D4.5

Testing Health Professional Panels in the US

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WP4 Agent Based Social Simulation

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D4.5 Testing Health Professional Panels in the US

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Executive Summary

Background

Transparent communications in Epidemics: Learning Lessons from experience, delivering effective Messages, providing Evidence (TELL ME) is a 36 month collaborative project, which aims to provide evidence and to develop models for improved risk communications during infectious disease crises. The main outcomes of the TELL ME project will be an Integrated Communication Kit for Outbreak Communication and simulation software to assess alternative communication strategies. The simulation software model is a key work product of the TELL ME project.

TELL ME Simulation Model

The TELL ME simulation model is intended to help public health officials plan communications to minimize the effect of infectious disease epidemics, and to guide future data collection to allow more predictive model development. The model is unique in that it links three inherently connected aspects of an influenza epidemic: 1) communications, 2) personal protective behavior, and 3) epidemic progress.

Testing Methods

The TELL ME simulation model was demonstrated for two panels of health professionals in the US convened by NDLSF™ for the purpose of collecting reactions and recommendations from panels of end-users, and to facilitate progress toward model-specific validation. Panel 1 convened October 8, 2014 in Washington, DC in conjunction with the 10th Annual Directors of Public Health Preparedness meeting, and Panel 2 convened on January 12, 2015 at the Institute for Disaster Management at the University of Georgia College of Public Health. Following the model demonstration, validation questions were presented and panelists provided responses, open questions, and recommendations.

Recommendations of the US Panel members

- The model should aim to be adaptable for other infectious diseases including non-airborne agents.
- The model should aim to be able to fine-tune messaging based on real-time input data, such as vaccine shortages, so it is useful for more than just the planning phase for epidemics.
- Develop a means to measure and evaluate impact of various communications plans.
- The model evolution should be able to target specific geographic regions more effectively.
- The model evolution should be able to deliver targeted communications to special population sub-groups, e.g. input data that covers behavioral measures of the population in areas that have a predominantly antivaccinationist population.
- In the US, in particular, the messaging would be valuable to healthcare professionals staffing call centers during a pandemic.
- Consider tools such as Apps for handheld devices to augment the model.
- Seek high-level support and funding to advance the model evolution.
- Heed lessons from the H1N1 pandemic.
- Aim to enhance the model to improve its predictive capability and its utility.
- If the first version of the model is only to be disseminated to European countries, later iterations should be planned for use by other TELL ME partner countries (US and Israel), and other nations.
- Clearly identify how messages are to be disseminated, and they should be tailored for national, regional and community audiences.
- Clearly identify both the end-users and the target populations for the model.
- Develop a robust plan for broad dissemination of the model to facilitate its evolution.
- Collaborate with other professional groups focusing on the role of communicating during disasters and public health emergencies and how to influence behaviors.

1. Background

Transparent communications in Epidemics: Learning Lessons from experience, delivering effective Messages, providing Evidence (TELL ME) is a 36 month collaborative project, which aims to provide evidence and to develop models for improved risk communications during infectious disease crises. TELL ME integrates inputs from public health, social sciences, behavioral sciences, political sciences, law, ethics, communication and media, in order to develop an evidence-based behavioral and communication package to respond to major epidemic outbreaks, notably flu pandemics. The main outcomes of the TELL ME project will be an Integrated Communication Kit for Outbreak Communication and simulation software to assess alternative communication strategies. The simulation software model is a key work product of the TELL ME project.

The TELL ME Consortium comprises 12 partner organizations; 10 based in Europe, one based in Israel and one based in the U.S. The TELL ME project is co-funded by the European Commission within the 7th Framework Programme - GA 278723.

