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EXECUTIVE SUMMARY I

Population behavioural response to infectious diseases outbreaks among general population

Introduction

When an outbreak of pandemic influenza occurs, high relevance assumes the understanding of factors that could influence the behavior of people in order to decrease the risk of infection, transmission, and disease severity. This information represent the main keys of health policies and communication strategies whose design and implementation aims at minimizing both the impact and spread of the disease. The aim of this review is therefore to select empirical research results in order to improve the conceptual framework, which can facilitate communication guidelines during the outbreak of an infectious disease.

Methods

MEDLINE, Cinahl, EMBASE and the Cochrane Central Register of Controlled Trials (Cochrane Library) were used as references for studies on severe acute respiratory syndrome (SARS), avian influenza/flu, H5N1, swine influenza/flu, H1N1, and pandemics. The studies that were selected for the purposes of this deliverable on the basis of reporting behavioural responses among general population during infectious diseases outbreaks and associations between a protective measure or vaccination (reported, intended, or actual behaviour) against outbreak disease and demographic factors, knowledge, attitudes, perceptions, and behaviours. Meta-analysis makes reference to pertinent variables only.

Results

Sixty papers met the study inclusion criteria. A number of variable quality studies on different populations were carried out considering different infectious disease outbreaks. The research highlighted several demographic differences in behaviour: older people and women are associated with higher chances of adopting protective behaviors while older people and men are associated to vaccine uptake. There is also evidence that greater levels of perceived susceptibility and perceived severity of the diseases together with a greater belief in the effectiveness of recommended behaviors to protect against the disease - vaccination included - can be precious predictors. Evidence has also shown that greater levels of anxiety and trust in authorities are associated with protective behaviours. Past behaviours are strongly associated whit vaccination.

Conclusions

The findings suggest that both intervention studies and communication strategies should focus on particular demographic groups and on raising levels of pandemic disease-perceived threat and individual/community belief in the effectiveness of protective measures.

1. POPULATION BEHAVIOURAL RESPONSE TO INFECTIOUS DISEASES OUTBREAKS

1.1 Introduction

Pandemics have occurred periodically; to limit the spread of disease, WHO recommends the use of non-pharmaceutical interventions (NPIs), and vaccination. However, a compliance approach is based on community understanding of required control measures as well as their important role in disease mitigation. When an outbreak of pandemic influenza finally occurs, the understanding of those factors that could influence the people's behaviour and thus lower the risk of infection, transmission, and disease severity, is highly relevant. This information represents the most precious health policies communication strategies aimed at minimizing both the impact and spread of the disease. The principal aim of this review is therefore to select empirical research results in order to improve the conceptual framework, which can facilitate intervention guidelines. This review covers diseases characterized by their pandemic or potential pandemic status. Severe Acute Respiratory Syndrome (SARS) spreading from China to 37 countries around the world. Avian influenza was considered as a potential pandemic threat. In addition, a novel strain of H1N1 influenza, known as swine flu, was isolated in the UK in 2009 and finally spread to over 100 countries around the world.

1.2 Methods

1.2.1 Criteria for considering studies for this review

The studies included in this review have a cross-sectional study design, taking under consideration the general population irrespective of demographics such as age, gender, ethnicity, nationality, and so on.

1.2.2 Search methods for identification of studies

We have been considering the main infectious outbreaks during the last ten years, in accordance with WHO Global Alert and Response (GAR). The present report is based on a systematic search in the: MEDLINE; Cinahl; EMBASE and the Cochrane Central Register of Controlled Trials (*Cochrane Library*).

The search has been conducted from 2002 to present day, though initially we did not use a language restriction (see **Appendix 1. Electronic search strategies**). We also proceeded with scanning the references of all included articles to identify other potentially relevant studies.

1.2.3 Data collection and analysis

Selection of studies

Two authors first screened the titles and the abstracts from the whole comprehensive literature, later we retrieved full text of any potentially relevant report and carefully examined them with the following eligibility criteria, for their inclusion in this study:

a) Population: general population (excluding patient groups, healthcare workers, etc.).

b) Behaviour: preventive, avoidant, or management of pandemic disease, behaviors and vaccination against influenza pandemic.

c) Demographic characteristics and psychological variables were also included as well as associations between these and behaviors (reported, intended, or verified behavior) were then integrated.

d) Date: from 2002 to present.

e) Study design: cross-sectional studies.

f) Language: English.

Data extraction and management

An author retrieved data from each included study: general information (title, authors, source, publication status, publication date); details of study (location, recruitment methods of participants, response rate); participants (description, geographical location, age, gender, ethnicity, socio-economic status); outcomes (methods for measuring outcomes, tools used to measure outcomes) and final results.

Analysis

Data synthesis began with a narrative overview of the findings in the form of a table gathering the extracted results systematically and highlighting relevant behaviors during a pandemic such as preventive and avoidant vaccination or disease behaviours management. The attitudinal and demographic factors assessed in each study were later recorded before examining the associations between these factors and the behaviors. When possible, a quantitative analysis was performed - pooling the prevalence estimates - by using standard meta-analytic techniques. All of the reported *confidence intervals* (CIs) represent the 95% CIs. Data were analyzed using Stata 11.0 and a pooled estimate of prevalence was calculated by using a random-effects model with inverse-variance weighting. Statistical heterogeneity between and within groups was measured by using the χ2 test for heterogeneity. Since we expected to find important heterogeneity among studies, we used meta-regression analysis to identify sub-groups in which pooling is acceptable in order to investigate the extent to which heterogeneity among studies is related to different study characteristics.

Results of the search

Overall, we scanned 6087 titles and abstracts of potentially relevant studies, 6023 of which were excluded on the basis of not fulfilling at least one of the eligibility criteria, described in the previous section. In total, 69 full papers were retrieved and a final number of 60 were included (*Fig. 1*). The studies were therefore heterogeneous, carried out in different countries with differing populations and methods. The studies were of variable quality (see *Tab. 1. Characteristics of included studies*, and *Tab. 2. Characteristic of excluded studies*).

The final selection actually included 36 papers on H1N1, 5 papers on H5N1, 14 papers on SARS and 4 papers on a hypothetical influenza pandemic. A total of 16 studies were carried out in Europe (France n=2; Greece n=1; Germany n=3; Italy n=2; The Nederland n=5; UK n= 3), one study in Saudi Arabia and another one in Israel. Moreover,a total of 11 studies were carried out in the United States, 8 studies in Australia and 22 studies in Asia (China n=3, Hong Kong n=12, Singapore n=2, India n=1, Taiwan n=3, among Asian populations n=1,). Finally, 3 of the selected studies were carried out internationally.

Nearly all studies examined the mediating role of perception, attitudes and beliefs (n=60). Twenty-three studies were concentrated on factors associated with vaccination uptake, and 47 on carrying out preventive and/or avoidant behaviors. Only a few were based on explicit theoretical framework (n=7)[1].

Fig 1. Flow of information through the different phases of a review.
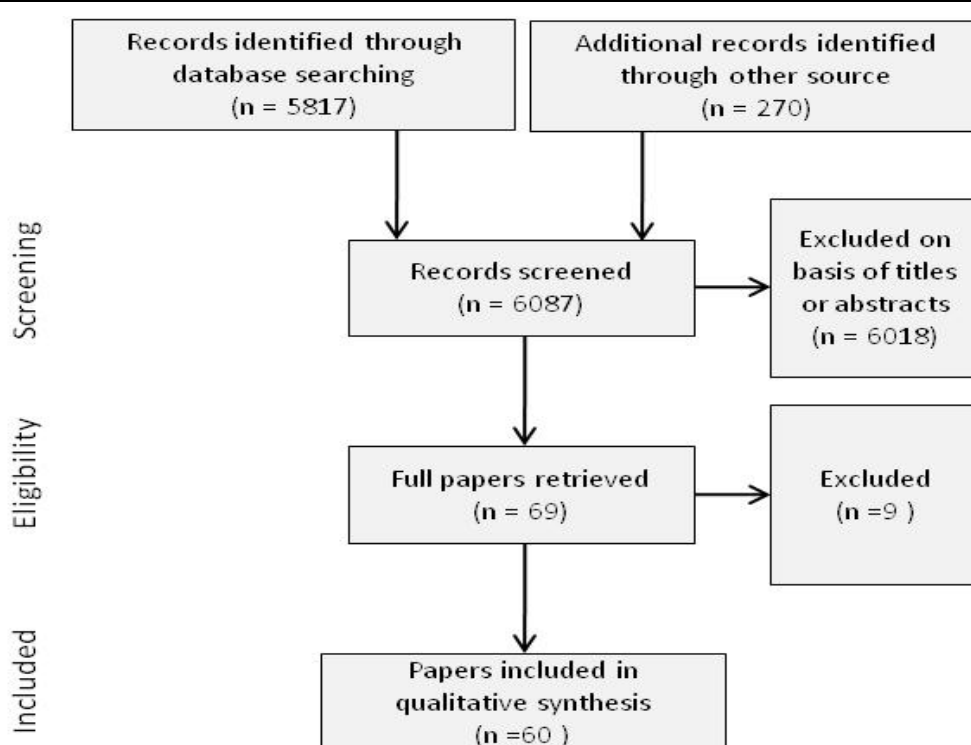
The results for demographic factors have been presented considering age, gender, ethnicity, educational level and other socio-economic factors such as employment and marital status. The results for psychological factors were later presented according to the structure of the Health Belief Model (Janz et al 1984; Rosenstock et al 1988), the Protection Motivation Theory - PMT (Rogers 1975 and 1983), the Theory of Planned Behaviour - TPB (Ajzen 1991; Armitage et al 2001), and the Extended Parallel Process Model - EPPM (Witte, 2000). The first one theorised that people's beliefs about whether or not they were susceptible to disease - and their perceptions of the benefits of trying to avoid it - influenced their

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[1] These add up to more than 60 as some studies examined more than one type of issues.

readiness to act. The second one explored the relation between behaviour and beliefs, attitudes and intentions, assuming that attitude is the most important determinant of behaviour itself.

Meta-analysis was presented following these preliminary results; as for the studies that could not be pooled we used prevalence measures reported by the authors.

1.3 Results of quantitative meta-analysis

Meta-analysis results to be considered "Ad Interim"; as a matter of fact, although a variable effect model has been adopted, heterogeneity was high in any variable. Such an outcome made further analysis necessary in order to evaluate the weight of studies on the pooled estimates. We recalculated the pooled prevalence estimates conducting a sensitivity analysis by examining the effect on the most heterogeneous studies exclusion. The studies included in the meta-analysis are 51 though, for any considered variable, the number of included studies can even differ (*see Results of quantitative meta-analysis*).

1.4 Protective behaviour against infectious diseases outbreak and compliance among general population

From the 57 papers included in this review, a total of 33 studies focus on preventive behaviours and their related factors. The studies concern different outbreak diseases of the last ten years; in particular, 16 studies were about the A/H1N1 pandemic, six studies were on pandemic avian influenza, 14 concerned the SARS epidemic, and four studies were relevant to an hypothetical pandemic influenza. Nineteen studies were conducted in Asiatic regions (China n=1, Hong Kong n=12; India n=1; Singapore n=2; Taiwan n=3), one in Saudi Arabia, four studies in the US, five in Australia and eight studies were carried out in Europe (Germany n=2; Italy n=2; Netherlands n=3; UK n=1), while only three were international studies.

1.4.1 Demographic factors associated to protective behaviours

Age

A survey carried out in Singapore and Hong Kong examining age-related behaviours against SARS have found that older people are more likely to undertake precautionary behaviours (hand washing, respiratory hygiene, mask wearing, using utensils, and washing after touching contaminated surfaces) to protect themselves from infection (Lau et al 2003; Leung et al 2003; Quah et al 2004; Tang et al 2004; Tang et al 2003).

Older people resulted more likely to report the intention of self-protective behaviours also in the event of an outbreak of avian influenza (Lau et al 2007a), H1N1 (Balky et al 2010; Bults eta al 2011) or in the case of an influenza pandemic in the future (Barr et al 2008). A study carried out during H1N1 showed that the intention to adopt protective measures increased with age (van der Weerd et al 2011). The association between older age and behaviour could be explained by the fact that older people feel more vulnerable to

a possible influenza pandemic (Barr et al 2008). A study on a hypothetical influenza pandemic has shown that younger persons were less likely to avoid entertainment (Sadique et al 2007).

However, in contrast with the above-mentioned findings, the pattern of age-related behaviors was different when the threat of the 2009 swine flu pandemic was studied. In this case, people aged 18–24 were found to be more likely to adopt recommended behaviours (hand washing, cleaning surfaces, and getting a flu friend) than older people in the UK (Rubin et al 2009).

Nevertheless, older people were more likely to adopt preventive behaviours such as avoiding public places during the SARS outbreak (Lau et al 2003) and staying away from crowds when an avian flu outbreak occurs (Lau et al 2007a). Older people were also associated with increased probability of reporting avoidance of crowded places and rescheduling of travel plans during H1N1 pandemic outbreak (Crowling et al 2010). Actually, an Australian survey revealed lower levels of willingness to isolate oneself or even wear a face mask in younger people (especially aged 16-24 group) (Taylor et al 2009).

A study carried out in Australia did not find any difference in the intentions to comply with quarantine between age groups (Eastwood et al 2009). Even if some evidence shows that increasing age is associated with a greater possibility of carrying out preventive behaviours, eventually, there is no clear indicator as to which is the real effect of age on preventive behavioural patterns.

Gender

In Hong Kong and Singapore women were found to be more likely than men to adopt precautionary behaviours to protect against SARS and H1N1 (Lau et al 2003; Leung et al 2003; Leung et al 2004; Quah et al 2004; Tang et al 2004; Lin et al 2011; Crowling et al 2010; Miao et al 2012). These behaviours included hand washing, respiratory hygiene, mask wearing, using utensils and washing after touching contaminated surfaces. The likelihood of women to follow recommended behaviours (hand washing, cleaning surfaces, and getting a flu friend) was greater than in men in the event of a H1N1 pandemic (Crowling et al 2010; Rubin et al 2009; Prati et al 2011; va der Weeder et al 2011). The same trend in gender-dependent behavior was found in surveys carried out in the US and in Hong Kong in the early stages of the H1N1 outbreak; here, women were more likely than men to adopt avoidant behaviors (Lau et al 2010b).

The origin of the gender-related differential behavior could be therefore explained by the observation that women perceive themselves as more susceptible - to SARS for example - than men (Brug et al 2004).

Women, in fact, when asked to report their intentions in the event of a future pandemic, were observed to be more likely than men to comply with home quarantine restrictions in Australia (Eastwood et al 2009).

On the other hand a study carried out in Saudi Arabia during H1N1 influenza pandemic showed that a high level of precautionary measures was taken by men (Balky et al 2010). Even in the UK, no difference was

observed between men and women's avoidant behaviors (Rubin et al 2009). Other studies evidenced no gender differences in the intentions to wear a facemask (Barr et al 2008; Taylor et al 2009) in Australia or to use a facemask in The Netherlands and Hong Kong during SARS (Brug et al 2004; Tang et al 2004).

As already discussed for age-related factors, a proportion of studies do not find any gender differences. Nevertheless, the pattern of reported results highlighted that when there is a significant difference in behaviors, women are consistently more likely than men to undertake protective and avoidant measures.

Ethnicity

As a matter of fact, the results on the adoption of many precautionary measures have always been influenced by the geographical areas where the studies were carried out. For example, Europeans were more likely than Asians to report that they would keep their children away from school, even though the same Europeans were less likely to report that they would avoid seeing physicians (Sadique et al 2007). However, a study performed in the UK revealed that participants from non-white ethnic background were more likely to carry out protective action or to adopt avoidant behaviors, compared to participants of a white ethnic background (e.g., avoiding large crowds or public transport) (Rubin et al 2009). In Australia, individuals speaking a language other than English were less inclined to declare their intention to wear a mask and to be vaccinated, quarantined or to isolate themselves in the case of an outbreak of pandemic flu (Barr et al 2008; Taylor et al 2009). In contrast, in Singapore (Qua et al 2004) no clear association was observed between ethnicity and precautionary behaviour.

Only a few studies have considered the relationship between ethnicity and behaviour during a pandemic. This may be due to the difficulties in adopting study designs ensuring ethnical homogeneity of samples or even to the scarce availability of literature on such a specific argument; we therefore ascertain insufficient evidence to draw any definitive conclusions about the role of ethnicity in affecting pandemic-related behaviours.

Educational level

In several studies carried out in Hong Kong, higher educational levels of individuals were found to be associated with a greater chance to adopt precautionary behaviours to protect against SARS (Leung et al 2003; Leung et al 2004; Tang et al 2004), avian influenza (Lau et al 2007a), and H1N1 (Balky et al 2010). The list on these behaviors included hand washing, respiratory hygiene, mask wearing, using utensils, and washing after touching contaminated surfaces. In the same way, a greater intention to wear a face mask in the event of pandemic influenza was observed in more highly educated people in studies performed in Australia (Barr et al 2008).

Other studies carried out in Hong Kong observed a higher likelihood to avoid public places during the SARS outbreak in more educated people (Lau et al 2003; Leung et al 2003). A study on the intention to comply

with quarantine restrictions during a pandemic influenza, has shown evidence that people with high educational levels were more likely to report intended compliance (Barr et al 2008).

In a survey on a hypothetical pandemic flu, the respondents with higher educational levels reported being more likely to avoid entertainment and shopping than did those with lower educational levels (Sadique et al 2007). Similarly, an Australian survey showed that people with higher levels of formal education were more likely to report high willingness to isolate themselves from others if needed and to wear a face mask (Taylor et al 2009). However, other studies conducted in Hong Kong and The Netherlands failed to detect significant association between educational level and the reported use of mask or hand washing (Tang e Wong 2003; Blendon et al 2004). Eventually, a general tendency of more educated people undertaking protective and avoidant behavior, is reported in literature only.

Other socio-economic factors

Some studies conducted in the UK during the H1N1 pandemic has found out that unemployed, poorer people or persons having no educational qualifications, were more likely to undertake avoidant behaviours, e.g., avoiding large crowds or public transport (Rubin et al 2009). Furthermore, a Dutch study (Bults et al 2011) conducted among unemployed people has shown a significantly higher intention to comply with preventive measures. An Italian survey, showed that people suffering from economic hardship were more likely to clean objects, to wash hands and use tissues when sneezing (Prati et al 2011). The retirees in Taiwan were still more likely to increase hand hygiene practice than students (Miao et al 2012).

Moreover, in another research performed in Australia people who were employed but not able to work from home did not fully recognize the quarantine restrictions (Eastwood et al 2009); in addition, people in full-time employment were less likely than others to avoid going out in Hong Kong during H1N1 (Lau et al 2010b). In a study on a hypothetical pandemic influenza, only a few employed people reported being likely to avoid public transportation, entertainment venues, and work (Sadique et al 2007).

The influence of marital status is not examined in many studies. However, one study in Hong Kong observed that married people had greater chance to wear face masks against SARS (Tang et al 2004); also a Hong Kong study found out that married people often reported the intention to comply with quarantine policies in the event of an avian influenza outbreak (Lau et al 2007a). In the same way, the Hong Kong study carried out during H5N1 influenza showed that those respondents who were not currently married were less likely than others to adopt preventive behaviors (Lau et al 2010a).

In opposition the mentioned studies, other works failed to obtain an association between the marital status and the reported use of face mask, hand washing and other precautionary behaviors (Lau et al 2008; Leung et al 2003; Leung et al 2004). In these studies, the association between marital status and behaviour is even inconclusive.

1.4.2 Psychological factors associated with carrying out the protective behaviours

Threat appraisal

Perceived susceptibility to the disease

In order to classify the perception of susceptibility, the following types of assessment were considered: worry about developing disease, likelihood of developing disease, and chances of disease. With the aim to assess personal perceived susceptibility, some studies also included the analysis of association between perceived susceptibility of an individual's family or community.

Associations between perceptions of risk and carrying out preventive behaviours have been found in studies conducted in the US, the UK, Hong Kong, Australia, and The Netherlands. During the SARS epidemic, greater perception of risk was associated with certain protective behaviours such as likelihood of hand washing (Brug et al 2004; Lau et al 2003; Tang et al 2003; Leung et al 2004); disinfecting the home/objects or cleaning (Lau et al 2003), mask wearing (Tang et al 2003). Similar associations with adopting other precautionary behaviours to protect against SARS including hand washing, respiratory hygiene, mask wearing, using utensils, and washing after touching contaminated surfaces (Barr te al 2008; Leung et al 2003) have also been found. Anticipated preventive behaviour in case of human-to-human transmission was also related to a higher perceived susceptibility to H5N1 infection for oneself or one's family (Lau et al 2007a). Furthermore, preventive measures were taken more often among people having a higher perceived susceptibility (de Zwart et al 2010).

