterli mi? *Türk Aile Hek Derg* 2012; 16:157-63.
- [44] Yamazhan T, Durusoy R, Tasbakan MI, Tokem Y, Pullukcu H, Sipahi OR, Ulusoy S. Nursing students' immunisation status and knowledge about viral hepatitis in Turkey: a multi-centre cross-sectional study. *Int Nurs Rev* 2011; 58:181-5; PMID:21554290; <http://dx.doi.org/10.1111/j.1466-7657.2010.00869.x>
- [45] Telli TA, Ozisik L, Tanriover MD, Unal S. "Low awareness of adult vaccination among internal medicine residents," 12th European Congress of Internal Medicine, Prague, Czech Republic, 2-5, 2013.
- [46] Tanriover MD, Soyler C, Ascioğlu S, Cankurtaran M, Unal S. Low seroprevalence of diphtheria, tetanus and pertussis in ambulatory adult patients: the need for lifelong vaccination. *Eur J Intern Med* 2014; 25:528-32; PMID:24814432; <http://dx.doi.org/10.1016/j.ejim.2014.04.010>
- [47] Celikbas A, Ergonul O, Aksaray S, Tuygun N, Esener H, Tanir G, Eren S, Baykam N, Guvener E, Dokuzoguz B. Measles, rubella, mumps, and varicella seroprevalence among health care workers in Turkey: is prevaccination screening cost-effective? *Am J Infect Control* 2006; 34:583-7; PMID:17097453; <http://dx.doi.org/10.1016/j.ajic.2006.04.213>
- [48] Aypak C, Bayram Y, Eren H, Altunsoy A, Berktaş M. Susceptibility to measles, rubella, mumps, and varicella-zoster viruses among health-care workers. *J Nippon Med Sch* 2012; 79:453-8; PMID:23291844; <http://dx.doi.org/10.1272/jnms.79.453>
- [49] Alp E, Cevahir F, Gokahmetoglu S, Demiraslan H, Doganay M. Pre-vaccination screening of health-care workers for immunity to measles, rubella, mumps, and varicella in a developing country: What do we save? *J Infect Public Health* 2012; 5:127-32; PMID:22541258; <http://dx.doi.org/10.1016/j.jiph.2011.11.003>
- [50] European Centre for Disease Prevention and Control. Seasonal influenza vaccination in Europe - Overview of vaccination recommendations and coverage rates in the EU Member States for the 2012-13 influenza season. Stockholm: ECDC; 2015.
- [51] Seasonal influenza vaccine uptake amongst frontline healthcare workers (HCWs) in England Winter season 2015 to 2016. [https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/544536/Seasonal\\_influenza\\_vaccine\\_uptake\\_HCWs\\_2015\\_16\\_Annual\\_Report.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/544536/Seasonal_influenza_vaccine_uptake_HCWs_2015_16_Annual_Report.pdf) [Accessed on 29 11 2016]. 2016.
- [52] Darina O'Flanagan, Suzanne Cotter. Jolita Mereckiene Hepatitis B vaccination in Europe The Health Protection Surveillance Centre European Centre for disease Control VENICE II project. 2009 [http://venice.cineca.org/Report\\_Hepatitis\\_B\\_Vaccination.pdf](http://venice.cineca.org/Report_Hepatitis_B_Vaccination.pdf) [Accessed on 29.11.2016].
- [53] Black CL, Yue X, Ball SW, Donahue SM, Izrael D, de Perio MA, Laney AS, Williams WW, Lindley MC, Graitcer SB, et al. Influenza Vaccination Coverage Among Health Care Personnel - United States, 2015-16 Influenza Season. *Morb Mortal Wkly Rep* 2016; 65:1026-31; PMID:27684642; <http://dx.doi.org/10.15585/mmwr.mm6538a2>
- [54] CDC. Flu Vaccination Coverage, United States, 2015-16 Influenza Season <http://www.cdc.gov/flu/fluview/coverage-1516estimates.htm#age-group-adults> [Accessed on 29 11 2016].
- [55] Williams WW, Lu PJ, O'Halloran A, Kim DK, Grohskopf LA, Pilishvili T, Skoff TH, Nelson NP, Harpaz R, Markowitz LE, et al. Surveillance of Vaccination Coverage Among Adult Populations - United States, 2014. *MMWR Surveill Summ* 2016; 65:1-36; <http://dx.doi.org/10.15585/mmwr.ss6501a1>
- [56] Hollmeyer HG, Hayden F, Poland G, Buchholz U. Influenza vaccination of health care workers in hospitals—a review of studies on attitudes and predictors. *Vaccine* 2009; 27:3935-44; PMID:19467744; <http://dx.doi.org/10.1016/j.vaccine.2009.03.056>
- [57] Beguin C, Boland B, Ninane J. Health care workers: vectors of influenza virus? Low vaccination rate among hospital health care workers. *Am J Med Qual* 1998; 13:223-7; PMID:9833335; <http://dx.doi.org/10.1177/106286069801300408>
- [58] Hofmann F, Ferracin C, Marsh G, Dumas R. Influenza vaccination of healthcare workers: a literature review of attitudes and beliefs. *Infection* 2006; 34:142-7; PMID:16804657; <http://dx.doi.org/10.1007/s15010-006-5109-5>
- [59] European Centre for Disease Prevention and Control. Vaccine hesitancy among healthcare workers and their patients in Europe - A qualitative study. Stockholm: ECDC; 2015. <http://ecdc.europa.eu/en/publications/Publications/vaccine-hesitancy-among-healthcare-workers.pdf> [Accessed on 29 11 2016].
