

Behavioural Responses to Pandemic Influenza: Contingency Planning and its Implementation in the UK*

Joyce Tait and Ann Bruce

Introduction

Concerns about a possible human influenza pandemic arising from infected birds (H5N1 avian influenza) led to major contingency planning efforts internationally since before 2005. A European Centre for Disease Control (ECDC) report noted in 2007 that “A further two to three years of intense work are needed at all levels, but especially at the local level, and by all European partners in order to finish the job”¹. The later unexpected emergence of ‘swine flu’ (an H1N1 strain of the virus) in Mexico and its subsequent elevation to pandemic status added urgency to these ongoing national and international planning initiatives. The United Kingdom was the third worst affected country, after Mexico and the USA, but it was also regarded as one of the best prepared to deal with a pandemic.

Efforts to combat a pandemic influenza (PI) crisis involved contingency planning at national, regional, and local delivery levels, in government departments, public bodies and commercial companies. Each plan had a specific role in protecting public health, ensuring public safety and minimizing disruptions to society, the economy and national life. Assumptions about human behaviour are an important part of the effectiveness of these plans. Individuals (including citizens and those involved in implementing contingency plans) will interact with each other and with organisations in a multitude of different ways. Prediction and analysis of the extent and nature of various behaviours, particularly organisational and administrative behaviour, were seen as a crucial determinant of the success of the UK’s planning system.

This paper describes the UK’s institutional response structures and reports on research undertaken to establish (a) the ways in which these might work in practice and under pressure (b) how institutional responders’ assumptions about the behaviour of the general population are likely to affect their own responses.

Research Base

The research on which this paper is based² explored the assumptions made about the behaviour of people and organisations in the development of contingency plans for England, Wales and Northern Ireland and considered how robust these assumptions were likely to be in the face of uncertainties about the scale and severity of any pandemic, and the societal and organisational complexity of a pandemic event. The focus in 2008 when the research was conducted was on the emergence of a potential pandemic event in Asia, arising from the avian H5N1 virus. The subsequent emergence of H1N1 made consideration of these behavioural assumptions and response structures particularly pressing, and provided an opportunity to observe contingency planning in action, with conclusions that could contribute to improved future responses, for example if the H1N1 strain were to emerge with increased virulence in future waves of infection.

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The research built on a model of infectious disease emergence developed for the Office of Science and Innovation (OSI) Foresight project on Detection and Identification of Infectious Diseases (DIID)³. Three workshops were held with participants from operational response organisations (army, police and ambulance service), policy, health and business sectors in England, Wales and Northern Ireland.

Participants were mainly senior people who would be involved in implementing PI contingency plans, with a focus on the range of socio-economic drivers expected to have a pronounced impact on the course of the pandemic and its outcomes. The two key outcomes of interest were the progress and severity of the pandemic itself and the impact of the pandemic on the UK economy. The workshops explored participants' expectations of the behaviour of citizens and of other key actors in similar positions to themselves (i.e. those involved in implementing contingency plans).

The workshop design ensured that participants were able to express their views anonymously and were also able to respond in real time to the views and perceptions of other workshop participants⁴. Individual perceptions and understandings on which this paper is based thus arose from key staff involved in contingency planning. However the analysis and interpretation of these workshop outputs are the responsibility of the authors.

The main drivers of emergence of the new disease, important in contingency planning for PI in the UK, assumed emergence from a zoonotic source, **followed by** distribution throughout the population by airborne transmission, fomites and/or direct human to human contact. However, such a simple linear relationship is not a sufficient explanation of the complex processes whereby the impacts of a potential epidemic or pandemic are either amplified or attenuated.

The following socio-economic drivers were identified by participants in workshops as likely to have a pronounced systemic impact on the outcomes of the pandemic. They were derived from over 600 statements made by participants at the workshops as being those most likely to be important for the performance of the UK contingency planning system.