Similar precautionary behaviours (hand washing, mask wearing an cleaning things or disinfecting home) were associate during H1N1 pandemic (Rubin et al 2009; van der Weerd et al 2011; Prati et al 2011). Perceiving H1N1 to be more transmissible than avian influenza was significantly associated with increased hand hygiene practice, suggesting that such relative susceptibility (i.e., perceived risk of H1N1 infection relative to avian influenza) may be more influential in people's behavioural change (Miao et al 2012). Only in a few studies was observed no association between perceived susceptibility and precautionary behaviours. For example, perceived susceptibility to avian flu did not correlate with hand washing in one study (Lau et al 2007b) and no association was found between perceived likelihood of contracting SARS and the adoption of precautionary behavior (Qua et al 2004). Furthermore, in a Taiwanese national survey, perceived likelihood of contracting H1N1 in the future was not significantly associated with increased hand hygiene practice.

A larger susceptibility for SARS and influenza was perceived in association with avoidant behavior. In an Australian study was observed that individuals with greater perceptions of the risk of pandemic influenza were more likely to report an intention to comply with quarantine restrictions (Barr et al 2008). Similarly, another survey conduct in Australia showed that people reporting higher levels of concern about the

possibility to be affected by pandemic influenza, were more likely to report high willingness to wear a face mask or isolate themselves when needed (Taylor et al 2009).

In the UK, a relation was found between a greater perceived susceptibility to H1N1 influenza and avoiding public places (Rubin et al 2009). In the early weeks of the H1N1 pandemic, a study carried out in both Europe and Malaysia found that individuals who perceived themselves to be at risk of developing H1N1 virus were more likely to say that they had reduced their use of public transport or cancelled/delayed their flights (Goodwine et al 2011; Rubin et al 2009; Sadique et al 2007). Those individuals in the US and Canada who perceived themselves to be more susceptible to SARS were found to be more likely to have consulted a health professional or a website for information than those who perceived themselves to be less susceptible (Blendon et al 2004). Nevertheless, it is always important to emphasize the fact that the attitudes and the behaviors declared by the respondents and the deriving observed associations are strongly dependent on whether the epidemic was in its rising or in its declining phase. For example, Lau and colleagues (2003) studied risk perception of SARS in Hong Kong during the outbreak with ten surveys and observed changes both in the risk perception and in the precautionary behaviour. These surveys provided evidence that perceived susceptibility usually declined in the second phase of the epidemic together with the number of new infections. During the initial phase of the epidemic - with rising figures of new cases - there was a sharp increase in preventive measures.

Perceived severity of disease

Constructs of perceived severity was assessed in the studies by including the chances of dying from the disease, its infectivity and risk factors estimates. Some studies report clear association between greater perceived severity of the disease and the adoption of both precautionary and avoidant behavior.

A survey conducted in the UK has shown that the common belief of H1N1 as the most severe disease was associated with a greater likelihood to carry out hand washing, disinfecting or getting a flu friend (Rubin et al 2009; Bults et al 2011). An Italian study (Prati et al 2011) showed that perceived severity predicted recommended behaviours (cleaning, disinfecting objects, washing hand more often than usual, using tissue when sneezing, social distancing). Those who felt that avian flu might be more severe than SARS were observed to be more prone to influenza vaccine uptake and mask wearing in Hong Kong (Lau et al 2008). In contrast, other studies did not find any association between the likelihood of surviving SARS and the adoption of precautionary behaviours in Hong Kong (Leung et al 2003; Tang et al 2004) or of the use of face masks (Tang et al 2004).

Those who believed in higher fatality rates and greater impact on individuals of avian flu than SARS were more likely to report avoidance behaviours (not going out, keeping children off school, avoiding crowds, avoiding hospitals, and travelling) in a study carried out in Hong Kong (Lau et al 2007a; Lau et al 2007b). A

higher perceived impact of H1N1 was also associated with avoidant behaviors (such as avoiding large crowds and public transport) (Rubin et al 2009).

State of anxiety and emotional distress

Some studies evaluated the state of anxiety, as measured by the State-Trait Anxiety Inventory (STAI). High levels of panic and distress in the general public were reported during and after the SARS epidemic in Hong Kong (Lau et al 2003). The level of anxiety in Singapore during the SARS outbreak was high or moderate in 45% of the respondents while 24% demonstrated high level of anxiety in the UK (Rubin et al 2009; Leung et al 2003, Qua et al 2004).

More specifically, other studies assessed the emotional distress as described by the presence of panic, depression or further emotional disturbs, being equal to 6%, 20% and 32% respectively during the H1N1, H5N1 and SARS crisis in Hong Kong (Lau et al 2010b; Lau et al 2009; Lau et al 2007b; Ko et al 2006; Lau et al 2006).

Studies carried out in Asian countries (Hong Kong, Singapore) have found that the likelihood to adopt recommended precautionary behaviours against SARS (hand washing, cough hygiene, mask wearing, using utensils, and washing after touching contaminated surfaces) was associated with higher individual levels of general anxiety (Leung et al 2003, Qua et al 2004), such an association has been highlighted within two studies conducted in Hong Kong concerning the H1N1 pandemic (Lau et al 2007b; Lau et al 2010a).

In a study conducted at the Netherlands, it was found out high anxiety was associated with taking preventive measures and strong intention to comply (Bults et al 2011). Moreover, the likelihood to carry out avoidant behaviours was observed in those individuals affected by emotional distress in the UK (Rubin et al 2009). A study performed in Hong Kong evidenced a greater association between increased anxiety and increased frequency of avoidance measures (Crowling et al 2010). Such avoidance behaviours were associated with negative psychological responses; emotional elements may therefore be strongly involved in making the decisions (Lau et al 2010b).

On the contrary, a study in earlier stage of H1N1 in Hong Kong showed a negative correlation between state anxiety and hygiene that has not been reported in previous epidemics. Some authors explain this evidence with the fact that a greater use of hygiene measures helps individuals to reassure themselves that they would be protected against infection, leading to lower anxiety (Crowling et al 2010).

Coping appraisal

Perceived efficacy of behaviour

Perceived efficacy of behavior was assessed in the studies by how far the respondents believed that the behaviour would protect them from disease. The hand washing was recognized as the main effective

measure followed by avoiding crowded place and by the use of face mask (Kiviniemi et al 2011; Lau et al 2009; Lau et al 2007a; Lau et al 2003). In a study based in the UK, some protective behaviours (hand washing, making flu friend plans, cleaning surfaces) reported to have been carried out, were found to be associated with the belief of their efficacy in protecting against H1N1 (Rubin et al 2009). It is noteworthy the fact that in a recent Taiwanese study the participants who perceived hand washing to be very effective were more likely to increase it, but not those who merely regarded it as effective (Miao et al 2012). Also in this study were found that perceived difficulty of hand washing after coming in contact with possibly H1N1-contaminated objects or surfaces was among the strongest factors associated with increased hand washing (Miao et al 2012). Another study carried out in Hong Kong demonstrated a relation between disinfecting the home and frequent hand washing with their perceived efficacy in protecting against SARS (Lau et al 2003). Furthermore, an interaction between the possibility of avian influenza outbreak and the efficacy of hand washing, was also shown (Lau et al 2007a). An association has been found in Hong Kong between those who felt avoiding public places as an effective measure against SARS (Lau et al 2003) and voluntary quarantine (Lau et al 2007a). An association was also observed between those who believed in the efficacy of face mask use and reported intentions to wear one in the event of an avian influenza pandemic (Lau et al 2007a). Similar connection was observed in the UK between the perceived efficacy of avoidant behaviours in protecting against H1N1 and individuals reporting having adopted them (Rubin et al 2009).

Perceived self-efficacy

Perceived self-efficacy was assessed in the studies by asking respondents to indicate the degree with which they felt capable of carrying out the required behaviours. Some studies performed in Hong Kong with adults, older adults, and adolescents, evidenced that a greater perceived self-efficacy to adopt precautionary behaviours and to wear masks was related with the adoption of these preventive behaviours (Tang et al 2004; Tang et al 2003). A higher level of self-efficacy was a predictor of taking preventive measures in a Dutch study (Bults et al 2011).

1.4.3 Trust

A British study (Rubin et al 2009) has reported that government recommended preventive health behaviours, all the people who trusted the authorities adopted those measures.

As a matter of fact, trust in the government has shown a key role during the severe acute respiratory syndrome epidemic in China in 2003, for example. Attitudes towards the government's SARS prevention measures - including confidence in the government's ability to control the spread of SARS - were linked to the engagement of preventive health behaviours (Tang et al 2003). A study conducted in Singapore showed that the high level of trust - regardless low level of knowledge - could imply the government control of public measures (Deurenberg-yap et al 2005). Moreover, Singaporean people who thought that authorities

were open to communication were more inclined to practice high number of SARS preventive measures (Quah et al 2009).

1.4.4 Knowledge

In studies conducted among Chinese general population during H1N1, a possible relation between knowledge, risk perception and practices, was found to indicate that a high level of knowledge may be important to enable individuals to have better attitudes and practices in influenza risk reduction (Lin et al 2011). Similarly, the high frequency of precautionary measures was associated among people with elevated level of knowledge. In addition, an Indian study showed a positive association between knowledge and protective behaviours during the influenza H1N1 outbreak (Kamate et al 2010). In a study carried out in Hong Kong during the H5N1 influenza, a number of misconceptions (such as those related to long-distance airborne transmissions and poultry meat), were identified, while -though decreased over time - the ones related to insect bites, were still highly prevalent(Lau et al 2010a).

We should also consider how the belief in waterborne transmission was significantly associated with the high number of anticipated behavioural responses (Lau et al 2010). In addition, Leung et al (2004) found out that a greater knowledge about the transmission routes of SARS (in Hong Kong), predicted the adoption of more precautionary measures. Finally, a study conducted in Australia gave proof about the strong association between a demonstrated basic knowledge of pandemic influenza (compared to the lack of such knowledge) and the willingness to comply with home quarantine (Eastwood et al 2009).

1.4.5 Discussion

The first part of this study aimed at demonstrating how important the socio-demographic characteristics - together with psychological factors - have been on the scenario of preventive behaviors global disease outbreak. Some conceptual frameworks, as the Theory of Planned Behaviour (TPB), Health Belief Model HBM), the Protection Motivation Theory (PMT), and the Extended Parallel Process Model (EPPM)were useful to introduce and make a theoretical analysis of the psychological factors. Actually, understanding those precious aspects has been important to highlight any effective communication strategy that could reduce both the spread and the impact of infectious pandemic outbreaks.

A number of factors have been found to foster NPIs behaviour among the general public (*see Tab 3. Factors associated to protective behavior.*):

- Being elderly people
- Being woman
- Having a high education level
- Perceived efficacy of the behaviour
- Perceived susceptibility to the disease

- Perceived severity of the disease

- Perceived self-efficacy to adopt behavior

- Trust in the authorities

- Having a high level of knowledge

- Having a high level of anxiety

Regardless the socio-cultural different responses to pandemic diseases, some similar factors have influenced the behaviours and/or the intentions of global population. Some of the socio-demographic variables have been associated with the action of preventive and avoidant behaviours. More specifically, studies have found that women are more inclined to put those preventive behaviours into practice.

Age factor is another precious element of this review: generally speaking, old people are more likely to adopt protective measures than young people. Only one study - among those we considered - has found a positive correlation between being young and preventive behaviours such as hand washing more, cleaning surfaces more or getting a flu friend (Rubin et al 2009). On the contrary, a study conducted in Australia gave proof that age is not a predictive factor (Eastwood et al 2009).

Generally speaking, people having a high education level are more likely to adopt preventive or avoidant behaviours, though two studies have shown that no direct correlation could be found between education and such positive behaviours during the SARS epidemic (Tang e Wong 2003; Blendon et al 2004).

Some psychological factors were associated with protective behaviours. Evidence has been found that perceiving oneself to be more susceptible to SARS, avian flu, H1N1, or pandemic influenza can be associated with undertaking preventive, and avoidant behaviours to protect oneself. There is also evidence that perceived severity of disease is associated with carried out preventive and avoidant behaviours. These results can be better explained if related with the above-mentioned models, particularly the HBM, the PMT, and the EPPM describing the important role of threat perception in determining behaviour.

A factor, closely associated with the adoption of protective behaviours, is the perceived effectiveness of the same measures whose practice can be fostered by the real capability of producing the desired results. This review has also given the proof that a high level of anxiety is associated with the implementation of preventive/avoidant behaviours. Knowledge as well seems to be correlated to the implementation of such measures together with the willingness to comply with home quarantine.

Finally, a key factor for putting into practice the preventive behaviours as a whole is the trust for institutions and the satisfaction with the received communications about the disease. Trust and effective communication are of particular importance especially in the case of a pandemic fatality when the role of

the institutions is to provide information on the progress of the epidemic itself, on the measures to be put in place and on the available health treatments.

1.5 Pandemic influenza vaccination and compliance among general population

Among the 60 articles of this review, 23 of them have focused on the factors related to vaccination or the intention to be vaccinated. Most of the studies were concentrated on H1N1 vaccination (n=20), one study was on avian influenza and two were about an hypothetical pandemic influenza vaccination. Twelve were about both H1N1 and seasonal influenza vaccination. The studies were carried out in the following countries[2]: Australia (n=4), USA(n=6) France (n=2), Germany (n=1), Greece (n=1), Italy (n=2); Netherlands (n=2), UK (n=1), Israel (n=1), India (n=1), Hong Kong (n=3), Malaysia (n=1), and China (n=1) [3].

1.5.1 Demographic factors associated with vaccination

Age

The included studies showed that the influence of age on general public's intentions and behaviours toward vaccination is varied, even though great part of these studies pointed out that older people are more likely to get vaccinated. Many studies in France, Germany, Greece, Israel, UK, and the US found that older people are more likely to be vaccinated (Schwarzinger et al 2010; Walter et al 2011; Sypsa et al 2009; Velan et al 2011; Myers et al 2011; Maurer et al 2009). Furthermore, some studies carried out in the US, France and Germany found that the intention of being vaccinated against novel H1N1 increased with age (Maurer et al 2009; Vaux et al 2011; Walter et al 2011). Also according to Schwarzinger et al (2010), vaccination acceptance was significantly lower in adults under 35 and increased with age. An Italian study (Ferrante et al 2011) showed that individuals in the middle age group (35-49 years) were less likely to get vaccinated.

On the contrary, one study carried out in the US and other two in Australia found that younger people are more likely be vaccinated (Garlace et al 2011; Eastwood et al 2009; Seale et al 2010).

Gender

In general, studies pointed out that women were less likely to accept vaccination, or show intention to vaccinate as compared to men. Two studies carried out in Germany and Israel showed lower vaccine acceptance rates among women (Walter et al 2011; Velan et al 2011).

Moreover, in five studies conducted in Greece, France, Italy, the Netherlands and Australia, women respondents were less willing to get vaccinated than men (Sypsa et al 2009; Schwarzinger et al 2010; Ferrante et al 2011; Zijtregtop et al 2010; Eastwood et al 2009).

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[2] In alphabetical order.
[3] These add up to more than 23 as some studies were conducted more than one country.

In some studies any association between pandemic vaccination coverage and gender (Vaux et al 2011), or between vaccine uptake and gender was found (Seale et al 2010).

Ethnicity

Evidence of ethnicity influence on vaccination intention is also varied. In a study conducted in the US white people had higher H1N1 vaccine coverage than both Hispanics and black people. Furthermore, in a study carried out in Israel, very low H1N1 vaccination compliance rates were found among Israeli Arabs, even though, as pointed out by the authors, Arab population is strongly under-represented in this study (Velan et al 2011).

On the other hand, two studies carried out in the US and Australia and other two in the UK showed that people from ethnic minorities were more likely to be vaccinated (Quinn et al 2009; Seale et al 2010; Rubin et al 2010; Myers et al 2011).

Educational level

Three studies conducted in the US, France and Germany showed that higher education was associated with H1N1 vaccine uptake (Santibanez et al 2012; Vaux et al 2011; Walter et al 2011). On the contrary, if we consider the intention of being vaccinated, two studies showed that graduated people from high school or with undergraduate degrees at university were less willing to get vaccinated than others (Zijtregtop et al 2010; Schwarzinger et al 2010). In conclusion, any association between educational level and vaccination uptake in an Israeli study (Velan et al 2011) or between educational level and the intention toward vaccine uptake in any Australian study was found (Seale et al 2010).

As for preventive behaviours, literature analyzed in this review shows that reliance of vaccination uptake on education is controversial.

Other socio-economic factors

With regard to income, a US study found a significantly association between receipt of H1N1 influenza vaccine and a higher income level (Santibanez et al 2012). Moreover, one study conducted in France (Vaux et al 2011) suggested that a higher professional and managerial occupation, or an intermediate occupation or retirement (compared to manual labor) were indicative of greater vaccine uptake. On the contrary, a study carried out in the UK showed that unemployed participants were more likely to be vaccinated (Myers et al 2011).

Another variable was associated with vaccination uptake. In fact, living in a household with one or more children is associated with higher level of vaccination (Sypsa et al 2009; Vaux et al 2011). Also the presence of only one child in a household was associated with a higher acceptance when compared with both

households with no children and those with more than one child (Schwarzinger et al 2010). This may suggest that compliance with pandemic vaccination campaign was higher in families with children.

Also, housing area seems to have an influence on vaccine compliance. A French study found that A/H1N1 vaccine acceptance was lower among respondents living in small towns with 20,000 to 100,000 inhabitants (Schwarzinger et al 2010). Similarly, negative association with vaccine uptake of people living in a city with more than 500,000 inhabitants was found in a German study (Walter et al 2011). On the contrary, Asian population was more likely to be vaccinated against 2009 H1N1 influenza when residing in an urban area than in a rural one (Wong et al 2010).

1.5.2 Previous vaccination against seasonal influenza

The evidence of association between previous vaccination against seasonal influenza and intentions and behaviours toward pandemic vaccine is confirmed in several studies. A US study suggests a strong relationship between the stated probability of being vaccinated against novel H1N1 and seasonal influenza vaccine uptake. In this study, the probability of pandemic influenza vaccination was two times higher among vaccinated people than among unvaccinated people. This positive association was mostly expressed by people aged 65 years and over (Maurer et al 2009). Other four studies carried out in Europe (France, Germany, Greece, The Netherlands) and two in Australia pointed out that people vaccinated against seasonal influenza were more likely to be vaccinated against pandemic influenza (Vaux et al 2011; Walter et al 2011; Sypsa et al 2009; Zijtregtop et al 2010; Eastwood et al 2009; Seale et al 2010).

Similarly, those who had received seasonal influenza vaccine in the same year or at least once in the previous three years were also more likely to get the H1N1 vaccine in France and in the US (Schwarzinger et al 2010; Garlace et al 2011). Moreover, the history of seasonal influenza vaccine was significantly associated with behavioural intention to take up H1N1 vaccine in Hong Kong (Lau et al 2010c).

In general it seemed that beliefs about seasonal influenza vaccine would influence novel H1N1 vaccine uptake (Seale et al 2010; Maurer et al 2009; Sypsa et al 2009).

1.5.3 Psychological factors associated with pharmacological measures

Threat appraisal

Perceived susceptibility to the disease

In the US studies respondents who believed to be likely to get sick with influenza if not vaccinated had significantly higher H1N1 influenza vaccine coverage than those who did not agree with this opinion (Santibanez et al 2012). Another US study (Quinn et al 2009) found that people who declared they have accepted a seasonal vaccination annually or in the last years had a higher perception of personal consequences than those who affirmed they have been vaccinated ''once or twice'' or never.

Respondents' concern over the risk related to infection was associated with the mentioned intention of getting vaccinated (Sypsa et al 2009; Seale et al 2010; Wong et al 2010; Horney et al 2010; Rubin et al 2010; Schwarzinger et al 2010; Myers et al 2011). In the same way, a low personal perceived susceptibility was associated with a negative intention to be vaccinated (Zijtregtop et al 2010).

In some studies conducted in the US and Hong Kong, susceptibility perceptions were not associated with pandemic influenza vaccine uptake (Garlace et al 2011; Lau et al 2010c).

