H2020-DSR-4-2014

PANDEM

Pandemic Risk and Emergency Management

D3.3 Review of best practice, inventory of digital/social media for communications and analysis of current systems and technologies

Authors: Emily Loud and Iain Simpson, IGS Strategic Communications, United Kingdom.

Coordinator: Máire Connolly, National University of Ireland, Galway (NUIG), Ireland.

Project website: pandem.eu.com
Grant agreement number: 652868

Table of Contents

Executive Summary

Pandemics and epidemics are a serious threat in this era of globalisation, yet the important role of communications in preparedness and response has been historically under-examined.

This review aims to examine the literature and real-life experiences of pandemic communications, identifying good practice, key challenges and priority research questions in the process.

Our investigation uses two methodologies: firstly, we conducted a systematic literature review, with specific analysis on tools, skills, staff and infrastructure, and systems and roles. Secondly, an expert workshop, and a small number of expert interviews were conducted with sources from the UK, Sweden, Canada and a global health organisation to capture a more up-to-date, operational perspective of these same areas.

The results showed a fragmented research landscape. Where good practice was identified, it included advanced planning and relationship building, early and/or live communications interventions, and consistent use of multiple channels. At EU and similar regional levels, simulations and stress tests that enabled these kinds of preparations were found to be useful. However, the evidence base for what works is not strong, with the majority of studies performed retrospectively and with limited ability to understand causes and pathways for influence.

There are significant challenges and gaps in knowledge in this sector, most prominently in the skills base at national levels. Training in media relations and risk communications for senior management and technical staff is important, so that clear and consistent messages can be delivered from different levels within any government or other organisation. However, these areas were often reported as deficient. This was the same for competences related to social and digital media, whose novelty and importance for engagement, detecting rumours and listening were regularly mentioned but never really fulfilled.

Among the literature at national level, there was consistent confusion about the best ways messaging could be used to influence protective behaviours. Authors often acknowledged that this varied by population and stage of the outbreak, but had difficulties targeting specific groups of people.

Collaboration and co-ordination also remained a significant challenge at global, regional, national and sub-national levels. The gaps between international principles and guidance for communications and the reality of practice at country level also seemed to be wide.

Setting clear metrics and measuring performance against them was regularly said to be important but very rarely found in practice. Pre-established mechanisms for measuring the impact of communications, related risk perceptions and behavioural results en masse are also needed. The importance of these two points was especially stressed by interviewees who work in outbreak communications.

Based on this analysis, we proposed the following possible research questions:

GLOBAL

- How can pandemic and epidemic communications better achieve behaviour change? How can existing behavioural science knowledge be operationalised in this context?
- How can countries, governments and organisations adapt global communications guidance and information most effectively for their audiences?
- What networks or collaboration techniques can help experts around the world develop messaging that is clear, consistent and not confusing?
- What research is needed to develop a higher quality evidence base for outbreak communications around the world?
- What are the competing political, technical, policy and legal pressures on decision-makers in the event of a pandemic? How can these be better balanced with communications needs at global, regional and national levels?
- How can governments/officials/authorities be encouraged to listen to their populations, in particular people's concerns, as part of their communications efforts, and incorporate what they hear into their response? What tools could help with this?
- What systems could be created or built on to allow those working on communications for pandemic planning and response to share good practice, national plans and information before, during and after an outbreak?
- How is trust impacted by messaging and what is the impact on public health?

EU AND OTHER REGIONS

- How can more regional stress testing for communications during outbreaks be monitored, evaluated and learned from?

- How can regional networks aid country communications staff by sharing updates and regional rationales for country decision making, so they can better anticipate, understand and align messaging with neighbouring countries?

NATIONAL

- How can outbreak communications preparedness plans be ensured across all countries?
- What is needed to help governments and response partners understand and implement the principles of risk communications?
- How can social and digital media be used to engage the public in line with risk communications principles?
- How can training or other interventions help spokespeople and governments become comfortable with communicating uncertainty?
- How can health care workers be prioritised as part of the communications response, both in terms of targeting them for vaccination and helping them communicate with patients?
- How can information needed to communicate effectively during a pandemic or epidemic be collected before it happens?
- What is needed to help countries pre-test messaging most effectively?
- What tools can be developed to help countries monitor risk perceptions and use them to feedback into communications activities during an outbreak?
- What training, tools or structures can help governments engage early and more effectively with the media?
- How can health workers be better trained and involved to be part of outbreak communications response and preparedness?
- What information (about the target group, about the threat etc.) collected before an emergency will increase the effectiveness of risk communications?
- Does pre-testing of messaging improve the uptake of risk communications during an emergency?
- Do countries that have an outbreak communications strategy or plan communicate more effectively (and with whom?) during an emergency?

Although these questions span a range of different areas, there are multiple opportunities to develop tools, training and other interventions that would assist the European Commission in supporting EU member states, strengthening preparedness across the region and beyond.

The next steps will be to understand – from surveying the community of users and conducting further expert discussions – which research questions are the very most pressing and could have the greatest impact.

List of Abbreviations

CBRN	Chemical, biological, radiological and nuclear defence
CDC	Centers for Disease Control (US)
DEFRA	Department of Environment, Food and Rural Affairs (UK)
DG	Directorate General (European Commission term for department)
DG HOME	European Commission Department for Migration and Home Affairs
DG SANTE	European Commission Department for Health and Food Safety
EC	European Commission
ECDC	European Centre for Disease Prevention and Control
EU	European Union
EWRS	Early Warning and Response System (EU)
HEDIS	The Health Emergency & Disease Information System (EU)
HSC	European Commission Health Security Commission
PHAC	Public Health Agency of Canada
PHE	Public Health England
PHEIC	Public health emergency of international concern, as defined by the revised International Health Regulations (2005)
SiS	Science in Society
SME	Small- to medium-sized enterprise
WHO	World Health Organization

List of Figures

List of Tables

1 Introduction

1.1 Introduction to PANDEM

The aim of the PANDEM project is to identify innovative concepts to strengthen capacity-building for pandemic risk and emergency management in the EU. The overall objective is to reduce morbidity, mortality, environmental and economic damage from future pandemics by identifying improvement needs for technologies, procedures and systems. Specific attention is being given to enhancing capacity for collaboration on cross-border risk assessment, response and recovery at national, EU and global levels. Communications is part of this.

The specific objectives of the project are to:

- Assess current practice, tools and systems for pandemic management at national, EU and global level in priority areas including risk assessment and surveillance, communication and public information, governance and legal frameworks;
- Identify gaps and improvement needs through consultation with users and stakeholders;
- Identify and describe innovative solutions for capacity strengthening, efficient use of resources and better integration;
- Identify and describe demonstration concepts and future research and development needs to be integrated in a roadmap for the Phase II demonstration project.

The project is building on previous research and development efforts and will provide recommendations for DG Home and DG Sante, in addition to other EU DGs and agencies at a global and national level.

PANDEM work approach

The structure of the PANDEM work approach is shown in Figure 1. This document presents the review of communications good practice (Work Package 3); the conclusions and the research priorities identified will be synthesised into a proposal for practical action in the form of demonstration topics.

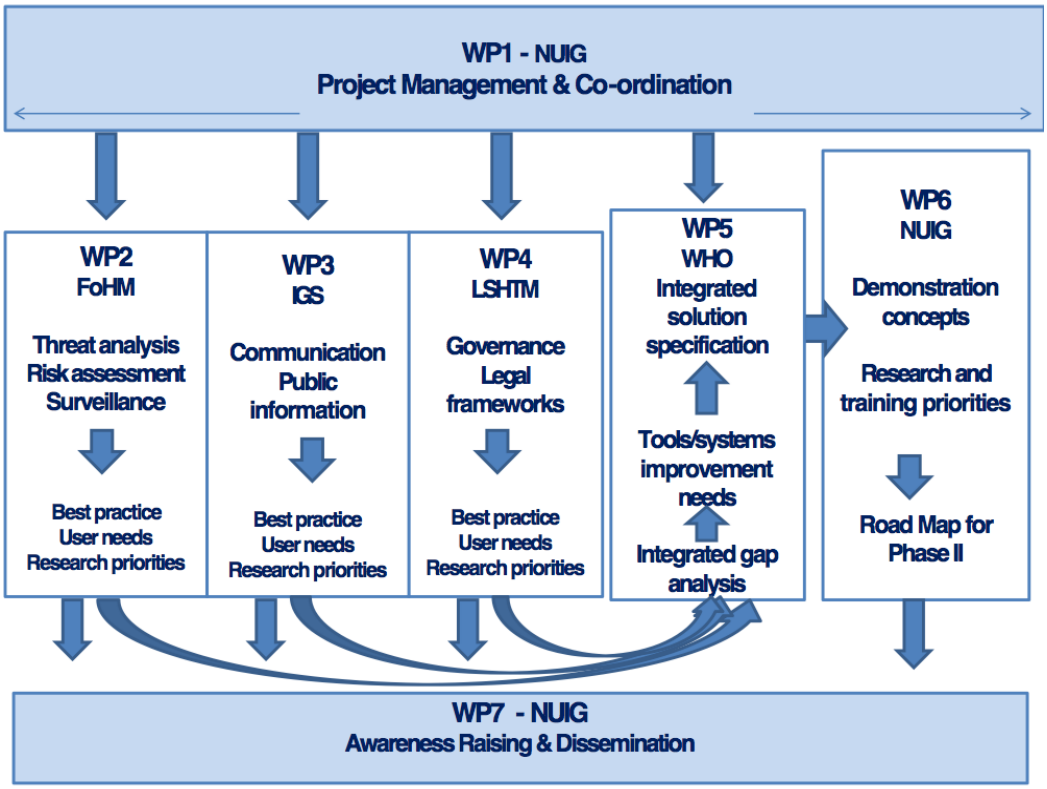


Figure 1. The PANDEM Work Approach.

Expected results and impact

The proposed impacts of the overall project are:

- Identification of research gaps and priorities for improving capacity-building at transnational level with a view to prepare for a Phase II demonstration project involving all relevant stakeholders, including SMEs;
- Identification of innovative concepts that would allow better integration of existing tools and systems to build capacity for health and security protection in case of large-scale pandemics;
- Preparation for a future Phase II demonstration project on large-scale pandemics;
- Increased security for European citizens.

This communications review is expected to cover the first two points, enabling the others to proceed.

1.2 Communications Research Questions

What is good practice for pandemic communications, and how can it best be established and shared across the EU? What are the key challenges and evidence gaps that require research in this area? In our search we will be acknowledging the possible roles of digital and social communications.

1.3 Review Scope & Definitions

The scope of PANDEM is not limited to pandemics but also includes large-scale epidemics at risk of becoming pandemics – if the disease spreads rapidly, potentially overwhelming health services result due to high numbers and severity of cases involved.

Pandemic - this has been defined as "an epidemic occurring worldwide, or over a very wide area, crossing international boundaries and usually affecting a large number of people" [2]. This definition can be applied to other infections subject to global spread such as cholera or HIV but for the purposes of the PANDEM project, we are focussing on the rapid spread of an infectious agent over a relatively short time-frame. While there is no element of severity in this definition, we will look at threats that have the potential to lead to severe pandemics. The research findings of PANDEM will also be relevant to pandemics due to natural, accidental and intentional release events. There have not been many true pandemics, which is why we will also be considering learning opportunities from other types of epidemics and outbreaks.

Epidemic - "The occurrence in a community or region of cases of an illness, specific health-related behaviour, or other health-related events clearly in excess of normal expectancy. The community or region and the period in which the cases occur are specified precisely. The number of cases indicating the presence of an epidemic varies according to the agent, size, and type of population exposed, previous experience or lack of exposure to the disease, and time and place of occurrence." [3]

Outbreak - defined as a localised epidemic.

Outbreak communication - by this we primarily refer to the transferral (broadcasting or exchange) of information before, during and after an outbreak, epidemic or pandemic.

European Union – the European Commission, related directorates and institutions, as well as the 28 member countries [4]. These will be the focus for any recommendations and the definition of further research questions. However, lessons can also be derived from further afield and conclusions may be relevant to other national, international and supranational bodies.

Social media - websites and applications dedicated to interaction with other users, and to finding people with similar interests. Examples include Facebook, Twitter, and Instagram.

Digital media - any media that can be read by a computer. This includes websites, online newspaper articles, videos, audio, images and social media, to name but a few.

1.4 Rationale for the Review

Emerging diseases and their pandemic potential pose a great security threat at national and EU level, particularly in the era of globalisation when disease can spread more rapidly than previously. Communications and public information are increasingly recognised as being vital to effective pandemic risk management. Changes in technology allow information – both accurate and inaccurate – to spread very rapidly. It is more important than ever to ensure that verified information and appropriate messages are communicated quickly and effectively.

For a pandemic response to be successful, populations must be willing to co-operate with measures such as surveillance, quarantine, social distancing, mass interventions (e.g. vaccination, chemoprophylaxis), as well as responding to direct instructions, which may be implemented through emergency rather than the usual arrangements, and restrictions on travel or gatherings. In order for this to happen, communities must have and maintain a high level of visibility and trust in what their local, national and international governmental institutions are doing. This begins before a pandemic event, with information being provided to communities regarding preparedness activities, creating public awareness and confidence.

Communications directed at the population not only provide vital information for preventing infection or accessing care but are also important to maintaining trust and societal cohesion, both of which are central to effective pandemic management. The loss of trust and cohesion can have far-reaching consequences, as events related to the recent Ebola epidemic illustrate.

Many new strategies, techniques and tools for communication have been developed and applied with varying success, and the landscape is constantly evolving. By reviewing existing literature on pandemic and epidemic preparedness and real-life events, this review will compile practical lessons in good practice for the EU that can be applied using different scenarios and

technologies. This will contribute to improving capacity among EU member states for domestic and global communications in the event of a pandemic.

1.5 Objectives of the Review

- Describe good practice and explore possible variables for success
- Develop research questions for testing in the second part of the project
- Define gaps in the literature
- Assess challenges, gaps and innovations with specific reference to social and digital tools in this context
- Work towards an intervention to improve outbreak communications for the EU, with a global outlook, including both preparedness and response.

1.6 Structure of the Review

Literature analysis

After literature is identified it will be analysed to understand good practice according to the capacity building model identified by Potter and Brough [1]. This approach is shared across the PANDEM work packages to enable synthesis, and identifies four main areas enabling a programme to work:

- Tools
- Key skills, such as decision making
- Staff and infrastructure
- Structures, systems and roles

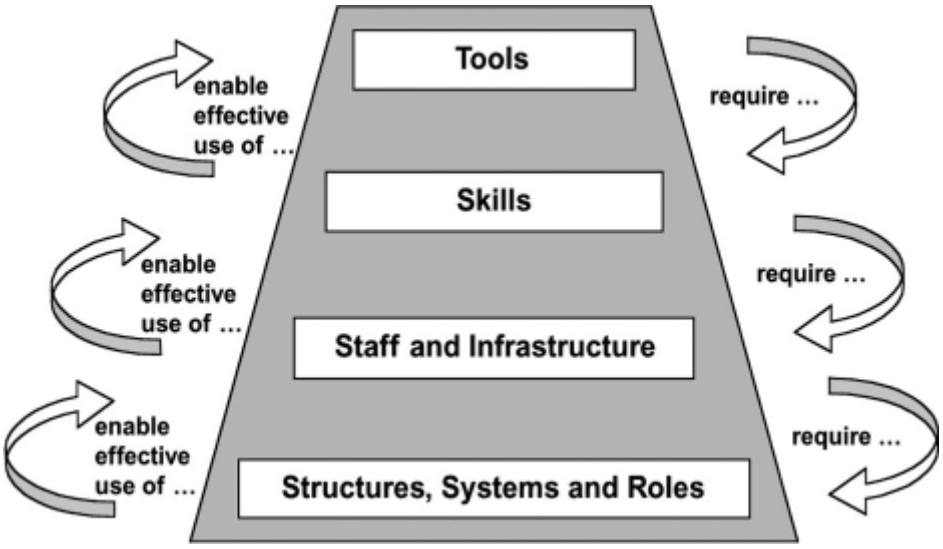


Figure 2. Capacity Pyramid [1].

Considering the literature across these competencies will enable the review to conclude with practical recommendations for the transnational, national and sub-national systems for pandemic preparedness and response communications in the European Union.

To the same end, the ways in which these different levels interact will be examined through a set of case studies, which will push initial findings further by evaluating the variables on which good practice depends.

Gap analysis

This initial literature review will also be used to identify gaps in the evidence, and form possible research questions for future investigation, in combination with conclusions of an expert workshop in February 2016. Follow up interviews with these and other experts have been conducted as necessary and are included in this second stage of evaluation.

Further research questions and decision support tools

The two stages of research are combined to produce a more specific set of research questions that directly shape a decision support tool for pandemic and epidemic communications in the EU. These questions will be reviewed, prioritized and expanded in a roadmap to be implemented in a forthcoming Phase II demonstration project.

1.7 European Context

In the European context, Decision 1082 on cross border threats to health states that communications is a vital part of pandemic preparedness, while warning that inconsistent messaging could hinder the outbreak response and allocating responsibility for communications co-ordination across the region to sub-groups of the Health Security Committee (HSC). Member states are advised to consult each other within the HSC to adapt risk assessments and guidance as appropriate to their nation [5].

Prior to Decision 1082, the Health Security Committee also established the “EU health security committee’s communicator’s network” [6], which was designed for member state representatives to exchange good practices and co-ordinate during a crisis.

The 28 member states of the EU and those in the European Economic Area also fall under the WHO’s International Health Regulations (IHR), which recognise risk communications as a core skills area, “integral to risk management” for pandemic and epidemic preparedness [7].

Overall, the region collectively has recognised and member states have agreed to act upon the importance of communications for pandemic preparedness and response.

1.8 Theoretical Approach

Our review is being conducted with an understanding and awareness of prominent theoretical concepts that intersect with our area of investigation. These will be used to interpret our findings, rather than narrow our initial search.

