Perceptions towards the A/H1N1 vaccine among risk groups.
- A study conducted in Stockholm, Sweden.

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Abstract

Influenza type A is associated with most severe complications to humans and is historically recognized to cause pandemics. If a new subtype replicates well in humans it might upsurge in a new pandemic strain, one such example is the Influenza A (A/H1N1). The A/H1N1 pandemic in 2009/2010 was not as severe in Sweden as expected. Criticism has targeted the fact that authorities having misjudged the need for vaccination, concerns have been raised regarding the effect of the campaign on people’s willingness to be vaccinated in the future. This study aims to investigate if there are significant differences in attitudes towards the vaccination of A/H1N1 among different population groups in Stockholm, Sweden. The main groups explored are risk groups and non-risk groups, defined by objective definitions. A quantitative method was approached using questionnaires. The result indicates that people in a risk group and vaccinated had more favorable attitudes towards the vaccine compared to other groups. They also expressed less troubled concerns regarding vaccine safety and were more likely to immunize referring to inadequate health. It is evident that people at risk also define themselves as more vulnerable, in which vaccination is more acceptable. The expressed attitudes are in such dependent on risk-perceptions and vaccine status.

Keywords: perceptions, A/H1N1, risk group, non-risk group, vaccine and health preventions.
1. Introduction
The virus causing influenza can be categorized into three different groups, influenza type A is the one associated with most severe complications to humans and is historically recognized to cause pandemics. Except the human host, most influenza A viruses circulate naturally among organisms. Some of these viruses have crossed species barriers and have become established in humans and pigs, resulting in the creation of human influenza- and swine influenza viruses. Influenza type A viruses contain eight segments of single-stranded RNA which code for ten proteins, their RNA polymerases is a low-fidelity transcription enzyme lacking the proofreading function ability of DNA polymerases, which means that their mutation rate is high. The two most important proteins are classified by the type of hemagglutinin and neuraminidase proteins which are present on the virus surface. The compositions and variations of these two specific proteins cause the virus to transform into different subtypes, resulting in periodical epidemics of influenza (Nelson & Williams, 2006). This occurrence is often referred to as antigenic drift and antigenic shift. Antigenic drift is the result of minor antigen changes through spontaneous mutations, any such change of epitopes makes the antibody detection of the virus much more problematic. The antigenic shift on the other hand is the creation process of a new subtype. In such case two influenza viruses, human or animal, infect the same host cell at the same time resulting in an exchange of genes and their genomes. Pigs are very likely to serve as a mixing vessel that may result in such a shift. Antigenic change of the influenza virus is constantly occurring randomly in nature and if a new subtype replicates well in humans it might upsurge in a new pandemic strain, one such example is the Influenza A (A/H1N1) (Gauci et al. 2010).

The transmission of the A/H1N1 influenza to humans occur in the same way in which the seasonal influenza transmits, which is through respiratory secretions from an infected person. These secretions are airborne and spread via direct and/or indirect contact. In practice, the transmission of the virus is
caused by the action of coughing, sneezing and contact with contaminated surface objects (Centers for Disease Control and Prevention, 2010).

In the beginning of 2009, spatial and temporal distant cases were identified by the surveillance systems monitored by infectious disease controlling authorities in the Americas. The symptoms were similar and the findings were reported to the World Health Organization (WHO). The case definitions among other included the symptoms of febrile respiratory illnesses experienced by mainly young and otherwise healthy children. Initially it became evident that the patients were infected with a novel swine flu virus. By the time the virus was isolated it could be scientifically proven that the virus originated from the same strain and that it replicated well in humans (Gauci et al. 2010).

The evolvement of the disease took even greater proportions in the next upcoming weeks of 2009. The inability to control the disease was evident and by the time the epidemiological status of the A/H1N1 was upgraded to the highest level, phase six, the A/H1N1 influenza had spread in more than two continents and reaching pandemic proportions. By the encouragement of WHO vaccination programs were adapted as a respond to the increased responsibility on country levels and the implementations of protective measurements (Gauci et al. 2010).

In Sweden the implementation of pandemic phase six status was met with a decision to order vaccine doses enough to offer immunization to its entire population. Initially, the aim was to target populations of health care workers and individuals with underlying illnesses. The risk groups were (and are still) defined by the recommendation from the Swedish National Board of Health and Welfare (Socialstyrelsen), as people with risk of complicated course of disease. This includes pregnant women, people older than six months of age with underlying illnesses or other immune compromised conditions and people aged ≥65 (Socialstyrelsen, 2009). In Sweden, the mass vaccination campaign against the influenza A/H1N1 in 2009/2010 resulted in a 60 percent vaccination coverage which is described
as a successful intervention. However, many countries had difficulties in motivating citizens to get vaccinated (Socialstyrelsen, 2011).

According to the World Health Organization (2010) the pandemic phase was officially over in August 2010. The laboratory confirmed death cases were globally estimated to more than 18,000. It was acknowledged that the majority of people experienced the most severe illness conditions occurred among young adults.