Although these two studies do not stress any association between perceived susceptibility and vaccine compliance, several studies carried out in different countries (three in the US, Australia, Asia, France, Greece, the Netherlands, and UK) considered perceived susceptibility as an important factor in choosing vaccine uptake.

Perceived severity of disease

Respondents with a higher perception of the severity of influenza-pandemic disease were significantly more likely to accept vaccination (Eastwood et al 2009; Sypsa et al 2009; Schwarzinger et al 2010; Zijtregtop et al 2010; Ferrante et al 2011; Myers et al 2011). Moreover, respondents who already faced a case of H1N1 influenza-pandemic disease in their close relationships (family members and/or work colleagues) were more likely to accept the H1N1 vaccine (Schwarzinger et al 2010; Wong et al 2010).

According to previous studies on H1N1pandemic, a study conducted on avian influenza showed that a higher perception of the severity was associated with intention of vaccine uptake (Lau et al 2008).

On the other hand, only two studies did not stress such association. In particular, a Hong Kong study about severity perception of influenza pandemic disease was not found to be associated with vaccine uptake (Lau et al 2010c). Furthermore, a study carried out in Australia did not find any difference in vaccine acceptance between participants who reported cases of H1N1 among their friends or family members and those who did not (Seale et al 2010).

Coping appraisal

Perceived efficacy and safety of vaccine

In a study conducted in the US, about three-quarters (74%) of respondents conferred to influenza vaccine a certain or at least somewhat effectiveness. Respondents who believed vaccine was effective in preventing influenza had significantly higher influenza vaccination coverage (Santibanez et al 2012). The same result emerged from a study carried out during the avian influenza outbreak (Lau et al 2008), which showed people who believed vaccination would have been effective in preventing influenza transmission to be more likely than others to receive vaccination.

As far as safety of pandemic vaccination is concerned, in a study conducted in the US, vaccine safety beliefs were found to be decisive determinants of H1N1 vaccine uptake. In fact, those who believed that the H1N1 vaccine was safe were more likely to get vaccinated (Garlace et al 2011). Among Indian population vaccine was considered the most effective method for H1N1 influenza prevention (Kamate et al 2010).

Perceived barriers to having the vaccine

Among those who expressed the intention not to be vaccinated, concern about the side effects of vaccination becomes relevant. Santibanez et al (2012) found out that 31% of respondents declared they were very ⁄ somewhat worried about getting sick from H1N1 influenza vaccine. In some studies conducted in France and Greece, one of the main reasons respondents did not accept vaccination was the fear of vaccine side effects (Schwarzinger et al 2010; Sypsa et al 2009). In the same way, Walter et al (2012) found out that concern about the safety of the pandemic vaccines was identified as the main obstacle to vaccination.

Lau et al (2010c) found out that one of the factors associated with intention to take up H1N1 vaccine would be the price of vaccination. To conclude, Wong et al (2010) demonstrated that, when Muslims were in doubt whether to be immunized against H1N1 influenza or not, concern that vaccine could be halal was greater than safety concerns.

Trust

Some studies investigated the trust in institutions toward vaccination matter. In a US study, respondents who would accept vaccine had a higher level of trust in the government than those who refused (Quinn et al 2009). In a study carried out in the Netherlands higher level of trust in the government increased the intention to accept vaccination (van der Weerd et al 2011).

Similarly, there was also a significant difference in the number of respondents who agreed that official authorities had informed the population openly and honestly about pandemic influenza vaccination, when comparing vaccinated with unvaccinated respondents (Walter et al 2012).

Again in the US, it has been found that 14% of people who would not get the vaccine declared not to trust information provided by public health officials concerning vaccine safety (Garlace et al 2011). In a study carried out in Israel was observed a prominent manifestation of mistrust among Israeli Arabs (Velan et al 2011).

1.5.4 Knowledge

A German study (Walter et al. 2012) showed that 92% of vaccinated respondents had fully or partially agreed to be sufficiently informed in order to make a balanced decision over vaccination, while only 78% of the non-vaccinated respondents felt well informed.

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A US study pointed out that knowledge about H1N1 vaccine, by following news closely, and risk perception were associated with vaccination intention. This study also showed that changes in influenza terminology during the initial stages of the pandemic caused some confusion among general public (Jehn et al 2011).

On the other hand, a study carried out among Asian population found that knowledge on the 2009 H1N1 influenza was not a significant index for vaccination intention, and suggested that disseminating knowledge alone is insufficient (Wong et al 2010).

1.5.5 Sources of information

A study conducted in the US (Maurer et al 2010) showed that respondents were equally likely to report healthcare providers, CDC/public health departments, and news reports as the most influential information source for deciding whether to be vaccinated against pandemic influenza or not. Uptake of pandemic vaccine was higher among adults who declared employers or healthcare providers were their most influential information sources and was lower among those declaring "none of the above". Moreover, Maurer et al (2010) found out that perceived safety and value pandemic vaccine were generally higher among adults who mostly relied on information from healthcare providers and public health officials. Yet, considerable doubts remained about safety and value of pandemic vaccine among people who relied mostly on alternative information sources (Maurer et al 2010).

In a study carried out in Germany, Walter et al (2012) found out that the use of radio or television as well as family and friends as main source of information were associated with lower vaccine uptake. In contrast, the association between vaccine uptake and the search of information on vaccination was found when physicians or official materials were used as main source of information.

A positive advice from a primary care physician significantly increased acceptability of vaccination; however, in the case of a positive advice by other health care professionals, this was not confirmed (Schwarzinger et al 2010; Seale et al 2010; Ferrante et al 2011).

A study conducted in Arizona (Jehn et al 2011) showed that most of the people who were more likely to receive the H1N1 vaccine, expressed the intention to go to a family doctor to get vaccinated.

1.5.6 Discussion

The second objective of this review concerns the identification of socio-demographic and psychological variables related to the acceptance of vaccination in the event of a pandemic. The data gathered in this report have shown how the compliance to vaccination, particularly against the H1N1 pandemic influenza, remains very low, as it is the availability (intention) to be vaccinated.

A number of factors have been found to foster vaccination acceptance among the general public (*see Tab 3. Factors associated to protective behaviour*):

23

- Previous history of the seasonal influenza vaccination uptake

- Receiving an advice/information from primary care physicians

- Being elderly people

- Perceived safety of the vaccine

- Perceived efficacy of the vaccine

- Perceived susceptibility to the disease

- Perceived severity of the disease

- Trust in authorities

- Presence of children in the household

- Cost of the vaccine

Other factors negatively affected the vaccination acceptance:

- Being woman

- The fear that the vaccine could cause disease or side effects

Among the socio-demographic factors, age is associated with a higher intent to get vaccinated. Even if a study conducted in the U.S and two Australian studies gave proof that young people are more likely to be vaccinated, old people generally appear to be more likely than them (Garlace et al 2011; Seale et al 2010 and Eastwood et al 2009). Gender factor as well can be linked to the intention to be vaccinated: women were less willing to get vaccinated than men. Another variable associated with vaccination is the presence of children in the household. The roles of ethnicity, educational level, and income level, from the literature analyzed in this review, are instead controversial. On the other hand is clear the influence of past behaviour, in fact those who have been vaccinated in the past against seasonal influenza were more likely to be vaccinated against pandemic influenza. In agreement with the above-mentioned theories, perceived severity and – above all - perceived vulnerability were positively linked to the intention to adopt protective measures and to accept vaccination; such a correlation was also highlighted in a recent systematic review on this topic. (Brewer et al 2007).

Beliefs in the effectiveness of the vaccine are strongly associated with influenza vaccination or with the intention to get a vaccination. Many studies have focused on the safety and efficacy of the vaccine as the most important factors in the decision to be immunized (Wong et al 2010; Lau et al 2009; Eastwood et al 2010).

On the other hand, the low acceptance of pandemic vaccination showed great fears about the safety of the H1N1 vaccine and general mistrust of new vaccines. In particular, the public attention focused on the potential adverse effects of the vaccine. Trust and institutional communication therefore are the fundamental keys in vaccination. Finally, many studies have shown that behaviors, attitudes, and advice

from primary care physicians were strongly associated with their patients' immunization behavior for seasonal influenza or with the intention to get a vaccination (Maurer et al 2009; Schwarzinger et al 2010; Seale et al 2010; Ferrante et al 2011; Jehn et al 2011; Walter et al 2012). However, most respondents in this studies were not advised to get vaccinated. HCWs reported a very low uptake rate while they usually were the first priority group to access pandemic vaccines.

1.6 Limitations

The studies included in this review are heterogeneous and regarded different populations per different infectious disease. The surveys were conducted in different stages of the epidemic and most had short data collection periods and therefore can only provide a snapshot of intentions and behaviors at a particular time. Furthermore, measurement of the psychological constructs included in the studies was heterogeneous. As for the preventive behaviors, studies coming from different countries have focused on different epidemics, while studies concerning vaccination have given attention to H1N1 influenza. As for the cross-sectional study design we were not able to infer causality. Furthermore, cross-sectional studies suffer from problems of study design and data collection methodology. In particular, most of the studies have been using telephone surveys, a method subject to reporting bias leading to undesirable behaviors results. Despite these limitations the findings from many different countries are remarkably consistent and supported by similar studies conducted by different authors (Godin et al 1996; Brewer et al 2006; Chapman et al 2006; Stefanoff et al 2010; Bish et al 2010 and 2011).

CONCLUSIONS AND RECOMMENDATIONS

We can actually conclude that some of the socio-demographic factors are related to both the implementation of protective behaviors and the compliance to vaccination. Older people are generally more willing to uptake vaccination and put into practice protective behaviors. Men were more likely to get vaccination while women were more likely to comply recommended behaviors. The use of audience segmentation for communication messages that consider demographic, ethnic, cultural and social differences also may allow for more effective and targeted communication to promote influenza vaccination and recommended behaviors (Slater et al 1991; Wong et al 2010; Velan et al 2011; Santibanez et al 2012).

Several studies showed that during the H1N1 pandemic, communication inequalities in the population were correlated with differences in knowledge of H1N1 itself in terms of virus transmission and signs and symptoms of infection. The relationship between this knowledge and both level of education and home ownership found in this studies, suggests the need for public officials to integrate information about the

characteristics of communities and individuals, with a particular focus on socio-economic level in their communication planning efforts (Savoia et al 2012).

Public health messages are often subject to different interpretation that may considerably vary according to individual perception of the risk or trust in the government together with the different abilities in understanding and interpreting data and information, especially in a context of uncertainty (van der Weerd et al 2011; Kiviniemi et al 2011). This could be carried out in partnership with providers, community leaders or community and faith-based organizations using a variety of strategies including social media (Reissman et al 2006; Task Force on Community Preventive Services, 2000; Vaughan et al 2009).

Demographic differences in opinions about recommended behavior, influenza vaccine and disease suggest that improving communication strategies within these groups may improve vaccination coverage and the implementation of protective behaviors.

Vaccine acceptance is correlated to seasonal vaccine uptake and the expert's advice is decisive and always a significant factor. Making appropriate health information available to the general public is a priority in emergency situations. For this purpose, an effective contribution could come from the cooperation of health professionals. In fact, different studies have shown that one of the most trusted sources are the general practitioners and family pediatricians (Schwarzinger et al 2010; Seale et al 2010; Maurer et al 2010; Ferrante et al 2011; Jehn et al 2011; Walter et al 2012). This confirms that involving family doctors in the communication strategies is important for designing effective communication. Trust in institutions, clarity and transparency in the communication are important factors for the adoption of protective behaviors and vaccination compliance.

During H1N1 pandemic outbreak, representatives of many international health institutes predicted a worst-case scenario with large numbers of fatal cases, based on influenza pandemics in the past and early reports concerning the new Influenza virus. In the following months, local viral transmission in many countries remained relatively limited and governments announced that the pandemic appeared to be mild. Following such claims, there was a significant decrease in perceived reliability of information received by the government: in the beginning the general public believed the pandemic would be severe as pronounced by the government though this turned out to be mild. As a matter of fact, rebuilding trust in recommendations of public health authorities and addressing common misinformation about immunization against pandemic influenza it is a real communication challenge when preparing for future pandemic situations (Walter et al 2012).

Some psychological factors as perceived susceptibility, perceived severity and perceived efficacy of vaccine or behavior can be predictive of both the implementation of proper behaviors and vaccination uptake. This conclusion suggests that the concomitant worry of an actual pandemic might be sufficient to increase

public health compliance to required levels, as noted in Hong Kong during SARS (Lau et al 2003). Also, Rubin et al (2010) claim that during a future outbreak, raising levels of worry about the possibility of catching a disease from low levels is likely to increase uptake of behavioral recommendations. Although the adoption of such an approach might seem compelling, there is evidence that interventions that increase perceived threat can be ineffective if they increase anxiety to such an extent, leading the individual to denial or even avoidance of the issue itself (Middaugh et al 2008; Reissman et al 2006). In order to avoid this, messages about risk should not be alarmist and should be combined with advice about how to manage this risk effectively (Witte et al 2000).

Emphasizing the efficacy of recommended behaviors in any future campaign should therefore help to maximize the campaign's impact on those behaviors, but Rubin et al (2010) suggest that communicating the efficacy of a specific behavior may have an impact on that behavior alone. Moreover, the results about vaccination indicate the importance of highlighting the risks of not being vaccinated and the benefits of vaccination thus explicitly acknowledging and tackling safety concerns (Bish et al 2011).

In conclusion, the data suggest that public health officials should take into account differences in population subgroups as they develop public communication strategies in order to avoid or to exacerbate inequalities. Public officials need to develop methods and strategies (i.e., rapid surveys) to test their messages and assess their impact on the population (Savoia et al 2012). These might include developing messages able to create a feeling of trust in the government as well as selecting non-governmental channels of communication such as community-based organizations, community leaders, or family networks to facilitate the diffusion of effective messages among all social groups.

In general, future health promotion strategies will be more effective if they adopted some of the basic principles of attitude change (Panagopoulou et al 2011):

− People would change their behavior if they believe that they could get more benefits than losses.

− People would change their behavior if they believe that they are at risk; the importance people give to their changed behavior is directly proportional to the severity of the risk itself.

− People would change their behavior if they believe that they can do it.

− People would change their behavior if they believe that other people expect them to change.

EXECUTIVE SUMMARY II

Outbreak communication during 2009 H1N1 pandemic

Introduction

In a health crisis situation, as it did in 2009 with the outbreak of the H1N1 or "swine flu" virus, communication has become a central issue to manage the risk. Appropriate communication and education will ensure the public, health care professionals and stakeholders know how to best protect their health and the health of others. It will also inspire continued confidence in the authorities's response to the pandemic situation. Clear, consistent and co-ordinated messaging across the full range of communication channels, tailored to the needs of specific audiences, is crucial to maintain the public trust and to ensure essential compliance and support to the effective management of a pandemic.

Methods

MEDLINE, Cinahl, EMBASE, Google Scholar, World Health Organization Library Information System (WHOLIS), System for Information on Grey Literature (Open SIGLE), Networked Digital Library of Theses and Dissertations, Pro Quest Digital Dissertations, Dissertation Abstracts (North American and European theses) and Electronic Theses Online Service (Ethos), were used as references for studies. Also, references of all included articles to identify other potentially relevant studies were examined.

Results

Regarding the public, the communicators have to take in consideration that information distribution is not "one size fit all" and must be tailored to the communication preferences of those who need to have the information (Klein et al 2010). H1N1 attracted greater media coverage especially during the spring 2009 when the novel virus emerged and spread around the world. The media, but also the health authorities, had been accused of exaggerating risks and contributing to public worry and confusion. The H1N1 pandemic also showed several examples of mediated risk conflicts, where statements or demands from stakeholders led to a change in the recommendations made by public health authorities. In this occasion some agencies used new and social media as main ways of communication.

Conclusion

Communication was indicated as a complex issue that needed further improvement. The challenges were to respond to the various public concerns and to achieve a high level of transparency over the disease burden. The existing WHO outbreak communication principles of early announcement, trust and transparency achieve this to a certain extent. However, additional work is required to develop practices and principles to ensure visibility and legitimacy of communication. Choosing the best channels of communication, targeting primary audiences and finding spokespeople who provide legitimacy are some of the issue that need to be explicitly addressed.

2. OUTBREAK COMMUNICATION DURING 2009 H1N1 PANDEMIC

2.1 Introduction

In a health crisis situation, as it did in 2009 with the outbreak of the H1N1 or "swine flu" virus, communication has become a central issue to manage the risk. Appropriate communications and education will ensure the public, health care professionals and stakeholders know how to best protect their health and the health of others. It will also inspire continued confidence in the authority's response to the pandemic situation.

From the perspective of health care professionals, health authorities and other key stakeholders, effective coordination of messaging will help to ensure they are receiving timely and relevant information to respond to a pandemic appropriately and effectively. Pandemic communications must incorporate a number of critical elements to be effective:

− Keep the message consistent

− Establish a credible voice

− Build trust and demonstrate empathy and caring

Furthermore, the risk communication strategies must acknowledge the importance not just of openness but also of transparency in the way in which assessments are made and decisions taken.

Clear, consistent and co-ordinated messaging across the full range of communication channels, tailored to the needs of specific audiences, is crucial to maintain the public trust and to ensure essential compliance and support to the effective management of a pandemic.

2.2 Methods

2.2.1 Search methods for identification of studies

The second part of the present report is based on a systematic research in the: MEDLINE; Cinahl; EMBASE. Initially, we did not adopt any language restriction (see **Appendix 1. Electronic search strategies** We also searched for "H1N1 OR pandemic AND Communication"; "H1N1 OR pandemic AND preparedness" on: a) Google Scholar (we obtained 29.800 results but we limited the screening to the first 500 results); b) World Health Organization Library Information System (WHOLIS); c) System for Information on Grey Literature (Open SIGLE); d) Networked Digital Library of Theses and Dissertations; e) Pro Quest Digital Dissertations; f) Dissertation Abstracts (North American and European theses), in the British Library; and g) Electronic Theses Online Service (Ethos).

We examined references of all included articles to identify other potentially relevant studies.

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Data collection and analysis

The author checked all titles and abstracts obtained from the comprehensive literature research, and retrieved the full text of potentially relevant reports. An author review extracted data for each included study: general information (title, authors, source, publication status, publication date); details of study (location, methods of recruitment of participants, response rate); participants (description, geographical location, age, gender, ethnicity, socio-economic grouping); outcomes (methods for measuring outcomes, tools used to measure outcomes) and results. Data synthesis began with a narrative overview of the findings in the shape of a table systematically summarizing the extracted results.

2.3 Communication during 2009 H1N1 pandemic

2.3.1 Opinions and perception of the general public about the H1N1 pandemic

A first step toward any change is made of the acquisition of knowledge and information on a given matter concerning health (Prochaska and DiClemente, 1982). In the first part of this report we saw how knowledge is associated with the adoption of protective behaviors (Lin et al 2011; Kamate et al 2010; Lau et al 2010; Eastwood et al 2009; Leung et al 2004) and the vaccine uptake (Walter et al 2012; Jehn et al 2011). Therefore, communication is essential to facilitate this process. Great part of studies analyzing population knowledge investigate aspects concerning H1N1 virus transmission modes, symptoms related to them, and, as we saw earlier, the knowledge of the main measures to control the spread of virus.

As expected, the level of knowledge acquired over the H1N1 pandemic influenza increases with time, as well as the level of satisfaction on information received (Lin et al 2011; Walter et al 2012; Rubin net al 2010). Moreover, in general it seems it exist a positive association between knowledge and educational level (Walter et al 2012; Savoia et al 2012; Aburto et al 2010; Kamate et al 2010). Furthermore, in the US Savoia et al (2012) found out that ethnicity, age, language spoken at home, home ownership, and community cohesion (trust in the community), all individually demonstrated a positive association with the knowledge about signs and symptoms of H1N1 infection. In particular, white people showed a greater likelihood of being at a higher level of knowledge than non-white people.

A remarkable data showed that in a US study respondents were more familiar with terms concerning swine flu (94%) than they were with the H1N1 (86%). Also familiarity with influenza terms appeared to vary according to the age groups and, particularly, for H1N1. In fact, older respondents were less familiar (79%) when compared with respondents aged 35 to 64 years (90%).Changes in influenza terminology during the initial stages of pandemic appeared to cause some confusion. Moreover, only 66% of respondents declared that the terms H1N1 and swine flu referred to the same virus (Jehn et al 2011). Furthermore, in an Indian study 83% of respondents affirmed to have heard about swine flu whereas only 40% knew about the H1N1

virus, and 81% did not think that the terms "swine flu" and "H1N1" referred to the same thing (Kamate et al 2010).