Risk communication

A key approach on which this review will draw is risk communication, broadly defined as:

"Information exchange about health risks caused by environmental, industrial, or agricultural, processes, policies, or products among individuals, groups, and institutions" [8]

For Sandman [9] this means that the public perception of and response to a hazard is a necessary part of defining risk, such that "Risk = Hazard + Outrage". As a result, risk communication must be multidirectional rather than one-directional, and its effectiveness can be measured by the "openness of the process to all viewpoints and the extent to which values are distinguished from scientific claims, rather than whether the audience's opinions, feelings, and actions come to reflect the source's assessment of the risk."

Other definitions stress the importance of risk communication as a two-way activity in which both the expert and non-expert stakeholders acquire information about and from each other, making it distinct from crisis communication [10]. In this way risk communication is also defined as an iterative process.

Risk perception

Several other theories exist to help us understand the dynamics of risk communication [11], but particularly important for a supranational authority such as the EU is risk perception. This recognises that it is often perception of risk that drives behaviours rather than evidence of risks themselves, and that authorities' responses must take this into account [12]. However, theorists also argue that responses may suffer by responding directly to public perceptions rather than realities [13].

Public risk perception and the nature of the hazard also together define four different types of risk communication [14]. However, across all types, establishing the profile of those communicating as trustworthy and credible is thought to be essential.

In light of these discussions, we will be making the distinction across case studies between communicating to highlight risks (where perception of risk is low) and communicating in response to perceived risks (where perception of risk is high, and in many cases higher than is justified by the actual situation). We also acknowledge that these may happen within the same pandemic, but at different times.

2 Methodology

2.1 Literature Review

The literature search itself was carried out between 28th December 2015 and 10th January 2016, using databases accessible through the James Hardiman Library portal of the National University of Ireland, Galway.

Criteria for considering studies

Table 1. Types of literature

INCLUDED	EXCLUDED
English language	In a language other than English
Available online	Not available online
Dated from after 1993	Dated from before 1993
Academic literature published in a peer-reviewed journal	News or editorial
Communications, information exchange, behaviour around both of those elements	Purely technical, epidemiological or other aspect
Communicable disease capable of rapid outbreak - plausible cause of epidemic or pandemic	HIV/AIDS, sexually transmitted diseases, any chronic or long term disease or disability that is non-communicable. Computer systems oriented papers (these use the language of epidemic so were common in initial search results
Describing a case study anywhere in the world	None

Types of studies

The types of literature suitable for inclusion report on:

- Communications activities-related scenarios - real or projected - during pandemics or epidemics.

- AND/OR factors influencing communications activities, where their implications are clearly linked.

Types of participants

We typically considered communications activities involving an authority responding to the epidemic or pandemic, a population at risk of the disease, and/or a population with perceived risk of the disease. Particular attention was given to collaborative and cross border approaches.

Types of interventions

Communication interventions were defined broadly, including any kind of information transmission outside of straightforward epidemiological surveillance. They were considered for their contents, pathways of change attempted and channels, including (but not limited to) advertising (billboards, television, radio, and print media); direct mail newsletters, leaflets and emails; press conferences, media briefings and press releases; seminars and workshops; news, blogs and other digital content; online social networking and updates. Interventions that are not themselves communications but have some direct effect on them were also included.

Types of outcome measures

Anticipating the difficulty of measuring the impact of communications across a large group of people, we took into account a variety of different indicators of success, including but not limited to surveys of knowledge and attitudes, uptake levels for practices or products encouraged as part of the response and tone of dialogue between the communicating body and its recipients.

Lessons for good practice included both quantitative and qualitative measures of information dissemination, message development and communications methodologies, including the impact these messages had on public understanding and confidence.

Table 2. Search Terms.

CONDITION		INTERVENTION
Epidemic OR pandemic OR outbreak	AND	communication

Further screening criteria

We were aware of concepts such as risk perception, but did not have time to consider their effects on communications independently. This means that our literature review only included literature that itself made the link from such concepts to communications.

In addition, due to volume and time constraints, articles simply stating that communications preparedness was important, with no further analysis or detail, were excluded for being too shallow to add to our review.

Sources of literature

We searched the following academic literature databases using the search strategy at the end of this protocol document:

- Medline and PubMed http://www.ncbi.nlm.nih.gov/pubmed
- Embase (via Ovid SP) https://www.elsevier.com/solutions/embase-biomedical-research
- Campbell Library of Systematic Reviews http://www.campbellcollaboration.org/lib/
- Centre for Reviews & Dissemination https://www.york.ac.uk/crd/
- The Cochrane Library http://www.cochranelibrary.com/
- Web of Science http://wokinfo.com/
- ZetocSearch http://zetoc.jisc.ac.uk/

Grey literature was considered for case studies and when investigating projects related to PANDEM.

Hand searching

After analysis of the search results, the journals or sites that came up most frequently were hand searched to ensure no relevant studies have been missed. Throughout the searching process, bibliographies from included studies were also checked for leads.

Data collection and analysis

Storage

Search results were imported into EndNote reference management database and duplicates were removed. A record of the total number of included studies at each stage of the systematic review is presented as a flow chart in the body of the review.

Selection of studies

In the first stage of study selection, once duplicates were removed, titles and abstracts of studies were screened against the inclusion criteria in EndNote (Thomson Reuters, version 7).

Literature identified at this stage was obtained in full text and screened for relevance. Remaining studies were then included.

Limitations

Our search was only conducted in English language. We did not have sufficient time to systematically review the grey literature, although interviews and case studies provided a snapshot.

Quality, relevance and risk of bias assessment

After the initial analysis, based on the mix of study designs and reviews, we selected the weight of evidence framework as a systematic tool to understand quality and relevance of articles included [15], details of which can be found in the Annex . However, we had limited time to assess all studies in this detailed manner, so we assigned sequential numbers to all selected studies based on their ascending alphabetical order. We then used Research Randomizer [16] to generate random numbers for 10% of the sample, and looked at these studies in detail with the weight of evidence framework.

Although rarely explicitly relevant due to observational design, our understanding of bias and where it originates was informed by the Cochrane handbook [17], and sampling techniques and related information points were accordingly noted though the data extraction process.

Data extraction and synthesis

Information extracted from reviewed literature includes:

- bibliographic information (author, publication year, publication type)
- characteristics of study population, their location and age, gender, socio-economic and ethnic composition
- communication intervention contents, delivery methods and theoretical basis (if any)
- medical or other objectives of the intervention, such as vaccine uptake
- study design elements, including whether any control/comparison
- outcome, including direct response of target population or wider consequences for the outbreak

A standardised data extraction form was developed after studies were selected, and data extraction was carried out and double-checked.

Analysis was in the form of narrative synthesis for whole review findings and trends. From these findings, a small number of case studies with particular practical relevance for the EU were picked out for further discussion and analysis.

2.2 Expert Consultation

Expert consulation was held primarily at a meeting in Brussels on February 16-17th 2016, which included a specific working group on communications, and a session for wider feedback to the rest of the group (see Annex 6.2 for full agenda). A range of experts representing EC institutions, EU member states, academic institutions and the private sector attended (see Annex 6.1 for full list).

The working group was asked to discuss current practice in pandemic and epidemic communications, as well as gaps and needs. They were specifically asked to share their knowledge of grey and unpublished research and country case studies.

2.3 Case Studies

Key individuals and organisations, identified through the search process above, were also contacted to identify further publications, as well as good practice and research gaps in relation to the specific case studies, see Annex 6.5.

Their views and suggestions have been supplemented by country specific content from the main literature review, and a specific search of grey literature for the country involved. This involved hand searching sites using the same key words as above (plus the relevant country name), covering:

- European Centre for Disease Prevention and Control
- Ministry of Health websites for EU member states
- World Health Organization
- Relevant parts of the UN
- Communications Initiative
- Websites of NGOs and institutions involved in pandemic/epidemic response, such as MSF International, International Federation of the Red Cross and the Red Crescent, International Rescue Committee, CDC

2.4 Digital Inventory

This will be where we pay specific attention to digital tools, drawing out those mentioned in the literature, expert consultation and case studies to give an overview of existing and future potential in these areas.

2.5 Similar Projects

To avoid duplication of what other research projects are already doing, the previous PANDEM scoping deliverable (D3.1) has been used to collate reports from existing EU projects in similar areas.

3 Results and Discussion

3.1 Literature Review

3.1.1 Overview

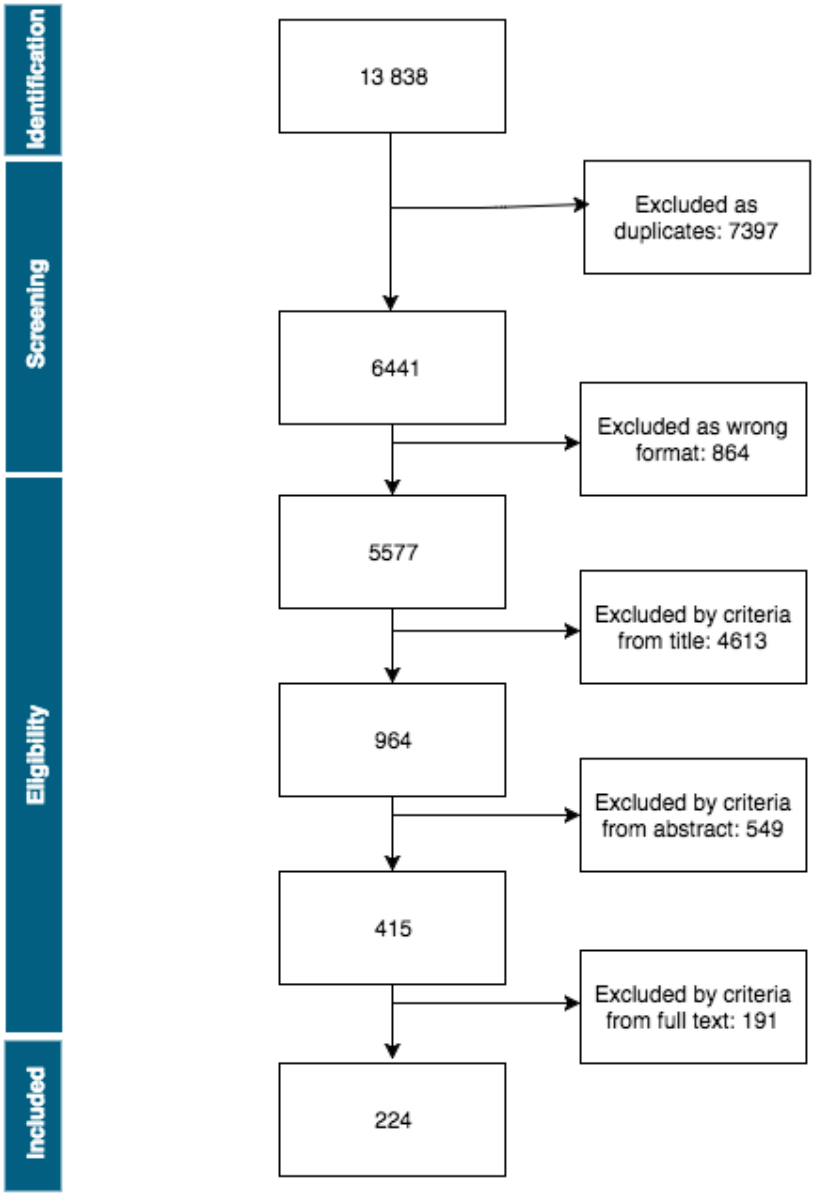


Figure 3. Flow diagram of literature review results.

The included articles spanned a range of countries, audiences, diseases, channels and aims, demonstrating the diversity and importance of communications in a pandemic response.

Although there was a high number of hits included in our final search set, most of them concentrated on local examples and very specific aspects of communication. The result is a very fragmented research landscape, with few attempts at gathering generalisable principles or doing national, regional or global analysis.

The literature consequently demonstrates a general lack of synthesis; only one broad systematic review was identified [18], with three more on specific aspects of outbreak communications such as perceptions, behaviour and communications [19], perceptions and behaviour around non-pharmaceutical interventions [20], media content [21], and health worker immunisation [22].

Populations

The most featured country was the USA, which was specifically covered by 22% of articles. Literature with a global focus came a close second, followed by articles looking at populations in Australia, Canada, China and the UK. Other countries including Germany, Italy, the Netherlands, Norway, Singapore, Sweden and Taiwan were also covered, but lower income and developing country settings were almost entirely absent. Only 4% of literature looked at populations in lower income countries, which covered Cambodia, Guinea, Guinea Bissau, Ivory Coast, Laos, Sierra Leone, Sri Lanka and Vietnam.

The most common sub-national groups studied were the "general public" [23], healthcare workers [24] and university students [25]. Some more specific population groups targeted included those with low income [26], ethnic minorities [27] [28], marginalised communities [29], and at risk groups such as poultry workers [30], other kinds of animal handlers [31] and those preparing food [32].

It is important to note that the general public was often considered a homogenous group. This is understandable given that many of the studies are observational and take place during an outbreak, when it could be desirable to gage a broad overview of how communications tactics are working for a large number of people.

Moreover, studies that went into more granular detail reported that different groups had different needs and reacted differently to the same communications materials, distinguishing between men and women [33][23], different levels of education and wealth [34] [35]. These trends are striking, since the areas where pandemics and epidemics are most likely to spread and originate – among lower income populations - are not well identified or targeted at all.

Interventions

Not many studies were experimental, meaning that the interventions were out of the researcher's hands. Cross sectional, observational studies dominate, and few had clear, transparent methodologies. 95% of studies were observational.

Since most studies reported on activities that went on during a live pandemic, the intervention was usually specific campaign information from the government public health authority. The exact content of this was not always provided in the study. In the few cases where the study consisted of preparedness research, the interventions were terminology [36] or health message [37], whose efficacy in terms of understanding and behaviour change were then tested [38].

Two randomised controlled trials (RCTs) were included in the search results. One focused on regularity of messaging to health workers, and its association with message fatigue [39]. The other was based around a communications and decision making tool to convince health workers to get vaccinated [40].

Given that much of this research happened during real past pandemics and epidemics, the intervention information was most commonly related to influenza, with H1N1 as the strain most written about.

Comparisons

For communications interventions in general, it can be difficult to compare intervention and non-intervention populations.

It was therefore unsurprising that, aside from the two aforementioned RCTs, control groups were rarely used. The few exceptions employ a control group to assess impact of specific messaging [41], and to compare the decision making processes and their communications implications for a group of unvaccinated and a group of vaccinated pregnant women [42].

Within results of other studies, sometimes countries or different population groups were compared instead, but this was often done very casually. In one Canadian study, provinces were compared [43].

Outcomes

As specified in our search criteria, we were looking for literature that involved communications in the intervention, the outcome or both, with an emphasis on linking these to the role of communications in an outbreak. A variety of outcomes fit this description.

When done properly, the communications intervention studied was linked to an outcome that was directly part of the pandemic response, whether positive or negative. The clearest links seem to come from food-borne outbreaks, perhaps because buying items is a more easily

monitored protective behaviour than involved in other circumstances. For example, in Germany and the US, media coverage and government press releases affected consumer purchasing [44], and in Vietnam, government communications and media attention resulted in rapid decrease and then fluctuations in poultry purchasing during waves of avian influenza from 2004-6 [45].

In Australia, links were drawn between media releases, timely alerts for GPs, and early diagnosis for pertussis during an outbreak [46]. However, the majority of articles measured more intermediate outcomes and did not use experimental studies, making their effects on pandemic response harder to gage.

Most of the cross sectional studies relied on qualitative outcome measurements, asking survey populations about their perceptions of outbreak risk, knowledge about the outbreak at hand, opinion on messaging, whose relation to outbreak control measures was not always strong. Additionally, many outcome variables were often measured at once, making causation even more difficult to establish.

Attempts were made to measure how credible citizens thought authorities' communication was [47] [48], and to understand information seeking needs [49].

Real and intended behaviours in relation to communication campaigns were also recorded, such as intention to perform preventative behaviours for the benefit of others [50] and intention to vaccinate [34] [50].

Group communications responses were measured, including tactics different organisations, companies and government departments used during the H1N1 outbreak in the USA [51].

Cross sectional content analysis was also performed, while media and social media activity was also analysed for its accuracy [52] [53], its tone and content [54]. Mostly this was done for written content, but there was one example of image based analysis for social media during Ebola [55].

Media volume and content were measured to explore their relationships with disease case numbers [56], and with the EU communications response [57]. However, this was often a weak proxy measure as studies could (and did) select favourable sets of evidence, and the relation to behavioural outcomes was hard to establish.

Other metrics studies used were case numbers reported and exposure to communications campaign [58], and the possible case impact of certain types of media interventions, according to modelling [59].

Notably, there were no efforts in the published literature to measure a systematised set of outcomes that could summarise the effectiveness of an entire communications campaign. This perhaps reflects the difficulty in identifying causal pathways and influential factors that ensure an act of communications transfers into an action that contributes to outbreak control. It also illustrates the challenge of evaluating communications efforts, with unclear pathways to impact.

3.1.2 Summary of possible causal pathways

Occasionally causal pathways investigating how communications impacted outbreak response directly were modelled or hypothesised. These often related to ideas of behaviour change and risk perception. While they are often complex and there is no consensus on which theories are the most influential, they are worth acknowledging here to show the academic challenges communications staff may face when trying to influence outcomes.

The most commonly occurring ones, along with examples of where they were used, include:

- Health belief model [60]
- Risk communications [61]
- Protection motivation theory [62]
- Theory of planned behaviour [20]

A full explanation of these models used can be found in Annex 6.4.

3.1.3 Weight of evidence

Our random sample of 10% of the review studies aimed to give a more detailed indication of study qualities; we did not have time to review all the articles in this manner. We found that around a third of articles had methodologies that were clearly designed, where biases did not wholly undermine their findings and limitations were fully explored. For example, one used experimental design and correctly implemented significance tests [63], and another took multiple outcomes in a case control design [58]. However, even these were commonly limited by a lack of baseline measurements [64] [65], or were limited by the possibilities of recall bias. The remainder of the sample did not explain their methodology clearly enough to be critiqued [66] [36] [67], were not systematic or rigorous in their review approach [68], or used limited methods when taking in wider perspectives and literature would have been more suitable [69]. Another

troubling limitations included the strong possibility of bias originating from small sample sizes [70], or sample groups that may not have been representative of the population researchers aimed to measure [24].