In retrospect, the pandemic occurrence in 2009/2010 was not as severe in Sweden as expected. Criticism has targeted the fact that authorities having misjudged the need for vaccination. Furthermore, concerns have been raised regarding the effect of the campaign on people’s willingness to be vaccinated in the future, if a new and severe pandemic occurs (Börjesson & Enander, 2013). It can further be argued that the mass vaccination program, which was the main prevention measurement against A/H1N1, was met with a lot of public attention and criticism. The reporting media was a major actor in shaping people’s opinions in Sweden and even though the low mortality rates was explained by the successful vaccination campaign, the discussion and comparisons with countries (e.g. Germany) which experienced low vaccination coverage and low mortality rates was non-existence. The further intensive discussions regarding the safety and side-effects of the vaccine in the mainstream media continued to confuse the public (Odén, 2010). As outlined by Steelfisher et al. (2010) in the event of a future pandemic, a substantial proportion of the public may not take a newly developed vaccine, because they may believe that the illness does not pose a serious health threat. Moreover, additional concerns about the safety of the vaccine may dominate their actions, meaning more research should aim to address these beliefs.
2. Research Objective

Vaccination is critical in order to control infectious disease transmission during a pandemic (Socialstyrelsen, 2009). Yet little is known about how the population at risk perceives the ongoing change of attitudes towards vaccination against A/H1N1. Since several researchers have observed a negative approach among the general population towards the willingness to be immunized, serious threats are posed on future health interventions (Peretti-Watel et al. 2013; Walter et al. 2012; Björkman & Sanner, 2012; Seale et al. 2010; Rachiotis et al. 2010).

This study’s intention is to evaluate if there is a difference between attitudes among different groups. The two groups, which will be compared, are defined as an experimental group; which is at risk of experience complicated outcomes of the influenza (risk group) and one control group that is not (non-risk group). The inclusion criteria to define the groups are based on objective definitions following the recommendation from Swedish authorities and can be found on page five. The independent explanatory variables (X) will in this case meet the criteria to define people as a risk group and will be used to explain variations of the dependent response variables (Y).

2.1 Research question

The aim of this thesis is to:

- Investigate if there are significant differences in attitudes and perception towards the vaccination of A/H1N1 among different population groups in Stockholm, Sweden. The null hypothesis \((H_0)\) tested is in such: there are no differences of attitudes towards vaccination of A/H1N1 between people defined as risk group and people not being defined as risk group. The alternative hypothesis \((H_1)\) is that there are differences among these groups.
3. Previous Research

A number of previous researches have addressed factors associated with the attitudes towards the A/H1N1 vaccine. In a recent study conducted by Peretti-Watel et al. (2013) the researchers investigate the impact of the 2009 influenza A/H1N1 pandemic on the attitudes towards general vaccination among residents living in France. The authors conclude that unfavorable attitudes towards vaccination in general have dramatically increased from 8.5 % in 2000 and 9.6 % in 2005 to 38.2 % in 2010. During 2010, unfavorable attitudes varied significantly during different periods of time. All age groups expressed an increased negative approach during the study period, while higher education- and income levels were factors associated with less opposed attitudes towards vaccinations. As pointed out, low socioeconomic groups have more sensitive risk perceptions and are thus more prone to distrust authorities which are a key issue to obtain high vaccination coverage among its citizens.

Rachiotis et al. (2010) explored, during the pandemic, the attitudes among Greek healthcare workers towards the A/H1N1 vaccination. The data reveal that vaccine uptake during this time period was low. The motivation for the low uptake was due to low perception of defining the illness as serious but also the fear of side-effects. It was found that the acceptance of the vaccine increased with aged and with information received from primarily medical journals. The concerns regarding possible side-effects on the other hand were also dependent on source of information, specifically targeting the mainstream media channels.

Börjesson and Enander (2013) examine perceptions and socio-demographic factors influencing vaccination uptake and precautionary behaviors in response to the A/H1N1 influenza in Sweden. The study was conducted during the final phase of the implementation of the Swedish vaccination program in 2010, which was before the intense debate regarding the relevance of the vaccination. The variables which defined risk to get infected were in this study subjective and was based on the respondents own perception. The strongest reason for not becoming vaccinated were concerns
related to the low threat perception of the A/H1N1 and possible side-effects associated with the vaccine. Low vaccination rates were as well associated with demographic- and socio-demographic factors such as low age, education and income. A similar study with comparable conclusions was executed by Seal et al. (2010), addressing the Australian public perceptions towards the A/H1N1 2009 pandemic and the willingness to accept the influenza vaccine. No distinction was however made between the subjective and the objective risk perceptions. Main reasons for not vaccinate concerned the respondents perspectives as regarding the swine flu as not serious, not being at risk and fear of side-effects. The data from 2009 suggests that vaccination coverage in adult age groups (18-64) remained low, but was three times higher (42%) in the older group.

Björkman & Sanner (2012) explores in a qualitative study the Swedish A/H1N1 vaccination campaign and the motives, beliefs and reactions of individuals with varying backgrounds, who did not get vaccinated. The conclusions correspond with previously findings where respondents unwillingness to be immunized was related to the subjects own risk perception. Trust towards public authorities is related to the uptake of vaccination, the respondents regarded the public information only as an additional source among others. The respondents further stressed the lack of motivation to be immunized and felt that recommendations alone from responsible authorities were not enough to influence the vaccination uptake among them.

In a study conducted in Germany during the A/H1N1 pandemic 2009/2010, Walter et al. (2012) researched the changing attitudes of the public. During the peak of the pandemic only 18% of the participants claimed that the risk of contracting influenza was high. The vaccination coverage was low in Germany, even in the targeted risk groups. The main reasons were mentioned as fear of adverse effects and perceptions that the vaccine was not fully evaluated. By using a health belief model, the author claimed that the two major factors influencing vaccine decisions concerns risk perception and a view that the preventive measurements are safe and
effective. Risk perceptions postulated by the media were explained to
exaggerate the situation in Germany. Similar findings are outlined by
Steelfisher et al. (2010). The two major reasons to not vaccinate in the
United States concerns vaccine safety, side-effects and fear of getting other
additional diseases. The second reason was that the vaccine was not
regarded as needed and respondents valued their personal health as adequate
and out of risk to get serious complications of the disease. In 2009 roughly
40 % of the respondents thought that the vaccine was produced to fast to
guarantee its safety. Persson et al. (2013) researched in a most recent
comprehensive study the risks of neurological and immune-related diseases,
including narcolepsy, after vaccination (against A/H1N1) with Pandemrix.
The findings support the increased risk in children and adolescents to suffer
from narcolepsy after vaccination with Pandemrix. The cohort study
observed a three-fold increased risk of a diagnosis of narcolepsy among
people aged 21-30 (2.92, 95% CI: 1.78–4.79).