H1N1 virus transmission modes

A study carried out in Mexico shows that 85% of respondents correctly identified close contact with infected people, 30% identified contact with contaminated surfaces and approximately 10% identified sharing utensils as a mode of H1N1 virus transmission. But a greater percentage of respondents with a low socio-economic level did not know any transmission mode related to the middle and highest socio-economic level. Furthermore, nearly one fifth of respondents in this study, with a low socio-economic status, declared messages were contradictory or confusing (Aburto et al 2010).

A US study (Savoia et al 2012) showed that 69% of people had a high level of knowledge and recognized the correct mechanism of H1N1 virus transmission. In this study ethnicity was associated with knowledge, white people being more likely to have more knowledge than black people and Hispanics. As other studies showed, knowledge level is associated with a high education level and household income. Moreover, a study carried out by Lin in China (2011) showed that those with a high education level were more likely to know transmission routes compared to other people.

Symptoms associated with H1N1 infection

A study carried out in Mexico, pointed out that 70% of individuals could cite fever and at least two additional symptoms. Fever (80%), headache (70%), cough (40%), and sore throat (20%) were the most commonly cited (Aburto et al 2010). This study showed also that the order of the H1N1 facts listed in messages corresponded to the frequency with which respondents reported those facts (Aburto et al 2010). These results are consistent with studies reporting that people have difficulty in remembering more than a few main messages (Keselman et al 2005; Rubin et al 2010) and that people in such situation could be the cause of high levels of concerns, such as pandemic, further hindering recall ability (Covello et al 2001).

With regard to vaccination, a study carried out in China (Lin et al 2011), found that 72% of participants knew that H1N1 vaccination was free of charge and 68% were informed about the state's initial vaccination strategy. In a study conducted in Arizona about 80% of respondents was aware of vaccine availability against H1N1 (Jehn et al 2011). In a Saudi Arabia study it came out that nearly one-half (47%) of participants thought there was a vaccine available for the disease at the time of the survey, even though it was not available yet.

The findings in Savoia study (2012) showed that during the H1N1 pandemic communication inequalities in the US population were correlated with differences in knowledge of H1N1. The relationship between this knowledge and both level of education and home ownership found in this study suggests the need for

authorities to use information about the characteristics of communities and individuals, with a particular attention on the socio-economic status in their communication planning efforts.

Misconceptions

A study carried out in Hong Kong during the early phase of the H1N1 influenza epidemic showed a higher number of misconceptions among the general public. The results showed that 43% of all respondents wrongly believed that the new H1N1 influenza was a type of avian flu. The prevalence of unconfirmed beliefs related to transmission modes was high: 'via eating well-cooked pork' (7%), 'via long-distance airborne aerosols (e.g. from one building to another)'(39%), 'via insect bites' (25%), or 'via water sources' (39%). Most of respondents (66%) had at least one of the fore mentioned misconceptions or unconfirmed beliefs (Lau et al 2009). A following study, conducted in July 2009, Lau et al (2010) showed that 59% of respondents gave at least one item response corresponding to a misconception about model of H1N1 transmission.

A Mexican study showed that few respondents (1.5%) reported the erroneous belief that handling pork products would transmit infection (Aburto et al 2010). In China, Lin et al (2011), found out that 30% of public wrongly believed that H1N1 was food borne, which was associated with the previous knowledge about the avian flu and the new H1N1 flu in the general population.

In a study carried out in Saudi Arabia a large number of participants mistakenly believed that the disease was an immunodeficiency disease (28%), and although most people reported accurate information about the transmission mode, 43% stated that sexual contact was a mode of transmission (Balky et al 2011).

Moreover, in Hong Kong a total of 39% of people wrongly believed that influenza vaccine against seasonal flu could effectively or very effectively protect one against the new H1N1 virus, and 43% believed that there are no effective drugs available to treat the disease (Lau et al 2009).

Vaccination

Personal beliefs about transmission and vaccination played an important role in appraising and responding to the authority recommendations.

In a comment posted in on-line news in Canada people showed concern on H1N1 vaccine. Most of comments refer to high concern than a low one (106 vs.39 comments). Four main concerns contributed to increase fear of the vaccine: fear of adjuvant, in particular, commentators were suspicious of the H1N1 vaccine adjuvant, squalene; fear of mercury; a main cause of fear about the vaccine stemmed from what was perceived to be insufficient safety tested and the lack of information about side effects. People also showed mistrust on pharmaceutical companies. Commentators seemed annoyed that pharmaceutical companies would financially profit by public health crisis (Henrich and Holmes, 2011).

In a focus group carried out in UK people expressed doubts about effectiveness of vaccination, and argued that it could be unnecessary as people build up a natural immunity to flu viruses. Moreover, the perceived barrier to get vaccine was about safety concerns, and especially the development process (Teasdale and Yardley, 2011).

Personal protective measures

In a study conducted in the UK, participants generally felt that some advice - like working if in good health - were *common sense* and advisable to put into practice. Moreover, they expressed doubts about the effectiveness of the recommendations to stay at home in presence of symptoms, considering that virus transmission is mainly aerial. In addition, people felt guilty and anxious about their missing work, considering that pandemic was relatively mild (Teasdale and Yardley, 2011). Similarly, in a focus group conducted in New Zealand the economic pressures to go to work instead of staying at home were the greater concern (Gray et al 2012).

On the Canadian news-sites commentators remind or educate other people about basic ways to prevent disease transmission and infection. Also, many comments proposed a healthy diet and/or dietary supplements as an alternative to vaccination (Henrich and Holmes, 2011).

Trust in authorities

The Canadian news-commentators posted two hundred and fifty-two comments were the government was criticized (only 66 comments were positive). The government was blamed for a general incompetency, the mishandling of "the pandemic being just one more example which showed its ineptitude". Also the government was accused of taking too little action to prevent and control the pandemic, particularly with regard to the handling of the H1N1 vaccine in terms of acquisition, promotion and dispensing of the vaccine (Henrich and Holmes, 2011). Among comments which express mistrust, there were three mainly reasons. The first was that Government was motivated by politics. People claimed that the Government was conducted only by economic/financial reasons, and criticized it for financially supporting pharmacy industry. A final concern, though less frequently mentioned than the other subthemes, concerned government mistrust and government claims about vaccine safety (Henrich and Holmes, 2011).

Finally, a qualitative study carried out in New Zealand showed that people felt they were not being given all the facts (from the authorities) and that this affected their capability to make informed decisions (Grey et al 2012).

Even if it is important to stress that people are more likely to post comments when they disagree with a news story or feel discontent about an issue, thus biasing our understanding of public opinions, this element was useful to understand what issues could affect people's decision making (Henrich and Holmes, 2011).

Information source

Television and radio were the most common sources of H1N1 information in Mexico. In particular, more than 90% of respondents declared to receive information from the TV and over 30% from the radio. Less than 7% of them declared to access information from Ministry of Health website. The access to web site as source of information seems to be associated with a higher socio-economic status (Aburto et al 2010).

Different studies showed that the main sources of information were the mass media, such as television and radio, as well as the print media, such as newspaper or magazine (Walter et al 2012; Jehn et al 2011; Horney et al 2010; Hilton and Smith 2010). The Internet was used as a source of information (range), mainly among young people and among people with a higher education level (Walter et al 2012; Jehn et al 2011)

On the other hand, an Italian study (Ferrante et al 2011) it came out the most believable source of information, which people would contact in case of need, were: GPs and family pediatrician (81%), internet (12%), and other health practitioners. TV, radio, newspapers, magazines and dedicated toll. Free telephone services were mentioned by less than 4%. The same results were found in a study conducted in Arizona (Jehn et al 2011), were the medical professional was the most credibility source, even if followed by local television news 88%, national television 85%, and public health officials 75%.

An interesting point of view come from a focus group study conducted in the New Zealand (Gray et al 2012). Even though participants reported a variety of media sources (like newspapers, TV, radio and the internet), their main source of information was their workplace and/or community. It seemed that when people face uncertainty, they turn to others to reduce their insecurity; these are often family and friends, but also health agencies or *GPs* with whom they have a direct relationship (Paton, 2008).

TV was still the predominant source of information. Nevertheless, the impact of risk communication messages is dependent not only on the way to reach it but also on the public's trust on the source, understanding, and accuracy of messages. Nonetheless, the use of the Internet was found to be low when compared with other information sources. Moreover, the Internet does not seem to be effective in reaching certain population groups such as elderly people or those with a low educational level (Walter et al 2012; Savoia et al 2012).

2.3.2 Traditional media news coverage, and public response

During both the spring and summer of 2009, the general alarm and uncertainty over the emergence of H1N1 was spread through the news media. While some agencies such as the World Health Organization (WHO) and the Centre for Disease Control and Prevention (CDC) were providing risk and precaution information to the public, the news was sensationalized by the media.

Table 1. *Major H1N1 related events*

Month	Day	Event
March	18	Mexican authorities begin picking up cases "influenza-like-illness". In the weeks prior to the first recorded H1N1 death. Local media in Mexico was reporting an increase in instances of flu-like illnesses.
April	12	A 39-year old woman suffering from an acute respiratory dies in Oaxaca, Mexico.
	23	The CDC confirm 7 cases of H1N1 in California and Texas.
	24	Mexican authorities speak for the first time of an "epidemic".
	25	The WHO warns that the virus has "pandemic potential".
	27	First cases confirmed in Europe (in Spain and Scotland). The WHO rise alert level to 4 on a scale of 6.
	28	The epidemic continues to progress, affecting all five continents in the world, from New Zealand to Israel to Costa Rica. FDA approves the CDC's H1N1 test.
	29	The first confirmed death in the United States. WHO raises to 5 its level of alert calling on countries to prepare for an "imminent" pandemic. WHO officially refers to this disease as New Influenza A (H1N1).
May	1	The first confirmed case of H1N1 in Asia is recorded in Hong Kong. WHO says it has "no doubt" that a successful vaccine against the H1N1 virus could be developed within the next six months.
	5	WHO reports 1490 cases from 21 countries and 30 deaths.
	15	34 countries have officially reported 7520 cases of influenza H1N1 infection and 65 deaths.
	20	WHO reports 10243 cases in 41 countries and 80 deaths.
June	11	WHO Director General declares that "the world is now at the start of the 2009 influenza pandemic" (phase 6).
	29	Denmark reports the first case of H1N1 resistance to flu drug, Tamiflu.
August	28	The WHO states that H1N1 is the most prevalent global flu strain.
September	15	The FDA approves H1N1 vaccine.

Sources: World Health Organization – WHO; Centre for Disease Control and Prevention – CDC; Food and Drug Administration – FDA.

As we saw, concern and fear can be associated with the adoption of preventive behaviors. Indeed, many studies showed how these factors can be useful in planning communication activities (Witte et al 2000), even though we know less about the effects of fear appeals in news coverage. However, studies investigated the effects of news coverage of the 2009 H1N1 pandemic in the general public.

A study conducted during the first days of the pandemic collected 3979 media articles from 31 European countries. This study showed two peaks in the media coverage. The first one was on April27th, the day the WHO raised the level of influenza pandemic alert to phase 4; the second one was linked to the WHO's declaration of phase 5 of pandemic alert. National and international public health authorities were

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identified as the main source of information in 75% of the articles, and the overall tone (94%) of these articles was neutral, and spead factual information only (70%) (Duncan et al 2009).

A British newspaper coverage showed that most articles (46%) were published during the first peak in the UK cases. Approximately 27% of the articles appeared in April - May 2009 showing that concerns about a potentially pandemic grew and the number of reported cases began to increase worldwide (Hilton et al 2011; Olowokure et al 2012).

Furthermore, a UK study found that, in general, increases in West Midlands regional newspaper coverage about H1N1, preceded increases in the number of people tested. The increase was linked to a positive association between volume of school-related articles and the number of laboratory-confirmed cases of H1N1 (Olowokure et al 2012). In the UK, the interest in H1N1 pandemic decreased from September (21%), despite a second peak of cases in the UK since the 'normal' flu season came around (Hilton et al 2011).A study conducted in the main US national print and electronic news coverage during the first five months of H1N1 outbreak, showed that the heaviest coverage emerged during May 2009, and that different terms were used to refer about the virus (including H1N1, swine flu, and influenza A). The most used term was "swine flu" (95%), followed by "H1N1" (75%) and "influenza A". The last term was rarely used, though used by the WHO and the CDC (Goodall et al 2011). Similar results were found in an Australian study (Fogarty et al 2011). Also a study carried out on media coverage in Ontario, showed that during the first period media attention occurred between April 27 and May 1, 2009 when cases of H1N1 first occurred in Mexico and the United States and, soon after, in Canada and Ontario. By mid-September, media attention to H1N1 began to trend upwards once again, and increased media interest in various facets of the story in anticipation of the second wave expected in the fall (Laing, 2011).

The content analysis (Goodall et al 2011; Fogarty et al 2011) showed that the severity of the pandemic was reported in a higher number of news (from 63% to 86%). This was communicated through the description of daily tallies of infection and mortality. The stories pointed out that infection rates were serious and they could turn into hospitalization and death (Goodall et al 2011; Fogarty et al 2011; Hilton et al 2011; Rachul et al 2011). Coverage also referred to the spread using descriptive language with epidemiological terms, but moreover some statements provided commentary that suggested rapidly spreading outbreaks difficult to contain (Fogarty et al 2011).

The seriousness was also communicated in comparison with other virus such as seasonal flu, avian flu and SARS (Goodall et al 2011; Fogarty et al 2011; Hilton et al 2011). Yet there was disagreement whether H1N1 was similar, less severe or more severe than other familiar virus. Different news stressed the need for calm responses. In addition, 23% of statements assured people that the government was handling the situation by elaborating on its own current and proposed actions (Fogarty et al 2011).

The news also referred to advices about what people could do to reduce or prevent the spread of H1N1 (e.g. hand washing, getting vaccinated) (Goodall et al 2011; Fogarty et al 2011; Hilton et al 2011). Most of these news (77%) did not make explicit statement about the effectiveness of these actions. The things got even worse about the statement on community actions (e.g. quarantine or school closure). In fact, most articles (89%) do not specify the importance and the effectiveness of such actions (Goodall et al 2011).

In Goodall study (2011) around 30% of the articles implied that only particular group were susceptible (7% in a Fogarty study), stressing the fact that the risk group was not included in those traditionally vulnerable to seasonal flu. In particular, statements indicated greater disease burden of H1N1 among people under 25 years, followed by pregnant women and people with chronic illnesses. On the contrary, in a Canadian study the most commonly group identified at greater risk to contract the virus was the health professional one (Rachul et al 2011). In the UK articles paid attention to people at high risk. This corresponded with the introduction of the H1N1 vaccination program addressed to people at high risk of developing H1N1 (Hilton et al 2011).

A Canadian paper examined the discussion on the newsprint articles about vaccine and vaccination against H1N1 virus (Rachul et al 2011). This study found that most media coverage occurred during that first month of vaccination program in Canada. Great part of news provided reasons in support of vaccination (72%), while 18% provided reasons against getting vaccinated. Unfortunately, only less than one third of articles provided evidence or suggested effectiveness (Rachul et al 2011; Goodall et al 2011).

Among news that provided reasons against vaccination uptake, only 7% stated or suggested scientific evidence against getting vaccinated (Rachul et al 2011). Also in the US there were debates about vaccine safety (19%), and its availability (11%) (Goodall et al 2011). In the UK during the summer some newspapers paid attention on the development of a vaccine, but this issue attracted relatively little press coverage, and in general, very few articles discussed potential side effects of a vaccine, the vaccine safety, or stated that the vaccine had been adequately tested or not tested (Hilton et al 2011). In a Rachul study the mentioned risks associated with the H1N1 vaccination were: development of autism in children (2.6%), allergic reaction (2.1%), Guillain-Barrè syndrome (2.1%), various neurological conditions (1.7%), and expected flu-like symptoms (1.7%).

Approximately 33% of stories mentioned public fear of H1N1. But among them, great part affirm in population there is an unjustified excessive fear. In particular, some statements reported that the virus was not severe, as it seemed at first, when direct statements that implied the level of fear were disproportionate, and advised the public not to panic. Only a few articles emphasized pessimism over both the unpredictability and rapid spread of the virus, stating that people had the right to be fearful.

The studies showed that latest news were less likely to talk about fear than stories appearing earlier (Goodall et al 2011; Fogarty et al 2011). Finally, the Australian study showed that most statements were made by reporters (54%); a further 21% by delegates of the government and 12% by public health experts. The remaining 13% was a combination of general public statements and comments from overseas officials, athletes or other stakeholders (Fogarty et al 2011).

Media coverage and public response

A few studies were included in this review to assess whether the changes in the volume of media coverage on H1N1 were associated with changes in people behaviors or worries.

The findings of a Canadian study determined that the level of concern, among general population, shows a clear relationship between the rise and fall of concern with the level of media attention (Laing, 2011). Similarly, a UK study (Rubin et al 1010) found that the level of concern in the population remains generally low, despite a very high level of media reporting. However, the percentage of people who affirm to be worried to catch a H1N1 is associated with the total volume of media reporting relating to H1N1. In particular, the number rose during May 2009, when the WHO declaration of a full pandemic occurred, and in mid-July at the higher peak of the summer surge of the outbreak. A small increase was observed with the start of the winter surge of the outbreak and the start of the vaccination campaign.

Rubin et al (2010) also found out that exposure to the media news or advertising was associated with the adoption of some preventive behaviors (like using tissues or buying sanitizing gel), but lower probability of avoiding public transport or using National Health Services (NHS).

Another study carried out in Malaysia showed that in view of an intense media coverage of dead people number related to H1N1 there was an increase of fear (being in contact with people who contracted influenza, or people returning from overseas, fear of hospital visits, and even fear of eating in public places), and an increase of avoidance behaviors (avoiding public/crowded places, public transport, and going abroad).The apparent reduction of some avoidance behaviors - as the number of deaths declined - may indicate a decrease in risk perception, with a consequent decline in the adoption of preventive measures (Wong et al 2010).

2.3.3 News coverage and new media information seeking and public response

The information given to most of the public institutions is packaged to serve unidirectional announcements. Online resources, on the other hand, are considered as a more interactive communication, where people can share information and fill knowledge gaps on health matters.

A study focused on the analysis of information, provided both online and in newspapers on the H1N1, found that the attention on this issue increased rapidly in conjunction with the first WHO announcement of

the presence of influenza H1N1 cases in Mexico and US. The analysis of language in "swine flu" blog entries and newspaper articles on H1N1 show a higher use of health-related words, death-related words, and anxiety-related words. The attention paid to H1N1 occurs most rapidly in Wikipedia, then in blogs and finally in newspaper. The findings suggested that public reaction was visible in online information seeking before it was visible in the amount of newspaper coverage (Tauscszik et al 2012). In addition, a study conducted on Google showed that the main enquiry peak was observed when the WHO announced the emergence of the novel H1N1 virus, although it had been featured on the news media for some time (Nougairède et al 2010). Another study carried out in Wales found that Google News search for news articles H1N1-releted showed the highest concentration when the WHO raised the level of influenza pandemic alert to phase 4 and later to phase 5 (respectively April 27 and 29). Also a high period of media activity occurred in conjunction with the launch of influenza vaccine in the UK (Keramarou et al 2011).

A study simulated a search for generic information on pandemic flu by using generic web search engines in four English speaking countries. The results showed that most websites were from Public Health Agencies and from news providers (37% and 40% respectively). This study showed an overall high probability of finding on the web appropriate information regarding hand washing and main steps of the respiratory etiquette consistent with WHO recommendations, while other recommendations regarding behaviors that can prevent transmission of influenza H1N1 influenza were rarely found through a generic web search on pandemic flu (Gesualdo et al 2010). The study is useful to understand the main topic posted online by the public on the Yahoo! Answers during H1N1 outbreak, showed that people were concerned about overall issues of general health care for preventing H1N1 (Kim et al 2012). Most part of the subjects included in the categories supported those conventional clinical questions including disease, therapy, symptoms, prognosis, prevention and control, and etiology.A second classification generated interesting classes such as feel, doubt, emotion, help, learning, and reply, which display the real frustration of people who seek out flu information.