3.1.4 Good practice

- Most effective channels varied by population.
- Multi-channel approach, with clear and consistent messaging worked well.
- Transparent communications and involving the public were valued.

Most literature focused on challenges and failures rather than good practice. However, a few studies reported successes and very specific positive findings.

The most appropriate channels naturally varied by population; in the Netherlands television and newspapers were preferred during SARS [71], while poultry handlers in Australia preferred websites and newspapers to government communications, though this varied by gender and age [72].

One randomised control trial [40] found that using a structured decision aid when attempting to convince health workers in Canada had some effect on intention to immunise, though it was not significant when results were adjusted. However, the tool did reduce uncertainty.

Another study [73] collected expert views on what effective, successful outbreak communication looked like. Key points from their analysis included the importance of response partners clearly agreeing on goals and ethical framework for their communications, engaging with the media earlier, and planning before the outbreak begins. Analysis of an outbreak of acute hemorrhagic conjunctivitis in Taipei led other authors to conclude that having a multi-platform communications plan ahead of time, keeping the message clear and consistent and choosing a trusted spokesperson were all important factors in a successful communications response [58].

One case in the USA successfully used basic channels for direct verbal communication between surveillance staff and infectious disease hotline workers to keep the latter group informed and able to respond quickly to enquiries [74].

Involving the public, and explaining the rationale behind communicating scientific uncertainty study was a valued communications strategy for boosting public trust, according to one

Australian study [75]. A survey from Israel backed this up, as the majority of those surveyed valued transparency over certainty [76].

3.1.5 Gaps and needs

The majority of literature was focused at national level, and within this the biggest gaps were at the skills level. This is perhaps due to lack of decisive pathways between communications and behaviour, meaning there is a wide range of skills needed by responders to cover all areas.

GLOBAL

- Tools to help countries adapt the global guidance that does exist are missing.
- Skills gaps exist for social media and applying principles of risk communications at global level.
- Global funding structures for better quality research and interventions are needed.

Pandemics and epidemics by definition cover many countries and have global significance, yet communications at this level is highly complex and variable. This is perhaps why it did not feature strongly in the literature.

Those that did consider pandemic and epidemic communications at the global level pointed firstly at inadequate tools. Pre-decided methods communicating essential information and data between countries and to global hubs like the WHO in the same format [77], co-ordinating scientific messaging between experts [78], ensuring that countries have detailed enough communications preparedness plans that take into account the needs of minorities [29], and agreeing on official terminology to make global communication easier [79] were all called for. Other basic tools were needed, such as an empirical evidence base about what works for communications in emergencies beyond observational studies and theories [18], and data gathering tools, search engines for responsive communications and surveillance [80]. A lack of tactics to help interpret and understand differences in perceptions and risk amplifications relevant to communications across different countries was highlighted [81], as well as an absence of support tools and organisational routines for social media at the global level [61].

International tools and guidance, such as WHO's risk communications approach, were mentioned more at this level than others, but often as being too narrowly focused, missing out other academic theories and not addressing the political context of pandemic communications [82,83]. Others explored the practical consequences of this political context, sharing how governments during H1N1 ignore their own and WHO's guidance and evidence during an pandemic in order to be seen taking action [84].

A few skills gaps were also illuminated, such as understanding how to influence and get messages out through media across different countries, where habits and priorities in the news are different [85]. Social media was a key area where skills were lacking, with authors concluding that social media was not being used adequately for risk communication [86], taken seriously for response and engagement [87], or used collaboratively or across all stages of an outbreak [61].

One study [88] found a significant gap in research funding and structures to increase our understanding of communication, designing communication interventions, implementation and evaluation and research methods. Another concluded that the leadership for clear, comprehensible communications was inadequate at a global level, with technical considerations ranking more highly [89]. Finally, a combination of reviews exposed an evidence gap around trust and reputation building for communicable disease communications, and noted that cost-effectiveness measures were also lacking [90].

REGIONAL

- Regional stress tests for communication were useful, though not common enough.
- Regional healthcare workers not well included in communications response through their regional networks.
- Regional communications staff capacities varied widely, and information about focal points was not always up to date.

Here again, the literature pointed to a major gap in tools for communication. Stress testing and message harmonisation across regions [91], pre-tested ways to flag countries differences and adapt communications accordingly [64], pre-tested messaging [92], common tools to combat vaccine hesitancy [93], campaign evaluation tools in low income regions [94] were all missing. The problem of not being able to monitor and process rumours was established for the Western Pacific region [95].

For structures, systems and roles, European healthcare workers were not included adequately, given insufficient communications and information around H1N1 vaccine [96].

Media structures were also shown to differ in their risk priorities across European, American and Asian regions, leaving the question of how international communications guidelines can influence media across different contexts [85].

Finally, regional communications staff and infrastructure varied greatly, with data about national focal points not always up to date, and capacities like internet and phone were different and occasionally insufficient [97].

NATIONAL

The majority of literature was focused at the national level, so there is most evidence to synthesise here. An overwhelming number of challenges and gaps were shown to exist, including targeting and monitoring communications, pre-testing messages, having the right skills to talk to the media, use social media and implement risk communications principles.

Tools

- Ways of targeting specific groups, monitoring public opinion, helping to communicate uncertainties, co-ordinating messaging were all needed.
- Decision making tools, strategies and messages with pre-tested effectiveness were sometimes absent.

At the generic country level, methods for collecting information about recipients of pandemic communications before the need arises to actually communicate with them in an outbreak settings was a priority [98].

Literature from the Netherlands pointed to tools to help decision makers choose the right channels for messages [99], information with content that accurately outlines population vulnerability [100], and ways to communicate and persuade around outbreak vaccination to parents of children [101]. One study considering knowledge and perceptions of SARS in the Netherlands and Finland noted differences across populations, but lacked the evidence or tools to explain why this was and better target communications [102].

In Norway, tools for regular public opinion monitoring were required [47]. For the UK, they felt the lack of a communications checklist for response team [103], a lack of contextually specific information for survey baselines, and the appropriate survey questions to understand and measure the public's behaviours and perceptions during the outbreak [19]. Ways of identifying conflict of interest and putting any risk assessment in that context, promoting transparency were also needed there [104].

In Morocco, context specific tools to advocate for pandemic vaccination for high risk groups were needed [42].

Literature on Australia noted the absence of tools to enable spokespeople to confidently and helpfully communicate uncertainties [75], as well as communications strategies for GPs, established before outbreaks [105]. Tools to get experts to unify around a particular message, to not hold damaging, public disputes were desired [106], and a plan with pretested messages for the public was generally regarded as important [107]. Health department campaign messages also needed to challenge misconceptions and methods to help measure perceptions over time were required alongside this [108].

Similarly, Canadian literature discussed a lack of tools to ensure consistent messaging between spokespeople [70], tools to evaluate uptake and results of public health education and messaging campaigns [109], and evaluation tools for post crisis [73]. Pre-tested language that outbreak partners and the public both understand (e.g. around quarantine) was another defined need [110]. More broadly, another study from around the same time highlighted the lack of a pretested, clear communications protocol to explain vaccination, prophylaxis and other key measures to the public [111].

For China, messaging and data were the more important tools. Media messaging containing instructions for preventative behaviour [112], greater use of social media for faster risk communication [113], and the data to know what information the public had understood [114] were all needed. Mapping of information dissemination to track communications was also a challenge [115].

In Taiwan, the tool required was a communications strategy based on existing risk perceptions, and established before a pandemic [116].

For Israel, terminology appropriate for risk communication with the public was needed, in light of how the word epidemic was perceived by lay audiences [117]. This finding is also backed up by a European study [92].

Tool-based needs in the USA mirror those seen elsewhere. Messaging that produces the most pro-social outcome [63], that is pretested [37], and is both clear and actionable [118] were common needs outlined. Others pointed out that information provided during an outbreak needed readable and accessible (which it was not), allowing the public and journalists to actually use it [119].

Methods to enforce good practice via specific frameworks or principles in crisis were also needed [120], and also to help official sources to communicate early, to keep up with other media

[121]. One suggestion to meet this need was information sources and alerts for first responders [122].

Other gaps noted were tools for decision and scenario planning [36], for community tailored communications plans [123], for risk communications planning during food borne outbreaks [124], and for planning and maintaining trust [125].

Skills

- Understanding how to use communications effectively to influence behaviour, how to engage successfully with the media, and how to apply risk communications principles were noted gaps.
- The ability to tailor communications to specific groups was another generally unfilled need.
- An understanding of how best to use healthcare workers and social media for outbreak communications was lacking.

In lower income countries, the skills needed related to being able to specifically communicate with communities; these included being able to take community feedback and not use static materials in Guinea [126], being able to incorporate local constructs of disease into communication in Guinea Bissau [127], and being able to reproduce key materials and translate them into local languages in Ivory Coast [128].

In European countries, understanding and measuring both perceptions and behaviour was a common skills gap. For Italy, understanding, measuring and influencing the channels through which communications campaigns change behaviour [129], and understanding the links between risk perception, compliance and preventive behaviours and education/information measures [130] were important. In the Netherlands, the skills to maintain trust over the duration of an epidemic were needed [48]. In Norway, media management and spokesperson consistency were both challenging areas [66] [131]. In Slovakia, there was a government skills gap, meaning that tailoring information products to specific audiences, being proactive and using social media were not done, and there was an assumption that the public will come looking for information [132]. In Spain, authorities were not able to monitor behaviour, respond to consumers via social media or use Twitter to its full communications potential [133]. In Sweden, influencing perceptions to drive vaccinations at all stages of outbreak [134], the ability to convey clear messages that combined with existing biases and perceptions to create action, and understanding individual choice narratives and objections to “pharma capitalist” interventions were not achieved [135].

A study considering both the UK and the Netherlands found that being able to target specific groups based on their media preferences, perceptions and information needs was a key gap [27].

For the UK alone, the ability to respond fast, to the right communities, and ensure information was conveyed from person to person was a gap [59], as was the ability to communicate specifically with different audiences [136]. Understanding how people's experiences during the 2009 H1N1 pandemic affected their perceptions of health warnings, and what impact this might have on their response to future warnings about a potentially more severe pandemic was another challenging area, requiring additional research and skills development using evidence-based theories of behaviour change [137]. GPs were also suggested to lack risk communications skills needed for influencing their patients to get vaccinated during an outbreak [138].

For the Swiss, understanding the impact of government and media trust on communications and behaviour change was needed, and a systematic research program on how trust can inform public health communication campaigns was called for [139].

In Japan, skills to influence the overall media narrative were lacking [52], while in Malaysia understanding information needs of different groups and meeting them was challenging [140].

New Zealand authorities found their media relations skills needed work, with a need to build relationships with media and journalists around public health, and so support accurate reporting [53].

For Singapore, understanding how to pitch the right content was a key gap, spanning what language to use [141], how to optimise actionable behaviour [142], whether or not to focus on symptoms of the disease [143], and how to make messages engaging and interactive [144]. Knowledge and skills to target specific communities was another challenge, including an inability to target groups with less knowledge and trust [145], and those with lower economic status [146].

Similarly in South Korea, knowing how to communicate appropriately with people based on their existing ideas, perceptions and characteristics, using entertainment media as a vehicle for influencing risk perception [147], and organisation understanding of how risk is interpreted in a variety of social settings [33] were lacking.

In Israel, communicating scientific uncertainty around Ebola was a challenge in terms of skills [76].

In Australia, the skills were not available to ensure communications campaigns transformed worry or information into vaccination uptake [148]. The ability to make messages culturally relevant and effective, developing tactics formatively with communities to ensure this was another unfilled need [149]. Again, the confidence and ability to communicate uncertainty at the appropriate level and openly with the public was not there [75]. Understanding risk perceptions and how they influence parents' vaccine decision making with communications [60], use of social marketing to achieve behaviour change through communication [107], and the skills to engage the media [150] were other noted gaps.

Across Australia and UK, the ability to tailor communications, to understand, measure and respond to public opinion, avoiding skepticism generated by prescriptive communications from government [151] was needed. Understanding and acknowledging the real-life pandemic experiences of the public and being able to engage with them was another gap [23].

In Canada, the skills to understand the relationships between media trust and preventative behavioural attitudes [152] and the effects of the type of mass media message on social distancing behaviour [153] were both needs identified. Another study called for pandemic training for information providers such as librarians to assist the public and widen the response [49].

In China, the skills lacking were understanding the trajectory of online interest and intervening where appropriate [154], how information is received and to be able to differentiate between surveillance information and opportunities for communication on social media [155], the ability to use social media to disseminate information and dispel rumour [156]. Understanding perceptions, trust levels relating to particular spokespeople ahead of time was another gap [157]. Using the right kind of behavioural tactics within communications to promote action was not always a given skill [158]. Briefing the Hong Kong population on the importance of quarantine was also an unfilled need [159] [160].

Taiwan faced inadequate media relations abilities among spokespeople [161], as well as a lack of understanding of political context for risk communications [30]. Also lacking was an understanding of how different media messages would influence behaviour differently [162], and securing accurate media presentations of the outbreak that avoided provoking panic [67].

There was a wealth of literature from the USA, and much of it pointed to skills gaps as well. The challenge of targeting specific communities arose more than once, in general [163], in relation

to vaccine communications [164], for those particularly at risk [165], and minorities [118]. The skill to tailor communication based on knowledge about group attitudes was also absent [35].

Knowledge and understanding of public opinion was another gap, with a lack of certainty about what, beyond the facts, changes perceptions [166]. Understanding how different people process information differently, and how messaging can affect their interpretations was another challenge [63].

Effective messaging was also a considerable gap; clear and fear-free communications around issues like quarantine [167], and messages producing action and compliance [118] [168] were both difficult. Knowing what types of information to release to manage fear levels and having the confidence to communicate uncertainty to the public were two further gaps [41]. Vaccine communications using narratives rather than statistics was a particular challenge Being able to tell a compelling story to people about why they need vaccines in an outbreak, not just using statistics [68].

Part of the reason for these messaging challenges could be because more evidence is needed about the emotional pathways to action involved in communication [169], which cannot be employed without a strong evidence base.

Better abilities to conduct media relations [170], and confidence to engage early with media and awareness of the importance of this for the outbreak trajectory [171] were both needed.

Specific training needs were also outlined in some of the earlier literature, for example, in risk communications for journalists, public affairs officers and community leaders ahead of an outbreak, to give a shared responsibility and understanding about the complexity involved in response and the need for communications co-ordination and accuracy [172].

Understanding how best to train clinicians in aspects of response such as using central information resources, communicating with other professionals, and reporting events to a central agency was a significant skills and learning gap [173].

Finally, a couple of newer studies based around the USA also highlighted the need for social media skills to spread accurate information, and track the outbreak and response [55] [174].

Staff and infrastructure

- There weren’t always adequate number of staff to manage outbreak communications.

In Australia communicating with GPs was not prioritised during pertussis outbreak [46].

In Canada there was no single trusted spokesperson during SARS [110], and an embedded communications function was needed across all outbreak response partners [175]. Similarly in China and Hong Kong, the lack of separate media spokesperson inhibited response efforts, by keeping them political [176].

For the USA, Freimuth, Musa et al. [28] argued that healthcare workers should be used to communicate more in an outbreak, since they were more trusted.

Structure, systems and roles

- Collaboration, co-ordination, follow up and leadership were challenging and sometimes absent.

For Australia, systems allowing targeting of specific groups were needed [62], as were better structures to allow different authorities to collaborate [177], and segmented messaging systems led by the government [72]. The public part were also seen not to have a good enough role in pandemic planning and implementation [178].

In Canada, co-ordination of messaging between actors [110], and establishing communications relationships between response actors before an outbreak [69] were key challenges. For both Canada & USA, health workers often weren't given a role in communication, which possibly undermined SARS response [43].

A study looking at France and Quebec found co-ordination and unity of messaging between authorities and media to be a major gap [179].

In Turkey, the role of health communicator and expert was damagingly taken from the health ministry and healthcare professionals by unqualified media and politicians, which highlighted importance of getting the people in communications roles [34].

Leadership was also not taken by the UK government in the foot and mouth outbreak, which instead allowed rumour to spread [180]. For an older study looking at the UK, the system of information flow was observed as not always reaching public-facing call handlers, and that there were no accepted standards for this [181].

For the only study that looked at a low income setting in this section, a study on Sierra Leone during Ebola showed that a system to consistently follow up inbound communications from public would have contributing meaningfully to outbreak control [182].

3.2 Expert Consultation

The Communication Working Group gathered external experts and PANDEM consortium members to discuss the current good practices, gaps, user needs, research and innovation needed in all the versatile aspects of communications between pandemic stakeholders, including both professional communication and communication with general public in preparedness and response phases.

3.2.1 Review of good practice

A key question that was discussed here was: what does it mean for a communications strategy to be effective? How do we judge success?

The group concluded that there were two key aims, which can be summarised in this simple diagram:

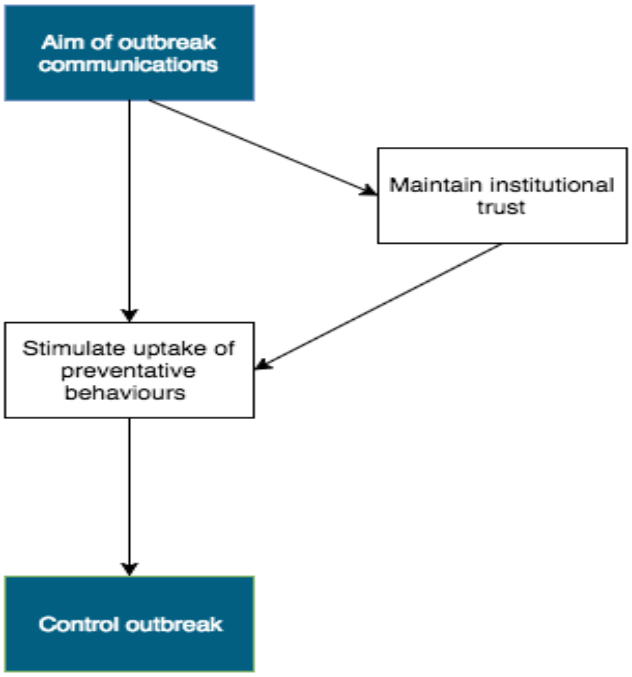


Figure 4. Aims of Communication.