Visit the TELL ME project online at www.tellmeproject.eu

1.1 Introduction

This summary report describes the demonstration of the TELL ME Simulation Model by Jennifer Badham, PhD, TELL ME partner and model developer from the Centre for Research in Social Simulation (CRESS) at the University of Surry, UK followed by discussion, questions and feedback from two groups of expert panelists assembled by TELL ME partner James James, MD, DrPH, MHA from the National Disaster Life Support Foundation, Inc. (NDLSF™) of the Medical College of Georgia – Georgia Regents University, US. In addition to being a member of the NDLSF Board of Directors, Dr. James' current position is Executive Director of the Society for Disaster Medicine and Public Health. He also serves as Editor in Chief of the peer-reviewed journal, *Disaster Medicine and Public Health Preparedness*, and is Adjunct Professor at the University of Georgia School of Public Health. The report concludes with a synthesis of validation questions and responses and overall recommendations from both groups. The purpose of the panel demonstrations was to collect reactions and recommendations by panels of expert end-users to the model, and to facilitate progress toward model-specific validation. It should be noted that individual panelists, as addressed in the original TELL ME Statement of Work, did not test the model, as the model was still in a developmental stage. The demonstrations, however, did provide important input to the final model construct.

For Panel 1, Dr. Badham was in-person, on site; and for Panel 2, Dr. Badham was present electronically via Skype. Both programs began with a slide presentation by Dr. Badham consisting of a brief overview of the TELL ME project, followed by an explanation of the model implementation using both an agent-based model for protective behavior and the SEIR mathematical epidemic model with a two-way connection with behavior. The SEIR compartmental mathematical model allows modelers to assign individuals in a given population to specific compartments that represent different phases of an epidemic, i.e. susceptible (S), exposed (E), infectious (I), and recovered (R). The TELL ME simulation model is intended to help health officials plan communications to minimize the effect of influenza epidemics, and to guide future data collection to allow more predictive model development. The model is unique in that it links three inherently connected aspects of an influenza epidemic: 1) communications, 2) personal protective behavior, and 3) epidemic progress. The model uses open source software. The current model is not a predictive model because there is insufficient data to calibrate connections between epidemic status, communication and behavior. Please refer to Appendix II for a copy of the TELL ME simulation model slide presentation. A quick review of these slides will provide the reader with a much better understanding of the model in terms of both its challenges and, more importantly, its promise.

Next, the programs opened for questions and comments from the panel, and discussion of the validation questions related to the model's usefulness and applicability:

- Qualitative behavior
  - Do epidemics spread in a realistic way?
  - Do epidemics and personal behavior respond to each other appropriately?
  - Do different communication plans have the expected impact?
- Model usability
  - Can communication plans of interest be input to the model?
  - What other inputs would be useful?
  - Does the model report the appropriate information?
  - Are model users able to interpret the model output?

2. Panel 1 Results

2.1 Background

Washington, District of Columbia, United States
Army and Navy Club
6:00 – 8:30 p.m.
October 8, 2015

Panel 1 was planned to coincide with the 10th Annual Directors of Public Health Preparedness (DPHP) meeting of the Association of State and Territorial Health Officials (ASTHO) on October 7 – 9, 2014 in Washington, DC., United States. The TELL ME project, the simulation model and the purpose of the panel were presented to DPHP meeting participants at the opening of the meeting on October 7th. Seven to eight state or territorial health officials were expecting to participate in the panel. However, the US DPHPs attending the meeting were heavily involved with the emergent response to the first US Ebola virus victims, and most were unable to attend the panel due to conference calls with their home state public health authorities. The six expert panelists who did assemble were experienced and respected public health professionals who embodied subject matter expertise in the areas of disaster and humanitarian assistance, disaster medicine, public health preparedness, graduate-level disaster education, public health preparedness for state, and local health officials, and specialized disaster information and communication services at the national level.

2.2 Questions, Comments and Recommendations

Questions from Panel 1 and Answers from Dr. Badham included:

Q: Does the model account for social media communications?
A: An example is that a scare about the vaccine will change behavior, and will eventually be factored into the model. The model itself was constructed using three established psychological theories: 1)

theory of planned behavior, 2) health belief model, and 3) protection motivation theory that adds the element of fear.