Due to this background there are signs of a growing anti-vaccination
movement where reduced reliance towards authorities and medical expertise
is distinguished (Peretti-Watel et al. 2013). While some factors appear quite
universally significantly, distinct national variations exist. Several studies
have aimed at understanding the perceptions and the changing attitudes
towards the A/H1N1 vaccination among the public. Often such studies
distinguish the subjects own risk perception of the influenza and side-effects
as determination to receive vaccination (Walter et al. 2012; Björkman &
Sanner, 2012; Seale et al. 2010; Rachiotis et al. 2010; Steelfisher et al.
2010). As attitudes and behaviors are generally consistent one with another,
this phenomenon could have considerable impact on future vaccination
coverage. However, little is known about how chronically ill patients and
other groups identified at risk perceive the A/H1N1 vaccine compared with
people not at risk (Peretti-Watel et al. 2013), making the aim of this present
study valuable for further in-depth understandings.
4. Material and Method
Since the study purpose was to examine different attitudes towards the A/H1N1 vaccine among different groups and compare these findings, a quantitative approach was conducted using questionnaires. The information collected was carried out with a standardized approach, with the main goal that the information collected should be as generalizable as possible. Data was collected by systematic structured closed categorical question. A Likert scale was used as a measuring tool in order to quantitative transforms the measurement of attitudes. The questions were prepared in advance where even answer choices were fixed.

4.1 Questionnaire
The choice of method is motivated based on the eligibility to address the research objective and research question. In order to address attitudes and perceptions among citizens in Stockholm this choice of method is preferable. Other criteria regarding selection of questionnaires are the cheap administer advantages and the ability to collect large samples in a less time consuming way (Holme & Solvang, 1997). Williams (2003) argues that the placement of words, language used and placement of questions and statements in the questionnaire has a direct impact on the response rate. With this in mind, the questions were created with the ambition to be short, using simple language and strategically placed statements in a logical order. General demographic questions were thus included early in the placement order. In addition, a facility in Microsoft Word was used and enabled to calculate the reading ability of the questions using the Flesch Reading Ease Score test (FRES) (Microsoft Office, 2014).

As previously mentioned, the questions were designed using a self-complete structure with closed dichotomous questions. However, two exceptions were made where the respondents had the option to answer using multiple tick boxes. The demographic questions (questions 1-7) in such were used primarily as inclusion criteria to define risk groups and non-risk groups. Additional following statements in the questionnaire explored the respondents’ attitudes towards vaccination. In such case the respondents
were asked to what extent they disagree or agree about certain issues, using a Likert scale with a four-point scale. The first grade on the point scale indicate that the respondent completely disagree and closer to number four on the point scale the more the respondent agree in the presented statement. It is common to use a five-point scale when conducting a Likert scale. However, in order to influence the respondents to avoid neutral answers the four point scale was motivated and consequently the respondents was merely urged to select a side of opinion. The questionnaires given to the respondents were presented in Swedish. An English version is found in (Appendix 1).

4.2 Selection and limitations
In order to identify participants, respondents were located outside health centers, face-to-face. The research area was limited to only include districts in the inner-city of Stockholm due to reduce the influence of non-representative respondents where socioeconomic factors, language skills and other could affect the outcome.

Since it is not possible to investigate an entire population due to economic- and time constraints sampled units and respondents are utilized. The theoretical population is residents in Stockholm. A restriction has been made to only include the central districts. In order to obtain an objective and representative sample the districts and health centers were sampled based on a randomized probability sample using additional functions in Microsoft Excel. However, since it was not possible to compile a selection frame for the entire population to sample from, the respondents were sampled based on a non-random probability sample. Hence, the respondents included in this study are the ones available at the time (Holme & Solvang, 1997). Every potential respondent present during that specific time had equal opportunity to participate in the study. This choice of selection of sample is somehow justified based on the time- and economic constrains this study

1 The Swedish version of the questionnaire can be found on: https://docs.google.com/forms/d/13QHlqKvOljlx5rz9u9B69h8WrVPMfJi9WPwIFG-d_A/viewform
experienced. The addressed restraints regarding choice of sample has been acknowledged since coincidentally selections is not representative of the population as a whole and can lead to misleading conclusions about the population. This is something that has been regarded during the analysis and interpretation of the data.

4.3 Data Collection
Respondents were approached face-to-face outside the selected health centers. All respondents present during the data collection had equal possibilities to be included in the study.

All data was collected during the period April 14 to April 26, 2014.

4.4 Pre-pilot and Pilot study
To be able to create and collect valid and reliable data the questionnaire initially underwent an informal pre-pilot procedure and a more formal pilot study. In both cases the external input from students and other subjects were located at Södertörn University College. These respondents were met based on a face-to-face approach. A more detail explanation on how this was carried out is explained in the following section regarding Validity, Acceptability and Reliability.