3.2.2 Review of challenges

The skills gap (behavioural science, risk communications) took a recurring role in our discussion. The skills and ability to communicate uncertainty - learning from disciplines of science communication and agnotology (the study of ignorance and uncertainty) were highlighted as an ongoing challenge, as was risk communication - being able to keep channels of communications open and two way, with a “tell us what you’re worried about” approach.

As well as the issue of not being prepared enough, we also broached the subject of preparation being inflexible, and the issue of feedback mechanisms - how to know ways to adapt the plan as you go along. A related difficulty was how to update a plan and a message as you go along and maintaining trust of populations as you do this, despite breaking consistency.

Real time data on how communications is working was accepted as very difficult to obtain, and the experts couldn’t share any examples this is being done in real life.

Responding rapidly via new channels (for example, social media) and how to determine the number of resources to assign to this approach was identified as a recent challenge for governments and organisations.

We also discussed the difficulties presented by of cultural variations in terms of messages and approaches, as what works will vary by member state and community. Similarly, how to access relevant data on this from private sector partners, or getting it in advance, for example, advertisers in most countries test messages and collect data on this all the time.

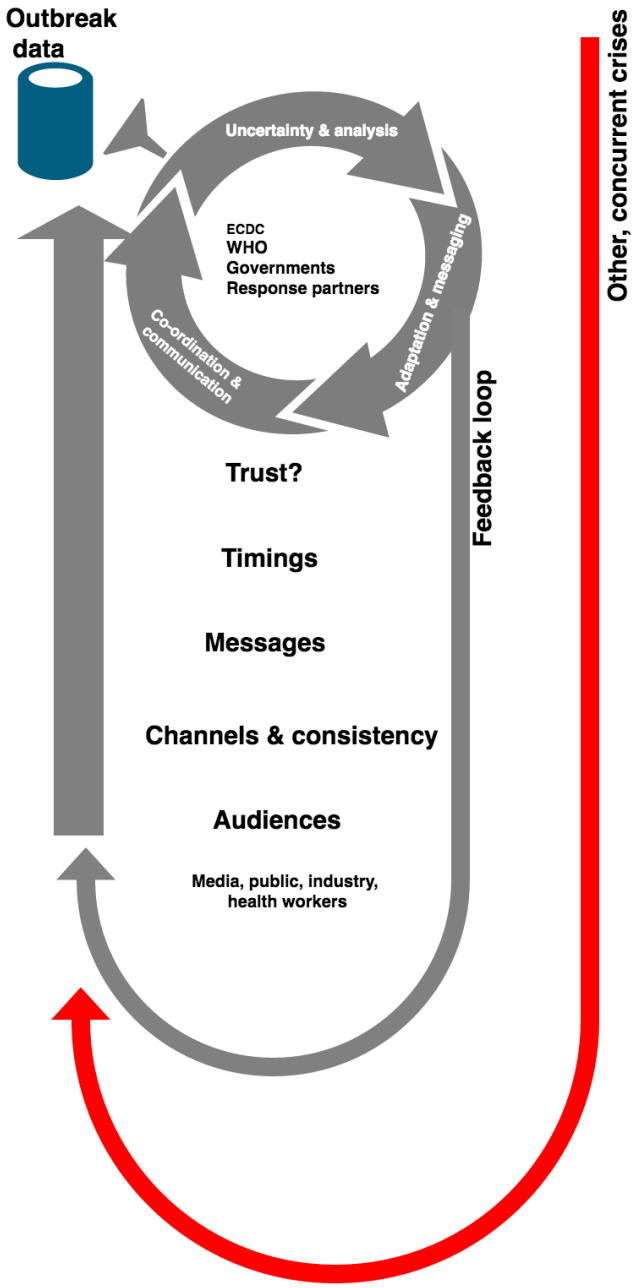
The group discussed the challenge of building trust with highly resistant communities, in light of the specific example of vaccine communications.

Personalisation is another challenge when it comes to messaging - the need to make messages and communications personal, ensuring that they have the best chance of prompting action. Communicators need to get the right level of warning into messaging - governments and authorities should avoid being seen to “cry wolf”. However, understanding audiences and specific segmentation is also difficult, given that separate communities at very local levels can react very differently. One suggestion tabled was that we could adopt levels of warning similar to earthquakes and natural disasters.

The underused role of health workers in communications was highlighted, along with the challenge of how to help them say the most effective things, even “the mavericks”. The same

challenge applied to scientists - they are human too, and so can have vested or other interests in threat rating and communications.

A key question arose around journalists and the media in spreading fear and misinformation for the sake of making profit - how can you get them on side?



These challenges and how they flow together were summarised by a diagram constructed by the group.

3.2.3 Research and innovation needed

We had a wide-ranging discussion about where priorities for research lie, which was initially dominated by considering the possibilities of new tools. All areas of the "capacity pyramid" [1] were included in the analysis:

Tools

ICT tools (crisis management, data management, knowledge engineering, decision support tools) are necessary to manage a high volume of data, to manage data-sharing between actors and to interface with the public. There are plenty of ICT tools available on the market, but the tools specifically dedicated for pandemics were thought to be lacking. Any new tools have to be developed with proper consideration of health data sharing with the ethical and privacy considerations for data protection integrated "by design".

Crowdsourcing for data on symptoms to bridge the gap between communications and surveillance was recommended, as was guidance about how to communicate during a pandemic or epidemic, with built-in variables and flexibility to allow for unknown pathogens and national/sub-national differences.

A conceptual map of how communications, surveillance and governance all overlap for pandemic preparedness and response, to acknowledge how they all work together is required.

Skills

The competencies to actively incorporate new knowledge and theory about communications into planning and action, from areas such as marketing, behavioural science and other aspects of the social sciences.

The research skills to evaluate communications interventions and build a more solid evidence base, as well as differentiating exactly why and how interventions work.

The skills to interpret technical (e.g. scientific or medical) risk assessment and to appropriately communicate it to the general public, despite uncertainties or expert disagreements.

Training the right people, including spokespeople, in the use of social media and how to deliver effective messages, including communicating uncertainty when appropriate.

Number of staff allocated to communications before and during a pandemic or epidemic has another challenge in this field, and it was highlighted that there is a disparity among EU countries in that some have very limited staff capacity for communications even during a pandemic, let alone in the preparedness phase.

Structures and systems

The research is needed on how to provide the right information to the right users at the right moment. Right actors shall be targeted. Policy-makers, first responders, all other actors – they all have different information needs that have to be taken into account and the delivered information shall be tuned for a particular actor to become efficient.

Contribution to the CoU (Community of Users on Disaster Risk and Crisis Management) in the security field, initiated by DG HOME is important to facilitate communication between various actors, to map all the relevant actors and research, to be sure that the right tools are developed.

A platform on which member states and other relevant parties could share knowledge about preparedness and response, including their plans (which are currently confidential) or simplified versions of the plans, with the aim of developing common approaches to communication where relevant.

A similar system through which research, evaluations and risk assessments could be more widely shared between member states and other relevant bodies, enabling universal access across countries to information and reporting about communications before and during a pandemic or epidemic. This could help to alleviate skills and resource differences between nations, and build on existing work by ECDC and the Health Security Committee.

3.2.4 Conclusions

After presenting an overview of our findings and discussions, the plenary group session with all consortium members and experts raised a series of questions and issues:

- How to involve the private sector in communications response (e.g. telecommunications companies, marketing companies and others).
- The importance of a “bottom-up” approach and the population’s capacity to communicate among themselves and “self-organise” during a crisis.
- The importance of considering the future of communications and the possible role of the “internet of things” was discussed.
- The potential impact of the EU’s data protection reform on the working group’s ideas was also raised.

3.3 Case studies

3.3.1 EU

Context

The most recent communications review by ECDC across countries was in 2006, again influenza focused (ECDC 2007). From the publicly available list, all 28 EU member states have some form of influenza preparedness planning [183]. Of the 28, seven are in English, and only nine have been updated since the H1N1 pandemic in 2009. ECDC has also collated evaluations of pandemic response to H1N1 [184], and provided a basic template for evaluating a response based on older literature from WHO, the US CDC and the Canadian PHAC [185]. This template mentioned communications as an area needing assessment, but the older ECDC pandemic preparedness toolkit referenced contains more detail [186], including a simple checklist of communications functions needed in a pandemic. Despite these provisions, national evaluations from just nine countries in the EEA are listed, representing the typically wealthier European countries.

The independent review of the H1N1 response contained important communications findings [187], including that member states were confused over dual reporting systems EWRS and HEDIS, communication between WHO and the Commission needed to improve, and that messaging between member states (particularly those with shared borders) needed to be better co-ordinated. Communicating with vulnerable groups (e.g. migrants) and monitoring media understanding and accuracy were other gaps pointed out. The vaccine specific review [188] pointed to further needs for co-ordination of messaging timing and content, specific targeting of risk groups and further research into use of social media in this context.

In terms of the International Health Regulations, Europe seems to do better; the WHO reports that 85% of the EURO region has implemented its risk communications core capacity [189], which should mean that countries have or are working to acquire a range of skills, established practices and strategies for using risk communications in outbreak and health emergency settings [7].

Expert profile

We spoke to an expert in risk communications based at a European level office of a global health organisation, with specific experience working with in central and eastern Europe.

Expert comment

GOOD PRACTICE

Emergency risk communications is not specific to outbreaks. The International Health Regulations (IHR) call for development and implementation of multi-hazard plans, including risk communications, to address disease outbreaks, but also natural and environmental disasters.

Responding to recent global health crises, implementing the IHR and preparing for pandemic influenza, have stimulated the need for specialized training in emergency risk communications. 28 countries in the European Region were trained to communicate health risks in emergencies. In addition, we sent a monitoring tool in the context of Zika preparedness, including on emergency risk communications, to all European countries. This has been useful to obtain an overview of strengths and gaps and work with countries to address their needs.

Emergency risk communications works effectively when risk communications capacity is embedded in the response and when you have a national plan developed, tested or implemented and evaluated - these two measures are highly recommended and were the focus of our trainings.

In addition, the emergency risk communications function should be ongoing; this means it should be prepared in time of peace with daily work with technical experts, and be activated in an emergency, including a pandemic. This is starting to happen in Europe, as risk communicators are working with technical experts on a more regular basis. Having established mechanisms for communicating with other sectors and partners, co-ordinating messages and announcements are key to build and maintain trust.

Media relations skills are also essential, and they are improving. European countries are now becoming more open and available to talk to media - more aware that in a globalised world, you need to be ready not only to react to the media, but also to foster relations proactively. However, media are not the only channels of communications: while often communications and media communications are perceived as equal, channels are much more varied and should be selected on a specific basis.

CHALLENGES AND GAPS

Preparedness is a key challenge, since many countries consider that emergency risk communications is reactive. Countries tend to understand the need to communicate in an emergency when they are in the midst of one, but not always beforehand and this often results in lack of prioritization and investments.

Communications is among the first things to go under when finances are tight. Within countries, advocacy should target people in charge of budgets so that they understand the importance of investing in these services for controlling outbreaks and contributing to disaster response. Recent experience of Ebola and Zika is making this obvious.

The multi-hazard approach is also not used enough. Communications plans are often part of pandemic plans, but these are specific in their focus, and don't include chemical, biological, radiological and nuclear (CBRN) hazards. When these plans were made, communications plans followed the original six pandemic phases. Now that these are no longer used, communications plans should instead follow the emergency cycle - from preparedness, start, peak, phase out and recovery. A shift in thought is needed in terms of focus and cycle to make it applicable to wider situations.

Lack of standard operating procedures is another important challenge for timely and transparent communications. It's difficult for international actors to standardise the process of setting these up, since countries differ so much in terms of rules and perceptions. Country assessments are needed for this.

Emergency risk communications cannot be effective if it is not intersectoral, meaning plans be signed off by all relevant actors, but this is really hard. Before an emergency, partnerships are virtual, as often you don't know what kind of partnerships will be needed. How do you do this beforehand and get buy-in? The highest level in the government should lead this process, but again that's not straightforward beforehand.

Listening mechanisms to get an understanding of risk perceptions are very much needed. Many countries don't have this in place, and others have this through media monitoring, social media, and hotlines. However, when it comes to behavioural changes interventions for emergency response, community engagement is key, but this needs experts and tools on the ground.

Finally, the communications function in countries is often at the highest governmental level. Technical people working on the response still sometimes don't talk to communications specialists on a daily basis, which is a challenge.

RESEARCH PRIORITIES
Risk perceptions and community engagement are among the biggest priorities for me.

People initially working on Ebola thought that they could apply the same messages and approaches that worked in other parts of Africa to this disease, but this was not the case. You must listen to the public and be country specific or the communications will fail.

Rapid responses required in an emergency often cause people to overlook risk perceptions and vital information gathering. We need to use rapid simple tools already in place to understand initial risk perceptions. Engaging more with anthropologists and social scientists will be part of improving this.

3.3.2 Canada

Context

Canada has faced several epidemic shocks over the past decade, including SARS and H1N1. They have a recently updated, very detailed pandemic plan available online, with a significant section on risk communications [190]. The plan's role in the H1N1 response was also evaluated [191], finding that communications had improved markedly since SARS, but that more could be done to make sure messaging around vaccines was consistent and to limit the damage of contradictory viewpoints expressed on traditional and social media.

The academic literature indicated that there was less of a skills gap in Canada than elsewhere, but instead gaps lay in co-ordination of messaging and communications relationships between actors [110] [69], and using health professionals as channels for communication [43]. However, these articles were all fairly dated.

Expert profile

We spoke to a public health and risk communications expert, with considerable experience working in this sphere both in Canada and at a global level.

Expert comment

GOOD PRACTICE

Risk perception levels went through the roof at the outset of H1N1. Most of the world was rolling their eyes, but Canada was freaked out. We had a couple of high profile cases – a young hockey player got the disease early on and there was a run on vaccines.

In response, the Health Agency ramped up and had 100 people involved in the communications alone – 3 shifts, 24 hours a day, and it continued for months. Not necessarily best practice, but this gives an idea of the resources needed to engage with a community. You need this kind of resource focus. CDC is probably the only other organisation anywhere that could have resources at that level.

Second, the Canadian public health authorities also used social media to inform people about where/how to get vaccine: tweeting line lengths, real-time processing of people, trying to provide information more efficiently and more effectively. We now have to think about how school boards and schools communicate about kids – these networks are already set up, so we would want to tap into schools and school boards to communicate with parents and communities.

CHALLENGES AND GAPS

We overstate how significant social media is in providing people with health information. Boring old TV and radio are much more significant in terms of who people trust and how they make decisions. People tend to trust these as “voices of authority”.

Overemphasis on social media as a communications vehicle is potentially problematic. Where social media does have significance is that reporters are tracking what’s happening and then run a story. People are still trying to figure social media out, but the data suggests it’s not as significant as we thought it was. Governments can use social media to track rumours and send corrections, but they can’t control messages.

For example, during the H1N1 epidemic in France, high levels of risk perception and lack of certainty in terms of kill rate, government ordered 60 million doses of vaccine, expected high levels of concern. As risk perception dropped, vaccination rate went with it. Messages from the government never changed – said people have to get vaccinated – but they were swimming upstream and by the end they had 5% uptake and risk perception levels dropped off a cliff.

What doesn’t work is trying to tell people what to worry about. What works better is figuring out where people are at and trying to get guidance/statements that might shift them in a small way and see where they are going.

Messaging needs to focus on what really matters to people, not trying to shift that perception.

More generally, through Ebola and also H1N1, there was a mistaken notion that a country or government is controlling the message and that authorities are looked to as key sources of information. Really, narratives just unfold on their own and often the best a country can do is monitor for constructive, positive behaviours and encourage them, not telling people what to do.

Ministers and senior officials still think they can control the message – and they do have to be responsible for what they say – but lower down, people understand that they can't really control or influence.

The listening function is more significant, for example, when it comes to conversations around vaccine hesitancy, where monitoring is the only possible response.

To give Ebola as an example, "official" advice was to look for symptoms and take people to special centres, but in fact we know that people hid their loved ones, and did not bring people to the clinics.

COUNTRY PREPAREDNESS

There is a 3,000 page main plan and then a risk communications Annex 6.4. It's a joint plan between provinces and territories and federal government, which was updated in 2015 [190].

There is a big flu outbreak every year; Canada is a cold country with a big annual flu outbreak, but nobody is worried about pandemic flu now; people are talking about other threats.

From what I understand, the response was really close to the plan. The way they had this 24/7 capacity, daily press conferences, dedicated websites, coordinated calls, etc. All the pieces of the puzzle were in place.

If the plan is good, what happens is that the response unfolds and sometime later you end up finally looking at the plan, it matches. As a result, to many observers, the H1N1 response in Canada was completely over the top compared to the threat.

The plan was also evaluated, and communications was a big part of the senate study of the H1N1 response [191]. There were also internal evaluations done but that was the high-profile one.

Key recommendations from the report included updating and revising the communications section of the pandemic influenza plan, collaborating with sub-national government to clarify

roles and responsibilities, study methods for real time policy communications and harmonised messaging, develop and evaluate social media plan, launch public health campaigns involving social media, define pandemic in terms of disease severity rather than geographical spread, explore how to strengthen two way communications with health providers and establish a communications network for healthcare providers and the national bodies that represent them.

Health Canada commissioned a literature review of what we learned in the last pandemic and there was very little to draw on [192]. Key for the whole thing was that the point at which people were no longer scared shows that the response has been successful.

One big lesson was that if you are disconnected from what people are worrying about, doesn't matter what you communicate because it will be ineffective. In the case of H1N1 people went from "over-reacting" to "under-reacting".

In terms of research at a national level, the concern would be that the government's credibility is weak post-H1N1. I'd be worried that people will roll their eyes next time we start talking about pandemic flu. Research would be useful to better understand that cynicism and the way it might change. But that's hard to do.

You can understand (through opinion surveys etc), trust levels and skepticism levels regarding institutions.