Q: Does the model account for data "noise"?
A: No it does not.

Q: Does the communications message change based on a feedback loop?
A: The model cannot adapt, and is intended for use in the planning stage for the epidemic.

Q: Can the model be used to collect real-time data from a pandemic event?
A: This model is only intended for the planning phase.

Q: What exactly is needed to advance the model?
A: Dr. Badham explained she was seeking input to these key questions in order to further develop and validate the model for its release: Does the model contain the basic tools? Is the model logic sensible enough so it is useful as is; or do we need to do more? Are there other inputs that would be useful to end-users?

Observation:

The intent is to release a model that is an invaluable tool for public health communicators so the extensive use of the model will stimulate data collection and collaboration toward evolution of a more sophisticated model, and also one (or more) that can be used for other types of epidemics in addition to influenza and other airborne agents. It is important to note that this is a unique model in the early stages of formulation, and further iterations may well be more flexible and adaptive.

Q: Would this model work for bioterrorism?
A: It could be used for airborne agents, but if not for airborne agents, then it is not useful – again, in its current version.

Additional panelists' comments and questions:

- Get the information about the model to or connect with the US Centers for Disease Control and Prevention (CDC) Public Health Information Network (PHIN).
- The US is considering how to move the population to using call centers vs. flooding emergency departments and doctor's offices, and this would be an important part of the messaging/communications.
- A Harvard group is looking at the role of communicating during disasters and how to influence behavior, and they would be interested in this model.
- Factor key communications lessons from H1N1 into the model:
  - The Food and Drug Administration released antivirals, and used an App for handheld devices to report adverse events. There were no reported adverse events from the vaccine.
  - Consider tools such as Apps for handheld devices to augment the model. Such tools will make it easier for public health planners to use the model, thus supporting widespread adoption.
- There is possibly a need for the model to be able to factor in "noise" and cultural "recalcitrants" (anti-vaccination population compartment).
  - For example:
    - In West Africa, there is distrust that there really is an Ebola epidemic.
    - US Anthrax Vaccine Immunization Program (AVIP) for US service personnel controversy
    - Cultural distrust in the US, e.g. Tuskegee syphilis experiment by the US Public Health Service
    - In Haiti the government is denying the Cholera epidemic.

- How would "crying wolf" affect the model?
- Some communications are focused on trying to avoid hysteria, and the appearance of political motivation.
- Local health departments have a greater influence on communication.
- Public health communities are forming around risk communication and there is a need to engage them.
- Also engage public health planners. We plan for how people do react vs. how we want them to react.
- Different communities have different norms; can the model allocate communities?
- The methodology for the communications has to be tailored to determine the effective platform.
- Did you consider the H1N1 communications campaign?
- In West Africa communications is one of the areas most needed for the Ebola epidemic.

Additional information shared with the group by Dr. Badham:

- Another use for the model is to stimulate more in-depth discussion.
- Most existing data shows behavior peak occurs before the epidemic peak, and that is mathematically impossible in modeling.
- In Hong Kong, news headlines broke 5 months before the H1N1 epidemic peak.
- Information overload – what is the best time to release the message? The model needs to account for decaying interest.
- Currently there is not good methodology for evaluating a communications campaign.
    - Some emerging science measures social media emotion.
    - It is hoped the communications community will start tracking data – right now there is no dynamic communication data.
    - It is difficult to get funding to support a communications attitude survey when there is not a crisis.