This finding could suggest that people who post questions are not only seeking for medical information but also for emotional support learning how to manage the disease. This study has also identified the main reference sources to help getting the right information to people through peer-questioners about the H1N1. The findings indicated that people primarily cares about commercial sources for their information on H1N1, rather than Wikipedia or YouTube. This suggested that people seekinf for H1N1 information online frequently refers to more accessible information sources. A much more heartening set of results showed that references to a ".gov" site (of which the CDC and the US Food and Drug Administration are most signified) are almost as common as references to a ".com" (Kim et al 2012).

A study conducted on comments posted on the three main Canadian on-line news sites (Henrich and Holmes, 2011) showed that there were nearly twice as many comments reflecting low fear (n=212)

compared to high fear (n=125). The reasons for a low fear on H1N1 were substantially three: a few deaths number; H1N1 was not different from seasonal flu; seasonal flu was more deadly than H1N1. On the other hand, comments reflecting a high level of fear were characterized from: H1N1 was a new disease; the virus would mutate; young adults were dying; and finally H1n1 would showed high mortality and morbidity.

A study carried out From May until December 2009 (Chew et al 2010), which used Twitter to monitoring public perceptions during the H1N1 pandemic, showed that H1N1-related tweet volume matched with the most important H1N1 news events. For example, to the WHO's pandemic level 6 announcement in June 11, but also when an actor from "Harry Potter" has been recovered from H1N1. An increase of tweet volume was observed also following the arrival of H1N1 vaccinations in the United States on October 6 and regarding vaccination experiences (Chew et al 2010). A content analysis found six content categories resulted from data: resources (like H1N1 news, information or updates), direct or indirect personal experience, personal opinion, jokes/parodies, marketing for H1N1-related products, and unrelated posts (Chew et al 2010). Almost all tweets (90%) provided references to information they were providing, allowing others to confirm the trustworthiness of the material. But, public health and government authorities such as the CDC and the WHO were rarely referenced directly by users (1.5% of links).

Another study that analyzed the use of Twitter in the US (Signorini et al 2011), found that the Twitter users' initial interest in antiviral drugs dropped at about the same time as health authorities indicated that most cases were relatively mild in nature, despite the fact that overall the number of cases was still increasing. Also, interest in hand hygiene and face masks seemed to be timed with public health messages from the CDC about the outbreak in early May.

An infodemiology study of information and search activity on the Internet showed that, as new vaccines and treatments were developed, search activity for supplements increased. Concerns about vaccination safety and efficacy may have directed individuals to look for alternative and natural ways of preventing or treating the disease. In particular, perceived unmet needs from conventional medical systems can prompt individuals to seek alternative therapies. This suggested that public health agencies should provide information about supplements on their websites in the context of specific illnesses (Hill et al 2011).

These findings highlight the role of online tools in rapid, widespread communication in emergencies. Considering the large number of people who use Web resources for seeking health information, these tools prove to be essential for disseminating information and interacting with the goal of serving health-related information questions.

Several authors underline that these tools can be used for near real-time infodemiology or infoveillance studies (Eysenbach, 2009) for public health, and allowing health authorities to become aware of it and to respond to real or perceived concerns raised by the public (Chew et al 2010; Tausczik et al 2012).

Anti-vaccination websites

Internet allows individuals' access to specialized medical scientific information previously available only to health professionals. And during 2009 H1N1 pandemic, the anti-vaccination movements spread doubts about the safety and effectiveness of pandemic influenza vaccines. The low safety of vaccines was raised regarding the 2009 H1N1 vaccine also in anti-vaccination websites. A recent article analyzed the contents of 25 anti-vaccination sites showing that one specific theme did not appear in previous analyses.. This included assertion of a manufactured or exaggerated threat to boost vaccination. "The H1N1 outbreak of 2009 and the campaign to promote widespread vaccination of vulnerable populations were deemed as *manufactured threats*. This new theme, emerging as a specific reaction to the H1N1 influenza vaccination promotion, was present on 44% of the sites in the current study, though it was absent from any of the earlier studies" (Bean, 2011).

Bean study (2011) also showed that the other themes which appeared on the anti-vaccination websites regarded: safety and effectiveness of vaccine. About 76% of all websites included content that asserted that vaccine causes damage, illness, or death. An issue about poisons, additive, and ingredients was present on 80% of the sites. Also, 84% of the websites mentioned conspiracy theory. A 52% of sites referred to that vaccination was promoted only for financial reasons. About 44% of the websites also noted that vaccine mandates were an example of excessive government control. And finally, alternative treatments, like homeopathy, chiropractic, and further alternative vaccination, were mentioned from 20% of this websites.

2.3.4 Crying a wolf?

Despite using the media as a key information source, it was also common among people to express distrust over the information provided by the media and the reasons behind media coverage. A qualitative study showed that participants were skeptics about the veracity of media reports. Indeed, there was a strong feeling that the New Zealand media had a central role in "overhyping" pandemic risk. Public distrust in media and the sensationalizing of health related stories can also be an obstacle to take the risk seriously and to undertake precautionary measures. A belief that risk has been overstated is associated with an increased sense of frustration and a reduction in the likelihood that people will prepare in the short-term (Gray et al 2012).

The commentators of online news in Canada generally characterized the media as irresponsible (260 comments, with only 45 comments crediting the media with responsible reporting). The main criticisms of the media were those reporting lacked context and facts, and the presence of too misinformation. There was also an element of mistrust, with some suspicions that the media "overhyping" stories in order to increase readership/viewership and consequently create a false sense of alarm. If the information conveyed by the media is deemed inadequate or mistrusted, then the public may be less likely to accept the messages (Henrich and Holmes, 2011).

Moreover, in a focus group conducted in the UK, the media coverage of H1N1 was described by many of the participants as '*scaremongering*'. They expressed concern about the way media deliberately tried to induce unnecessary panic. Nevertheless, people also judged that exaggerative journalism tended to have a greater influence on others than on oneself (Hilton and Smith 2010). Also, a strong theme emerged in a focus group study; it was a common general skepticism towards media messages about the pandemic. In particular, advertising and news surrounding the pandemic was seen as amplified and something causing unnecessary panic (Teasdale and Yardley; 2011).

2.3.5 Internal communication

The internal communication is a fundamental issue during crisis situation when an organization is struggling to deal with a rapidly developing and complex situation. Some paper face the internal communication issue from different points of view, particularly about information sharing among the various health agencies, and about information needs of HCWs.

Regarding the sources of information, the widest part of Emergencies Department (ED) personnel in US reported that they obtained information about H1N1 pandemic from multiple sources (88%), internal and external (e.g. Internet, from their own health care service, and other media sources). The CDC was cited as the most often used site for information. In this study, about 40% of ED staff felt that they were receiving mixed messages, but the majority (88%) were confident that the hospital had provided them with the information and equipment to protect them and their family from the H1N1 virus (Klein et al 2010).

A study carried out in Kentucky (Howard et al 2012) examined the role of Local Health Department (LHD) in disseminating information among local health care professional, in particular among primary care practitioners, and pharmacists. The survey showed that 72% of them did not receive information from the LHD regarding H1N1, also in a situation with confirmed cases (71%). In addition, LHDs were more apt to communicate with physicians than pharmacists, despite both groups were playing critical roles in the protection and control of health communities.

A survey conducted in Quebec among primary care practitioners found that about 85% of them encountered difficulties or experienced frustrations in their practice during H1N1 pandemic. In addition, more than 50% reported issues with the top-down management process, communication processes (clinical practice guidelines dissemination and communication routes), and patient management at the public health level. In particular, a slow communication process, an overwhelming number of communication sources, and an overwhelming number of divergent messages, sometimes lacking clarity, were identified as the main problems (Nhan et al 2012).

According with the Crisis and emergency risk communication (CERC) (CDC, 2006) a timely information to the public is a central component of emergency response. In accord with this indication a study assessed

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the response of Health departments to provide online information within twenty-four hours after a public health emergency declaration. This study showed that the 46 out of 51 states had at least some specific information on H1N1 on their web sites, and the information was generally easy to access. Thirty sites included information for health care providers; fourteen provided their own content, and sixteen linked to the CDC information. Slightly over half had press releases posted on their sites. Nine states had information or a link to information in another language on their home pages. In contrast to what was observed for states, only 34% (52 out of 153) of local health department Web sites sampled provided any information specific to H1N1 within twenty-four hours after the declaration of a public health emergency. More than half (54%) accomplished this by linking to the CDC or their respective state health department web sites. Less active communication was noted for local health departments: only 14% had posted a press release (Ringel et al 2009).

About the informational and educational need, two studies conducted in Quebec and the US highlights that primary care physician (like family practitioners, general internists, pediatricians) needed additional information, in particular related to infection control measures, influenza vaccine and its administration, in general and for specific risk groups (Clark et al 2011; Nhan et al 2012).

2.3.6 Discussion

About the population

The Protection Motivation Theory and Extended Parallel Process Model (Rogers 1975 and 1983; Witte, 2000) suggested that individuals will engage in adaptive behaviour if they perceive a significant and relevant threat, and perceived that the proposed solution will effectively avoid the threat. However, the results of this review showed that little news addressed all four recommended components of threat and efficacy (severity, susceptibility, individual and collective efficacy) (Witte et al 1992), which could potentially reduce the likelihood of readers or viewers responding adaptively (Goodall et al 2011). Furthermore, in order to improve future pandemic preparedness, the findings suggest that attempts should be made. In particular it is crucial to elicit and address common doubts and concerns, to reduce perceived barriers to recommended behaviours, to emphasize the benefits and to find ways to support people to adopt them, also considering the likely contextual factors that may affect perceptions of the advice (Teasdale and Yardley 2011). The communicators have to take in consideration that information distribution is not "*one size fit all*" and must be tailored to the communication preferences of those who need to have the information (Klein et al 2010). It is widely recognized that the information alone is not sufficient to motivate people to be prepared. The way in which information is presented or conveyed is an important factor in determining an individual's response. People wanted messages about specific actions that they could have taken to protect themselves and their families and to mitigate any consequences. They wanted transparent and honest communication where both good and bad news is conveyed. There

was a desire across all groups for clear and specific information, such as infection and/or death rates and defining symptoms. This reflects a failure to distinguish between the pandemic and its consequences and highlights the importance of doing so for the risk communication (Gray et al 2012).

About the strategy

As suggested by Duncan (2009), in the early phases of a pandemic, the public health communication seems to be appropriate. In particular the national and international Health Authorities follow the suggestion of the WHO's Outbreak Communication Guidelines or CDC's advice on the need to *"announce early"*, or "*Be first*" engaging with the media proactively as soon as they become aware of a major public health event, such as the emergence of a new virus (WHO, 2005; CDC, 2006). In general, H1N1 attracted greater newspaper coverage especially during the spring 2009 when the novel virus emerged and spread around the world. The media coverage was also following the major events related to H1N1 pandemic. Later, the media had been accused of exaggerating risks, but also the health authorities, and contributing to public worry. In the EU countries occurred a kind of regret among members of the press after the relatively mild course of the pandemic. Some also accused epidemiologists and public health authorities of having overstated the threat (Nerlich and Koteyko, 2012).

Whilst a systematic analysis of newsprint media coverage has found no evidence of exaggerating the content of reporting (Hilton et al 2012; Duncan et al 2009), in qualitative studies participants found that the high levels of H1N1 coverage disconcerted and created a false sense of alarm (Teasdale and Yardley, 2011; Gray et al 2012; Hilton and Smith, 2010; Henrich and Holmes, 2011). This seems to correspond with the 'agenda setting' model which refers that there is a strong correlation between the emphasis that mass media put on certain issues (e.g., based on relative placement or amount of coverage) and the importance attributed to these issues by mass audiences (McCombs and Shaw, 1972; Scheufele and Tewksbury, 2007). But not only, in fact it is interesting that participants to the focus group were asked to describe their images of H1N1. Usually, they reported images of 'Mexico', 'pigs', and people wearing 'face masks'. Some participants mentioned more dramatic images including: 'chaos', 'death', 'borders and airports closing' and 'people being quarantined'. Many of these images appeared to have come directly from the media and it was common for participants to state that they had seen these images on TV, or in the newspapers (Hilton and Smith, 2010).

The H1N1 pandemic also showed several examples of mediated risk conflicts, where statements or demands from stakeholders led to a change in the recommendations made by public health authorities. For example, on 28 April Besser, the acting head of the Centers for Disease Control and Prevention, approved CDC recommendations that schools should close if one student or staff member came down with confirmed flu, and stay closed for 14 days. But this decision wasn't completely appreciated for the political ramifications. In particular at the education department, weren't satisfied that they hadn't been consulted.

Finally, Besser was handed guidelines with a mild revision: closure for one week followed by reassessment (Maher, 2010).

About new and social media

In response to the H1N1 pandemic, some health agencies decided to use the social media. The CDC in particular used any kind of news media. CDC started with podcast, RSS feeds, Facebook, MySpace, Flickr, and Twitter in first instance. Then increased its action to offer buttons and badges, a pilot mobile texting program, YouTube videos, widgets and pilot syndicate Web pages (Reynolds, 2010 A video about the "Symptoms of H1N1 (Swine Flu)" uploaded on YouTube on the 28th of April was viewed by 2.130.028 people, most of the visits were during the same uploading day though there were only 140349 viewers for an educational video called "Clean hands to prevent flu".

However a general consideration can be made: sometimes these new advanced tools are used accordingly to old-traditional communication strategies. The NHS published on YouTube a video called "Catch it. Bin it. Kill it", viewed by 12787 people. Most of the people viewed this video during the first day of publication: (30th April 2009). On the other hand, a parody version uploaded in the same day by a YouTube user, drowed 138365 viewers, almost fifteen times more than the original one. This doesn't mean that the best way to communicate is to provide funny videos during a crisis time but to found a key for more effective web 2.0 communication strategy.

It is paradigmatic what Barbara Reynolds (the crisis communication senior advisor in the Office of the Director, Centers for Disease Control and Prevention) said: "CDC made the conscious decision to maintain its scientific integrity in its messaging through these new media (e.g., it used simple but still formal language, not jargon) and also respect the norms of the social networks it joined" (Reynolds, 2010).

2.4 Lessons learnt, exercises undertaken by various countries and international organizations

"Conflusion (the aggregation of streaming together of multiple confusing items, as in a confluence of confusion) is what the public is feeling in response to the seemingly endless stream of contradictory news about H1N1 influenza"

Picard A., *The Globe and Mail*, October 9, 2009

"The fundamental difficulties are that the messages will be more numerous and more complex, and the precise content of the messages is uncertain for now and will depend on the specifics of how the public health situation unfolds"

Executive Office of the President of the United States, 2009

In the case of a pandemic, appropriate communication and education ensure that the public, health care professionals and stakeholders know how to best protect their health and the health of others. Timely and

accurate communication is essential to inform and educate, so addressing concerns and reactions to a spreading pandemic. Also, effective communication is considered to be essential not only to provide advice, information and reassurance, but also to encourage individuals to take personal preventative actions and to ask support for necessary national responses, and to build and maintain their confidence in the government response during a pandemic.

Pandemic influenza communication has been based on a strategic risk communication approach, and consisted of five principles (WHO, 2004, 2005a; 2005b; CDC, 2007): building trust, announcing early, being transparent, respecting public concerns and planning in advance. These goals were to address and meet the communication expectations of the public and the partners, including government officials, medical professionals, and the public.

The communication strategy included flexibility and proactive communication in response to the evolving situation, managing uncertainty, and acknowledging what was unknown, as well as what was known. The communication strategy was focused on few objectives: providing information to help health care services, addressing the public to manage the new virus, marketing and advertising tactics for infection prevention behaviours, personal preparedness, and over the time, a call to action for people and HCWs to get vaccinated.

If the guidelines and the objectives appeared clear, more difficult was to manage a complex situation that requires an understanding of the broader political, social and cultural environment in which communication occurs (Abraham, 2009). H1N1 pandemic management stimulated a number of controversies around the world in 2009 and, although world media coverage faded in 2010, the debate is still going on.

2.4.1 Internal communication

The internal communication is a fundamental key during crisis situation, and at the same time it is particularly critical; in fact, coordinating communication on both at vertical and horizontal level could be complicate. Within this scenario, the international organizations, such as the WHO and the CDC/ECDC played a precious role in regularly updating health professionals to address action and concerns on specific questions (EU Conference Report, 2011).

From many countries and agencies the need to improve internal communication emerged (Sweet, 2009; Deirdre Hine 2010; Tay et al 2010; WHO Europe, 2010; WHO, 2011; Greco et al 2011). For example, in Canada advanced work with national and international partners formed important links that were useful during the H1N1 response. But, the messages provided across federal, provincial, and territorial jurisdictions weren't always consistent. The reviewers indicate that is necessary to improve coordination among different approaches, communication and marketing tools, tactics and messaging. In particular, the

WHO (2010) suggested that the following are needed to improve communication effectiveness within the health care system:

- Development of vertical networks between the ministries of health and health care workers

- New communication tools (e.g. established through the internet) should be considered, as they have proved to be helpful

- Coordination within a hospital benefits from choosing one person to disseminate information, primarily necessary for early identification of cases, but also during other stages of the response

Moreover, the communication strategies for the healthcare sector should therefore take into account the possible differences in expectations, and explain clearly the rationale for the decision as well as customize the messages to different health care worker audiences (Tay et al 2010).

Other critical elements were the information and the communication about vaccine, and the related issues, such as the safety of adjuvants, the vaccination of pregnant women and serious adverse events following pandemic vaccination. A lesson learnt from most countries is that more communication on vaccine safety data was needed at the time the vaccination was implemented (EU Conference Report, 2011; DH / NHS Flu Resilience, 2010). Furthermore, healthcare professionals were considered as the keystone for reliable information speading about vaccines and antivirals. For this reason it is therefore fundamental to explore particular needs and concerns of healthcare professionals, focusing on the design of future communications strategies (European Medicines Agency, 2011).

In the UK appeared of fundamental importance to involve professional health bodies in discussion able to create sources of direct clinical advice for health professionals during a pandemic. This may be most appropriately hosted by one or more of the professional bodies (Deirdre Hine 2010). The development of CDC guidance is an example of this collaborative communication and sharing of information that took place between CDC, HHS, other federal agencies, and external partners (CDC, 2010). This process is particularly important since there have been several instances in which recommendations have been controversial, particularly those regarding hospital infection control, which have sometimes been based on hypothetical concerns rather than epidemiological data. Some of these recommendations generated controversy and even outright opposition from caregivers. For example, CDC's recommendation for use of N95 respirators by those caring for hospitalized 2009-H1N1 patients is discordant with the views of several other expert bodies. Such conflicts can generate confusion and anxiety at many levels in the hospital workplace, impairing effective compliance with proper infection control, and undermining physician confidence in health agencies and public confidence in local infection control measures at a time when confidence levels need to be maximized (US President 2009; Socialstyrelsen and Swedish Civil Contingency Agency, 2011).

2.4.2 Communication "with" the general public

The institutions must get […] learn to communicate "with" public and not "to" the public

EU, 2010

Tickle the public, make 'em grin, the more you tickle, the more you win;

teach the public, you'll never get rich, you'll live like beggar and die in ditch

Old jingle on the journalism - O'Doherty – The Dublin review of books

The difficulties found in communication during H1N1 pandemic, induced some agencies to think that in the future, science and research may want to focus more on firmly determining a pandemic's virulence before communicating it to the public (Public health agency of Canada and Health Canada, 2010). But it is by now evident that this approach is unsuccessful (WHO, 2005; CDC 2007). It is important to bear in mind that any future pandemic will take place in a multisource environment and therefore a wait-and-see approach may not be the best one to take with the general public.

National health agencies put a great effort in developing a clear, consistent and coordinated communication across the full range of communication channels, tailored to the needs of specific audiences, even if these activities have been implemented with great variability in the various countries. This was considered crucial for maintaining public trust, compliance and support essential to the effective management of a pandemic.

2.4.3 Communication to the media

Media standards and values differ from those of the scientific and health communities. The major goals of the media are to be first, write stories with impact, win prizes, impress sources, figure out what is really happening, tell stories in a compelling way, and get on the front page. These aims do not properly coincide with the health expert's goal of educating the public and gaining public confidence, understanding, and cooperating (Fineberg, 2008). For this reason it is important to engage a trusty relationship with journalists to better guarantee good working relationship during a crisis. Having consistent news briefings and working to establish a collaborative relationship with the media during this time, is important to maximize communication through traditional media (Tay *et al* 2010). The European Union recommended also the constitution of a selected group of available experts to answer question from journalists, as well as the availability of spokesperson, factors both considered essential (EU, 2010).