During SARS, the WHO advised against all but essential travel to Canada. The response was regarded as totally chaotic here - not coordinated, high frustration levels were high, and people felt betrayed.

But then there was a second outbreak of SARS – the government had to put in place quarantine and other social-distancing measures to isolate people, and people followed almost completely. So in fact, trust was not broken, despite indications that communications was dysfunctional and trust gone. I'm personally not convinced that trust is directly related to how people view their authorities.

For Canada now in an international context, we're watching Zika response and how actively WHO is communicating the PHEIC. There are things that institutions can do – can reinforce what government wants to do.

Canada's messaging is more impactful if WHO and others are saying "these are the things you should be worried about". Canada has a lot of resources and it's easy to isolate yourself from other people. Things are a lot easier for us in terms of managing pandemic influenza. May not be great at managing response, but we have every advantage.

If WHO issued guidance on response and how to communicate, that would be very useful for countries like Canada and avoid over-promising. Specific international risk communications guidance would be incredibly useful.

RESEARCH PRIORITIES

These events are intensely political, and so involve the most senior politicians. There's an area of research about how decisions get made. Because these events and the communications are also intensely political – that's what they do – there's a gap between the politics and reality. Typically, people put communications to one side but really communications is the operational response. Guidance is our primary tool, and it's really the whole response. How to manage the political reality of communications.

The last pandemic unfolded in slow motion and we all assumed that because of the length of time, researchers would get in and start studying it in real time, but that didn't really happen.

Research also gets out of date so quickly. There was an interesting study on how people get info during emergencies (25 countries, 2012-13), shows that people still trust newspapers, radio, TV more than online/social sources [193]. Has that changed since? H1N1 Harvard study showed radio and TV are the most trusted sources; is it going to be different next time? People trust what their friends and family say, that could include social media (Facebook/Twitter), but unknown or unfamiliar sources are not trusted.

3.3.3 Sweden

Context

Sweden has a planning guide for pandemic communications with a special focus on influenza. It was written in 2012 drawing from the evaluation and experiences from the pandemic in 2009. The plan was last updated in 2015 [194].

An evaluative study looking at the communications response and environment during the 2009 pandemic found that intense media coverage contributed to vaccination rates, though media portrayals were not universally trusted, nor productively investigative [195].

From our literature review, three reviewed articles were also based in Sweden; two reflected on the 2009 H1N1 outbreak and the challenges around vaccination communications, and the confusion and uncertainties that led to vaccine refusals [134] [135]. The other stressed the importance of establishing institutional trust with the public before an outbreak, and releasing information quickly [196].

Expert profile

We spoke to two communications officers working at the Public Health Agency of Sweden who are both involved in current communications planning for outbreaks, knew the communications guidance well and had experience of how the previous plan had worked during the 2009 H1N1 outbreak.

Expert comment

GOOD PRACTICE

National structures for co-ordination of messages and other communications in emergencies was put in place several years before the H1N1 pandemic in 2009, following the avian flu events in the mid-2000s.

The former pandemic communication plan in place at the time involved the above mentioned structures and routines for co-ordination of messages. In that way some of the resources had already been employed and tested before the outbreak in 2009. These elements were further built on and have been preserved since.

Communicators' networks are regularly used among national, regional and local players to respond to issues, such as smaller outbreaks or other crisis situations. Those structures are being tested regularly in everyday activities and through simulation exercises.

CHALLENGES AND GAPS

Most part of the challenges and gaps identified concern detailed knowledge and specific planning to communicate timely and efficiently. These include preparation and procurement of listening functions, such as quick setup of focus groups and surveys – including social listening in traditional and social media. A further challenge is detailed segmentation of target groups, planning of information material and mapping of ways to reach out in collaboration with other players and stakeholders. Planning in advance for enough resources – time, money and human resources - is also essential but difficult activity.

These challenges are identified in our existing pandemic planning guide, but need more attention before, in the beginning and during a pandemic.

COUNTRY PREPAREDNESS

The current pandemic plan provides guidelines for communication in an outbreak situation, and outlines the necessary resources that a good response will need in advance. For example, it points out the importance of early messages, as well as the tools for dialogue that need to be in place immediately.

The current pandemic influenza communication guide has not yet been tested. Later this year, the Public Health Agency of Sweden is going to further revise and develop the pandemic plans including the communication plan.

The aim of the planning guide is to provide an overview of the resources needed for all players involved. The planning guide is one way to co-ordinate communication among the many stakeholders in Sweden, it's a framework for all levels to share. In addition, county and local healthcare providers are responsible for having their own communication plans, as well as are all national authorities.

Also, the Swedish Civil Contingencies Agency can share communications resources with national, regional or local authorities if needed during an emergency.

RESEARCH PRIORITIES

Evaluation and evidence of campaigns and other communication activities, behavioural sciences implemented on risk and crisis communications, and further support from EU and international organisations are our priority areas.

Information sharing and co-ordination. For example, at the moment the European Commission Health Security Committee are sharing information on communication activities on Zika, so we can see what other countries in Europe are doing, how much they are preparing, and if there are new reports or decisions from the EU point of view. This may be particularly important when neighbouring countries come to a decision that is different to what your country has decided.

3.3.4 UK

Context

The current pandemic preparedness plan was released in 2014, sits with Public Health England and is influenza dominated [197]. There is also a strategic framework that goes alongside it

[198]. Communications is mentioned as part of both of these and is a key responsibility of PHE as part of outbreak response, and include operational instructions, mapping of information flow and details of the 24/7 responsibilities of the communications directorate. However, neither of these documents appear to refer to an academic evidence base.

The UK government's H1N1 response was independently evaluated [199], and a chapter was devoted to communications. The overall judgement was that the communications response had been positive in many ways, but that releasing more detailed information, responding more aggressively to inaccuracies, and engaging the public more on social media could have been beneficial. Key recommendations included finding more pro-active ways to engage both media and the public (podcasts, transcripts of media briefings suggested), the Cabinet Office should ensure that its approach is treated as best practice and used again, and that the Department of Health and devolved administrations should consider how best to use professional health bodies for communications.

Similarly, the literature from our review concentrates on H1N1 for UK pandemic communications, finding that it failed to bring about desired preventative behaviour change, and that understanding how to influence action through the media was inadequate [137]. Addressing skepticism was also identified as a key challenge [200].

A priority area for future research was identified as a tool or a plan to measure behaviour and perceptions [19].

Expert profile

We spoke to a UK based expert, with significant experience working in both international outbreak research and with the UK government.

Expert comment

ECDC is outstanding in risk assessments; a real plus for Europe. Within the UK, the Science Media Centre has been a very good way of getting out messages on risks. BBC and others have done a good job at communicating risk, though they can be more sensationalist than I would like. Public Health England also does an excellent job of conducting and sharing risk assessments. One positive UK example is the HAIRS [human-animal infections and risk surveillance] network. Every month, it reviews reports of animal infection evidence from around the world and conducts risk assessment on a "one health platform" of veterinary and human public health experts.

Best practice is to let the press know exactly what is going on and make sure it has fully understood, and make sure they are fully informed. WHO has sometimes been too cautious due to political sensitivities. Other organisations and governments are also known to tailor their communications.

CHALLENGES AND GAPS

Currently, policy makers and public health experts are focused on rapid detection and response while what is needed to prevent human sickness and death, and related economic shocks, is prevention at the source This would often involve prevention measures in animals such as improved hygiene and vaccination. If these interventions cannot be shown to be cost-effective, however, they will not be accepted. The difficulty is that the bottom line is different for human and animal health. In animal health, the bottom line is not only to have healthy animals, but to make a profit as well, and there are therefore financial implications; farmers and producers want and will use only cost-effective interventions.

WHO, FAO and OIE work together on a one health platform to conduct risk assessment on animal infections, and on human zoonotic infections through the Global Early Warning System for Major Animal Diseases, including Zoonoses (GLEWS). This risk assessment provides independent information and advice through these three governmental organisations and their technical staff.

COUNTRY PREPAREDNESS

In the UK the preparedness plan is linked up to COBRA - the cabinet office briefing room - which is politically led. Under the risk communications plan for issues related to health, the Chief Medical Officer has a leading role in risk communications. PHE contributes to the risk communication in the health community and also produces its own independent risk assessment reports.

RESEARCH PRIORITIES

Risk communications is different from day-to-day communications, and often has a technical face other than the usual communicators.

Priority research questions: understanding who communicates most effectively, and how – i.e. whose messages are best understood by the public, and whose messages are best understood by the health community?

3.4 Digital Inventory

3.4.1 Elements from the literature

Overall, digital tools were not often used or mentioned in the academic literature, and when they were it was typically for observation and data gathering rather than engagement. Many were theoretical explorations, or reviews pointing out gaps.

Social media

Content from both Chinese and Western platforms were analysed. Underused for foodborne outbreaks [86], governments are expected to use it but haven't quite adapted their messaging for outbreaks/emergencies [28].

Very early social networking platforms became tools for misinformation during the UK foot and mouth disease outbreak in 2001 [180].

For Ebola, Facebook posts on Ebola had high engagement for the US CDC, which was different for men and women, and had a specific, new audience that was not the organisation's usual one [201].

An analysis of an Instagram and Flickr sample during the 2015 Ebola outbreak sensibly concluded that different platforms operate differently, and that understanding this would be key to getting accurate information to spread socially [55].

A study from Finland showed that governmental trust did not extend to online discussion fora, and that government interventions to try to regain this trust did not work [54].

Social networks - and the authorities' failure to use them - were found to be important for influencing student knowledge of H1N1 [25].

Extracting social media data to feed into surveillance efforts as well as communications was explored favourably by one study, although the challenge of sifting through the data to find the most important information was noted [87].

Another study looked at a social media based intervention to educate and communicate with users in Sri Lanka around dengue outbreaks, concluding that it was most effective on richer, better off participants, highlighting the inequity which affects many social and digital tools [38].

Search engines

Volume of Baidu search queries was used as a proxy for online awareness of H7N9 [154].

Untapped use of Google Trends to identify information needs during Ebola, highlighting high search volumes across West Africa [202], and another study used search engine data to measure public risk perception [166].

Google was a primary route for information seeking in the USA for influenza [37].

A greater understanding of how people search for information as a process could also inform communications interventions to influence preventative behaviours [80].

Websites

Daily web updates were used in the UK during H1N1 by the outbreak communications team to keep the public and other expert parties up to date [103].

Media websites were reported as being used by epidemiologists and other outbreak responders, since proper, verified sources are not as available or as fast [122].

Despite demand from internet searches, one study found a lack of accurate website information about the (non-existent) efficacy of natural supplements against H1N1 [203]. This type of search indicates the need for search trends to be monitored by authorities to provide users with accurate information, not just about the most obvious topics relating to the outbreak.

Interactive potential from websites that ask internet users to enter their symptoms exist, but haven't been tested in outbreak settings [80].

Email

Email had been used so EU operational partners can communicate with each other easily since the late 1990s [204] [205].

Mobile technology

SMS spread rumours and initial unofficial news of SARS in China [206], which shows it to be a technology with power for negative and positive results in a pandemic setting.

In conjunction with other channels, officials in Taipei successfully used SMS messages sent to 2.2 million residents to contain an outbreak of acute hemorrhagic conjunctivitis by asking parents to

keep school age children at home [58]. This was enabled by a law that allowed the government to overrule individual right to privacy during a health emergency, and also by government partnerships with telecomm providers in the area.

Computer modelling

Modelling and computer simulation was used to input the effects of media intervention at various stages of an epidemic, concluding that early intervention could be effective, but if started late, then reporting current data rather than historical disease data could be more useful in reducing prevalence [171].

3.4.2 Expert verdicts

All experts interviewed for case studies acknowledged that there is a role for social media and digital tools in outbreak communications. However, the EU and UK perspectives stressed that these were just another channel through which to work. Canada and Sweden saw them as important to know more about and explicitly single out for further research and planning.

3.4.3 Broader communications context

The PANDEM project was asked to pay particular attention to digital and social communications, given their novel and ever changing nature. What has become clear, however, in the course of the review is that this is one channel in a landscape where gaps are numerous. While social and digital media certainly deserve acknowledgement as important parts of any future communications response to the next pandemic or epidemic, especially when it comes to engaging with the private sector, many of the challenges that stand in the way of this are not unique to this platform.

3.5 Similar Projects

Being aware of these recent project allows us to contextualise our findings, and ensure recommendations build on existing knowledge as best they can.

FoodRisC, 2010-13

This project aimed to produce a toolkit for policymakers, food authorities and others to aid food communication and to improve public understanding in this area [207]. Researchers gathered new evidence on the challenges of communicating the risks and benefits of food and preventing spread of misleading information across social media, consumer responses to uncertainty, information seeking and deliberation.

Primary conclusions [208] included that there was a limited window during which to communicate with consumers on social media, and that consumers most often started with search engines when considering food risk, although channels and depth of research varied by country. The project also developed an online tool called 'Vizzata' to help understand consumer deliberation, as well as a six step strategy for communicating risks and benefits related to food.

CommHERE, 2011-14

CommHERE (Communication of European Health Research) focused on methods to improve communication of EU funded health research to the media and general public. Project partners conducted a baseline survey to establish best practice and then proceeded to cultivate local networks, use social media, establish a website for the public (HorizonHealth.eu), conduct outreach sessions at conferences, mentor EU research projects and engage journalists in scientific tours in order to communicate research [209].

The final evaluation showed mentoring, local networking and outreach at conferences to be particularly effective, and presented some guidelines for strengthened research communications based on this. However, findings did not clearly differentiate between audiences or contexts, so the reasons for this effectiveness and its transferability across different health research topics are not certain. In addition, the project's evaluations were written chiefly from the perspective of the research projects rather than the public, media representatives or other recipients of the research information, which may limit their broader usability [210].

ECOM, 2012-2016

This project was funded by the EU Seventh Framework to compile an evidence based communications package for use in major outbreaks. Taking the H1N1 outbreak in 2009 as a case study, headline findings included that media attention peaked before the height of the epidemic, decision-making communications needed to include emotional appeals, risk perception evolves over time and must be monitored, health care professionals should promote pandemic vaccines, and under-vaccinated groups had distinct needs that should be addressed before the next pandemic [211].

Tools like apps and infographics were developed based on these findings, including a standardised risk perception questionnaire [212], and a guide to designing a choice experiment around vaccinations [213], to both help measure public opinion during an epidemic. These are interesting tools whose usage does not seem to have been evaluated at present, but which we will bear in mind if we consider broader ways of measuring public perceptions.

TELL ME, 2012-15

This project aimed to provide evidence and develop models for improved risk communication during infectious disease crises [214].

Considering population behaviour in epidemics, they concluded that selecting communications channels and legitimate spokespeople, targeting specific audiences, and including behaviour change and social mobilisation in the response were key [215].

In a review of outbreak communications challenges they named its “main challenge” as “successfully identifying new methods that help us answer the communication requirements of diverse groups of stakeholders” [216].

To answer these issues, they proposed a framework model [217], which in its basic form looked like this:

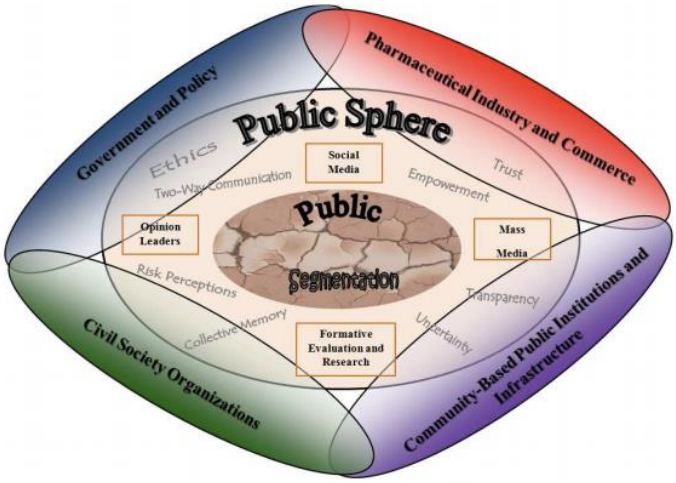


Figure 5. Proposed Framework Model (TELL ME) [217]

While this model combined important concepts and theories, and was also mapped onto different outbreak stages by TELL ME authors, its practical use for planning and response still seems unclear.

Another solution was the guidance document to help health agencies boost influenza vaccine uptake by health workers [218]. This rightfully acknowledged the importance of local research, considering gaps in the evidence, lessons from H1N1 and information sources of health workers. A specific practical strategy based on ethos, pathos and a participative approach, involving refinement and testing.

Finally, the project proposed that three risk indices be combined into one pandemic threat index and designed a simulation software to train and assist communications managers in planning for outbreaks [219] [220]. These two outputs will be particularly important when considering research questions and what has already been tried.

INfluENCE, 2013 –2015

This project was funded by the Department of Health in the UK, and aimed to examine the factors behind pandemic vaccine uptake and the communications consequences on the back of the 2009 H1N1 pandemic [221].

One of the key publications from this project was captured in the literature review [200]. Two further relevant articles were published after the searching dates; one concluded that communications targeting females, those without longstanding illness, who had not previously had seasonal flu vaccination, or skeptics could be useful [222]. The other indicated the broad value of examining Twitter as a barometer for public concerns about pandemic vaccinations [223].

PHEME, 2014-2017

PHEME has set out to address the challenge of veracity in social media, though it is not outbreak specific [224]. It is also funded by the EU's Seventh Framework Programme.

A system to detect and classify rumours on social media is currently in development [225]. We will watch how it develops closely, given that these kinds of tools were directly called for in some of the reviewed literature [95] [156].

ASSET, 2014-2018

This is an ongoing project funded by the EC's Seventh Framework Programme, which aims to address scientific and societal challenges raised by pandemics and explore and map related SiS-issues [226]. The deliverables are not yet completed, but we will monitor their progress for relevance as PANDEM goes forward.

3.6 Summary

There are several projects, both past and present, which overlap with PANDEM's remit on the communications side. However, none of them have taken as broad and structural a view of the communications landscape as we have done here. By continuing to be aware of their findings

and developments, we can ensure that our proposals for future research are as informed as possible.