4.5 Validity and acceptability
Williams, (2003) define validity, in the context of questionnaires, as the ability to measure what it aims to measure. Thus, the measurements should be relevant to the objective and the questions should directly target the main research question. Validity, in more practical terms includes the criterion validity and face validity. Criterion validity was met with a mixed result. In some cases questions were reused from already established questionnaires used by healthcare workers in Sweden. Such questions addressed mainly demographic topics, but also the respondents own health status. Those questions that were self-created were evaluated in the pilot study. Face validity was as well obtained in the pilot study by interviewing the respondents after completing the questionnaire and asked whether the responses correspond to their real opinion. In same discussion the students
were urged to give opinions of the questionnaire. This input led to changes in the placement order of two of the questions and the inclusion of additional options of risk factors.

4.6 Reliability

Reliability, in the context of using questionnaires as an instrument to collect data, is referred to as if several independent measurements of the one and same phenomena provide similar result. The process to obtain high reliability in this case refers to the test-retest reliability. Most often this is tested by providing the questionnaire to one group in two different points in time. Since there is a short defined time limit during this study, this procedure was not possible. However, internal consistency and reliability was tested during the pilot study by including one question in the questionnaire that was asked once again but rephrased (Williams, 2003). It is further stressed that the interpretation of the questions is a central problem during a survey research. To include as clear statements as possible, the inclusion criteria of the statements were based on a judging process carried out by students at Södertörn University College. This process was conducted before the pilot test. The students rated how favorable each statement was with respect to the construct of interest. The intercorrelation (item-total correlation) between the judging scores and all pair of items were computed. Based on these ratings, any item identified with a low correlation was removed. Using such process five statements with low correlation were eventually excluded from the questionnaire. During this process a correlation value of 0.45 was used as a cutoff point to determine the inclusion and exclusion criteria of the statements.

In order to further meet the validity and reliability criteria the questionnaire, layout and statements was pre-pilot tested. The intention of the pre-pilot study was to make sure that the statements was appropriate and acceptable, which was done with discussion along with supervisor and other subjects.
4.7 Response rate
Using questionnaires and the face-to-face distribution a response rate was followed by 68%. Out of the 150 respondents participating in this study an additional 70 respondents declined to participate. To evaluate if the data might be biased, the non-response rate was met with an internal record of categorization of demographic factors to allow a brief description of the targeted group. This group was slightly overrepresented by people looking younger. The gender distribution was similar. The majority of people declining to participate did so without any knowledge of study topic. In such, there is no reason to imply that this group represented a homogenous group, sharing a common belief or opinion regarding the study objective. Out of the 150 participants included in this study nine respondents did not complete one of the asked questions or statements. In such, incomplete demographic responses could be completed based on already sufficient information. In case where statements were incomplete the missing value was replaced with a mean average from the score value from the other asked statements.

4.8 Methodological limitations
Firstly, the choice of selection of sample is somehow justified based on the time- and economic constrains this study experienced. It is therefore acknowledged that the collected coincidentally samples might not be representative of the population as a whole and that the outcome of this study is limited. This is something that has been regarded during the analysis and interpretation of the data in this research. However, based on previous findings the data are comparable. The vaccine coverage of 62% in Sweden corresponds well to the findings of this study (54%). The vaccination coverage between gender follow similar distribution, the coverage among men (57.2%) and women (67.2%) corresponds well with the current findings (52% men and 56% among women). In both cases the frequency of vaccination are slightly overrepresented by women. It is further stressed in both studies that respondents aged ≥65, indicate the highest vaccination uptake of 69.3% compared to 64% (Börjesson &
Enander, 2013). Secondly, the inability to completely control for the reliability associated with the creation of the questionnaire could have an impact on the outcome. In such, the test-retest process was neglected due to reasons already mentioned, meaning that the questions are under the influence of different subjective interpretations. Thirdly, the attitudes expressed by the respondents in this study were collected during one specific time period. The perceptions and attitudes given by the participants are in such case dynamic and might change during time and with new information.

4.9 Data analysis
Once the questionnaires were collected the data for each respondent was submitted based on the existing code scheme. In case where the items were reversed in meaning from the overall direction of the scale, the response values were reversed. Once the data had been collected and compiled in Excel, the data was processed and transformed into statistically units to enable the interpretation and evaluation using statistical software R version 3.0.2. Since the dependent variables were treated as continuous and the independent variables as categorical, general linear models where used. The data followed normal distribution and thus parametric tests were enabled. In case when the differences between two independent samples were explored, welch two sample t-test was used. In three cases single asked statements were analyzed. In such case, the data followed a slightly skewed but still normal distribution, the t-test was thus motivated due to the robustness and high power of such data characteristics. Where two or more categorical variables were examined an ANOVA type II test was required for statistical processing (Grandin, 2003).
5. Result

The following results present the correlations between attitudes towards the A/H1N1 vaccine among different groups. The explanatory variables researched are primarily the association between belonging to a risk group or not, using objective definitions provided by Swedish authorities. This variable is also intercorrelated with other demographic factors such as gender, age and vaccination status.

A total of 150 people participated in this study. They were approached in three different health centers located in different inner city districts. The data in (Fig. 1) reveal that women are slightly overrepresented compared to men with a distribution of 56 % respective to 44 %. Other demographic data such as age tend to represent more elderly; nearly 70 % of the respondents were aged 46 or older. Approximately 41 % of the respondents belonged to a risk group while the other 59 % did not. A total of 54 % of the respondents were immunized with the A/H1N1 vaccine. An overview of further description of the participating respondents can be found in (Table 1).

![Gender and age distribution](image)

**Fig 1.** An overview of central demographic factors such as gender and age among the respondents.

2014: William Raske
### Table 1. Demographic characteristics of the participants included in research.