- *Communication* – public relations, government and local communication strategies (including lack of information and conflicting messages from different sources), potential media irresponsibility
- *Shortages* – particularly of food and fuel, leading to panic buying and hoarding, possible public disorder, black markets
- *Staffing* – maintaining key facilities, services and infrastructures including banking systems, water and electricity supplies, also staffing shortages among medical and other staff responding to the needs of the sick
- *Health care* – overload on health care systems from large numbers requiring treatment, the complexity of the systems set up to provide diagnosis and treatment for those affected, limited availability of drugs, vaccines and face masks, lack of co-ordination and consistency across different regions and different functions within the system
- *Social distancing* – school closures with parents staying off work to look after children, the difficulty of maintaining control of public responses to official advice, the relative impacts of social distancing to avoid spreading infection and precautionary social distancing to avoid being exposed to infection

- *Travel and transport* – maintaining an effective public transport system despite staff shortages, avoidance of transport as a component of social distancing
- *Planning* – general management and governance, the need for rapid re-focusing on flu-critical activities, excessive micro-management by government, lack of planning for the aftermath of the pandemic
- *Societal resilience* – willingness of people to support one another, provision of social care for the vulnerable, willingness to comply with advice and share resources, emergence of a ‘survival’ response including withdrawal within narrow family of social group boundaries

Systemic analysis

Collectively these drivers are involved in synergistic and antagonistic feedback loops that are likely to hold the key to effective and robust management of PI in the UK. Our systemic, interdisciplinary analysis provided evidence-based advice for policy makers and practitioners to highlight areas of particular strength or vulnerability in the contingency planning process and to suggest how it could be made more robust in the face of unexpected or un-planned outcomes. We foresaw that, as the contingency planning system matures at various levels and in different contexts throughout the UK, in response to predicted or actual events, these complexities and uncertainties could multiply in ways that will be inherently unpredictable and may hinder overall control in the event of a pandemic. On the other hand, evidence from this research could ensure that the overall contingency planning system becomes more robust in future revisions.

Building on the outputs from the workshops we were able to demonstrate potential interactions among socio-economic drivers that are normally considered in isolation, but have the ability to form a series of feedback loops that could either improve capabilities to cope with a pandemic or alternatively could increase the vulnerability of the contingency planning system.

Partly based on connections made by participants at the workshops and partly based on our own analysis, several sets of interactions among socio-economic drivers were identified as key to the success of the UK’s response to PI. Figures 1 and 2¹ summarise the systemic interactions seen as key to the performance of the UK PI contingency planning system. No matter how thoroughly this system is planned and how clear the behavioural expectations for all involved parties, it would be unwise to assume that everything would go according to plan. These figures show the main components and interactions among socio-economic drivers that may be involved, either in the generation of systemic problems for PI contingency planning, or in preventing problems from arising for the economy or for the progress of the pandemic itself.

Concepts coloured red in these figures were seen by workshop participants as ‘problem-related’ and those coloured blue as ‘solution-related’. The arrows on the figures represent causal links between concepts; and a red arrow with a negative sign indicates an inverse relationship between concepts, e.g. in Figure 1 (top) a ‘strong government communication

¹ In figures 1 and 2, blue boxes relate to factors intended to mitigate the impacts of the virus and green boxes relate to factors exacerbating the impacts of the virus. The red arrows have a negative sign indicating an inverse relationship, e.g. the “Business as Usual” message is expected to lead to a reduction in staff shortages.

strategy now' will mitigate against 'media irresponsibility and failure to stick to the message', leading further along the line of concept links to reducing the likelihood of 'people being afraid of getting sick', 'public alarm', 'panic buying and hoarding' and 'breakdown in law and order'.

Factors impacting mainly on the economy (Figure 1)

The fact that people are sick is the main and most predictable trigger for the staffing shortages and the downstream economic impacts that could result from that (for example in food and fuel distribution, operation of banking systems, transport systems, and lack of maintenance of key infrastructures (e.g. electricity and water supplies). The 'just in time' nature of many supply chains makes the UK and many similar societies more vulnerable to such shortages. Even a modest crisis, for example in fuel supplies, can lead to panic-buying and exacerbation of supply problems. To counteract food shortages, supermarkets could collaborate to ensure that at least one food outlet is open for business in each community. The government or police could intervene if necessary to stabilise markets and help to avoid food and fuel shortages.

Keeping schools open and encouraging staff to continue to work so long as they are not sick are part of the 'business as usual' component of government plans, seen as key to minimising the impact of PI on the economy. Improved business continuity plans could also help to counteract staffing shortages. However, in some circumstances, public *fear* of getting sick could have as big an impact on the UK economy and on the resilience of the UK planning system as the numbers who are actually sick. Precautionary, fear-driven absenteeism could make it impossible to keep schools open even when this is the recommended action and communication-related approaches may not be sufficient to counteract such fears. Workshop participants attached a great deal of importance to transparency and openness and to a strong and consistent government communication strategy transmitted through credible sources, as a way of controlling this potential for precautionary absenteeism. Effective communication could encourage societal resilience and support systems to counteract fear-driven absenteeism with all its downstream consequences.