4 Conclusions

4.1 Overview

Communications is a critical part of outbreak preparedness and response, and comes in many forms. When done well, it is a vital part of controlling the spread of a pandemic or epidemic. Good practice to help this work includes the ability to transfer skilled staff, early and real-time intervention, transparency, national planning with an embedded risk communications function, investing in communications resources before a pandemic, and using consistent messaging across multiple channels.

However, the evidence for how each of these interventions works best is of generally low quality and contains many gaps. A major area for improvement is skills; in practice, communications theories were found to not be as well understood or consistently applied as they could be. We acknowledge that international guidance does exist (for example risk communications resources from WHO), but the fact that they were very rarely mentioned in our sources indicates that they may not be widely used.

The urgent need for monitoring and evaluation tools was articulated from all quarters, covering the ability to measure risk perception, trust and other variables as well as to test the link between communications and behavioural outcomes. This was accepted as requiring a significant amount of planning and message testing before an outbreak. Without these, the impact and effectiveness of communications responses are difficult to assess on a large scale, which in turn may limit communications professionals from lobbying for and accessing the resources they need an adequate response.

Social media and digital platforms were highlighted as significant for their novelty, the skills gaps that still exist among communicators and the failure of most examples to use this channel with risk communications principles. However, the importance of selecting the right channels for specific audiences was also stressed, meaning we should be careful about giving them too much significance at the expense of a reasoned, targeted communications strategy that uses context specific information.

The expert sources generally backed up the literature, stressing the importance of evidence and evaluation, monitoring and feedback loops, and significant, pre-allocated resources for pandemic and epidemic communications. Other key points they raised were the importance of listening for communications (and the possibilities that social media offered to help with this) and the challenge of a better, more open network or system for countries to share information, best practice and guidance both before and during pandemic situations.

The literature also indicated a strong need to adapt communications according to a wide range of variables, including specific national and sub-national populations and points of time during the outbreak. However, there was very little evidence of how this might be done and how successful it would be.

A consistent challenge for this review and for outbreak communications in practice is the generally poor level of evidence. While the volume of studies was reasonably high, their retrospective nature made understanding how and why communications worked or didn't very difficult. This was not aided by the regular homogenisation of populations within countries and across them. To some extent this could be addressed by more intervention studies, but these would have to be conducted and added to the evidence base with the understanding that what works in one population may not work in another. A key part of addressing this challenge may also be found in funding research when there is no pandemic or epidemic occurring, allowing baselines to be established and prospective, structured intervention studies to be conducted outside the pressure and panic of a real outbreak situation.

Pandemics and epidemics are by their nature geographically spread, yet it should be noted that the number of regional and global studies were vastly outstripped by those with a national focus. It was also especially worrying that such a small number of studies looked at lower income countries, since both inside and outside of the EU, these are likely to be sources of future pandemic and epidemic spread.

Our conclusions do touch on previous and current research projects. However, our perspective is broader, spanning the full range of communications activities at global, regional and national levels. Our proposed research questions reflect this, providing a range of options for future directions and highlighting the substantial need for more, higher quality evidence in this area.

Given the large scale of these challenges, the European Commission, its departments and EU member states are well suited to taking the lead in addressing them through targeted, high

quality research tailored for practical use, tackling the range of topics listed in the questions below.

4.2 Range of proposed Research Questions

GLOBAL

- How can pandemic and epidemic communications better achieve behaviour change? How can existing behavioural science knowledge be operationalised in this context?
- What tools can help countries, governments and organisations adapt global communications guidance and information most effectively for their audiences?
- What networks or collaboration techniques can help experts around the world develop messaging that is clear, consistent and not confusing?
- What incentives, structures or systems are needed to develop a higher quality of research and evidence base for outbreak communications around the world?
- What are the competing political, technical, policy and legal pressures on decision-makers in the event of a pandemic? How can these be better balanced with communications needs at global, regional and national levels?
- How countries be encouraged to listen as part of their communications efforts, and incorporate what they hear into their response? What tools could help with this?
- What systems could be created or built on to allow those working on communications for pandemic planning and response to share good practice, national plans and information before, during and after an outbreak?

EU AND OTHER REGIONS

- How can more regional stress testing for communications during outbreaks be encouraged, monitored, evaluated and learned from?
- How can regional networks aid country communications staff by sharing updates and regional rationales for country decision making, so they can better anticipate, understand and align messaging with neighbouring countries?

NATIONAL

- How can outbreak communications preparedness plans be ensured across all countries?
- What is needed to help governments and response partners understand and implement the principles of risk communications?
- How can social and digital media be used to engage the public in line with risk communications principles?
- How can training or other interventions help spokespeople and governments become comfortable with communicating uncertainty?

- How can health care workers be prioritised as part of the communications response, both in terms of targeting them for vaccination and helping them communicate with patients?
- How can information needed to communicate effectively during a pandemic or epidemic be collected before it happens?
- What is needed to help countries pre-test messaging most effectively?
- What tools can be developed to help countries monitor risk perceptions and use them to feedback into communications activities during an outbreak?
- What training, tools or structures can help governments engage early and more effectively with the media?
- How can health workers be better trained and involved to be part of outbreak communications response and preparedness?

References

1. Potter, C. and R. Brough, Systemic capacity building: a hierarchy of needs. Health Policy and Planning, 2004. 19(5).

2. Last, J., Pandemic, in A dictionary of epidemiology, J. Last, Editor. 2001, Oxford University Press: Oxford.

3. World Health Organisation. Humanitarian Health Action: Definitions: emergencies. 2015 [cited 2015 2nd November]; Available from: http://www.who.int/hac/about/definitions/en/.

4. European Union. EU member countries. 2015 [cited 2015 2nd November]; Available from: http://europa.eu/about-eu/countries/member-countries/index_en.htm.

5. THE EUROPEAN PARLIAMENT AND THE COUNCIL OF THE EUROPEAN UNION, DECISION No 1082/2013/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL, THE EUROPEAN PARLIAMENT AND THE COUNCIL OF THE EUROPEAN UNION, Editor. 2013: Official Journal of the European Union.

6. DG SANCO, COMMISSION STAFF WORKING DOCUMENT on communicating with the public and the media on Pandemic (H1N1) 2009. 2009.

7. World Health Organization. International Health Regulations implementation: Ensuring effective responses to public health emergencies: strengthening risk communication capacities of national systems. 2007 [cited 2016 19 May]; Available from: http://www.who.int/ihr/about/07_risk_communication.pdf.

8. Glik, D.C., Risk Communication for Public Health Emergencies. Annual Review of Public Health, 2007. 28: p. 33–54.

9. Sandman, P.M., Risk Communication, in Encyclopedia of the Environment, R.A. Eblen and W.R. Eblen, Editors. 1994, Houghton Mifflin: Boston, MA. p. 620–623.

10. Infanti, J., et al., A literature review on effective risk communication for the prevention and control of communicable diseases in Europe. 2013, ECDC: Stockholm.

11. Covello, V.T., et al., Risk Communication, the West Nile Virus Epidemic, and Bioterrorism: Responding to the Communication Challenges Posed by the IntentionalorUnintentionalReleaseofa Pathogen in an Urban Setting. Journal of Urban Health: Bulletin of the NewYork Academy of Medicine, 2001. Vol.78, No.2: p. 382-391.

12. McInnes, C., Health, security and risk society, in NUFFIELD TRUST GLOBAL PROGRAMME ON HEALTH, FOREIGN POLICY AND SECURITY. 2005, The Nuffield Trust.

13. Durodié, B., The Concept of Risk, in NUFFIELD TRUST GLOBAL PROGRAMME ON HEALTH, FOREIGN POLICY AND SECURITY. 2006, The Nuffield Trust.

14. Sandman, P.M., Four Kinds of Risk Communication. 2003.

15. Gough, D., Weight of Evidence: a framework for the appraisal of the quality and relevance of evidence. Research Papers in Education, 2007. 22(2): p. 213-228.

16. Research Randomizer. Generate Numbers. 2016 [cited 2016 11 June]; Available from: https://www.randomizer.org/.

17. Higgins JPT, A.D., Sterne JAC, Chapter 8: Assessing risk of bias in included studies., in Cochrane Handbook for Systematic Reviews of Interventions Version 5.1.0 (updated March 2011), G.S. Higgins JPT, Editor. 2011, The Cochrane Collaboration.

18. Savoia, E., L. Lin, and K. Viswanath, COMMUNICATIONS IN PUBLIC HEALTH EMERGENCY PREPAREDNESS: A SYSTEMATIC REVIEW OF THE LITERATURE. Biosecurity and Bioterrorism-Biodefense Strategy Practice and Science, 2013. 11(3): p. 170-184.

19. Rubin, G.J., et al., The design of a survey questionnaire to measure perceptions and behaviour during an influenza pandemic: the Flu TElephone Survey Template (FluTEST). 2014.

20. Teasdale, E., et al., Public perceptions of non-pharmaceutical interventions for reducing transmission of respiratory infection: systematic review and synthesis of qualitative studies. Bmc Public Health, 2014. 14.

21. Klemm, C., E. Das, and T. Hartmann, Swine flu and hype: a systematic review of media dramatization of the H1N1 influenza pandemic. Journal of Risk Research, 2016. 19(1): p. 1-20.

22. Prematunge, C., et al., Factors influencing pandemic influenza vaccination of healthcare workers-A systematic review. Vaccine, 2012. 30(32): p. 4733-4743.

23. Davis, M.D., et al., Beyond resistance: social factors in the general public response to pandemic influenza. BMC Public Health, 2015. 15: p. 436.

24. Brandt, C., et al., The impact of the 2009 influenza A(H1N1) pandemic on attitudes of healthcare workers toward seasonal influenza vaccination 2010/11. Euro Surveill, 2011. 16(17).

25. Wilson, S.L. and K. Huttlinger, Pandemic flu knowledge among dormitory housed university students: a need for informal social support and social networking strategies. Rural Remote Health, 2010. 10(4): p. 1526.

26. Bouye, K., et al., Pandemic Influenza Preparedness and Response Among Public-Housing Residents, Single-Parent Families, and Low-Income Populations. American Journal of Public Health, 2009. 99: p. S287-S293.

27. Voeten, H.A., et al., Sources of information and health beliefs related to SARS and avian influenza among Chinese communities in the United Kingdom and The Netherlands, compared to the general population in these countries. Int J Behav Med, 2009. 16(1): p. 49-57.

28. Freimuth, V.S., et al., Trust during the early stages of the 2009 H1N1 pandemic. J Health Commun, 2014. 19(3): p. 321-39.

29. Lee, C., W.A. Rogers, and A. Braunack-Mayer, Social Justice and Pandemic Influenza Planning: The Role of Communication Strategies. Public Health Ethics, 2008. 1(3): p. 223-234.

30. Liu, M.D., et al., Changing risk awareness and personal protection measures for low to high pathogenic avian influenza in live-poultry markets in Taiwan, 2007 to 2012. BMC Infectious Diseases, 2015. 15(1).

31. Erdozain, G., et al., Observation of Public Health Risk Behaviours, Risk Communication and Hand Hygiene at Kansas and Missouri Petting - Zoos 2010-2011. Zoonoses and Public Health, 2013. 60(4): p. 304-310.

32. Chapman, B., T. MacLaurin, and D. Powell, Food safety infosheets Design and refinement of a narrative-based training intervention. British Food Journal, 2011. 113(2-3): p. 160-186.

33. Jung, M., M. Choi, and T.-R. Lee, Determinants of Public Phobia About Infectious Diseases in South Korea: Effect of Health Communication and Gender Difference. Asia-Pacific Journal of Public Health, 2015. 27(2): p. NP833-NP843.

34. Akis, S., et al., Factors associated with parental acceptance and refusal of pandemic influenza A/H1N1 vaccine in Turkey. Eur J Pediatr, 2011. 170(9): p. 1165-72.

35. Santibanez, T.A., et al., Socio-demographic differences in opinions about 2009 pandemic influenza A (H1N1) and seasonal influenza vaccination and disease among adults during the 2009-2010 influenza season. Influenza Other Respir Viruses, 2013. 7(3): p. 383-92.

36. Casman, E.A. and B. Fischhoff, Risk communication planning for the aftermath of a plague bioattack. Risk Analysis, 2008. 28(5): p. 1327-1342.

37. Janssen, A.P., et al., "Why tell me now?" the public and healthcare providers weigh in on pandemic influenza messages. J Public Health Manag Pract, 2006. 12(4): p. 388-94.

38. Lwin, M.O., et al., Social media-based civic engagement solutions for dengue prevention in Sri Lanka: results of receptivity assessment. Health Educ Res, 2015.

39. Baseman, J., et al. Public health communications and alert fatigue. BMC health services research, 2013. 13, 295 DOI: 10.1186/1472-6963-13-295.

40. Chambers, L.W., et al., Randomized trial of the impact of the Ottawa influenza decision aid on healthcare personnel confidence to be immunized. Canadian Journal of Infectious Diseases and Medical Microbiology, 2010. 21(4): p. 212.

41. Johnson, B.B. and P. Slovic, Fearing or fearsome Ebola communication? Keeping the public in the dark about possible post-21-day symptoms and infectiousness could backfire. Health, Risk and Society, 2015. 17(5-6): p. 458-471.

42. Lohiniva, A.L., et al., A qualitative study of vaccine acceptability and decision making among pregnant women in Morocco during the A (H1N1) pdm09 pandemic. PLoS One, 2014. 9(10): p. e96244.

43. Blendon, R.J., et al., The public's response to severe acute respiratory syndrome in Toronto and the United States. Clin Infect Dis, 2004. 38(7): p. 925-31.

44. Bitsch, V., N. Kokovic, and M. Rombach, Risk Communication and Market Effects during Foodborne Illnesses: A Comparative Case Study of Bacterial Outbreaks in the US and in Germany. International Food and Agribusiness Management Review, 2014. 17(3): p. 97-114.

45. Figuie, M. and T. Fournier, Avian influenza in Vietnam: chicken-hearted consumers? Risk Anal, 2008. 28(2): p. 441-51.

46. Hiam, R., C. Guest, and G. Isaac-Toua, An evaluation of public health interventions during a pertussis outbreak in the ACT, 2003. Aust N Z J Public Health, 2005. 29(6): p. 552-4.

47. Wøien, G. and K.I. Tonsberg, Norwegians approve of the health authorities' strategy to communicate worst case pandemic scenarios. Euro surveillance : bulletin européen sur les maladies transmissibles = European communicable disease bulletin, 2009. 14(22).

48. van der Weerd, W., et al., Monitoring the level of government trust, risk perception and intention of the general public to adopt protective measures during the influenza A (H1N1) pandemic in the Netherlands. Bmc Public Health, 2011. 11.

49. Featherstone, R.M., et al., Provision of pandemic disease information by health sciences librarians: a multisite comparative case series. J Med Libr Assoc, 2012. 100(2): p. 104-12.

50. Chanel, O., et al., Impact of information on intentions to vaccinate in a potential epidemic: Swine-origin Influenza A (H1N1). Soc Sci Med, 2011. 72(2): p. 142-8.

51. Kim, S. and B.F. Liu, Are All Crises Opportunities? A Comparison of How Corporate and Government Organizations Responded to the 2009 Flu Pandemic. Journal of Public Relations Research, 2012. 24(1): p. 69-85.

52. Mizuno, Y., et al., Structural problems of medical news reports in newspapers: a verification of news reports on an incident of mass nosocomial Serratia infection. J Infect Chemother, 2010. 16(2): p. 107-12.

53. Turner, N.M., D.G. York, and H.A. Petousis-Harris, The use and misuse of media headlines: lessons from the MeNZB immunisation campaign. The New Zealand medical journal, 2009. 122(1291): p. 22-7.

54. Tirkkonen, P. and V. Luoma-aho, Online authority communication during an epidemic: A Finnish example. Public Relations Review, 2011. 37(2): p. 172-174.

55. Seltzer, E.K., et al., The content of social media's shared images about Ebola: a retrospective study. Public Health, 2015. 129(9): p. 1273-1277.

56. Nelissen, S., et al., The swine flu emergency department: the relationship between media attention for the swine flu and registrations in an emergency medicine unit. Prehosp Disaster Med, 2014. 29(2): p. 141-5.

57. Duncan, B., How the media reported the first days of the pandemic (H1N1) 2009: results of EU-wide media analysis. Euro Surveill, 2009. 14(30): p. 19286.

58. Yen, M.Y., et al., Taipei's use of a multi-channel mass risk communication program to rapidly reverse an epidemic of highly communicable disease. PLoS ONE, 2009. 4(11).

59. Kiss, I.Z., et al., The impact of information transmission on epidemic outbreaks. Math Biosci, 2010. 225(1): p. 1-10.

60. Bond, L. and T. Nolan, Making sense of perceptions of risk of diseases and vaccinations: a qualitative study combining models of health beliefs, decision-making and risk perception. Bmc Public Health, 2011. 11.

61. Sjöberg, E., et al., Social media and its dual use in biopreparedness: Communication and visualization tools in an animal bioterrorism incident. Biosecurity and Bioterrorism, 2013. 11(SUPPL. 1): p. S264-S275.

62. Schemann, K., et al., Perceptions of vulnerability to a future outbreak: a study of horse managers affected by the first Australian equine influenza outbreak. BMC Vet Res, 2013. 9: p. 152.

63. Yang, Z.J., Altruism During Ebola: Risk Perception, Issue Salience, Cultural Cognition, and Information Processing. Risk Anal, 2015.

64. de Zwart, O., et al., Perceived threat, risk perception, and efficacy beliefs related to SARS and other (emerging) infectious diseases: results of an international survey. Int J Behav Med, 2009. 16(1): p. 30-40.

65. Walter, D., et al., Risk perception and information-seeking behaviour during the 2009/10 influenza A(H1N1)pdm09 pandemic in Germany. Euro Surveill, 2012. 17(13).

66. Hansen, K.F., Approaching doomsday: how SARS was presented in the Norwegian media. Journal of Risk Research, 2009. 12(3-4): p. 345-360.

67. Jhao, W.S., et al., A survey in Taiwan 2009 for the public perception and the willingness to be vaccinated of pandemic influenza A(H1N1). International Journal of Infectious Diseases, 2010. 14: p. e97.