Panel 1 Recommendations:

- The model should be adjustable for other infectious diseases, including non-airborne agents, e.g. Ebola.
- The model should be adaptable to change communications messaging based on a feedback loop.
- Similarly, the model should be able to utilize real-time data.
- The model messaging should be able to address specific communities within a population, e.g. antivaccinationists.
- In the US, in particular, the messaging would be valuable to healthcare professionals staffing call centers during a pandemic, so the model could become even more useful through broad collaboration among public health professionals during a pandemic.
- Consider tools such as Apps for handheld devices to augment the model. Such tools will make it easier for public health planners to use the model, thus supporting widespread adoption.
- Employ lessons from the H1N1 pandemic.
- Develop a means to measure and evaluate the impact of various communications plans.
- Seek high-level support and funding to support the model evolution

3. Panel 2 Results

3.1 Background

Athens, Georgia
Institute for Disaster Management
College of Public Health, University of Georgia
1:30 – 4:00 p.m.
January 12, 2015

Panel 2 convened at the Institute for Disaster Management (DMAN) in the College of Public Health at the University of Georgia, US. DMAN has a well-respected local presence in Georgia since before the 9/11 attacks, working in the area of anti-terrorism and natural disaster response. DMAN's highly trained staff has attained national and international recognition relevant to current mass casualty research and training needs. The DMAN Director and staff have a national reputation in emergency healthcare training; have planned and implemented anti-terrorism, natural disaster, and mass casualty drills and exercises in dozens of states; and most relevant to the TELL ME model development, have extensive experience and recognition for the design and implementation of novel simulations for research. Event modeling and simulation at DMAN have been generated for over 20 major cities in the U.S. and overseas, and include nuclear, radiological, chemical, and biological events. Modeling and simulation occurs both on the training level with realistic high consequence event simulation, and on the planning level with mass casualty distribution models unique to natural, chemical, biological, radiological and nuclear terrorist attacks.

The fifteen expert panelists assembled at DMAN embodied subject matter expertise in the areas of public health preparedness and disaster management, disaster medicine, graduate-level disaster education, emergency communications, healthcare disaster management, private sector global disaster education and training, and catastrophic event modeling and simulation.

3.2 Questions, Comments and Recommendations

Questions from panelists and Answers from Dr. James or Dr. Badham included:

Q: Is there a plan to make the model predictive in the future?
A: The answer at this time is no.
Observation:
However, more advanced versions of the model would have higher predictive power.

Q: What is the model to be used for?
A: It would be mainly used for educational purposes.

Q: Where are the surveys (supporting data) coming from and how does the model push people to answer the questions?
A: The survey came from previous literature, and, for example, patients could answer questions at a doctor's visit.

Q: What type of avenues would information be disseminated through from country to country?
A: The model is for a European style country so access to media would not be an issue.

Q: If the model is not helping to predict the spread of infectious diseases and what the behaviors of the society or culture would be in response or preventing it then what is the end goal?
A: The model needs to go through further development if it is to be utilized as a communication tool for other infectious diseases in addition to influenza.

Observation:

What the model is intended for is to maximize the acceptance of specific public health interventions such as vaccination or hand washing within a population.

Q: What are the data sources?
A: The data is from area-wide census-like data.

Q: Can that data be refined to identify characteristics of sub-groups within a population?
A: Yes, but again, finding valid data is currently a limiting factor.

Q: What are the published literatures that you used for your source of information and how do you select the published literature?
A: Dr. Badham indicated she used the theory of planned behavior, health belief model, and protection motivation theory as the source of information on the psychology about the influences on behavior and published literature on influenza, particularly the case in Hong Kong.

Q: How confident are you with the model that you are developing?
A: Dr. Badham indicated that she was confident with the model.

Q: Based on the model inputs you showed us, does the model work for countries/regions with high levels of cultural/religious/socioeconomic diversity?
A: Currently the model only works on a countywide basis and is only being applied to countries in the European Union. With time and more data, Dr. Badham expects to be able to target specific regions more effectively.

Q: Could this type of psychological model be applied to other areas of public health communications? For example, could you use a model to test what communication strategy would best improve morale/attitudes after an attack or national disaster?
A: The principle of the psychological model could be applied to other areas, but finding data to create the model will most likely be the challenge.

Q: Is there any way to indicate stress on the healthcare system in the model? Is there a way to present an interruption in the process (person changes attitude and then takes preventative action) from the supply side (vaccination runs out; too long a wait at healthcare provider and discouraged patients, etc.).
A: Dr. Badham replied there currently were no plans to add a healthcare component to the simulation model.