2.4.4 Communication on vaccination

A particular challenge in communication about the vaccination program derived from public uncertainty regarding the safety of H1N1 vaccines. Some myths and rumours circulated widely on the Internet and through viral emails claiming unsubstantiated problems associated with vaccination. Although mainstream-

media generally discredited such claims, alternative media sources perpetuated myths and often used sensationalism to sustain viewer interest. Public health organizations sought to counter these rumours with frequent updates, including factual information about what was being found through safety monitoring and through disseminating tools and information to health care providers and other sources of consumer information (Schuchat et al 2011).

Rapid response strategies are needed to combat negative rumours about the vaccine and coverage, as well as criticisms in mass media. Hence, the information must be transparent to earn people's trust. Activities and messages should reflect an appropriate understanding of the information needs and communication practices required for each audience (PAHO, 2009). The nationals programming must proactively address safety concerns and adverse events, as well as respond to anti-vaccination messages (Levine *et al* 2010).

Finally, Levine et al (2010) reported that in Israel - and not only - National priority groups for pandemic vaccine were different than those for seasonal vaccine, thus leading to some confusion. Priority groups and vaccination strategies as well may be different among countries.

During the World Influenza Congress in Singapore, it was highlighted that poor communication may also underlie poor influenza vaccine uptake by health care workers despite recommendations that they should be vaccinated to protect the high-risk patients with whom they may have contact (Petrovsky, 2010).

In Sweden, where over sixty per cent of the population getting vaccinated, the factors that led to greater probability that a person would decide to uptake the pandemic vaccination were: a higher degree of perceived risk of being infected; a higher degree of anxiety about this form of influenza; and a higher degree of trust in the authorities. Furthermore, those who decided not to be vaccinated thought that the authorities were exaggerating the risks associated with the pandemic. Indeed, one of the most important questions for future preparedness is the need to maintain the public's confidence in the authority' (Socialstyrelsen and Swedish Civil Contingency Agency, 2011).

2.4.5 Effective communication

Language

Some reviewer suggested that some of the terminology used during the pandemic was not widely understood by the public. The scale of the government's planning assumptions did nothing to allay the widespread belief that a 'pandemic' meant a very severe disease, rather than referring, as it does, to the geographical nature of its spread. Also, the use of the terms 'containment' and 'reasonable worst case' should be reconsidered as they can be easily misunderstood (Deirdre Hine, 2010; EU Conference report, 2011). This requires that agencies should review their use of language during pandemics to ensure that it accurately conveys the aims of the response efforts and the levels of risk.

D1.1 Systematic review of studies addressing population behaviours during infectious outbreaks and review of outbreak
communication in 2009 pandemic
TELL ME project – GA: 278723

Media channels

During the events authorities should engage the most effective channel for reaching the general population and the specific risk groups. Communication strategies were based on the use of different media and communication channels. Among the traditional ones t television and radio (including community broadcasts), the printed press, and announcements on public thoroughfares were the most commonly used. Furthermore, new online communication technologies (including social networks) and mobile telephones have found to be effective. However, their use was mainly limited to urban areas and was selectively directed to people in the upper- and middle-class with high educational levels (PAHO, 2009).

Spokespersons

The countries adopted a 'single authoritative voice' to provide information to the media (Deirdre Hine, 2010), or different types of spokespersons who have credibility with the target population, that could help to transmit pandemic influenza messages (Public health agency of Canada and Health Canada, 2010; PAHO, 2009). Most states used their Chief Health Officers as their main media spokesperson, allowing for a natural link between decision-making and public communication responsibilities (Weeramanthri et al 2010).

Targeting messages

Reaching a particular group is essential for an effective communication. In Sweden, a public opinion surveys conducted during the pandemic found it hard to ensure that the message reached young people/young adults, and people whose mother tongue is not Swedish (Socialstyrelsen and Swedish Civil Contingency Agency, 2011).

Some countries use the *segmented communication* to reach the need of the different population targets or particular groups at risk, such as pregnant women, people with chronic diseases, and harder-to-reach communities or those with specific concerns (Deirdre Hine, 2010; CDC, 2010).General Public was reached through the dissemination of numerous print materials in multiple languages or by their active downloading from institutional or health authorities websites. For the CDC, special audiences were identified for additional print materials including Native Americans, African Americans, Hispanics, young adults, first responders, and health care workers (CDC, 2010).

Timely communication

One of the main lesson learnt was the importance of the strategies aimed to provide regular information on the latest developments of pandemic along with the public preventive measures. This has helped to prevent public panic and to promote personal protection against infection (Liang et al 2012). Another important factor for an effective communication was the timely and a transparent provision of updated information in order to ease anxiety, and to engage citizens successfully in measures to curb the spread of the disease (Tay et al 2010).

2.4.6 Planning communication

In many countries, a specific plan guided the communications and social marketing response during the H1N1 pandemic (Executive office of the President of the US, 2009; Sweet, 2009; CDC, 2010; Public health agency of Canada and Health Canada, 2010; Deirdre Hine, 2010; Van Tam et al 2010;). It appeared clear that without key activities, such as media training and creative development for the advertising campaign, it would have been very difficult to launch any effective campaign.

In general, during the first phase of communication the strategy intended to promote infection prevention behaviours including: frequent hand washing, coughing into one's arm not hand, staying home if sick. These messages were later complemented with personal preparedness and immunization information.

In some cases, a general plan including different responses and communication strategies based on different potential scenarios of the pandemic evolution were prepared in order to ensure preparedness and to cover a variety of contingencies (Executive office of the President of the US, 2009; Socialstyrelsen and Swedish Civil Contingency Agency, 2011).

On the other hand, in case of a H1N1 pandemic, it was observed that the absence of a comprehensive and coherent communication strategy created confusion leading to loss of credibility among the stakeholders and public alike (Van Tam et al 2010).

2.4.7 Areas for action

The expert reviewers (WHO Europe, 2010) found that the 2009–2010 response in the European Region suffered of some problematic areas and thus required stronger emphasis on the following main issues:

- Risk communication in general, especially regarding vaccination

- Vertical communication within the health care system (with greater emphasis on frontline health care workers)

During the pandemic the communication was designed on the 'reasonable worst–case'. This assumption meant that there was an obvious gap between what the government was saying and what was observable on the ground, namely that the disease was mild in most cases and that mortality levels were low. "This gap could have risked damaging the government's credibility and undermining public trust in the response" (Deirdre Hine, 2010).

Also in Switzerland, in order to raise public awareness, it was decided to adopt a communication strategy based on a worst case scenario. But due to the lack of coordination between the various stakeholders, within a relatively short time, the messages became confused. The delay in the delivery of the vaccine and the extensive academic discussions which took place about "which vaccine for whom?" were at the heart of

this confusion. To complicate matters even further, the escalation phase then turned into a de-escalation phase; clear, credible communication became close to impossible (Van Tam et al 2010).

In Australia, communication has been inconsistent partly because different parts of the country have gone through the pandemic at different times and officials have been faced with the challenge of adjusting the response to cope with an infection that has not been as dangerous as the worst case scenario expectations that underpinned planning (Sweet, 2009).

Internal communication

During the pandemic a strong effort to coordinate information across different level is needed. However, there were cases where contradictory or slightly different messages were communicated based on national, regional, and local level, but also among countries and International agencies. These differences led to confusion about whose advice to follow among citizens. For example, while the Public Health Agency of Canada's advice was based on the best scientific evidence available at the time, the application of this advice varied across the country due to differences in provincial legislation and policies. Only during the second wave, the federal and provincial/territorial governments collaborated on positions on masks and gloves and tried to take a collective decision so that all were approaching the issue in the same way (Public health agency of Canada and Health Canada, 2010).

Communicating risk and uncertainty

For a long time, there was considerable uncertainty about the pandemic's development and impact and the government, togheter with the devolved administrations were in the challenging position of simultaneously asking the health services to prepare for the worst, while trying to reassure the public and accurately communicate the level of risk.

The problem of communicating uncertainty, risk and shifts in scientific thinking is not limited to the public or other external stakeholders. It is also problematic when communicating findings, evidence and processes to decision makers and decision influencers (such as national agencies within the regional or local level) trying to ensure the approval of messages to be communicated to the general public.

In a crisis situation it is important to follow the communication principles which emphasize a focus on transparency and acknowledging uncertainty as well as the commitment to frequent updates if new information emerges. Empathy and openness are key components of message delivery and can even help to sustain credibility of the investigation and response, even when information is limited and there are more questions than answers available (Schuchat et al 2011). Furthermore, the best practice in communicating risk underlines the importance not just of openness but also of transparency in the way in which assessments are made and decisions are taken (Deirdre Hine, 2010).

Flexibility of communication

In unpredictable situations the plan statements should be very quickly revised, and the strategy, messages and materials might be promptly adapted to fit the circumstances (Deirdre Hine 2010).

Proactive and assertive communication

From the results of the reviewed papers it could be highlighted that the agencies could have been more proactive in identifying and challenging inaccurate information or advice and responding to concerns and misunderstandings. A more aggressive communications campaign that focused on dispelling concerns that the vaccine was not safe and had been rushed into production without the usual rigorous testing and licensing may have helped uptake rates. The communication with sections of the public with particular concerns may also have been useful, playing an important role in tackling rumours and misunderstanding. (Deirdre Hine 2010).

Targeting messages

Most of communication activities targeted the general population with guidance for specific populations coming later in the process. While a broad communication strategy is essential in keeping citizens informed, a more targeted approach may also be necessary to ensure higher risk groups or vulnerable populations to receive timely and specific information necessary to respond to face the pandemic (Public health agency of Canada and Health Canada, 2010; Deirdre Hine 2010). Agencies must also acknowledge that the public are different and need to be involved in both the development and management of pandemic response initiatives, appropriate for different communities and sensitive to existing cultural practices (Gray et al 2012).

New and social media

The H1N1 was "the first pandemic with a blogosphere and other rapid communication tools that were impossible to ignore" (ECDC, 2010). New and social media were used both to disseminate information and to monitor the issues of concern from population, with the aim, for example, to identify the concerns that pregnant women had about vaccination. Their use was different among countries and the best practice of their application comes from to CDC. In the UK were used Facebook, Twitter and YouTube are primarily used to re-direct people to National Health Service website rather than to engage in discussion (Deirdre Hine, 2010). However, in other countries the use of new media, and social networks in particular, islimited. For the future, the WHO declared that the use of new information technologies, including social networks, should be an essential part of strategic communications planning, including research, training and guidelines for Member States (WHO, 2011).

Communication with media

Different National Health Agencies started to consider that the journalists need to engage in a more proactively way.

Recommendations from WHO expert reviewers

The expert reviewers (WHO Europe, 2010) evidenced thet in the European Region the need of an effective communication among health care professionals, the public and other stakeholders are required. The areas that must be further implemented or developed were identified from the following critical points:

− Providing guidance on strategies for effective communication to the public, which include training needs of ministry spokespersons

− Developing indicators to monitor the extent to which the information received by health care professionals is appropriate and useful

Regarding risk communication capacity:

− General strengthening of risk communication capacity and capability at the national, regional and local levels is needed

− The communication on the criteria for the transition between the phases (e.g. geographical spread versus the severity of disease) needs to be improved

− Needs for a rapid information flow from national to regional levels, including outbreak investigation findings, surveillance data, etc. to ensure a timely response

A very critical issue was identified to be the communication about pandemic vaccines:

− It is important to communicate to health care workers and the public the efficacy and safety of vaccines in countries that have access to the vaccine in a unified and effective way

− Campaigns on vaccine efficacy and safety need to be more aggressive and run in a timely manner, e.g. before vaccine arrival

− Awareness and effective use of new information technologies and media (e.g. social media) is essential through the provision of training, guidelines and research

In this scenario and for the future, the role of International agencies, such as WHO, but also national agency like CDC, were fundamental to improve communication during crisis, in particular for:

- Support the development and reinforcement of risk communication networks

- Revise the pandemic guidance with respect to the phases

- Improve flexibility of guidance by providing multiple scenarios for planning (e.g. mild/severe situations) and clearer guidance on actions that are required and are dependent upon possible different situations faced at the regional level

Furthermore, this expert review suggest that there are common thematic elements that should be considered as essential by individual Member States when revising, re-formulating or updating national pandemic plans (and associated preparedness activities) during the post-pandemic evaluation period. These are:

- **C**ommunication

- **C**oordination

- **C**apacity

- **A**daptability (flexibility)

- **L**eadership

- **M**utual Support

    CALM

CONCLUSIONS AND RECOMMENDATIONS

In accord to WHO (2010), risk communication aims to promote a positive social response to pandemic interventions. It also aims to induce preventive action and appropriate behaviour change among populations. The strategies utilized during the influenza pandemic 2009 included 'speaking with one voice', involving academic experts and government officials in the effort, and targeting core groups of populations at risk. The activities include awareness campaigns, advocacy, call centers, on-line response capacities, NGO and private sector partnerships. However, during the European workshop in Brussels (2010) a number of participants reported that communication was a major and complex issue that needed further improvement. The challenges were to respond to the various public concerns and to achieve a high level of transparency over the disease burden. It was also emphasized that communication on vaccine issues should receive higher focus in pandemic preparedness, at all levels (EU Conference report, 2011; Ropero-Alvarez et al 2012).

To manage this complexity accordingly with Abraham (2009), successful communication requires an understanding of the broader political, social and cultural environment in which communication occurs. Communicators need to explicitly develop tools to ensure the visibility and legitimacy of their message in a crowded political environment. The existing WHO outbreak communication principles of early announcement, trust and transparency achieve this to a certain extent. However, additional work is required to develop practices and principles to ensure visibility and legitimacy of communication. Choosing the best channels of communication, targeting primary audiences and finding spokespeople who provide legitimacy are some of the issue that need to be explicitly addressed. Communicators skilled in behaviour change communication and social mobilization own a variety of tools to deal with these issues and so they are often called on during outbreaks. It would be beneficial if these tools were incorporated into general outbreak communication principles (Abraham, 2009).

Finally, the news media tools and the novel information sources were also considered the basis for an information revolution in public health, particularly in epidemiology and surveillance (i.e., biosurveillance) (Eysenbach, 2009). With the word of Khan et al (2010) this Internet revolution would lead to an increased availability of electronic heath-related information. Improved information technology have given public health practitioners unprecedented access to novel streams of information and the ability to establish social networks for analysis and dissemination. Capitalizing on this opportunity will require the public health community to change its organizational culture so that the uses of information are not limited to traditional surveillance and direct notification. Instead, we must collectively learn to share information, reward the sharing and reuse of information across domains, and expand the boundaries of public health to multiple new sectors". This is also for the public health communication, methods and evaluation.

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CONTRIBUTORS OF AUTHORS

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RESULTS OF QUANTITATIVE META-ANALYSIS

- People who received vaccination. Percentage pool = 12% (95% CI 0.06-0.19)

Study ID	ES (95% CI)	% Weight
Galarce EM (2011)	0.20 (0.18, 0.22)	11.11
Jehn M (2011)	0.01 (0.00, 0.02)	11.21
Lau JTF (2008)	0.18 (0.14, 0.22)	10.70
Lin Y (2011)	0.11 (0.10, 0.11)	11.21
Santibanez TA (2012)	0.24 (0.24, 0.25)	11.22
Schwarzinger M (2010)	0.02 (0.01, 0.02)	11.21
Vaux (2011)	0.11 (0.10, 0.12)	11.21
Velan B (2011)	0.17 (0.14, 0.20)	10.91
Walter D (2011)	0.08 (0.08, 0.09)	11.22
Overall (I-squared = 99.9%, p = 0.000)	0.12 (0.06, 0.19)	100.00

NOTE: Weights are from random effects analysis

0   .1   .2   .5   1

D1.1 Systematic review of studies addressing population behaviours during infectious outbreaks and review of outbreak communication in 2009 pandemic

TELL ME project – GA: 278723

— People who would received vaccination. Percentage pool = 42% (95% CI 0.31-0.52)

Study ID	ES (95% CI)	% Weight
Barr M (2008)	0.75 (0.74, 0.77)	6.26
de Zwart O (2010)	0.05 (0.04, 0.06)	6.28
Eastwood (2009)	0.67 (0.64, 0.70)	6.24
Ferrante G (2011)	0.22 (0.21, 0.23)	6.27
Jehn M (2011)	0.53 (0.49, 0.57)	6.23
Kiviniemi MT (2011)	0.64 (0.61, 0.67)	6.24
Lau JTF (2010)	0.36 (0.30, 0.41)	6.17
Mauer J (2009)	0.50 (0.47, 0.52)	6.26
Mauer J (2010)	0.20 (0.19, 0.21)	6.27
Quinn SC (2009)	0.09 (0.07, 0.10)	6.27
Schwarzinger M (2010)	0.17 (0.15, 0.19)	6.27
Seale H (2010)	0.50 (0.46, 0.54)	6.22
Sypsa V (2009)	0.23 (0.22, 0.24)	6.27
van der Weerd (2011)	0.43 (0.42, 0.44)	6.27
Wong LP (2010)	0.70 (0.67, 0.73)	6.25
Zijtregtop EAM (2009)	0.66 (0.61, 0.70)	6.22
Overall (I-squared = 99.9%, p = 0.000)	0.42 (0.31, 0.52)	100.00

NOTE: Weights are from random effects analysis

0   .1 .2   .5   1

- People with a high level of perceived risk. Percentage pool = 36% (95% CI 0.18-0.55)

Study ID		ES (95% CI)	% Weight
de Zwart O (2010)		0.90 (0.89, 0.91)	7.15
Eastwood (2009)		0.15 (0.13, 0.17)	7.15
Eastwood (2009)		0.20 (0.17, 0.23)	7.14
Jehn M (2011)		0.76 (0.73, 0.79)	7.14
Jones SC (2008)		0.11 (0.07, 0.15)	7.13
Kamate SK (2010)		0.35 (0.31, 0.38)	7.14
Lau JTF (2007)		0.74 (0.71, 0.77)	7.14
Lau JTF (2010)		0.12 (0.08, 0.16)	7.14
Lau JTF (2009)		0.13 (0.10, 0.15)	7.14
Quinn SC (2009)		0.42 (0.40, 0.45)	7.15
Schwarzinger M (2010)		0.36 (0.34, 0.37)	7.15
Seale H (2010)		0.44 (0.40, 0.48)	7.13
Walter D (2012)		0.18 (0.17, 0.19)	7.15
Wong LP (2010)		0.25 (0.23, 0.28)	7.14
Overall (I-squared = 99.9%, p = 0.000)		0.36 (0.18, 0.55)	100.00

NOTE: Weights are from random effects analysis

0   .1 .2   .5   1

D1.1 Systematic review of studies addressing population behaviours during infectious outbreaks and review of outbreak communication in 2009 pandemic

TELL ME project – GA: 278723

— People with a high level of perceived susceptibility. Percentage pool = 24% (95% CI 0.18-0.30)

Study ID	ES (95% CI)	% Weight
Blendon RJ (2004)	0.32 (0.28, 0.36)	3.82
Blendon RJ (2004)	0.57 (0.54, 0.60)	3.86
Brug J (2004)	0.05 (0.03, 0.07)	3.87
de Zwart O (2010)	0.02 (0.02, 0.02)	3.89
Eastwood (2009)	0.25 (0.22, 0.28)	3.85
Ferrante G (2011)	0.33 (0.32, 0.34)	3.88
Goodwin R (2010)	0.25 (0.19, 0.31)	3.73
Jehn M (2011)	0.34 (0.31, 0.37)	3.84
Kamate SK (2010)	0.35 (0.31, 0.38)	3.84
Lau JTF (2010)	0.12 (0.10, 0.14)	3.87
Lau JTF (2007)	0.41 (0.38, 0.45)	3.84
Lau JTF (2010)	0.41 (0.40, 0.43)	3.88
Lau JTF (2003)	0.09 (0.07, 0.10)	3.88
Lau JTF (2010)	0.22 (0.18, 0.27)	3.80
Lau JTF (2009)	0.07 (0.05, 0.10)	3.87
Lau JTF (2007)	0.27 (0.23, 0.31)	3.83
Leung GM (2003)	0.31 (0.28, 0.34)	3.86
Quah SR (2004)	0.14 (0.12, 0.16)	3.87
Quinn SC (2009)	0.14 (0.12, 0.16)	3.87
Schwarzinger M (2010)	0.08 (0.07, 0.09)	3.88
Seale H (2009)	0.21 (0.18, 0.25)	3.83
Seale H (2010)	0.17 (0.14, 0.20)	3.85
Vartti AM (2009)	0.29 (0.24, 0.34)	3.78
Vartti AM (2009)	0.49 (0.44, 0.54)	3.78
Wong LP (2010)	0.19 (0.16, 0.21)	3.86
Zijtregtop EAM (2009)	0.06 (0.04, 0.08)	3.87
Overall (I-squared = 99.6%, p = 0.000)	0.24 (0.18, 0.30)	100.00