68. Cawkwell, P.B. and D. Oshinsky, Storytelling in the context of vaccine refusal: a strategy to improve communication and immunisation. Med Humanit, 2015.

69. D'Cunha, C., SARS: Lessons learned from a provincial perspective. Canadian Journal of Public Health, 2004. 95(1): p. 25-26.

70. Cava, M.A., et al., Risk perception and compliance with quarantine during the SARS outbreak. Journal of Nursing Scholarship, 2005. 37(4): p. 343-347.

71. Brug, J., et al., SARS risk perception, knowledge, precautions, and information sources, the Netherlands. Emerging Infectious Diseases, 2004. 10(8): p. 1486-1489.

72. Hernandez-Jover, M., K. Schemann, and J.-A.L.M.L. Toribio, A cross-sectional study on biosecurity practices and communication networks of poultry exhibition in Australia. Preventive Veterinary Medicine, 2013. 110(3-4): p. 497-509.

73. Holmes, B.J., et al., Communicating with the public during health crises: experts' experiences and opinions. Journal of Risk Research, 2009. 12(6): p. 793-807.

74. Cavey, A.M., et al., Mississippi's infectious disease hotline: a surveillance and education model for future disasters. Prehosp Disaster Med, 2009. 24(1): p. 11-7.

75. Rogers, W.A., et al., Pandemic influenza communication: views from a deliberative forum. Health Expect, 2009. 12(3): p. 331-42.

76. Gesser-Edelsburg, A., et al., What does the public know about Ebola? The public's risk perceptions regarding the current Ebola outbreak in an as-yet unaffected country. Am J Infect Control, 2015. 43(7): p. 669-75.

77. Williams, S., et al., The challenges of global case reporting during pandemic A(H1N1) 2009. Bulletin of the World Health Organization, 2014. 92(1): p. 60-67.

78. Osterhaus, A.D. and C. Vanlangendonck, Stakeholder dialogue, broadening of support and use of communication: an integrated and integral part of influenza preparedness. Vaccine, 2009. 27(45): p. 6390-1.

79. Norgaard, O. and J.V. Lazarus, Searching PubMed during a pandemic. PLoS One, 2010. 5(4): p. e10039.

80. Eysenbach, G., Infodemiology and infoveillance: framework for an emerging set of public health informatics methods to analyze search, communication and publication behavior on the Internet, in J Med Internet Res. 2009: United States. p. e11.

81. Busby, J. and D. Duckett, Social risk amplification as an attribution: the case of zoonotic disease outbreaks. Journal of Risk Research, 2012. 15(9): p. 1049-1074.

82. Abraham, T., Risk and outbreak communication: Lessons from alternative paradigms. Bulletin of the World Health Organization, 2009. 87(8): p. 604-607.

83. Abraham, T., Lessons from the pandemic: the need for new tools for risk and outbreak communication. Emerg Health Threats J, 2011. 4: p. 7160.

84. Durodie, B., H1N1-the social costs of elite confusion. Journal of Risk Research, 2011. 14(5): p. 511-518.

85. Lewison, G., The reporting of the risks from severe acute respiratory syndrome (SARS) in the news media, 2003-2004. Health Risk & Society, 2008. 10(3): p. 241-262.

86. Chapman, B., B. Raymond, and D. Powell, Potential of social media as a tool to combat foodborne illness. Perspectives in Public Health, 2014. 134(4): p. 225-230.

87. Bernardo, T.M., et al., Scoping Review on Search Queries and Social Media for Disease Surveillance: A Chronology of Innovation. Journal of Medical Internet Research, 2013. 15(7): p. 239-251.

88. Shapovalova, N., et al., WHO public health research agenda for influenza: tools for strategic communication during pandemic and inter-pandemic periods. Influenza and Other Respiratory Viruses, 2011. 5: p. 266-268.

89. Doshi, P., The elusive definition of pandemic influenza. Bull World Health Organ, 2011. 89(7): p. 532-8.

90. Cairns, G., M. de Andrade, and L. MacDonald, Reputation, Relationships, Risk Communication, and the Role of Trust in the Prevention and Control of Communicable Disease: A Review. Journal of Health Communication, 2013. 18(12): p. 1550-1565.

91. Dausey, D.J. and M. Moore, Using exercises to improve public health preparedness in Asia, the Middle East and Africa. BMC Res Notes, 2014. 7: p. 474.

92. Hanquet, G., et al., Lessons learnt from pandemic A(H1N1) 2009 influenza vaccination. Highlights of a European workshop in Brussels (22 March 2010), in Vaccine. 2011, Copyright (c) 2010. Published by Elsevier Ltd.. All rights reserved.: Netherlands. p. 370-7.

93. Carrillo-Santisteve, P. and P.L. Lopalco, Measles still spreads in Europe: Who is responsible for the failure to vaccinate? Clinical Microbiology and Infection, 2012. 18(SUPPL. 5): p. 50-56.

94. Schiavo, R., M. May Leung, and M. Brown, Communicating risk and promoting disease mitigation measures in epidemics and emerging disease settings. Pathog Glob Health, 2014. 108(2): p. 76-94.

95. Samaan, G., et al., Rumor surveillance and avian influenza H5N1. Emerg Infect Dis, 2005. 11(3): p. 463-6.

96. Blasi, F., et al., Healthcare workers and influenza vaccination: an ERS-ESCMID Web-based survey. Clin Microbiol Infect, 2011. 17(8): p. 1223-5.

97. Fearnley, E. and L. Ailan, International Health Regulations (2005): public health event communications in the Western Pacific Region. Western Pacific surveillance and response journal : WPSAR, 2013. 4(3): p. 26-7.

98. Duggan, F. and L. Banwell, Constructing a model of effective information dissemination in a crisis. Information Research-an International Electronic Journal, 2004. 9(3).

99. van Velsen, L., et al., Public knowledge and preventive behavior during a large-scale Salmonella outbreak: results from an online survey in the Netherlands. Bmc Public Health, 2014. 14.

100. Bults, M., et al., Q fever in the Netherlands: public perceptions and behavioral responses in three different epidemiological regions: a follow-up study. Bmc Public Health, 2014. 14.

101. Bults, M., et al., Pandemic influenza A (H1N1) vaccination in The Netherlands: Parental reasoning underlying child vaccination choices. Vaccine, 2011. 29(37): p. 6226-6235.

102. Vartti, A.M., et al., SARS knowledge, perceptions, and behaviors: a comparison between Finns and the Dutch during the SARS outbreak in 2003. Int J Behav Med, 2009. 16(1): p. 41-8.

103. Cleary, V., et al., Pandemic (H1N1) 2009: setting up a multi-agency regional response centre--a toolkit for other public health emergencies. J Bus Contin Emer Plan, 2010. 4(2): p. 154-64.

104. Mandeville, K.L., et al., Academics and competing interests in H1N1 influenza media reporting. J Epidemiol Community Health, 2014. 68(3): p. 197-203.

105. Bocquet, J., T. Winzenberg, and K.A. Shaw, Epicentre of influenza - the primary care experience in Melbourne, Victoria. Aust Fam Physician, 2010. 39(5): p. 313-6.

106. Holland, K., et al., Risk, expert uncertainty, and Australian news media: public and private faces of expert opinion during the 2009 swine flu pandemic. Journal of Risk Research, 2012. 15(6): p. 657-671.

107. Jones, S.C., et al., Developing pandemic communication strategies: Preparation without panic. Journal of Business Research, 2010. 63(2): p. 126-132.

108. Jhummon-Mahadnac, N.D., J. Knott, and C. Marshall, A cross-sectional study of pandemic influenza health literacy and the effect of a public health campaign. BMC Res Notes, 2012. 5: p. 377.

109. Elliott, S.J., et al., Heeding the message? Determainants of risk behaviours for West Nile virus. Canadian Journal of Public Health-Revue Canadienne De Sante Publique, 2008. 99(2): p. 137-141.

110. DiGiovanni, C., et al., Factors influencing compliance with quarantine in Toronto during the 2003 SARS outbreak. Biosecurity and Bioterrorism-Biodefense Strategy Practice and Science, 2004. 2(4): p. 265-272.

111. Doxtator, L.A., C.E. Gardner, and J.M. Medves, Responding to pandemic influenza: a local perspective. Can J Public Health, 2004. 95(1): p. 27-31.

112. Yan, Q., et al., Media coverage and hospital notifications: Correlation analysis and optimal media impact duration to manage a pandemic. Journal of Theoretical Biology, 2016. 390: p. 1-13.

113. Zhang, E.X., et al., Leveraging social networking sites for disease surveillance and public sensing: the case of the 2013 avian influenza A(H7N9) outbreak in China. Western Pac Surveill Response J, 2015. 6(2): p. 66-72.

114. Lau, J.T., et al., Widespread public misconception in the early phase of the H1N1 influenza epidemic. J Infect, 2009. 59(2): p. 122-7.

115. Funk, S., et al., The spread of awareness and its impact on epidemic outbreaks. Proc Natl Acad Sci U S A, 2009. 106(16): p. 6872-7.

116. Hsu, J.L., et al., Consumer knowledge and risk perceptions of avian influenza. Poult Sci, 2008. 87(8): p. 1526-34.

117. Green, M.S., et al., When is an epidemic an epidemic? Isr Med Assoc J, 2002. 4(1): p. 3-6.

118. Steelfisher, G., et al., PUBLIC PERCEPTIONS OF FOOD RECALLS AND PRODUCTION SAFETY: TWO SURVEYS OF THE AMERICAN PUBLIC. Journal of Food Safety, 2010. 30(4): p. 848-866.

119. Friedman, D.B., M. Tanwar, and J.V. Richter, Evaluation of online disaster and emergency preparedness resources. Prehosp Disaster Med, 2008. 23(5): p. 438-46.

120. Reynolds, B. and S. Quinn Crouse, Effective communication during an influenza pandemic: the value of using a crisis and emergency risk communication framework, in Health Promot Pract. 2008: United States. p. 13s-17s.

121. M'Ikanatha N, M., et al., Use of the internet to enhance infectious disease surveillance and outbreak investigation. Biosecur Bioterror, 2006. 4(3): p. 293-300.

122. M'Ikanatha N, M., et al., Sources of bioterrorism information among emergency physicians during the 2001 anthrax outbreak. Biosecur Bioterror, 2003. 1(4): p. 259-65.

123. Hutchins, S.S., et al., Protection of racial/ethnic minority populations during an influenza pandemic. American Journal of Public Health, 2009. 99(SUPPL. 2): p. S261-S270.

124. Fischhoff, B. and J.S. Downs, Communicating foodborne disease risk. Emerg Infect Dis, 1997. 3(4): p. 489-95.

125. Longstaff, P.H. and S.-U. Yang, Communication Management and Trust: Their Role in Building Resilience to "Surprises" Such As Natural Disasters, Pandemic Flu, and Terrorism. Ecology and Society, 2008. 13(1).

126. Fu, C., T. Roberton, and G. Burnham, Community-based social mobilization and communications strategies utilized in the 2014 West Africa Ebola outbreak. Annals of Global Health, 2015. 81(1): p. 126-127.

127. Einarsdottir, J., A. Passa, and G. Gunnlaugsson, Health education and cholera in rural Guinea-bissau. Int J Infect Dis, 2001. 5(3): p. 133-8.

128. Bearth, T., Ebolang: An epidemic facing the challenge of multilingualism. The case of Western Ivory Coast. Tropical Medicine and International Health, 2015. 20: p. 355.

129. Prati, G.P., L.; Zani, B., Compliance with recommendations for pandemic influenza H1N1 2009: the role of trust and personal beliefs. Health Education Research, 2011.

130. Di Giuseppe, G., et al., A survey of knowledge, attitudes and practices towards avian influenza in an adult population of Italy. Bmc Infectious Diseases, 2008. 8.

131. Hansen, K.F., The politics of fear; how Norwegian media reported about SARS. Risk, Reliability and Societal Safety, Vols 1-3: Vol 1: Specialisation Topics; Vol 2: Thematic Topics; Vol 3: Applications Topics, ed. T. Aven and J.E. Vinnem. 2007. 1599-1605.

132. Krajcovic, A., et al., Effectiveness of the information leaflet personal measures during pandemic flu A(H1N1) issued by the ministry of health of the slovak republic during the 2009/2010 flu pandemic. Acta Medica Martiniana, 2015. 15(1): p. 36-44.

133. Gaspar, R., et al., Tweeting during food crises: A psychosocial analysis of threat coping expressions in Spain, during the 2011 European EHEC outbreak. International Journal of Human-Computer Studies, 2014. 72(2): p. 239-254.

134. Börjesson, M. and A. Enander, Perceptions and sociodemographic factors influencing vaccination uptake and precautionary behaviours in response to the A/H1N1 influenza in Sweden. 2014. p. 215-222.

135. Lundgren, B., 'Rhyme or reason?' Saying no to mass vaccination: subjective re-interpretation in the context of the A(H1N1) influenza pandemic in Sweden 2009-2010. Medical humanities, 2015. 41(2): p. 107-12.

136. Cole, J., Antimicrobial resistance, infection control and planning for pandemics: the importance of knowledge transfer in healthcare resilience and emergency planning. J Bus Contin Emer Plan, 2012. 6(2): p. 122-35.

137. Rubin, G.J., H.W.W. Potts, and S. Michie, The impact of communications about swine flu (influenza A HINIv) on public responses to the outbreak: Results from 36 national telephone surveys in the UK. Health Technology Assessment, 2010. 14(34): p. 183-266.

138. Alaszewski, A. and T. Horlick-Jones, How can doctors communicate information about risk more effectively? British Medical Journal, 2003. 327(7417): p. 728-731.

139. Bangerter, A., et al., Longitudinal investigation of public trust in institutions relative to the 2009 H1N1 pandemic in Switzerland. PLoS One, 2012. 7(11): p. e49806.

140. Wong, L.P. and I.C. Sam, Public sources of information and information needs for pandemic influenza A(H1N1). J Community Health, 2010. 35(6): p. 676-82.

141. Majid, S. and N.A. Rahmat, Information Needs and Seeking Behavior During the H1N1 Virus Outbreak. Journal of Information Management, 2013. 1(1): p. 42-53.

142. Quah, S.R. and L. Hin-Peng, Crisis prevention and management during SARS outbreak, Singapore. Emerg Infect Dis, 2004. 10(2): p. 364-8.

143. Vijaya, K., et al., Public knowledge, attitude, behaviour and response to the SARS outbreak in Singapore. International Journal of Health Promotion and Education, 2004. 42(3): p. 78-82.

144. Ho, S.S., X. Peh, and V.W. Soh, The cognitive mediation model: factors influencing public knowledge of the H1N1 pandemic and intention to take precautionary behaviors. J Health Commun, 2013. 18(7): p. 773-94.

145. Deurenberg-Yap, M., et al., The Singaporean response to the SARS outbreak: knowledge sufficiency versus public trust. Health Promot Int, 2005. 20(4): p. 320-6.

146. Ho, S.S., The Knowledge Gap Hypothesis in Singapore: The Roles of Socioeconomic Status, Mass Media, and Interpersonal Discussion on Public Knowledge of the H1N1 Flu Pandemic. Mass Communication and Society, 2012. 15(5): p. 695-717.

147. Oh, S.-H., H.-J. Paek, and T. Hove, Cognitive and emotional dimensions of perceived risk characteristics, genre-specific media effects, and risk perceptions: the case of H1N1 influenza in South Korea. Asian Journal of Communication, 2015. 25(1): p. 14-32.

148. Marshall, H., et al., Awareness, anxiety, compliance: Community perceptions and response to the threat and reality of an influenza pandemic. American Journal of Infection Control, 2012. 40(3): p. 270-272.

149. Massey, P.D., et al., Reducing the risk of pandemic influenza in Aboriginal communities. Rural Remote Health, 2009. 9(3): p. 1290.

150. Degeling, C. and I. Kerridge, Hendra in the news: Public policy meets public morality in times of zoonotic uncertainty. Social Science and Medicine, 2013. 82: p. 156-163.

151. Davis, M., et al., "We Became Sceptics": Fear and Media Hype in General Public Narrative on the Advent of Pandemic Influenza. Sociological Inquiry, 2014. 84(4): p. 499-518.

152. Taha, S.A., K. Matheson, and H. Anisman, The 2009 H1N1 Influenza Pandemic: the role of threat, coping, and media trust on vaccination intentions in Canada. Journal of health communication, 2013. 18(3): p. 278-290.

153. Collinson, S., K. Khan, and J.M. Heffernan, The Effects of Media Reports on Disease Spread and Important Public Health Measurements. Plos One, 2015. 10(11).

154. Xie, T., et al., Correlation between reported human infection with avian influenza A H7N9 virus and cyber user awareness: what can we learn from digital epidemiology? Int J Infect Dis, 2014. 22: p. 1-3.

155. Fung, I.C.H., et al., Chinese social media reaction to information about 42 notifiable infectious diseases. PLoS ONE, 2015. 10(5).

156. Gu, H.y., et al., Importance of Internet Surveillance in Public Health Emergency Control and Prevention: Evidence From a Digital Epidemiologic Study During Avian Influenza A H7N9 Outbreaks. Journal of Medical Internet Research, 2014. 16(1).

157. Goodwin, R. and S. Sun, Public perceptions and reactions to H7N9 in Mainland China. Journal of Infection, 2013. 67(5): p. 458-462.

158. Chan, D.K., et al., Preventing the spread of H1N1 influenza infection during a pandemic: autonomy-supportive advice versus controlling instruction. J Behav Med, 2015. 38(3): p. 416-26.

159. Chan, S.S., et al., Parental response to child's isolation during the SARS outbreak. Ambul Pediatr, 2007. 7(5): p. 401-4.

160. Blendon, R.J., et al., Attitudes toward the use of quarantine in a public health emergency in four countries. Health Affairs, 2006. 25(2): p. w15-w25.

161. Lyu, S.Y., et al., Perception of spokespersons' performance and characteristics in crisis communication: Experience of the 2003 severe acute respiratory syndrome outbreak in taiwan. Journal of the Formosan Medical Association, 2013. 112(10): p. 600-607.

162. Chang, C., News Coverage of Health-Related Issues and Its Impacts on Perceptions: Taiwan as an Example. Health Communication, 2012. 27(2): p. 111-123.