At the extreme, if not well managed, all these factors could combine to generate a break-down of law and order in some parts of the country, with police and military involvement. This was described by several workshop participants as 'the UK system grinds to a halt'.

Factors impacting mainly on the pandemic (Figure 2)

The red, problem-related boxes in Figure 2 show some of the interactions leading to serious problems for hospitals and health care systems. The blue, solution-related measures include effective drugs and the use of face masks. Workshop participants did question the effectiveness of both these options and neither was expected to be available to all members of the public so demand may exceed supply, fuelling fears and public unrest. At the time of the research workshops in 2008, anti-viral drugs were expected to be available for up to 50% of the population and this was seen as likely to lead to excess demand from the public, pressure on, and thefts from, distribution centres, and possible civil unrest requiring police intervention. Genuine and fake drugs were also expected to be available on the internet at black market prices. Here again effective information systems were seen as the most effective way to reduce public fears and participants considered that more attention could be given to imaginative ways of managing these inevitable fears.

Workshop participants raised many concerns about the operation of the National Pandemic Flu Line which was under active development at the time of the workshops. This was a dedicated telephone and web based system designed to assess an individual's symptoms remotely, verify their identity through a unique identifier, interface with the Department of Health stock management system to reconcile transactions at a local collection point and record authorisation on a patient's electronic record. The failure of Fluline for a variety of reasons was a very common prediction. It was seen to be un-tested and likely to be rushed in at short notice with the expected inoperability (based on recent experience) of other new IT systems. People were seen as likely to panic about anti-viral supplies. Also they could learn a "script" about the trigger symptoms to get access to anti-viral drugs via Fluline even when they were not sick, thus creating further shortages. It was also noted by participants that most people in the population would not know their NHS number⁵, which is the expected starting point for a transaction with FluLine. On the positive side, participants emphasised that Fluline must be maintained centrally; it cannot be allowed to fail and must be supported by making the relevant information available as soon as possible to the general public. Participants were also concerned that there should not be great inter-regional differences in service availability, although Scotland, Wales and Northern Ireland were not expected to be part of National Pandemic FluLine.

Another area of likely confusion was seen to be the use of face masks. The official line was that they would only be made available to certain groups of 'front-line' staff, although the influence of masks on public perceptions of risk is likely to be very important. Workshop participants considered it highly likely that there would be a big public demand for face masks and that they would run out causing people to stay at home rather than go to work when they felt unprotected. However, there were also strong opinions that the use of masks would not make a difference to the progress of the pandemic or could make it worse if they led people to feel safe to go into crowded areas where the danger of infection might be greater.

As a preventive measure, advice that people should stay at home if sick to avoid infecting others and adopt other social distancing measures (closing schools and avoiding crowded places such as major public events or public transport) are important components of UK plans to minimise the number of infected people in the event of a pandemic. However, large scale precautionary social distancing, where those who are well take action to avoid contact with others, could have major impacts on national ability to cope medically with the pandemic as well as impacting on the economy. Workshop participants considered that school closures could be an inevitable consequence of such precautionary behaviour even although it is not part of the planned response.

Risk governance deficits.

Common deficits in the analysis and management of major risk crises have been identified in a wide range of contexts to improve our abilities to predict and avoid such deficits in future⁶. Those that appear independently to have some relation to the views of participants in our workshops include: (i) omission of knowledge related to public perceptions; (ii) failure to take account of risk acceptability for different public groups; (iii) failure to understand how the components of complex systems interact and over-reliance on the use of formal models; (iv) not acknowledging the possibility of potential surprises and thus being less able to act in the face of the unexpected; (v) not anticipating the negative consequences of risk management

decisions; and (vi) lack of organisational capacity and inability to deal effectively with dispersed responsibilities. Thus, the experience of attempting to govern effectively the risks of PI in the UK could learn much from the experience of risk managers in other areas.

At the time this research was conducted, the UK had an opportunity to take pre-emptive action to reduce the chances of such deficits in contingency planning for PI. The unexpected emergence of H1N1 may mean that this policy guidance has been overtaken by events. On the other hand, given the apparently relatively low case fatality rate (CFR) of the H1N1 virus so far, this could provide a valuable testing ground to avoid risk governance deficits in the case of a future, more virulent pandemic.