NOTE: Weights are from random effects analysis

0 .1 .2   .5   1

D1.1 Systematic review of studies addressing population behaviours during infectious outbreaks and review of outbreak communication in 2009 pandemic

TELL ME project – GA: 278723

- People with a high level of worry. Percentage pool = 24% (95% CI 0.18-0.30)

Study ID		ES (95% CI)	% Weight
Blendon RJ (2004)		0.35 (0.31, 0.39)	6.59
Brug J (2004)		0.39 (0.34, 0.44)	6.50
Ferrante G (2011)		0.26 (0.25, 0.27)	6.79
Goodwin R (2010)		0.40 (0.33, 0.47)	6.21
Lau JTF (2010)		0.15 (0.14, 0.16)	6.79
Lau JTF (2003)		0.34 (0.31, 0.36)	6.73
Lau JTF (2009)		0.16 (0.13, 0.19)	6.69
Lin Y (2011)		0.25 (0.24, 0.26)	6.80
Peng EYC (2010)		0.60 (0.57, 0.63)	6.72
Quinn SC (2009)		0.46 (0.44, 0.49)	6.73
Santibanez TA (2012)		0.31 (0.31, 0.32)	6.81
Schwarzinger M (2010)		0.15 (0.14, 0.17)	6.78
Vartti AM (2009)		0.91 (0.88, 0.94)	6.68
Vartti AM (2009)		0.52 (0.47, 0.57)	6.49
Wong LP (2010)		0.34 (0.31, 0.37)	6.70
Overall (I-squared = 99.6%, p = 0.000)		0.37 (0.31, 0.43)	100.00

NOTE: Weights are from random effects analysis

0   .1 .2   .5   1

D1.1 Systematic review of studies addressing population behaviours during infectious outbreaks and review of outbreak communication in 2009 pandemic

TELL ME project – GA: 278723

- People with a high level of worry. Percentage pool = 37% (95% CI 0.31-0.43)

Study ID	ES (95% CI)	% Weight
Blendon RJ (2004)	0.35 (0.31, 0.39)	6.59
Brug J (2004)	0.39 (0.34, 0.44)	6.50
Ferrante G (2011)	0.26 (0.25, 0.27)	6.79
Goodwin R (2010)	0.40 (0.33, 0.47)	6.21
Lau JTF (2010)	0.15 (0.14, 0.16)	6.79
Lau JTF (2003)	0.34 (0.31, 0.36)	6.73
Lau JTF (2009)	0.16 (0.13, 0.19)	6.69
Lin Y (2011)	0.25 (0.24, 0.26)	6.80
Peng EYC (2010)	0.60 (0.57, 0.63)	6.72
Quinn SC (2009)	0.46 (0.44, 0.49)	6.73
Santibanez TA (2012)	0.31 (0.31, 0.32)	6.81
Schwarzinger M (2010)	0.15 (0.14, 0.17)	6.78
Vartti AM (2009)	0.91 (0.88, 0.94)	6.68
Vartti AM (2009)	0.52 (0.47, 0.57)	6.49
Wong LP (2010)	0.34 (0.31, 0.37)	6.70
Overall (I-squared = 99.6%, p = 0.000)	0.37 (0.31, 0.43)	100.00

NOTE: Weights are from random effects analysis

0   .1   .2   .5   1

D1.1 Systematic review of studies addressing population behaviours during infectious outbreaks and review of outbreak communication in 2009 pandemic

TELL ME project – GA: 278723

- People with a high level of trust. Percentage pool = 62% (95% CI 0.50-0.74)

Study ID		ES (95% CI)	% Weight
Jones SC (2008)		0.55 (0.48, 0.62)	10.84
Kamate SK (2010)		0.33 (0.29, 0.36)	11.13
Lau JTF (2010)		0.92 (0.91, 0.94)	11.19
Lau JTF (2009)		0.84 (0.81, 0.87)	11.14
Peng EYC (2010)		0.70 (0.68, 0.73)	11.16
Quinn SC (2009)		0.46 (0.43, 0.48)	11.17
Seale H (2009)		0.58 (0.54, 0.62)	11.06
Seale H (2010)		0.58 (0.54, 0.62)	11.09
van der Weerd (2011)		0.61 (0.60, 0.62)	11.21
Overall (I-squared = 99.6%, p = 0.000)		0.62 (0.50, 0.74)	100.00

NOTE: Weights are from random effects analysis

0   .1 .2   .5   1

D1.1 Systematic review of studies addressing population behaviours during infectious outbreaks and review of outbreak communication in 2009 pandemic

TELL ME project – GA: 278723

- People who increase a hand washing. Percentage pool = 57% (95% CI 0.40-0.74)

Study ID	ES (95% CI)	% Weight
Balkhy HH (2010)	0.58 (0.55, 0.60)	5.88
Blendon RJ (2004)	0.39 (0.37, 0.41)	5.88
Brug J (2004)	0.02 (0.01, 0.04)	5.89
Jehn M (2011)	0.92 (0.90, 0.94)	5.88
Kamate SK (2010)	0.55 (0.51, 0.58)	5.88
Kiviniemi MT (2011)	0.98 (0.97, 0.99)	5.89
Lau JTF (2003)	0.87 (0.85, 0.89)	5.89
Lau JTF (2009)	0.74 (0.70, 0.77)	5.87
Leung GM (2004)	0.82 (0.79, 0.85)	5.88
Leung GM (2004)	0.82 (0.80, 0.84)	5.88
Lin Y (2011)	0.57 (0.56, 0.58)	5.89
Miao YY (2012)	0.77 (0.75, 0.80)	5.88
Quah SR (2004)	0.81 (0.79, 0.83)	5.88
Rubin GJ (2009)	0.28 (0.25, 0.31)	5.88
Seale H (2010)	0.48 (0.44, 0.52)	5.87
Vartti AM (2009)	0.06 (0.03, 0.08)	5.88
Vartti AM (2009)	0.02 (0.00, 0.03)	5.89
Overall (I-squared = 99.9%, p = 0.000)	0.57 (0.40, 0.74)	100.00

NOTE: Weights are from random effects analysis

0 .1 .2   .5   1

D1.1 Systematic review of studies addressing population behaviours during infectious outbreaks and review of outbreak communication in 2009 pandemic

TELL ME project – GA: 278723

- People who avoided crowed place. Percentage pool = 29% (95% CI 0.14-0.43)

Study ID	ES (95% CI)	% Weight
Blendon RJ (2004)	0.07 (0.05, 0.09)	9.09
Blendon RJ (2004)	0.14 (0.12, 0.16)	9.10
Brug J (2004)	0.02 (0.01, 0.04)	9.10
Jehn M (2011)	0.45 (0.41, 0.49)	9.06
Kamate SK (2010)	0.53 (0.49, 0.56)	9.07
Lau JTF (2010)	0.55 (0.52, 0.58)	9.08
Lau JTF (2003)	0.76 (0.73, 0.78)	9.09
Lau JTF (2009)	0.09 (0.07, 0.12)	9.09
Lin Y (2011)	0.43 (0.42, 0.44)	9.11
Rubin GJ (2009)	0.04 (0.03, 0.05)	9.11
Seale H (2010)	0.09 (0.06, 0.11)	9.09
Overall (I-squared = 99.9%, p = 0.000)	0.29 (0.14, 0.43)	100.00

NOTE: Weights are from random effects analysis

0   .1 .2   .5   1

D1.1 Systematic review of studies addressing population behaviours during infectious outbreaks and review of outbreak communication in 2009 pandemic

TELL ME project – GA: 278723

- People who wearing face mask. Percentage pool = 21% (95% CI 0.12-0.30)

Study ID	ES (95% CI)	% Weight
Blendon RJ (2004)	0.03 (0.02, 0.04)	8.35
Blendon RJ (2004)	0.02 (0.01, 0.03)	8.37
Brug J (2004)	0.04 (0.02, 0.06)	8.34
de Zwart O (2010)	0.02 (0.02, 0.02)	8.37
Lau JTF (2003)	0.64 (0.62, 0.67)	8.32
Lau JTF (2009)	0.13 (0.11, 0.16)	8.30
Leung GM (2004)	0.79 (0.76, 0.82)	8.29
Leung GM (2004)	0.04 (0.03, 0.05)	8.36
Quah SR (2004)	0.04 (0.03, 0.05)	8.36
Tang CS (2004)	0.61 (0.59, 0.64)	8.31
Vartti AM (2009)	0.10 (0.07, 0.13)	8.27
Vartti AM (2009)	0.04 (0.02, 0.06)	8.34
Overall (I-squared = 99.8%, p = 0.000)	0.21 (0.12, 0.30)	100.00

NOTE: Weights are from random effects analysis

0   .1 .2   .5   1

D1.1 Systematic review of studies addressing population behaviours during infectious outbreaks and review of outbreak communication in 2009 pandemic

TELL ME project – GA: 278723

- People who willingness with quarantine. Percentage pool = 85% (95% CI 0.80-0.91)

Study ID	ES (95% CI)	% Weight
Barr M (2008)	0.70 (0.68, 0.72)	10.06
Blendon RJ (2004)	0.93 (0.91, 0.95)	10.02
Eastwood (2009)	0.94 (0.93, 0.95)	10.13
Jones SC (2008)	0.96 (0.93, 0.99)	9.95
Lau JTF (2010)	0.88 (0.87, 0.89)	10.15
Lau JTF (2007)	0.88 (0.85, 0.91)	9.93
Leung GM (2004)	0.93 (0.91, 0.95)	10.07
Leung GM (2004)	0.92 (0.90, 0.93)	10.11
Quah SR (2004)	0.72 (0.69, 0.74)	9.97
Seale H (2009)	0.63 (0.59, 0.68)	9.62
Overall (I-squared = 98.9%, p = 0.000)	0.85 (0.80, 0.91)	100.00

NOTE: Weights are from random effects analysis

0   .1 .2   .5   1

CHARACTERISTICS OF STUDIES

Tab. 1. Characteristics of included studies

Miao 2012

Study design	Cross-sectional
Methods	Telephone survey
Participants	n=1079, ≥ 15 years old
Country	Taiwan
Disease	Swine flu
Psychological theory	None stated
Behaviour	77% increase hand hygiene
Outcomes: factors associated with behavior or intention	Hand hygiene practice associate with health beliefs that pH1N1 was more transmissible than avian influenza; that pH1N1 was slightly more severe in Taiwan compared with other countries; that hand-washing was very effective in preventing pH1N1, and that hand-washing after contact with possibly pH1N1-contaminated objects ⁄ surfaces was not very/not difficult at all

Santibanez 2012

Study design	Cross-sectional
Methods	Telephone survey
Participants	n=55850, ≥ 18 years old
Country	US
Disease	Swine flu
Psychological theory	None stated
Behaviour	Vaccination: 24.5%
Outcomes: factors associated with behavior or intention	Opinions about influenza vaccine and disease varied significantly by race ⁄ ethnicity, income, and education level

Savoia 2012

Study design	Cross-sectional
Methods	Telephone survey
Participants	n=1569, ≥ 18 years old
Country	US
Disease	Swine flu
Psychological theory	None stated
Behaviour	Knowledge vs socio-economic status
Outcomes: factors associated with behavior or intention	Level of education and home ownership, reliable indicators of socioeconomic position (SEP), were associated with knowledge of H1N1. Level of education was found to be directly associated with level of knowledge about virus transmission. Home ownership versus renting was also positively associated with knowledge on the signs

and symptoms of H1N1 infection

Walter 2012

Study design	Cross-sectional
Methods	Telephone survey
Participants	n=13010, ≥ 14 years old
Country	Germany
Disease	Swine flu
Psychological theory	None stated
Behaviour	Information seeking and vaccination
Outcomes: factors associated with behavior or intention	Respondents who were not immunised against pandemic influenza stated more frequently to be not well or partially not well informed about the disease compared with those respondents who were immunised. No association between any source used to gather information on the disease in general and the uptake of influenza A(H1N) vaccine

Ferrante 2011

Study design	Cross-sectional
Methods	Telephone survey
Participants	n=4047, 18-69 year old
Country	Italy
Disease	Swine flu
Psychological theory	None stated
Behaviour	People's opinion and behaviors
Outcomes: factors associated with behavior or intention	Willingness to be vaccinated was associated with worry about pandemic, age, sex, having a chronic disease and timing of the interview

Galarce 2011

Study design	Cross-sectional
Methods	Online survey
Participants	n=1569, ≥ 18 years old
Country	US
Disease	Swine flu
Psychological theory	None stated
Behaviour	Vaccination rates and socio-demographic factors
Outcomes: factors associated with behavior or intention	Vaccine uptake is associated with sociodemographic factors; beliefs and seasonal vaccination. Strongly associated with age, urbanicity, perceiving the A(H1N1) vaccine as safe and seasonal flu vaccine uptake. Perceptions of safety and season flu vaccination show the strongest associations with A(H1N1) uptake. The reasons people gave to decline vaccination varied by respondents' sociodemographic group. Black participants were the most likely ethnic/racial group to reported having tried to get the vaccine but found it unavailable

Jehn 2011

Study design	Cross-sectional
Methods	Telephone survey
Participants	n=727, ≥ 18 years old
Country	Arizona
Disease	Swine flu
Psychological theory	None stated
Behaviour	Public knowledge, perceptions and preparedness for the 2009 influenza A/H1N1 pandemic. The survey highlighted a number of important misconceptions about H1N1 knowledge, treatment options and transmissibility
Outcomes: factors associated with behavior or intention	Knowledge on vaccine availability, H1N1 news closely and risk perception associate with vaccination intention

Kiviniemi 2011

Study design	Cross-sectional
Methods	Telephone survey
Participants	n=807, ≥ 18 years old
Country	New York State
Disease	Swine flu
Psychological theory	None stated
Behaviour	Individuals' interpretation of recommendations about precautionary behaviors, willingness to comply, and factors predicting willingness
Outcomes: factors associated with behavior or intention	No pattern of demographic characteristics consistently predicted willingness. Perceived efficacy was associated with willingness for all recommendations, and perceived severity was associated with willingness for some recommendations

Lin 2011

Study design	Cross-sectional
Methods	Telephone survey
Participants	n=10669, ≥ 18 years old
Country	China
Disease	Swine flu
Psychological theory	None stated
Behaviour	Community responses
Outcomes: factors associated with behavior or intention	Farmers and those with lower education level were less likely to know the main transmission route (cough or talk face to face). Female and those with college and above education had higher perception of risk and more compliance with preventive behaviors. Relationships between knowledge and risk perception and knowledge and practices were found among the study subjects. Taking up vaccination are several related factors, including the perception of life disturbed, the safety of A/H1N1 vaccine, the knowledge of free vaccination policy, the state's priority vaccination strategy, and taking up seasonal influenza vaccine behavior

Vaux 2011

Study design	Cross-sectional
Methods	Telephone survey
Participants	n=8905, ≥ 0 years old
Country	France
Disease	Swine flu
Psychological theory	None stated
Behaviour	Vaccination all ages group 11, 1%
Outcomes: factors associated with behavior or intention	Belonging to the 0-4 years age-group, to the 30-64 years age-group, living in a household with one or more children aged < 5 years, with 2 or more persons, where the head of the family is university graduated (>2 years), or where the head of the household was a farmer, has a higher professional and managerial occupation, has an intermediate occupation or was retired (compared with being a manual worker). People vaccinated against seasonal influenza were more likely to be vaccinated against pandemic influenza. No significant association was found between the pandemic vaccination coverage and being a subject at risk of influenza complications, the town size or gender

Velan 2011

Study design	Cross-sectional
Methods	Telephone survey
Participants	n=501, ≥ 18 years old
Country	Israel
Disease	Swine flu
Psychological theory	None stated
Behaviour	Vaccination
Outcomes: factors associated with behavior or intention	Uptake associated with: being men;older age; Jewish (compared with Arab).

Walter 2011

Study design	Cross-sectional
Methods	Telephone survey
Participants	n=1548, ≥ 14 years old
Country	Germany
Disease	Swine flu
Psychological theory	None stated
Behaviour	Vaccination 8,1%
Outcomes: factors associated with behavior or intention	Intention to be vaccinated associated with: sex, age, educational level, being HCW

Balkhy 2010

Study design	Cross-sectional
Methods	Intercept survey
Participants	n=1548, ≥ 18 years old
Country	Saudi Arabia
Disease	Swine flu
Psychological theory	None stated
Behaviour	Knowledge, attitudes, and use of precautionary measures
Outcomes: factors associated with behavior or intention	Education level was the only significant predictor of the level of concern. Precautionary measures were associate who were men, older , better educated, and more knowledgeable.

Bauerle Bass 2010

Study design	Cross-sectional
Methods	Telephone survey
Participants	n=1204, ≥ 18 years old
Country	Pennsylvania
Disease	Hypothetic pandemic flu
Psychological theory	None stated
Behaviour	Compliance whit quarantine
Outcomes: factors associated with behavior or intention	Sex, age, educational level, ethnicity, socioeconomic and employing status were associated to comply quarantine.

Lau 2010a

Study design	Cross-sectional
Methods	Telephone survey
Participants	n=3527, ≥18-60
Country	Hong Kong
Disease	Avian flu
Psychological theory	None stated
Behaviour	Changes in behavioral and emotional responses
Outcomes: factors associated with behavior or intention	SARS experience and unconfirmed beliefs about the transmission modes were associated with variables on anticipated preventive behaviors and emotional distress.

Lau 2010b

Study design	Cross-sectional
Methods	Telephone survey
Participants	N=999, ≥18
Country	Hong Kong
Disease	Swine flu

Psychological theory	None stated
Behaviour	Avoidance behaviors and negative psychological responses of the general population
Outcomes: factors associated with behavior or intention	Women, older respondents, those having unconfirmed beliefs about modes of transmissions, and those feeling worried and emotionally distressed due to H1N1 outbreak were more likely than others to adopt some avoidance behaviors. Those who perceived high severity and susceptibility of getting H1N1 and doubted the adequacy of governmental preparedness were more likely than others to feel emotionally distressed. Cognitions, including unconfirmed beliefs about modes of transmission, perceived severity and susceptibility were associated with some of the avoidance behaviors and emotional distress.

Lau 2010c

Study design	Cross-sectional
Methods	Telephone survey
Participants	n=301, ≥ 30 years old
Country	Hong Kong
Disease	Swine flu
Psychological theory	Health belief model, protection motivation theory
Behaviour	Intention 45% reducing to 15% or 5% with cost and safety issues
Outcomes: factors associated with behavior or intention	Intention to be vaccinated associated with: perceptions of the side effects of the vaccination; friends and family having been vaccinated.

Cowling 2010

Study design	Cross-sectional
Methods	Telephone survey
Participants	n=12965, ≥ 18 years old
Country	Netherlands
Disease	Avian Influenza
Psychological theory	Protection Motivation Theory
Behaviour	Anxiety, risk perception, knowledge on modes of transmission, and preventive behaviors.
Outcomes: factors associated with behavior or intention	Greater anxiety was associated with lower reported use of hygiene measures but greater social distancing. Knowledge that H1N1 could be spread by indirect contact was associated with greater use of hygiene measures and social distancing.

de Zwart 2010

Study design	Cross-sectional
Methods	Online Survey
Participants	n=3840, ≥ 18 years old
Country	Netherlands
Disease	Avian Influenza
Psychological theory	Protection Motivation Theory

Behaviour	Perceived vulnerability, risk perception, precautionary behavior.
Outcomes: factors associated with behavior or intention	Associate with taking preventive measures: time of the survey, higher age, lower level of education, non-Dutch ethnicity, vaccinated against influenza, higher perceived severity, higher perceived vulnerability, higher self efficacy, lower level of knowledge, more information about avian influenza, and thinking more about Avian influenza. Self efficacy was a stronger predictor of precautionary behaviour for those who never or seldom think about avian influenza.