Q: To Dr. James – a question after the session ended: Regarding the factors that could affect the model; what about climate change? Can climate change can cause the pattern of influenza season to change?

A: Climate change could affect the model in terms of input data. However, there are anomalies regarding the study on the change of the pattern of influenza season caused by climate change. Better examples of climate change impacts on infectious disease patterns are those involving a vector such as mosquitoes.

Additional panelists' questions and comments:

- Is there a way to take negative responses to protective behaviors into account, i.e. social media demoting a particular vaccine? Yes, but it is dependent on available data.
- Would it be considered whether a scale from -1 – +1 might be more effective than the 0 – 1 scale currently in place? A 0 – 1 scale provides a straightforward binomial.
- Panelist noted that on the "Design features still to be implemented" slide, "vaccine problems" is listed under "additional context choices for scenario," so this may be applicable to the question regarding vaccine supply shortages. However what these 'problems' would be was not specified.
- The panel discussed making the model more applicable to smaller subsets of the population, i.e. modeling behavior in different regions of the US.
- Can the model become adaptable for smaller subsets of populations? Yes, but only with valid data.
- The model should be able to address other non-airborne infectious diseases. The output from the model, like all models, is dependent on quantity and quality of inputs, and availability of more data increases flexibility of use.
- The panel was uncertain about when the model should be used. A noteworthy discussion followed on "triggers" to activate the model use, and what agency or agencies would be responsible for activation. The earlier use of the model would allow for more effective policy development.
- There was concern the model was not predictive, and it may be difficult to have an effective model that doesn't employ real-time information.
- In the early phase of an epidemic, it is local, and so it might be useful to collect data in that phase, and then apply it during later phases of the epidemic.
- The panelists further discussed the prospect that modifications might be made to the model as ongoing information became available. And potential uses were envisioned for non-airborne agents. Another notable discussion ensued on use of such a model for Ebola, and there was general consensus that the model could have a positive role in developing health communication strategies. What was felt to be important was using the model to craft messages with strategies that would maximize early uptake of critical public health interventions.

Panel 2 Recommendations

- Heed the lessons from the H1N1 pandemic. For example, message timing is important. Try to avoid delivering the right message at the wrong time!
- Aim to make the model predictive to improve its utility.

- If the first version of the model is only to be disseminated to European countries, then it should be planned for use by other TELL ME partner countries (US and Israel), and eventually globally.
- Clearly identify how the messages are to be disseminated, and messages should be tailored to the messenger(s).
- The model should be adaptable to other infectious diseases, including non-airborne agents.
- The model should aim to adapt the messages to real-time data such as vaccine supply shortages.
- The model should aim to account for smaller sub-sets of populations.

4. Validation Points

Validation points considered for the TELL ME model demonstration include a synthesis of results from the two US Discussion Panels. The validation process, primarily using face validity, involved two panels of US experts with broad knowledge and experience in disaster medicine and public health preparedness that subjectively assessed whether the logic in the simulation model was as it should be and whether the model's input and output relationships were realistic. The panelists also further contemplated the usefulness of the model for end-users. Both sets of panelists agreed that, as demonstrated, the model looks as if it will perform as expected.