The analytical device used here, of separating the explanation of 'impacts on the economy' and 'impacts on the progress of the pandemic' (Figures 1 and 2) is artificial. It allows for greater clarity in explaining the various expected interactions. However, the importance in both cases of the concepts "people are sick" and "people are afraid of getting sick", and also at the extreme the contribution to civil unrest and breakdown of law and order emphasises that the two areas are intimately intertwined.

A recurrent theme in the workshops was concern about ambiguity arising from the key messages related to the two key strands of PI contingency planning in the UK: 'business as usual' to protect the economy; and 'social distancing' to minimise infection rates. Many participants felt that it would be difficult to deliver the desired clarity in communications to the public and also to managers involved in contingency planning, and that a strategy to resolve this ambiguity should be an urgent priority. In risk governance terms, as shown in figures 1 and 2, this communication-related deficit could lead to unplanned and unexpected behaviours through a series of systemic interactions, making it more difficult to manage the pandemic and also seriously amplifying the impact on the economy.

We propose that one important key to resolving this ambiguity would be to have a greater focus on the case fatality rate (CFR) than is currently the case in developing modelling predictions of health and economic impacts of PI in the UK. Current modelling exercises vary the infection rate from 25 - 50%, and case fatality rate (CFR) between 0.4 and 2.5%, the latter being the CFR of the 1918 flu pandemic⁷. However, given that the CFR in recent cases of H5N1 avian influenza has been greater than 50%, there would be a strong case for also introducing a higher range of values for CFR into modelling predictions.

From the limited experience with the H1N1 strain of the virus in the UK, it makes medical sense to focus on the 'business as usual' message when the CFR is apparently equal to or less than a normal winter 'flu epidemic. However, with higher CFRs, there will be a cut-off point where it is rational to switch to a 'social distancing' message to minimise or delay the spread of the infection, to allow time to stockpile drugs and to develop vaccines. It could usefully be a priority, first to refine contingency planning based on this approach, and second to develop communication strategies to encourage better public understanding of these issues.

Models could be used to devise a rational cut-off point in CFR whereby, at a low level of CFR, 'business as usual' was the appropriate message; and at a higher level full precautionary social distancing was justified. The strategy would be to switch to a 'social distancing' message before this point is reached and adjust other elements of contingency planning to maintain overall control. Precautionary social distancing would help to delay the progress of the pandemic to allow the development of vaccines and the stockpiling of drugs and so to save considerable

numbers of lives in the event of a high CFR. This reasoning seems to have informed the English and Scottish Departments of Health responses to early cases of H1N1 by combining school closure with use of Tamiflu to treat detected cases and their contacts.

In addition to these medical effects, the level of CFR will have an important psychological impact on the population as a whole. It will be the major factor leading to fear-driven precautionary social distancing where people stay away from work or avoid social contacts when they are well, because they are afraid of contracting the disease. It is likely to be a much more potent driver of precautionary social distancing than the infection rate, and yet varying the infection rate is the main focus of most modelling studies.

Current modelling approaches could be extended to take account of the impacts of fear-driven social distancing. One would expect this factor to reduce the extent of the medical emergency but to increase the impact on the economy, particularly at the higher values of the CFR. Availability of effective drugs and vaccines is likely to be one of the most important factors modulating precautionary social distancing, so potentially reducing its impact on the economy. Including such factors in the cost-benefit analyses used to estimate the value of public investment in drugs and vaccines could justify maintaining higher levels of stockpiling of drugs or greater investment in vaccine development, for example using synthetic biology techniques⁸. To relate this example to Figure 2, if drugs are available to treat almost 100% of the population, there will be little incentive for people to cheat to get supplies *before* becoming ill, removing one of the major negative strands of interaction leading to social unrest.

UK experience with the H1N1 pandemic

The UK is one of the countries worst affected so far by the H1N1 pandemic, providing a very useful test case for the country's pandemic preparedness. On the basis of media reports, in the early stages of the progress of the pandemic in the UK, when the extent of the CFR was unknown, 'social distancing' was the official response, closing affected schools and distributing anti-viral drugs on a prophylactic basis. Once it became clear that the CFR was relatively low in the UK and that the disease was spreading rapidly, the response shifted to 'business as usual'.

At the time of writing the disease was still spreading rapidly and the CFR still seemed to be low. There seemed to be no public panic or even widespread lower-level concern. However, even so, some of the outcomes predicted by our workshop participants were reported in the media.