Kamate 2010

Study design	Cross-sectional
Methods	Self –administered questionnaire
Participants	n=791, ≥ 18 years old
Country	Udaipur
Disease	Swine flu
Psychological theory	None stated
Behaviour	Perceived seriousness of the disease, perceive efficacy of various preventive measures, avoidance and preventive behaviours.
Outcomes: factors associated with behavior or intention	Knowledge differed significantly according to gender, age groups, and educational status as well as working status. Women had better attitude than men.

Goodwin 2010

Study design	Cross-sectional
Methods	Online Survey
Participants	n=186, ≥ 19 years old
Country	UE
Disease	Swine flu
Psychological theory	None stated
Behaviour	Worry and behavioral responses
Outcomes: factors associated with behavior or intention	Values and family or friends perception of risks predicted worry about infection, while worry correlated with the purchase of preparatory materials, a lesser willingness to travel by public transport, and difficulty in focusing on everyday activities

Horney 2010

Study design	Cross-sectional
Methods	In-person interview
Participants	n=207, ≥ 18 years old
Country	North Carolina
Disease	Swine flu
Psychological theory	None stated
Behaviour	Knowledge of and intention to vaccination
Outcomes: factors associated with behavior or intention	Reporting great concern about H1N1 infection, receiving seasonal influenza vaccine in 2008–09, and intending to receive seasonal influenza vaccine in 2009–10 were

associated with intention to receive pandemic vaccine. Not associated were knowledge of vaccine, employment, having children under age 18, gender, race/ethnicity and age

Schwarzinger 2010

Study design	Cross-sectional
Methods	Online Survey
Participants	n=2253, 18–64 years old
Country	France
Disease	Swine flu
Psychological theory	None stated
Behaviour	Intention 17%
Outcomes: factors associated with behavior or intention	To be vaccinated associated with: sex, have one child, high perception of the severity, uptake seasonal vaccination

Peng 2010

Study design	Cross-sectional
Methods	Telephone survey
Participants	n=1278, 18–89 years old
Country	Taiwan
Disease	Sars
Psychological theory	None stated
Behaviour	Psychological distress
Outcomes: factors associated with behavior or intention	Major predictors of higher levels of pessimism after the SARS epidemic included demographic factors, perception of SARS and preparedness, knowing people or having personal experiences of SARS related discrimination, individual worries and psychiatric morbidity. The correlates of symptomatic cases included age ≥ 50 years, senior high school graduate, and worries about recurrence of SARS.

Seale 2010

Study design	Cross-sectional
Methods	Intercept survey
Participants	n=627, ≥ 18 years old
Country	Sidney
Disease	Swine flu
Psychological theory	None stated
Behaviour	Behavioural changes, acceptance of vaccination
Outcomes: factors associated with behavior or intention	Participants who were vaccinated against the seasonal influenza were more likely to receive the H1N1 vaccine. No association between gender or level of education and intention to receive the H1N1 vaccine. No significant difference in vaccine acceptance between participants who reported cases of H1N1 who reported cases of H1N1 amongst their friends or family members and those who did not.

de Zwart 2009

Study design	Cross-sectional
Methods	Telephone survey
Participants	n=3403, 18-75 years old
Country	Europe (Denmark, Poland, The Netherlands, Spain) and East Asia (Singapore, province of Guangdong China and Hong Kong)
Disease	SARS and other infectious diseases
Psychological theory	None stated
Behaviour	Perceived threat, perceived severity, perceived vulnerability, response efficacy, and self efficacy.
Outcomes: factors associated with behavior or intention	Country was strongly associated with perceived threat.

Quinn 2009

Study design	Cross-sectional
Methods	Online Survey
Participants	N=1543, ≥ 18 years old
Country	US
Disease	Swine flu
Psychological theory	Health Belief Model
Behaviour	Intentions to take antiviral medication or have a swine flu vaccine
Outcomes: factors associated with behavior or intention	Being Hispanic, having less education, having lower perceptions of personal consequences (susceptibility and severity combined) and lower perception of worry about the vaccine associated with vaccine intention Being Hispanic or White, lower perception of worry about the antiviral medication, greater trust in government, greater perceived personal consequences of illness associated with antiviral use intention

Lau 2009

Study design	Cross-sectional
Methods	Telephone survey
Participants	n=550, 18-60 years old
Country	Hong-Kong
Disease	Swine flu
Psychological theory	None stated
Behaviour	Community responses and preparedness.
Outcomes: factors associated with behavior or intention	

Leung 2004

Study design	Cross-sectional
Methods	Telephone survey

Participants	n=705 Hong Kong residents, ≥ 18 years old; n=1201 Singapore residents ≥ 21 years old
Country	Hong Kong and Singapore
Disease	SARS
Psychological theory	None stated
Behaviour	Precautionary measures recommended
Outcomes: factors associated with behavior or intention	Being older, female, more educated, higher anxiety, better knowledge, greater risk perceptions associated with adopting

Maurer 2009

Study design	Cross-sectional
Methods	Online and WebTV survey
Participants	n=2067, 18-91 years old
Country	US
Disease	Swine flu
Psychological theory	None stated
Behaviour	Intentions 50%
Outcomes: factors associated with behavior or intention	Intention to be vaccinated associated with: being older

Rubin 2009

Study design	Cross-sectional
Methods	Telephone survey
Participants	n=997, ≥ 18 years old
Country	UK
Disease	Swine flu
Psychological theory	None stated
Behaviour	Hand washing, surface cleaning, flu friend plans, avoidant behaviours
Outcomes: factors associated with behavior or intention	Being non-White, higher perceived risk, higher perceived severity, trust in authorities, higher perceived efficacy of behaviours

Zijtregtop 2009

Study design	Cross-sectional
Methods	Self-administered questionnarie
Participants	n=508, ≥ 18 years old
Country	Netherlands
Disease	Swine flu
Psychological theory	Health belief model
Behaviour	Demographical, behavioural and organizational determinants and intention to be immunized

| Outcomes: factors associated with behavior or intention | Negative intention to get a pandemic influenza vaccination: female gender, high education, no influenza vaccination in 2008, and living without partner with children. Behavioural determinants to get vaccinated: low personal risk of getting pandemic influenza at this moment, and low risk for people in environment to get pandemic influenza at this moment. |

Barr 2008

Study design	Cross-sectional
Methods	Telephone survey
Participants	n=2081, ≥ 16 years old
Country	Australia
Disease	Hypothetic pandemic flu
Psychological theory	None stated
Behaviour	Intentions: vaccination, quarantine, face mask use
Outcomes: factors associated with behavior or intention	Higher level of perceived threat of pandemic influenza, older age, more highly educated. Speak language other than English associated with less compliance

Jones 2008

Study design	Cross-sectional
Methods	Telephone survey
Participants	n=203, ≥18 years old
Country	Australia
Disease	Avian flu (H5N1)
Psychological theory	None stated
Behaviour	Vaccination and face mask wearing when symptomatic
Outcomes: factors associated with behavior or intention	Perceived severity of avian flu and efficacy of vaccination associated with being vaccinated. Perceived severity associate with mask wearing

Lau 2008

Study design	Cross-sectional
Methods	Telephone survey
Participants	n=302, 18–60 years old
Country	Hong Kong
Disease	Avian flu
Psychological theory	None stated
Behaviour	Intentions to wear mask, hand washing more, comply with quarantine, seek help promptly
Outcomes: factors associated with behavior or intention	Concern about their family and age

Lau 2007a

Study design	Cross-sectional

Methods	Telephone survey
Participants	n=503, 18–60 years old
Country	Hong Kong
Disease	Avian flu
Psychological theory	None stated
Behaviour	Intentions to wear mask, hand washing more, comply with quarantine, seek help promptly
Outcomes: factors associated with behavior or intention	Being older, employed, higher perceived susceptibility, severity, worry and efficacy related to intentions

Sadique 2007

Study design	Cross-sectional
Methods	Telephone survey
Participants	n=3436, 18–75 years old
Country	Europe (Denmark, Spain, Great Britain, The Netherlands, Poland) and Asia (Guangdong, Hong Kong, Singapore)
Disease	Hypothetic pandemic flu
Psychological theory	None stated
Behaviour	Precautionay
Outcomes: factors associated with behavior or intention	Individual characteristics such as age, sex, self-reported infl uenza vaccination, and health status had little effect on reported precautionary measures. Employment status appeared to affect many of the precautionary actions. Higher educational level and living in rural area associated with avoiding measures

Lau 2007b

Study design	Cross-sectional
Methods	Telephone survey
Participants	n=805, 18–60 years old
Country	Hong Kong
Disease	Avian flu
Psychological theory	None stated
Behaviour	Avoiding hospitals and eating poultry, taking antivirals, getting vaccinated
Outcomes: factors associated with behavior or intention	Belief that there was sustained spread of avian flu and misconceptions about mode of transmission associated with all behaviours

Lau 2006b

Study design	Cross-sectional
Methods	Telephone survey
Participants	n=818, 18–60 years old
Country	Hong Kong
Disease	SARS

Psychological theory	None stated
Behaviour	
Outcomes: factors associated with behavior or intention	Female respondents to be sharing feelings more frequently. Low educational level associated high IES score. Female, older and less educated were more likely than others to have such negative feelings

Ko 2006

Study design	Cross-sectional
Methods	Not clear
Participants	n=1552, ≥ 15 years old
Country	Taiwan
Disease	SARS
Psychological theory	None stated
Behaviour	Psychosocial impact and depression
Outcomes: factors associated with behavior or intention	'Impacted group' had higher depressive levels, poorer neighborhood relationships, poorer self-perceived health, and a higher economic impact than the 'non-impacted group'. The poorer self-perceived health and economic impact factors were associated with depression. The neighborhood relationship factor was negatively associated with depression for the 'impacted group'

Deurenberg-yap 2005

Study design	Cross-sectional
Methods	Telephone survey
Participants	n=853, 19-81 years old
Country	Singapore
Disease	SARS
Psychological theory	None stated
Behaviour	Knowledg and trust
Outcomes: factors associated with behavior or intention	Knowledge significantly associated with higher public trust

Blendon 2004

Study design	Cross-sectional
Methods	Telephone survey
Participants	n=500 US; 2000 Canada, ≥ 18 years old
Country	US and Canada
Disease	SARS
Psychological theory	None stated
Behaviour	Used disinfectant, avoided crowds, face mask use, seeking professional help
Outcomes: factors associated	Higher level of concern about contracting SARS

with behavior or intention	

Tang 2004

Study design	Cross-sectional
Methods	Telephone survey
Participants	n=1,329, 19–59 years old
Country	Hong Kong
Disease	SARS
Psychological theory	Health belief model
Behaviour	Face mask use
Outcomes: factors associated with behavior or intention	Women, older people and married people. Perceived susceptibility, social norms and perceived efficacy of face mask use

Myers 2011

Study design	Cross-sectional
Methods	Online survey
Participants	n=362, adult
Country	UK
Disease	Swine flu
Psychological theory	Extended theory of planned behavior
Behaviour	Intention (assessed on a scale of 1-7, strongly disagree to strongly agree) mean score 2.9
Outcomes: factors associated with behavior or intention	Intention to be vaccinated predicted by: having a positive attitude to vaccination; perceiving oneself to be in control of the decision to be vaccinated; perceiving oneself to be susceptible to H1N1; perceiving H1N1 to be serious; low perceived costs of vaccination; high perceived benefits to vaccination; high anticipated regret if not vaccinated; intention to have a seasonal flu vaccination; older age; being unemployed

Eastwood 2010

Study design	Cross-sectional
Methods	Telephone survey
Participants	n=1155, ≥ 18 years old
Country	Australia
Disease	Hypothetic pandemic flu
Psychological theory	None started
Behaviour	Intentions 67%
Outcomes: factors associated with behavior or intention	Intention to be vaccinated associated with: perceptions that pandemic flu is serious; previous seasonal influenza vaccination.

SteelFisher 2010

Study design	Cross-sectional
Methods	Telephone survey

Participants	n=301, ≥ 30 years old
Country	US
Disease	Swine flu
Psychological theory	None started
Behaviour	Protective measures, vaccination: 14%
Outcomes: factors associated with behavior or intention	

Maurer 2010

Study design	Cross-sectional
Methods	Online survey
Participants	n=3917, ≥ 18 years old
Country	US
Disease	Swine flu and seasonal influenza
Psychological theory	None stated
Behaviour	Behavior 20%
Outcomes: factors associated with behavior or intention	Vaccination behaviour associated with: relying on health care provider or public health department for information (rather than other sources); past seasonal influenza vaccination.

Wong 2010

Study design	Cross-sectional
Methods	Telephone survey
Participants	n=1025, 18-64 years old
Country	Malaysia
Disease	Swine flu
Psychological theory	None stated
Behaviour	Intentions 70%
Outcomes: factors associated with behavior or intention	Intention to be vaccinated associated with: a belief that the vaccine will offer protection; belief that the vaccine does not have side effects; belief that vaccine is safe. An Halal vaccine important for Muslims.

Eastwood 2009

Study design	Cross-sectional
Methods	Telephone survey
Participants	n=1166, ≥ 18 years old
Country	Australia
Disease	Pandemic influenza
Psychological theory	None stated
Behaviour	Intended compliance with quarantine and taking antiviral drugs

Outcomes: factors associated with behavior or intention	Greater knowledge of pandemic influenza, being female associated with compliance. Employed people less likely to comply. Perceived side effects associated with reduced

Sypsa 2009

Study design	Cross-sectional
Methods	Telephone survey
Participants	n=1000, ≥ 15 years old
Country	Greece
Disease	Swine flu
Psychological theory	None stated
Behaviour	Intentions 53% reducing to 37% by end of study
Outcomes: factors associated with behavior or intention	Intention to be vaccinated associated with: feeling at risk from pandemic flu; believing pandemic flu to be serious; having had previous seasonal flu vaccine; being men; older age Intentions not be vaccinated associated with: concerns about safety of the vaccine

Seale 2009

Study design	Cross-sectional
Methods	Interview face to face and by email
Participants	n=620, ≥ 18 years old
Country	Sidney
Disease	Swine flu
Psychological theory	None stated
Behaviour	Quarantine, vaccination
Outcomes: factors associated with behavior or intention	

Brug 2004

Study design	Cross-sectional
Methods	Online Survey
Participants	n=373, 19-78 years old
Country	Netherlands
Disease	SARS
Psychological theory	Non stated
Behaviour	Hygiene measures, face mask use, avoidance behaviours, avoidance of travel to infected areas (composite measure)
Outcomes: factors associated with behavior or intention	Higher level of perceived risk and worry about SARS. Women felt more susceptible to SARS and people with less education felt more worried

Quah 2004

Study design	Cross-sectional
Methods	Telephone survey

Participants	n=1201, ≥ 21 years old
Country	Singapore
Disease	SARS
Psychological theory	None stated
Behaviour	Precautionary hygiene measures practiced in last 3 days (hand washing, cough hygiene, using utensils mask wearing). Eight behaviours given then a composite score calculated of low or high adoption of them
Outcomes: factors associated with behavior or intention	Being female, older, being more anxious and having more belief that authorities' communication was open associated with behaviour

Lau 2003

Study design	Cross-sectional
Methods	Telephone survey
Participants	n=1397, 18-60 years old
Country	Hong Kong
Disease	SARS
Psychological theory	None stated
Behaviour	Hand washing, home disinfection, face mask use, avoidance behaviours
Outcomes: factors associated with behavior or intention	Higher perceived risk, higher perceived efficacy of protective behaviours, being older, female and more educated

Leung 2003

Study design	Cross-sectional
Methods	Telephone survey
Participants	n=1115, ≥ 18 years old
Country	Hong Kong
Disease	SARS
Psychological theory	None stated
Behaviour	Precautionary measures recommended by Hong Kong Government (maintaining good personal hygiene and a healthy lifestyle; washing hands with soap after sneezing, coughing, and cleaning the nose; building up body immunity with a balance diet, regular exercise, and adequate rest; ensuring good indoor ventilation; wearing face masks for those with respiratory tract infections and their carers; and consulting doctors promptly if there were symptoms of respiratory illnesses)
Outcomes: factors associated with behavior or intention	Being older, female, more educated, having higher risk perceptions, more anxiety, and being symptomatic all associated with greater chance of taking precautionary measures (classified as 5 or more of those recommended)

Tang 2003

Study design	Cross-sectional
Methods	Telephone surveys (one before promotion of community prevention activities and one during promotion)
Participants	n=1002; n=1329, 19-59 years old

Country	Hong Kong
Disease	SARS
Psychological theory	Health belief model, Theory of Planned Behaviour, Social cognitive theory
Behaviour	1st survey government recommended preventive behaviours 2nd survey mask wearing
Outcomes: factors associated with behavior or intention	1st survey: being older, greater perceived susceptibility, greater self-efficacy 2nd survey: higher perceived efficacy of behaviours and pre-exposure to messages about preventive behavior

Tab. 2. Characteristic of excluded studies

Study	Reason for exclusion
Brug 2009	Editorial
Gaygisiz 2011	Sampling method
Gaygisiz 2010	Sampling method
Goodwin 2009	Sampling method
Jones 2009	Preliminary results
Hong 2006	Study design
Ibuka 2010	Response rate 12,9%
Lee 2010	No cross-sectional study
Liao 2010	Validation Structural Equation Model (SEM)

Tab 3. Factors associated to protective behavior.

	Behaviour				
Variable	Hand washing n/N	Avoiding crowded places n/N	Wearing mask n/N	Quarantine n/N	Vaccination n/N
Older people	9/10	4/4	5/6	no association	9/13
Women	13/14	1/2	8/12	1/1	Na 7/9
High educational level	5/7	3/3	8/10	2/2	controversial
Unemployed people	2/2	2/2	..Ns	Ns	Ns
Perceived susceptibility	12/15	4/4	7/7	2/2	10/12

Perceived severity	3/5	3/3	1/2	Ns	9/12
High level of anxiety	5/6	2/2	2/2	Ns	Ns
Peceived efficay of behaviour	4/4	2/2	1/1	1/1	Ns
Perceived self efficacy	3/3	Ns	2/2	Ns	Ns
Trust	4/4	Ns	Ns	Ns	5/5
Knowledge	5/5	Ns	Ns	1/1	2/3
Uptake seasonal influenza vaccine	Ns	Ns	Ns	Ns	13/13
Primary care physician as source of information or advice from	Ns	Ns	Ns	Ns	6/6

N= number of studies where the effect of the variable on the behaviour was investigated; n= numbers of studies where a positive association between the variable and the behaviour was observed.
Na=where n/N refers to a negative association; Ns=where the association between the variable and the behaviour was not investigated.

Appendix 1. Electronic search strategies

The search used in MEDLINE (starting January 2002) was conducted the following Medical Subject Heading (MeSH) terms: "Influenza in Birds" OR avian flu OR avian influenza AND ("Communication"(Mesh) OR "Civil Defence" (Mesh) OR "Internet"(Mesh) OR "Television"(Mesh) OR "Mass Media"(Mesh) OR "Information Dissemination"(Mesh) OR "Behaviour"(Mesh) OR modeling OR preparedness OR information dissemination OR communication OR internet OR media OR television OR behaviour OR behaviour OR psychological response); "Influenza A Virus, H1N1 Subtype"(Mesh) OR H1N1 OR swine flu AND ("Communication"(Mesh) OR "Civil Defense"(Mesh) OR "Internet"(Mesh) OR "Television"(Mesh) OR "Mass Media"(Mesh) OR "Information Dissemination"(Mesh) OR "Behavior"(Mesh) OR modeling OR preparedness OR information dissemination OR communication OR internet OR media OR television OR behavior OR behaviour OR psychological response); "SARS Virus"(Mesh) OR severe acute respiratory syndrome OR SARS AND ("Communication"(Mesh) OR "Civil Defense"(Mesh) OR "Internet"(Mesh) OR "Television"(Mesh) OR "Mass Media"(Mesh) OR "Information Dissemination"(Mesh) OR "Behavior"(Mesh) OR modeling OR preparedness OR information dissemination OR communication OR internet OR media OR television OR behavior OR behaviour OR psychological response); "Pandemics"(Mesh) OR pandemic OR pandemics AND ("Communication"(Mesh) OR "Civil Defense"(Mesh) OR "Internet"(Mesh) OR "Television"(Mesh) OR "Mass Media"(Mesh) OR "Information Dissemination"(Mesh) OR "Behavior"(Mesh) OR modeling OR preparedness OR information dissemination OR communication OR internet OR media OR television OR behavior OR behaviour OR psychological response).