<table>
<thead>
<tr>
<th></th>
<th>Vaccinated (%)</th>
<th>Not vaccinated (%)</th>
<th>Risk (%)</th>
<th>Not in risk (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Men</td>
<td>34 (52)</td>
<td>32 (48)</td>
<td>27 (41)</td>
<td>39 (59)</td>
</tr>
<tr>
<td>Women</td>
<td>47 (56)</td>
<td>37 (44)</td>
<td>35 (42)</td>
<td>49 (58)</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18-29</td>
<td>3 (30)</td>
<td>7 (70)</td>
<td>2 (20)</td>
<td>8 (80)</td>
</tr>
<tr>
<td>30-45</td>
<td>20 (53)</td>
<td>18 (47)</td>
<td>6 (16)</td>
<td>32 (84)</td>
</tr>
<tr>
<td>46-49</td>
<td>31 (52)</td>
<td>29 (48)</td>
<td>12 (20)</td>
<td>48 (80)</td>
</tr>
<tr>
<td>≥65</td>
<td>27 (64)</td>
<td>15 (36)</td>
<td>42 (100)</td>
<td>-</td>
</tr>
<tr>
<td>Total</td>
<td>81 (54)</td>
<td>69 (46)</td>
<td>62 (41)</td>
<td>88 (59)</td>
</tr>
</tbody>
</table>

When comparing the difference between the risk group and the non-risk group and the effect on the response towards the vaccine, significant differences can be distinguished. The risk group had more favorable attitudes ($\pm$ SD= 33.31± 6.1) towards the A/H1N1 vaccine compared to the non-risk group ($\pm$ SD= 27.32± 5.92) ($p<.001$, welch two sample t-test, $t(129.078)=-5.9888$, CI 4.01- 7.97). In (Fig.2) the correlation between these variables and the response of attitudes is further visualized. The dashed lines illustrate the spread and the black markers indicate the central tendency. The higher the means, which are presented on the Y axis, the more favorable are the attitudes towards the A/H1N1 vaccine. This result supports that $p<0.05$, there is sufficient evidence to reject the null hypothesis ($H_0$) and accept the alternative hypothesis ($H_1$).
Fig. 2 Graphic visualization of the groups and attitudes towards vaccination. The dashed lines represent the spread of values and the solid black markers indicate the central tendency presented by the belonging to different groups. On the X axis the different groups are displayed and on the Y axis the attitudes towards the vaccine is represented. Those in a risk group expressed more favorable attitudes towards the vaccine.

The outcome between the correlation of the explanatory variables gender and risk group and non-risk group as the function of the response of attitudes, present the following result. For the 27 men in a risk group the mean was 33.81 (SD= 7.37). The mean for the 39 men in the non-risk group was lower, 27.79 (SD= 6.72). The corresponding mean values for the 35 women in risk was 32.91 (SD= 4.99) and for the 49 women not in risk the mean was 26.94 (SD= 5.25). Following the result in the ANOVA type II test table (Table 2), merely the risk group had a significant effect (p<0.05) to explain the different attitudes. Those participants belonging to a risk group was shown to have an increased mean value towards the response compared
to the non-risk group, implying that those in risks was more in favor to the A/H1N1 vaccine. The control of impact of other variables as gender, the combination of gender and risk group/non-risk group as a possible explanatory variable, found no significant difference effect (p>0.05). There is insufficient evidence to reject the null hypothesis ($H_0$).

**Table 2. Gender and risk group effect on the response towards vaccination.**

<table>
<thead>
<tr>
<th></th>
<th>Sum Sq</th>
<th>Df</th>
<th>F Value</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>28.3</td>
<td>1</td>
<td>0.7784</td>
<td>.3791</td>
</tr>
<tr>
<td>Risk Group</td>
<td>1307.2</td>
<td>1</td>
<td>36.0092</td>
<td>.001</td>
</tr>
<tr>
<td>Gender*Risk</td>
<td>0.0</td>
<td>1</td>
<td>0.0005</td>
<td>.9824</td>
</tr>
<tr>
<td>Residuals</td>
<td>5300.0</td>
<td>146</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The descriptive result from the correlation between the variables age and risk group/no risk group is reported as followed. The age distribution for people in the youngest age group 18-29 was represented by two people in risk with a mean of 32.5 (SD= 2.12) and respectively eight people was not in risk with a mean of 24.5 (SD= 3.7). Comparable description of respondents in age group 30-45 is acknowledge as six people in risk with a mean of 28.5 (SD= 7.48) and those 32 people not in risk had a mean of 26.19 (SD= 6.88). People aged 46-64 and in a risk were represented by 12 people, with a mean of 30.33 (SD= 6.6) while the 48 people in the same age group but not in risk had a mean of 28.54 (SD= 5.3). Finally, people aged ≥65 and in risk constituted of 42 people with a mean of 34.88 (SD= 5.32).

The following results in the (ANOVA type II test) table (Table 3) support the findings with a significant p value below the 0.05 threshold. Hence, age has an effect on the response towards the vaccine. People aged 46 or more can be described to have more favorable attitudes towards it. However, the

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2 ANOVA table (Type II test)
combination of including the variables risk and age show no relevant finding (p>0.05).

Table 3. ANOVA table (Type II test) presenting the effect of the different variables age and risk group.