- The contingency planning system seems to be operating well and as expected.
- Many health services were overwhelmed by exceptional levels of public demand for information and advice
- It was reported that Flu Line will not be in place until October 2009⁹, and in the interim patients should contact their general practitioner (GP) or the national telephone advisory service NHS Direct and explain their symptoms, when they would be given instructions on where and how to pick up their medication.
- Some people were advised to travel long distances to a collection point to pick up anti-viral drugs.
- There were reports of anti-viral drugs (including counterfeit drugs) being available on the internet

- Reputable newspapers had printed ‘scare stories’ about vaccines being rushed out without proper testing.
- There were reports of different, sometimes conflicting, approaches to the pandemic in different regions of the UK or from different organisations involved in responding to the pandemic. For example pregnant women were given conflicting advice about the advisability of ‘social distancing’ given that they seem to be one of the vulnerable societal groups¹⁰.
- The devolved nature of the UK and regionalised nature of the National Health Service means that there is in effect no ‘national’ response to PI.

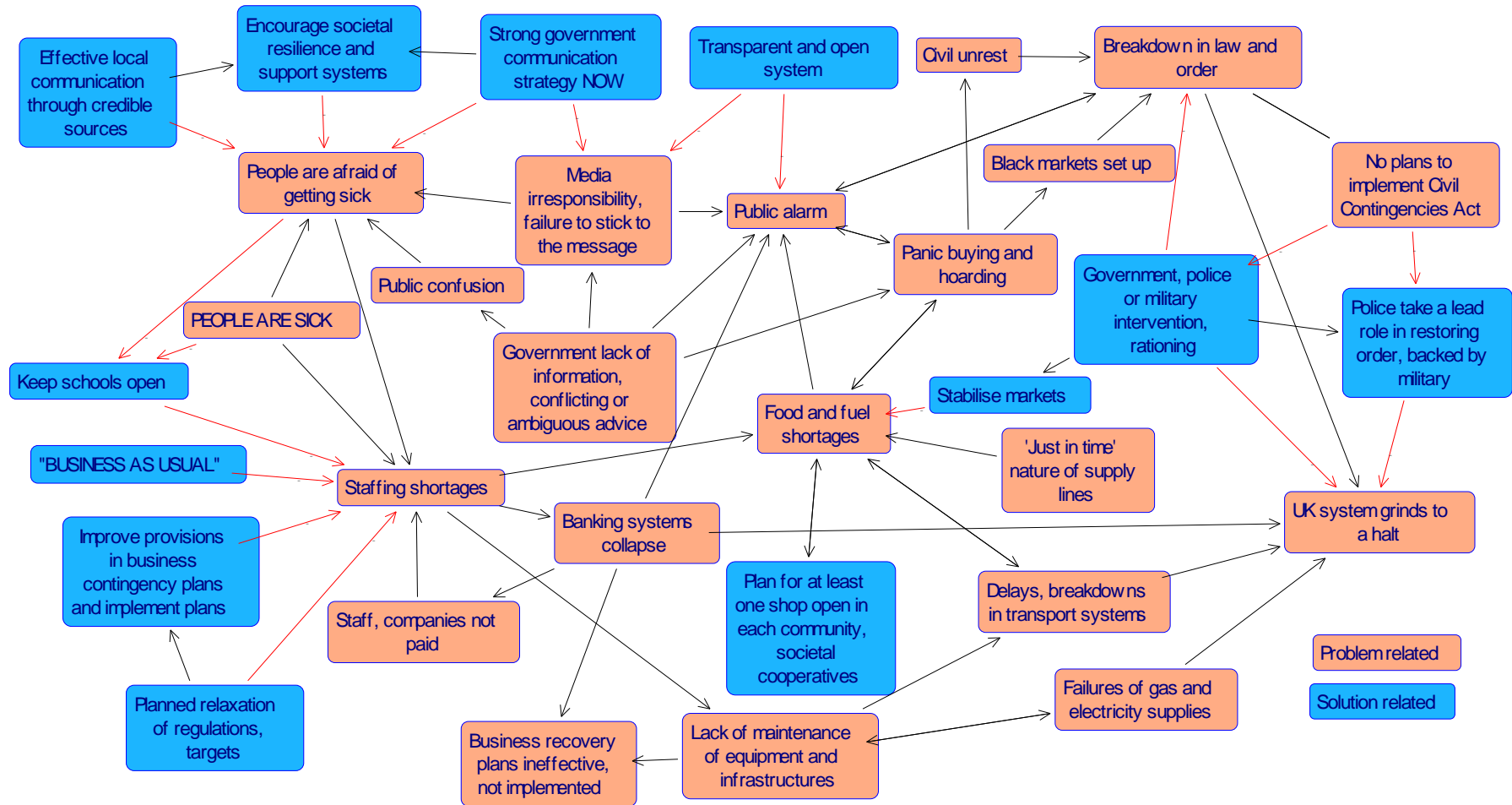
Policy conclusions for future pandemic contingency planning and management