- [60] Porcel JM, Casademont J, Conthe P, Pinilla B, Pujol R, Garcia-Alegria J. Core competencies in internal medicine. *Eur J Intern Med* 2012; 23:338-41; PMID:22560381; <http://dx.doi.org/10.1016/j.ejim.2012.03.003>
- [61] Simone B, Carrillo-Santistevé P, Lopalco PL. Healthcare workers role in keeping MMR vaccination uptake high in Europe: a review of evidence. *Euro Surveill* 2012; 17:pii: 20206; PMID:22790533
- [62] In: Nielsen-Bohlman L, Panzer AM, Kindig DA, eds. *Health Literacy: A Prescription to End Confusion*. Washington (DC), 2004.
- [63] Peerson A, Saunders M. Health literacy revisited: what do we mean and why does it matter? *Health Promot Int* 2009; 24:285-96; PMID:19372101; <http://dx.doi.org/10.1093/heapro/dap014>

- [64] Health Literacy Europe Survey. [http://ec.europa.eu/chafea/documents/news/Comparative\\_report\\_on\\_health\\_literacy\\_in\\_8\\_EU\\_member\\_states.pdf](http://ec.europa.eu/chafea/documents/news/Comparative_report_on_health_literacy_in_8_EU_member_states.pdf).
- [65] Durusu-Tanrıöver M, Yıldırım HH, Demiray-Ready FN, Çakır B ve Akalın HE (2014). Türkiye Sağlık Okuryazarlığı Araştırması, Birinci Baskı, Sağlık-Sen Yayınları, Ankara. <http://www.saglikksen.org.tr/cdn/uploads/gallery/pdf/8dcec50aa18c21cdaf86a2b33001a409.pdf> [Accessed on 29 11 2016].
- [66] Kutner M, Greenberg E, Jin Y, Paulsen C. The Health Literacy of America's Adults: Results From the 2003 National Assessment of Adult Literacy (NCES 2006-483). U.S. Department of Education. Washington, DC: National Center for Education Statistics.) 2006.
- [67] Rowlands G. Health literacy. *Hum Vaccin Immunother* 2014; 10:2130-5; PMID:25424830; <http://dx.doi.org/10.4161/hv.29603>
- [68] Castro-Sanchez E, Chang PW, Vila-Candel R, Escobedo AA, Holmes AH. Health literacy and infectious diseases: why does it matter? *Int J Infect Dis* 2016; 43:103-10; PMID:26751238; <http://dx.doi.org/10.1016/j.ijid.2015.12.019>
- [69] Jacobson TA, Thomas DM, Morton FJ, Offutt G, Shevlin J, Ray S. Use of a low-literacy patient education tool to enhance pneumococcal vaccination rates. A randomized controlled trial. *JAMA* 1999; 282:646-50.
- [70] Owais A, Hanif B, Siddiqui AR, Agha A, Zaidi AK. Does improving maternal knowledge of vaccines impact infant immunization rates? A community-based randomized-controlled trial in Karachi, Pakistan. *BMC Public Health* 2011; 11:239; PMID:21496343; <http://dx.doi.org/10.1186/1471-2458-11-239>
- [71] Ogilvie GS, Remple VP, Marra F, McNeil SA, Naus M, Pielak K, Ehlen T, Dobson S, Patrick DM, Money DM. Intention of parents to have male children vaccinated with the human papillomavirus vaccine. *Sex Transm Infect* 2008; 84:318-23; PMID:18445636; <http://dx.doi.org/10.1136/sti.2007.029389>
- [72] Pearce A, Law C, Elliman D, Cole TJ, Bedford H. Factors associated with uptake of measles, mumps, and rubella vaccine (MMR) and use of single antigen vaccines in a contemporary UK cohort: prospective cohort study. *BMJ* 2008; 336:754-7; PMID:18309964; <http://dx.doi.org/10.1136/bmj.39489.590671.25>
- [73] Betsch C. Overcoming healthcare workers vaccine refusal-competition between egoism and altruism. *Euro Surveill* 2014; 19:20979; PMID:25496574; <http://dx.doi.org/10.2807/1560-7917.ES2014.19.48.20979>