163. Hilyard, K.M., et al., The vagaries of public support for government actions in case of a pandemic. Health Aff (Millwood), 2010. 29(12): p. 2294-301.

164. Horney, J.A., et al., Intent to Receive Pandemic Influenza A (H1N1) Vaccine, Compliance with Social Distancing and Sources of Information in NC, 2009. Plos One, 2010. 5(6).

165. Birnbrauer, K., D.O. Frohlich, and D. Treise, Inconsistencies in reporting risk information: a pilot analysis of online news coverage of West Nile Virus. Glob Health Promot, 2015.

166. Liang, B. and D.L. Scammon, Incidence of Online Health Information Search: A Useful Proxy for Public Health Risk Perception. Journal of Medical Internet Research, 2013. 15(6).

167. Manuell, M.E. and J. Cukor, Mother Nature versus human nature: public compliance with evacuation and quarantine. Disasters, 2011. 35(2): p. 417-42.

168. Trumbo, C.W. and R. Harper, Perceptual influences on self-protective behavior for West Nile virus, A survey in Colorado, USA. Bmc Public Health, 2015. 15.

169. Kim, H.K. and J. Niederdeppe, The Role of Emotional Response during an H1N1 Influenza Pandemic on a College Campus. Journal of Public Relations Research, 2013. 25(1): p. 30-50.

170. Dausey, D.J., J.W. Buehler, and N. Lurie, Designing and conducting tabletop exercises to assess public health preparedness for manmade and naturally occurring biological threats. Bmc Public Health, 2007. 7.

171. Mummert, A. and H. Weiss, Get the news out loudly and quickly: the influence of the media on limiting emerging infectious disease outbreaks. PLoS One, 2013. 8(8): p. e71692.

172. DiGiovanni Jr, C., et al., Community reaction to bioterrorism: Prospective study of simulated outbreak. Emerging Infectious Diseases, 2003. 9(6): p. 708-712.

173. Agency for Healthcare, R. and Quality, Training of clinicians for public health events relevant to bioterrorism preparedness. 2002, Rockville: Agency for Healthcare Research and Quality (AHRQ).

174. Fung, I.C. and K. Wong, Efficient use of social media during the avian influenza A(H7N9) emergency response. Western Pac Surveill Response J, 2013. 4(4): p. 1-3.

175. Arya, N., et al., Time for an ecosystem approach to public health? Lessons from two infectious disease outbreaks in Canada. Glob Public Health, 2009. 4(1): p. 31-49.

176. Lee, K., How the Hong Kong government lost the public trust in SARS: Insights for government communication in a health crisis. Public Relations Review, 2009. 35(1): p. 74-76.

177. Bdeir, F., L. Hossain, and J. Crawford, Emerging coordination and knowledge transfer process during disease outbreak. Knowledge Management Research & Practice, 2013. 11(3): p. 241-254.

178. Braunack-Mayer, A.J., et al., Including the public in pandemic planning: a deliberative approach. BMC Public Health, 2010. 10: p. 501.

179. Rousseau, C., et al., Public media communications about H1N1, risk perceptions and immunization behaviours: A Quebec-France comparison. Public Understanding of Science, 2015. 24(2): p. 225-240.

180. Hagar, C., Information in Isolation Gossip and Rumour during the UK 2001 Foot and Mouth Crisis - Lessons Learned. Libri, 2009. 59(4): p. 228-237.

181. Lowe, G., M.R. Evans, and P. Myers, Help--we need a helpline! A public health audit case study. J Public Health Med, 2000. 22(2): p. 129-32.

182. Miller, L.A., et al., Use of a nationwide call center for Ebola response and monitoring during a 3-day house-to-house campaign - Sierra Leone, September 2014. MMWR Morb Mortal Wkly Rep, 2015. 64(1): p. 28-9.

183. ECDC. Influenza pandemic preparedness plans. 2015 [cited 2016 19 May]; Available from: http://ecdc.europa.eu/en/healthtopics/pandemic_preparedness/national_pandemic_preparedness_plans/Pages/influenza_pandemic_preparedness_plans.aspx.

184. ECDC. Pandemic 2009 evaluations: evaluations and lessons learnt. 2012 [cited 2016 19 May]; Available from: http://ecdc.europa.eu/en/healthtopics/pandemic_preparedness/pandemic_2009_evaluations/Pages/pandemic_2009_evaluations.aspx.

185. ECDC, ECDC Technical Document: Template for rapid national evaluations of the 2009-2010 pandemic response. 2010.

186. ECDC, Assessment tool for influenza preparedness in European countries – with a main focus on pandemic preparedness. 2006.

187. Health Protection Agency, Assessment Report on the EU-wide Response to Pandemic (H1N1) 2009. 2010.

188. Health Protection Agency and CriSMART, Assessment Report on EU-wide Pandemic Vaccine Strategies. 2010.

189. World Health Organization. IHR core capacities implementation status. 2015 [cited 2016 19 May]; Available from: http://www.who.int/gho/ihr/monitoring/region_europe/en/.

190. Public Health Agency of Canada. Canadian Pandemic Influenza Preparedness: Planning Guidance for the Health Sector. 2015 [cited 2016 14th May]; Available from: http://www.phac-aspc.gc.ca/cpip-pclcpi/report-rapport-2015-eng.php#a4i.

191. Standing Senate Committee on Social Affairs, S.a.T., Canada's Response to the 2009 H1N1 Influenza Pandemic. 2010.

192. Risk Sciences International, Risk Communication for H1N1 pandemic influenza. 2012.

193. Burger, J., et al., Trusted Information Sources Used During and After Superstorm Sandy: TV and Radio were Used More Often than Social Media. Journal of Toxicology and Environmental Health, Part A, 2013. 76(20): p. 1138-1150.

194. Folkhälsomyndighetens, Planering för kommunikation vid en pandemisk influensa. 2015.

195. Göteborgs Universitet JMG, Pandemin som kom av sig. 2010.

196. Bratanova, B., et al., Restoring drinking water acceptance following a waterborne disease outbreak: the role of trust, risk perception, and communication. Journal of Applied Social Psychology, 2013. 43(9): p. 1761-1770.

197. Phin, N., J. Simpson, and G. Marshall, Pandemic Influenza Response Plan. Public Health England, 2014: p. 88.

198. Phin, N., G. Marshall, and H.J. Moulsdale, Pandemic Influenza Strategic Framework. Public Health England, 2014.

199. Hine, D., The 2009 Influenza Pandemic: An independent review of the UK response to the 2009 influenza pandemic. 2010.

200. Rubin, G.J., et al., Who is sceptical about emerging public health threats? Results from 39 national surveys in the United Kingdom. Public Health, 2015. 129(12): p. 1553-62.

201. Strekalova, Y.A., Emergent health risks and audience information engagement on social media. Am J Infect Control, 2015.

202. Alicino, C., et al., Assessing Ebola-related web search behaviour: insights and implications from an analytical study of Google Trends-based query volumes. Infect Dis Poverty, 2015. 4: p. 54.

203. Hill, S., et al., Natural Supplements for H1N1 Influenza: Retrospective Observational Infodemiology Study of Information and Search Activity on the Internet. Journal of Medical Internet Research, 2011. 13(2).

204. Weinberg, J., et al., Electronic communications and communicable disease surveillance at the national level in the European Union. European Journal of Public Health, 1997. 7(4): p. 454-456.

205. Hugh-Jones, M., Global awareness of disease outbreaks: the experience of ProMED-mail. Public Health Rep, 2001. 116 Suppl 2: p. 27-31.

206. Tai, Z. and T. Sun, Media dependencies in a changing media environment: the case of the 2003 SARS epidemic in China. New Media & Society, 2007. 9(6): p. 987-1009.

207. FoodRisC. About the FoodRisC project. 2016 [cited 2016 19 May]; Available from: http://www.foodrisc.org/about_15.html.

208. FoodRisC, Perceptions and communication of food risks and benefits across Europe. 2013.

209. CORDIS. CommHERE Result in Brief. 2015 [cited 2016 19 May]; Available from: http://cordis.europa.eu/result/rcn/92716_en.html.

210. CORDIS. CommHERE Report Summary. 2015; Available from: http://cordis.europa.eu/result/rcn/164291_en.html.

211. CORDIS. E-com@eu Result In Brief. 2016 [cited 2016 19 May]; Available from: http://cordis.europa.eu/result/rcn/92767_en.html.

212. ECOM, Standard questionnaire on risk perception of an infectious disease outbreak. 2015.

213. ECOM, [Design tool: how to design your own Discrete Choice Experiment on pandemic vaccinations]. 2015.

214. TELL ME. Project summary. 2015 [cited 2016 19 May]; Available from: http://www.tellmeproject.eu/content/project-summary.

215. ISS TELL ME, D1.7 Population Behaviour in Epidemics Summary Report. 2012.

216. HU TELL ME, D2.8 New Challenges and New Methods for Outbreak Communication Summary Report. 2013.

217. HU TELL ME, D3.1 New framework model for communication. 2014.

218. ZADIG TELL ME, D3.2 TELL ME Communication Kit. 2014.

219. HU TELL ME, D3.5 Guidance for Using WHO Threat Index. 2014.

220. SURREY TELL ME, D4.3 Prototype Software (Documentation). 2015.

221. University of Southampton. Research project: Improving communication with the public about antivirals and vaccination during the next pandemic (INfluENCE). 2015 [cited 2016 19 May]; Available from: http://www.southampton.ac.uk/psychology/research/projects/improving_communication_with_the_public_about_antivirals_and_vaccination.page.

222. Han, Y.K.J., et al., Predictors of influenza vaccine uptake during the 2009/10 influenza A H1N1v ('swine flu') pandemic: Results from five national surveys in the United Kingdom. Preventive Medicine, 2016. 84: p. 57-61.

223. McNeill, A., P. Harris, and P. Briggs, Twitter influence on vaccination and antiviral uptake during the 2009 H1N1 pandemic. Frontiers in Public Health, 2016. 4.

224. PHEME. About PHEME. 2016; Available from: https://www.pheme.eu/.

225. PHEME, D6.2.1 Evaluation report - Interim Results. 2015.

226. ASSET. Description of Work. 2012 [cited 2016 19 May]; Available from: http://www.asset-scienceinsociety.eu/about/dow.

227. Glanz, K., B.K. Rimer, and K. Viswanath, Health behavior and health education : theory, research, and practice. 2008: John Wiley & Sons.

228. World Health Organisation. What is a pandemic? 2010 [cited 2015 2nd November]; Available from: http://www.who.int/csr/disease/swineflu/frequently_asked_questions/pandemic/en/.

Annexes

Annex 1: Organisations present at February Workshop

Centre de Sociologie des Organisations (CNRS – SCIENCES PO), France

Chatham House, UK

Directorate General for Health and Food Safety (DG SANTE), European Commission

Directorate General Humanitarian aid and Civil Protection (DG ECHO), European Commission

Directorate General Migration and Home Affairs (DG HOME), European Commission

European Centre for Disease Prevention and Control (ECDC), EU

Federal Public Service of Health, Belgium

George Washington University, USA

Georgetown University, USA

Health Emergency Response, Ireland

Heath Surveillance Protection Centre, Ireland

IGS Strategic Communications, UK

Karolinska Institute, Sweden

London School of Hygiene & Tropical Medicine, UK

Ministry of Health, Bulgaria

Ministry of Health, Luxembourg

National Institute of Public Health, Romania

National University of Ireland Galway, Ireland

National Institute of Public Health, Czech Republic

Public Health Agency of Sweden (FoHM), Sweden

Robert Koch Institute (RKI), Germany

Security Europe, Belgium

Swedish Civil Contingencies Agency, Sweden

Swedish Defence Research Agency (FOI), Sweden

The Warning Project, Belgium

Université catholique de Louvain, Belgium

University College Dublin, Ireland

University College London, UK

Wageningen University, Netherlands

World Health Organisation (WHO), Regional Office for Europe

Annex 2: Workshop agenda

Identifying needs and innovations to strengthen pandemic surveillance, communications and governance

PANDEM Expert Workshop, 17-18 February, 2016
Hotel Metropole, Brussels

FINAL AGENDA

Day 1: February 17, 2016

13.00 – 13.15	*Registration and welcome coffee*
13.15 – 14.30	**PLENARY SESSION** **Welcome of participants:** Jean-Luc Gala, Université catholique de Louvain **Purpose and structure of workshop:** Brooks Tigner, Security Europe - Moderator **Current context and PANDEM project:** Máire Connolly, National University of Ireland Galway **Pandemic preparedness and response – where are we now?** - **EU context and serious cross-border threats to health - Decision 1082:** Germain Thinus, DG SANTE - **Surveillance**: Anders Tegnell, Public Health Agency of Sweden - **Communications**: Iain Simpson, IGS Strategic Communications - **Governance**: Richard Coker, London School of Hygiene & Tropical Medicine **Plenary discussion**
14.30 – 15.45	**WORKING GROUP SESSION I – Current best practice/state of the art** **WG 1: Threat analysis, Risk assessment and Surveillance** Moderator: Anders Tegnell, Public Health Agency of Sweden **WG 2: Communications** Moderator: Iain Simpson, IGS Strategic Communications **WG 3: Governance and Legal frameworks** Moderator: Elizabeth Speakman, London School of Hygiene & Tropical Medicine

15.45 – 16.00	*Coffee break*
16.00 – 17.30	**WORKING GROUP SESSION II - Gaps and user needs** **WG 1 Threat analysis, Risk assessment and Surveillance** Moderator: Darina 0'Flanagan, Health Protection Surveillance Centre **WG 2 Communications** Moderator: Cecile Wendling, Centre de Sociologie des Organisations **WG 3 Governance and Legal frameworks** Moderator: Elizabeth Speakman, London School of Hygiene & Tropical Medicine
20.00 – 22.00	*Dinner*

Day 2: February 18, 2016

9.00 – 10.45	**WORKING GROUP SESSION III – Research and innovations needed** **WG 1 Threat analysis, Risk assessment and Surveillance** Moderator: Johan Giesecke, Karolinska Institute **WG 2 Communications** Moderator: Ben Duncan, The Warning Project **WG 3 Governance and Legal Frameworks** Moderator: Lawrence Gostin, Georgetown University
10.45 -11.00	*Coffee break*
11.00 -12.45	**PLENARY SESSION II -** Moderator: Brooks Tigner, Security Europe **Presentation by each WG on gaps/needs/research/innovations** **Plenary discussion** including **cross-cutting issues**
12.45 -13.00	**Summary of meeting, next steps** – Máire Connolly, National University of Ireland Galway
13.00-14.00	*Lunch*

Annex 3: Weight of Evidence Framework

Taken from [15].

Weight of Evidence A

This is a generic and thus non review specific judgement about the coherence and integrity of the evidence in its own terms. That may be the generally accepted criteria for evaluating the quality of this type of evidence by those who generally use and produce it.

Weight of Evidence B

This is a review specific judgement about the appropriateness of that form of evidence for answering the review question, that it the fitness for purpose of that form of evidence. For example, the relevance of certain research designs such as experimental studies for answering questions about process

Weight of Evidence C

This is a review specific judgement about the relevance of the focus of the evidence for the review question. For example, a research study may not have the type of sample, the type of evidence gathering or analysis that is central to the review question or it may not have been undertaken in an appropriate context from which results can be generalized to the answer the review question. There may also be issues of propriety of how the research was undertaken such as the ethics of the research that could impact on its inclusion and interpretation in a review (Pawson et. al. 2003).

These three sets of judgements can then be combined to form an overall assessment Weight of Evidence D of the extent that a study contributes evidence to answering a review question.

Weight of Evidence A: Generic on quality of execution of study Transparency - clarity of purpose Accuracy – accurate Accessibility – understandable Specificity – method specific quality **Weight of Evidence B:** Review specific on appropriateness of method Purposivity- fit for purpose method **Weight of Evidence C:** Review specific on focus / approach of study to review question Utility – provides relevant answers Propriety – legal and ethical research

in a high-impact epidemic or pandemic

Annex 4: Theories Referenced

Risk communications

As explained in section 1.8. this in approach to communications, which prioritises exchange of information over broadcasting, and also accepts that the social construction of a risk - compared to the technical definition of one - is different and important to understand when communicating.

Health belief model [60]

The four elements of the Health Belief Model are: perceived susceptibility (likelihood of getting the disease), perceived severity (perception of how serious an outcome or consequence is from the disease), perceived benefits (efficacy of preventive action undertaken) and perceived barriers (time, effort, money, inconvenience, pain, side effects of preventive action).

Protection motivation theory [63]

This theory outlines two cognitive mediating processes forming a threat and a coping appraisal; these two processes combine to form protection motivation or an intention to perform a protective behaviour. The threat appraisal results from intrinsic or extrinsic rewards, such as social acceptance associated with not performing the behaviour, which can be affected by how severe a person judges the disease to be, and how vulnerable they feel to it. The coping appraisal focuses on actions an individual can take to protect his or her animals: this depends on

an individ- ual's belief that a certain action or behaviour will reduce the threat ('response efficacy') and that they consider themselves able to carry out the protective measure ('self-efficacy'). However, a number of response costs such as availability of time, money or other resources to carry out the protective behaviour, may inhibit performance of the behaviour.

Theory of planned behaviour [20]

This builds on another hypothesis - "theory of reasoned action" - to state that an individual's behaviour is most determined by their intention to do something and their perception of control over that particular behaviour. [227]

Annex 5: Interviewee Questions (GUIDE)

What are some examples of communications good or best practice from outbreaks you've been involved in?

What doesn't work for outbreak communications, in your experience?

Which areas of outbreak communications need more research, in your opinion?

Which is the priority?

What do you think about the role of digital tools in outbreak communications? Do you know of any examples of them being used in a pandemic setting? How well did they work?

Does x country have a pandemic communications plan? What do you think of it? When was it last updated?

Has the plan been evaluated?

Has the plan been used in real life? What happened?

Were lessons learned, if so what were they?

At national level, which areas of outbreak communications do you think would benefit from future research and why? Choose from skills, infrastructure, systems and tools.

Would could the international community do to support pandemic preparedness in your country in terms of communications?