<table>
<thead>
<tr>
<th></th>
<th>Sum Sq</th>
<th>Df</th>
<th>F Value</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>473.1</td>
<td>3</td>
<td>4.6961</td>
<td>.003</td>
</tr>
<tr>
<td>Risk Group</td>
<td>106.9</td>
<td>1</td>
<td>3.1838</td>
<td>.076</td>
</tr>
<tr>
<td>Age*Risk</td>
<td>53.3</td>
<td>2</td>
<td>0.7940</td>
<td>.454</td>
</tr>
<tr>
<td>Residuals</td>
<td>4801.9</td>
<td>143</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The demographic data presented by the intercorrelation between vaccination and the different groups and the effect on attitudes towards the A/H1N1 vaccine, is presented in (Table 4). It is found that people associated with being vaccinated also report the highest mean values.

Table 4. Descriptive table presenting vaccination and risk groups.

<table>
<thead>
<tr>
<th>Risk Group</th>
<th>Vaccinated</th>
<th>Not Vaccinated</th>
<th>± Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>45</td>
<td>17</td>
<td>34.18</td>
<td>6.24</td>
</tr>
<tr>
<td></td>
<td>31.9</td>
<td>5.18</td>
<td>6.24</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>36</td>
<td>52</td>
<td>31.5</td>
<td>4.68</td>
</tr>
<tr>
<td></td>
<td>24.42</td>
<td>5.01</td>
<td>4.68</td>
<td></td>
</tr>
</tbody>
</table>

As presented in the ANOVA table (type II test) found below in (Table 5) all variables explored showed statistically significant interactions (p<0.05). These findings support the alternative hypothesis (H1), meaning that there are differences among the groups, all variables tested support a significant effect on the response. The main effect of the interaction indicate that the observed variables interact. In other words, the different attitudes towards the vaccine are dependent on if one are in a risk group or not, but the effect is different for vaccinated and not vaccinated. Respondents which were vaccinated, independent of risk status, expressed more favorable attitudes.
when compared to other groups. The finding also concludes that respondents not vaccinated but in a risk group expressed more positive attitudes towards the vaccine, while compared to people not vaccinated and not in a risk group.

*Table 5. Effect interaction between the different variables vaccinated and risk group.*

<table>
<thead>
<tr>
<th></th>
<th>Sum Sq</th>
<th>Df</th>
<th>F Value</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Risk Group</td>
<td>578.9</td>
<td>1</td>
<td>20.4225</td>
<td>.001</td>
</tr>
<tr>
<td>Vaccinated</td>
<td>1071.3</td>
<td>1</td>
<td>37.7950</td>
<td>.001</td>
</tr>
<tr>
<td>Risk*Vaccinated</td>
<td>118.7</td>
<td>1</td>
<td>4.1887</td>
<td>.042</td>
</tr>
<tr>
<td>Residuals</td>
<td>4138.3</td>
<td>146</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The illustration of the interaction between the variables can be found in the effect plot (Fig.3) on page 23. The left side of the graph includes those not vaccinated and those vaccinated are presented on the right side of the graph, on the X axis the risk group and non-risk group are visible. In similar structure the attitudes towards the A/H1N1 vaccine is represented as means on the Y axis. The higher mean value on the Y axis the more positive associations towards the vaccine are expressed. This graph provides a clearer overview of the interaction. People vaccinated or in a risk group tend to have a more favorable approach regarding the vaccine. People not vaccinated and not in risk pose a more restrictive approach regarding immunization against A/H1N1.

---

3 ANOVA table (Type II test)
The effect plot indicates the interaction effect between the variables vaccination and risk group and the outcome of attitudes (sum) found on the Y axis. Those not in risk and not vaccinated expressed the most negative concerns regarding the vaccine.

While further examine the result, the responses towards two central statements included in the questionnaire are highlighted and reported as followed. When asked to which degree the respondent think that the vaccine is safe, the people belonging to a risk group were more likely to agree (± SD= 2.73± 0.94) while the non-risk group was more likely to not agree (± SD= 2.03± 0.88) (p<.001, welch two sample t-test, t(126.539)=4.5251, CI 0.39-0.99). In (Fig.4) the result of asked question is further visualized.
Finally, when asked about a single statement (statement number 17 in appendix 1) concerning the respondents willingness to immunize and the relation to their own health, the risk group was more likely to vaccinate referring to inadequate health status ($\pm SD= 2.95\pm 1.06$). The non-risk group was more likely to not vaccinate claiming sufficient health ($\pm SD= 2.23\pm 1$) ($p<.001$, welch two sample t-test, $t(130.459)=-4.3255$, CI=0.39-1.06). The correlation is graphically presented in (Fig 5) for easier interpretation. Similar result is true when further exploring the same statement among those vaccinated ($\pm SD= 2.86\pm 1.05$) and the non-vaccinated group ($\pm SD=2.1\pm 0.95$) ($p<.001$, welch two sample t-test, $t(147.298)=-4.4922$, CI=0.41-1.06).

**Fig. 4** Graphic visualization of perceptions of side-effects. The dashed lines represent the spread of values and the solid black markers indicate the central tendency presented by belonging to the different groups. Those not in risk expressed more concerns regarding side-effects.
**Vaccination and health status**

**Fig. 5** Graphic visualization of the means. The dashed lines represent the spread of values and the solid black markers indicate the central tendency presented by belonging to the different groups. On the X axis the different groups are displayed and on the Y axis the mean is represented. Those in a risk group was more likely to vaccinate claiming insufficient health.
6. Analysis

The main purpose of this study was to examine the different attitudes towards the A/H1N1 vaccine among people defined as a risk group and people defined as a non-risk group in Stockholm, Sweden. Findings that can provide important input for future health interventions.