4.1 Qualitative behavior

- Do epidemics spread in a realistic way?
  - Within the context of the model based on inputs from the Hong Kong 2009 H1N1 surveys, it was generally felt that this output was realistic.
- Do epidemics and personal behavior respond to each other appropriately?
  - Personal behavior will change in response to an epidemic if there is perceived danger. For a given outbreak (real perceived risk, and a certain fear level), then behavior will change if it is perceived as protective. It is a multifactorial situation, and given the elements of risk and fear, a behavior that is perceived as conferring a protective effect, will be adopted. The timing of the communication was felt important on affecting behavior, i.e. health communication in the US regarding the 2009 H1N1 vaccine shortage was not synchronized. Timing is important; i.e. don't give the right message at the wrong time.
  - Who is the model intended for? The lay population as a whole is the target for the model output messaging. Healthcare providers are the intended users of the model to improve 1) preparedness for epidemics and 2) during response to an epidemic, both the timeliness and quality of their communications with the lay population. Policy makers are the intended operators of the model in terms of mediating inputs.
  - Given the above, changes in inputs are expected to lead to reasonable changes in outputs.
- Do different communication plans have the expected impact?
  - As there is no control group to measure impact, then the impact must be assessed empirically. It is likely that different plans will have different impact based on factors noted above. It is strongly recommended that indirect ways to measure impact be found by means of historical data such as vaccine uptake. Also, if available, data from different population groups on message vs. uptake can be compared.

4.2 Model usability (utility):

- Can communication plans of interest be input to the model?

  - Yes, and that's part of the input into the model
  - Other model inputs include controls for adapting behavior and effect and epidemic features.
- What other inputs would be useful?
  - More discreet demographic variables.
  - Different behavioral characteristics of given populations, e.g. data that covers behavioral measures of populations in areas that are predominantly antivaccinationist would require appropriate inputs.
- Does the model report the appropriate information?
  - The model doesn't provide information as much as public health data measuring different behaviors vis-à-vis different communications. If the model is valid, then inputs would be appropriately tailored and the expected outcome should be a flattening of the epidemic curve.
- Are model users able to interpret the model output?
  - Epidemic progress should reflect the influence of the prescribed messages.
  - Users should be able to interpret communication effect on adapting behavior and attitudes.

5. CONCLUSIONS AND RECOMMENDATIONS

5.1 Overall Recommendations

As demonstrated, and at the current stage of development, the model will serve as a useful tool to public health preparedness planners and communicators. It will also provide a framework for academic discussion and research in this extremely important area. The unique features of the model that connect personal behavior, epidemic progress and communications allow health providers to plan for and tailor health communications for the distinct phases of an epidemic in a particular region. The model accounts for many of the same factors that influence protective behaviors such as vaccination that were presented in the NDLSF™ D1.4 Report on Vaccine Acceptance/Refusal and Resistance to Vaccination. For example, in the event of a pandemic, acceptable risk for the protective behavior of vaccination is predicated in part on perceived severity and susceptibility to the targeted disease. As identified by Dr. Badham, it is recognized that some of the recommendations will need to be set aside for future iterations of the model. As such, they provide suggested goals for the model evolution. And it is acknowledged that as the model evolves, new information regarding future capabilities of such a model will become evident. Limitations are to be expected at this stage of model evolution, but further research can be configured to address and overcome these limitations.

Specific recommendations identified by US discussion panels for the model include:

1. The model should aim to be adaptable for other infectious diseases including non-airborne agents.
2. The model should aim to be able to fine-tune messaging based on real-time input data, such as vaccine shortages, so it is useful for more than just the planning phase for epidemics.
3. Develop a means to measure and evaluate impact of various communications plans.
4. The model evolution should be able to target specific geographic regions more effectively.

5. The model evolution should be able to deliver targeted communications to special population sub-groups, e.g. input data that covers behavioral measures of the population in areas that have a predominantly antivaccinationist population.
6. In the US, in particular, the messaging would be valuable to healthcare professionals staffing call centers during a pandemic, so the model could become even more useful through broad collaboration among public health professionals during a pandemic.
7. Consider tools such as Apps for handheld devices to augment the model. Such tools will make it easier for public health planners to use the model, thus supporting widespread adoption.
8. Seek high-level support and funding to advance the model evolution.
9. Heed lessons from the H1N1 pandemic. For example, message timing is important. Try to avoid delivering the right message at the wrong time!
10. Aim to enhance the model to improve its predictive capability and its utility.
11. If the first version of the model is only to be disseminated to European countries, later iterations should be planned for use by other TELL ME partner countries (US and Israel), and other nations.
12. Clearly identify how messages are to be disseminated, and they should be tailored for national, regional and community audiences.
13. Clearly identify both the end-users and the target populations for the model.
14. Develop a robust plan for broad dissemination of the model to facilitate its evolution.
15. Collaborate with other professional groups focusing on the role of communicating during disasters and public health emergencies and how to influence behaviors.