The UK seemed to be coping well with the H1N1 pandemic but it was clear that, even where the virus has a relatively low CFR, many of the difficulties with contingency planning for PI that were predicted by our workshop participants were emerging even at an early stage in the progress of the pandemic.

The value of the CFR and the associated potential relationship with precautionary social distancing is the key to predicting the impact of PI on the economy, which could be much greater than the impact of the pandemic itself. Even a small increase in the CFR could lead to an enhanced public distancing response and the H1N1 experience could be used to monitor all such events with a view to updating contingency plans in future to enable them to cope better with, for example, follow-on waves of H1N1 which may have increased virulence.

Based on the results of this project, we concluded that focusing on the CFR value of an emerging pandemic, including outliers in modelling predictions, followed up by flexibility in contingency planning based on this information to deal with communication, unexpected behaviours and systemic interactions, is likely to be the most effective way of avoiding future risk governance deficits.

Figure 1. Factors impacting mainly on the economy



¹ European Centre for Disease Control (2007) *Report for Policy Makers: Pandemic Preparedness in the European Union*, pp7. http://www.ecdc.europa.eu/pdf/2007_12_05_Pandemic%20preparedness%20for%20policymakers.pdf (accessed 31/07/08)

² *Behavioural Responses to Pandemic Influenza in the UK*, funded by the Economic and Social Research Council, the UK Department of Health and the Wales and Northern Ireland Regional Governments; PIs Professor Tony Barnett and Professor Joyce Tait. Report 6, Contingency Plans and their Implementation. Other outputs from the project included: (a) an extensive review of the social psychological literature on responses to acute respiratory infection epidemics such as SARS and avian influenza (b) responses to flooding events in the UK (c) the role of the Civil Contingencies Act 2004.

³ Lyall, C., Suk, J., and Tait, J. (2006) *Foresight. Infectious Diseases: Preparing for the Future. Risk Evaluation Work Package: Results from Expert Survey*. Office of Science and Innovation, London, pp 283. [http://www.foresight.gov.uk/Previous Projects/Detection and Identification of Infectious Diseases/Reports and Publications/Final Reports/T/T3.pdf](http://www.foresight.gov.uk/Previous%20Projects/Detection%20and%20Identification%20of%20Infectious%20Diseases/Reports%20and%20Publications/Final%20Reports/T/T3.pdf) (accessed 15/12/08)

⁴ The workshops were designed, conducted and analysed in collaboration with New Game-Plan (<http://www.new-game-plan.co.uk/>)

⁵ It appears that delays in activating National Pandemic FluLine arose in part from Treasury concerns about precisely this point. See The Observer, 19 July 2009, <http://www.guardian.co.uk/world/2009/jul/19/swine-flu-hotline-delayed?FORM=ZZNR4>

⁶ Renn, O. and Walker, K. (2008) *Global Risk Governance: Concept and Practice Using the IRGC Framework*. Dordrecht, NL: Springer Science and Business Media

⁷ Department of Health *Pandemic Flu – frequently asked questions*, http://www.dh.gov.uk/en/Publichealth/Flu/PandemicFlu/FAQonly/DH_065088 (accessed 25/04/09)

⁸ Smith R., Keogh-Brown, M, Barnett, T. and Tait, J. (2009). The Economy-Wide Impact of Pandemic Influenza on the UK: a computable general equilibrium modelling experiment. *BMJ*; 339: b4571. DOI: 10.1136/bmj.b4571

⁹ The Guardian, Friday 1 May 2009, <http://www.guardian.co.uk/world/2009/may/01/swine-flu-helpline-nhs-direct>

¹⁰ BBC Radio 4, Today Programme, 20 July 2009, interview with Health Secretary, Mr Andrew Burnham.