Based on these findings there are significant differences between the attitudes towards the vaccine and the identification to a specific group. Respondents categorized as a risk group expressed more favorable attitudes towards the A/H1N1 vaccine compared to those who were not at risk ($H_0$ rejected). While further exploring the explanatory factors, this study indicate that gender showed no significant effect while examining the outcome of attitudes towards the vaccine. It is merely shown that favorable attitudes (independent of gender) towards the vaccine were expressed by people in a risk group. It is also found that age, independent of risk as a factor, reveal a significant effect, where middle-aged people and older people expressed more favorable attitudes towards the vaccine compared to younger age groups.

In addition, the analysis of the intercorrelation between vaccination and risk and the effect on attitudes towards the vaccine indicate that vaccinated people express the most favorable attitudes. However, since all factors showed significant correlations, all variables are found to interact. Favorable attitudes are explained by being included as a risk group but the effect is different for those vaccinated and not vaccinated. These finding conclude that those respondents which were vaccinated, independent of risk status, were more in favor towards the vaccine. It implies that the outcome of pro vaccination attitudes largely depend on factors relating to the subjects’ own safety concerns and previous vaccination experiences.

Furthermore, it is stressed that people in a risk group who were not vaccinated also had a greater positive perception regarding the vaccine, compared to those whom were not in risk and not vaccinated. This implies that a proportion of the most vulnerable group decided not to vaccinate even though expressing favorable attitudes towards it, a view which support that
additional factors are likely to influence the respondents’ decision to immunize. It is questionable whether this group expressed more concerns regarding some specific safety aspects of this vaccine but simultaneously expressed an overall positive opinion. It is also likely that different information sources regarding vaccination affected this group differently compared to the risk group which was vaccinated.

The outcome of this study is further explored in two highlighted questions. When the respondents were asked whether or not they agree to believe that the vaccine against swine flu may cause serious side-effects, the risk group had less troubled concerns regarding vaccine safety and the potential side-effects of the vaccine. The non-risk group expressed more anxious opinions regarding the safety issues related to the vaccine. When asked if the respondents do not vaccinate because of already good health, the risk group was more likely not to agree and accept the immunization. The opposite assumptions were expressed among the non-risk group, they were more likely to decline vaccination referring to an already good health.

When asking the same question regarding subjective health among those vaccinated and not vaccinated, similar responses were given. Respondents who were vaccinated were more likely not to agree while the opposite assumptions were true for those not vaccinated. This information further supports the perceptions that those people in a risk group (based on objective definitions) also perceive their own health as more vulnerable and more susceptible for severe complication due to infections, the same explanations are valid for those vaccinated. Yet, the opposite assumptions are also true, people not in risk or vaccinated do not address the same safety concerns and are more common to refer to an already existing good health status.

To summarize, the variations of attitudes towards the vaccine are found to be dependent on risk perceptions and vaccination status. The risk perceptions among those in a risk group were higher when compared to others. The associations to a risk group and vaccinated are found to relate to more favorable perceptions towards the immunization.
7. Discussion
In this presented study, socioeconomic factors were aimed to be controlled for during the selections of the participants, with the intention to compare as equal groups as possible and isolate the effect in order to avoid previously found confounders. Generally, previous studies have shown that socioeconomic factors such as low education- and income level are persistent in influencing the negative approach towards health authorities and the uptake of immunization. It is also mentioned that the refusal by well-educated parents to vaccinate their children are motivated by subjective risk- and benefits assessments (Peretti-Watel et al. 2013).

This study has shown, being at risk (objective definitions) and vaccinated are both factors associated with favorable attitudes towards the vaccine while the opposite assumptions are valid for the more skeptical group. Such findings are comparable to subjective definitions explored in previous research (Walter et al. 2012; Steelfisher et al. 2010; Rachiotis et al. 2010; Seal et al. 2010; Börjesson & Enander, 2013). The two most common factors influencing vaccine decisions are related to the subjects own perception of risk and vaccine safety. Fear of side-effects and low perception of risk were commonly associated with the reasons for not becoming immunized. This view is supported based on the current findings that people described with additional health conditions and in a risk group, at a larger extent accepted the A/H1N1 vaccine due to a higher risk perception. The opposite argument is valid in the non-risk group and not vaccinated group, since they more generally decline health recommendations referring to adequate health; a view that support a lower risk perception.

The perception regarding the influenza as severe is strongly associated with an intention to take the vaccine. It has previously been explored that some people experienced this decision as balance between the risk associated with the disease and the risk associated with the vaccine (Steelfisher et al. 2010). However, the contribution of this present study to previous research is the understanding, that objective risk definitions also
are valid regarding the subjects own definitions. In other words, people defined as in a risk group also perceived themselves as more vulnerable, in which vaccine as an external safety measurement are more accepted. Such identifications are important regarding epidemiological concerns in controlling and sustaining good health during endemic or pandemic outbreaks. This reasoning is significant in the sense that the most vulnerable people also are the ones more susceptible towards vaccine uptake as a health measurement. It is simultaneously of concern, that people not identified themself to the risk reject the needed protection. The concept of immunity induced by vaccination in susceptible people is essential in infectious disease epidemiology. In case of infectious diseases, the purpose of herd immunity, which is dependent on high vaccination uptake, becomes even more important in controlling the spread of the disease (Giesecke, 2002).

Such arguments to vaccinate are not entirely obvious, as mentioned by Björkman & Sanner (2010), none of the respondents who declined vaccination, expressed any concern to protect others. In retrospect, the outcome of the pandemic influenza A/H1N1 in Sweden was not as severe as expected. The respondents who did not perceive the disease as a serious threat was to a larger extent not vaccinated. However, risk perceptions in a population are not static but dynamic (Björkman & Sanner, 2012). As further pinpointed by Steelfisher et al. (2010), such behavior or expressions change, even during a pandemic. People declining vaccination due to low risk perceptions also concluded that if more serious outcomes were noticed their opinions and actions would also very likely change, since the main concerns regarding neglecting the vaccine primarily is focused on the protection of their own health. The skeptical opinions given by the respondents during this study towards recommended safety measurements are in such case not influenced by strong philosophical assumptions. The findings which aim to explain the differences of attitudes between the researched groups, are thus only valid in the context of the specific conditions of A/H1N1, and should therefore not be applied to other (future) circumstances without precautions.
Previous studies have found that information sources have a great impact on the public’s risk perceptions and vaccination behaviour. The different media channels have the ability to both contribute to the creation of sceptical reactions but also to generate positive responses towards public recommendations. It is found that people aged 60 or older are more frequent users of conventional information sources then other age groups, older people and vaccinated are more likely to depend their decision on the expertise of physicians instead of alternative media sources (Walter et al. 2012). Such remarks suggest additional interpretations regarding why people not in risk but vaccinated expressed more favourable attitudes towards the vaccine. The same arguments are valid for the risk group which was not vaccinated. In such case there is likely that medical expertise as an information source is of fundamental importance regarding vaccine decision and health benefits. It is important that information reaching mainstream media is based on reliable quality and is reported in a non-exaggerated way.

The data suggests that in case of future pandemics, recommendations regarding immunization should be correlated with high risk perceptions among the general public. If not, the uptake might be neglected by people experiencing a lower subjective risk. Furthermore, it is argued that some of the respondents who belonged to a risk group were not immunized, even though they expressed positive attitudes towards it. In such case it is evident that additional factors exists that influence their decisions and future studies should aim to address such behaviours.

Since immunization constitute the one single most important health prevention measurement possessed by public health authorities during outbreaks of infectious diseases, future health implementations should recognize recent findings in order to avoid polarized behaviours among its citizens.
8. Conclusion

Immunization is recognize as one of the single most important health measurements during pandemics, with the ability to control the spread of disease and lowering the possible substantial health costs. This study has explored the different attitudes towards the A/H1N1 vaccine in Stockholm, Sweden. In spite of the potential methodological weaknesses, this study does distinguish different public attitudes towards vaccination.

The findings conclude that risk perceptions are central in determine vaccination uptake among the population. People defined as a risk group or vaccinated express more positive attitudes towards immunization. It is also distinguished that vulnerable people and vaccinated had a lower negative concern regarding vaccine safety and a more positive approach towards vaccination and the need to vaccinate. People not in risk and not vaccinated constituted for a more sceptical approach regarding safety and was more likely to neglect the vaccine referring to already good health status. It is evident that people in risk (object definitions) also define themselves as more vulnerable (subjective definitions). However, it should be stressed that some respondents who belonged to a risk group was not vaccinated, even though they expressed positive attitudes towards it. In such case it is evident that additional factors exist that influence their decisions.

This study concludes that in case of future pandemics, vaccine uptake is strongly correlated with peoples subjective and objective risk perceptions. It is important for future health interventions to acknowledge these behaviours.
References

Björkman, I., Sanner, M. 2012. The Swedish A(H1N1) vaccination campaign – Why did not all Swedes take the vaccination? Health Policy 2013, 63-70.


## Appendix 1

### Questionnaire

THANK YOU FOR YOUR COOPERATION!

Respondents participating in the following questionnaire are anonymous.

1. **Gender**
   - [ ] Male
   - [ ] Female

2. **Age**
   - [ ] 18-29
   - [ ] 30-45
   - [ ] 46-64
   - [ ] ≥65

3. **Are you vaccinated against swine flu?**
   - [ ] Yes
   - [ ] No

4. **If YES, were you pregnant when vaccinated against swine flu?**
   - [ ] Yes
   - [ ] No

5. **Are you pregnant?**
   - [ ] Yes
   - [ ] No

6. **Do you have any chronic illness?**
   - [ ] Yes
   - [ ] No

7. **If YES on the previous question, do you have:**
   - [ ] Chronic lung disease, including asthma.
   - [ ] Severe obesity (BMI > 40).
   - [ ] Neuromuscular disease (e.g. MS)
   - [ ] Chronic heart disease
   - [ ] Severely immunocompromised (by disease or medication)
   - [ ] Chronic liver or heart failure
   - [ ] Diabetes mellitus
   - [ ] Multifunction Handicap

**INSTRUCTION**

Please indicate to what extent you agree with the following statements. Enter your answer using the following 4-point scale where 1 = Strongly disagree, 2 = Do not agree, 3 = Agree, 4 = Strongly Agree.
8. I believe vaccinations can prevent infections.

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agree</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

9. I am generally opposed to vaccinations.

<table>
<thead>
<tr>
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<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agree</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

10. Only those who have chronic illnesses or are pregnant should be vaccinated.

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agree</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

11. I'm worried that the vaccine against swine flu has not been properly tested.

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agree</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

12. I believe that the vaccine against swine flu may cause serious side-effects.

<table>
<thead>
<tr>
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<th>1</th>
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<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agree</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

13. I'm more worried about the vaccine than the swine flu.

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agree</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

14. To effectively stop the spread of swine flu everyone should get vaccinated.

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agree</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

15. I vaccinate against swine flu if the Swedish authorities recommends it.

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agree</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

16. I plan to get vaccinated against swine flu in future seasons.

<table>
<thead>
<tr>
<th></th>
<th>1</th>
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<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agree</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

17. I do not vaccinate against swine flu because my health is good enough.

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agree</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

18. I believe that the vaccine against swine flu provide poor protection.

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agree</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>