5.2. Conclusion

The TELL ME simulation model, in its current version, has several limitations, mainly resulting from a paucity of validated data sets. The potential benefits from this type of model in better addressing and controlling epidemic disease far exceed any costs in further development and application. It must be stressed that this is a first generation model that uniquely integrates three complex multifactorial constructs, namely communications, personal behavior, and epidemic progress, into a common agent-based simulation commications model. When tested, refined and validated, the model will provide significant public health benefit in allowing us to better prepare for and respond to epidemic infectious disease.

APPENDIX I : Comparison of US and EU Testing Panels

A direct quantitative comparison of the EU and US test panel results is difficult for these reasons :

1. The make-up of the panels, although similar in some aspects, is divergent enough to preclude direct comparison. In the EU, the panels consisted of General Practitioners (GPs) and family doctors involved in the clinical practice of medicine. In the US, the panel members were from a broader background of disciplines with a majority representing public health practitioners involved in providing public health services, health communications, policy development, modeling and academics. It should be noted that this disparity, although limiting direct quantitative comparisons, enabled a much broader and more comprehensive input for empirical comparisons.
2. While both efforts utilized essentially the same sets of validation questions prepared by Dr. Badham of Surrey, the questions themselves were administered in the format of a questionnaire by the EU group, whereas in the US, the questions were used to stimulate open-ended discussion. Each of these approaches has its merits, however, a direct statistical comparison between the two sets of response data would not be meaningful. This in no way precludes a comparative analysis of recommendations resulting from each approach, and in many ways, enables a richer comparative analysis that should better inform the needs of the modelers.

In order to provide the reader with a discussion framework, the comparison will be made by sequentially listing and addressing each EU recommendation in the context of those from the US panels :

- EU Recommendation 1: Inclusion of new determinant factors (inputs) into the model, e.g. traveling, migration, cross-border influences, families, health workers, GPs', and patients' (mis)perceptions, numbers of predicted deaths, etc. The US respondents almost unanimously were concerned with the need for more specific, detailed, and validated data sets to enter into the model in order to better attune outputs (communication messages) to more discrete sub-groups of the population as well as to look at different geographical entities, e.g. cities, states, regions, countries, etc.

- EU Recommendation 2: Differentiation (weighting) of certain factors, e.g. healthcare professional groups, media channels, quality of the message. This recommendation was not discussed by the US panelists. Author's comment – this is indeed an important and critical considération, but how weighting is assigned must also be addressed. If based on subjective criteria, then model effects can be biased and not generalizable.
- EU Recommendation 3: Increase heterogeniety of the population, e.g. age groups and other characteristics. This was strongly amplified by the US panels which felt that the more specific (targeted) the model could be, then the greater its utility as a public health tool. Much of this discussion supported EU Recommendations 1 and 3.
- EU Recommendation 4: Provide more detailed explanation about where/how the epidemic has started. Although the US panelists did not discuss this directly, there was robust discussion on like factors. The US panels felt that the model needed to have applicability in both the planning and the response phases of an epidemic. There was also some concern about defining triggers as to when an event is declared and when a health communication strategy is launched. A better understanding of the origins of a given event will enable early data collection that can better inform the communications model inputs and enable more effective messaging. The complex difficulties inherent in the sensitivity and timing of triggers has been all too well evidenced in the West Africa Ebola virus epidemic and the sluggish response which proved detrimental in controllint the event.
- EU Recommendation 5: To allow a user to choose where an epidemic starts would be useful. Again, this question was not directly addressed by US panels, but in planning for an event this capability would be of great benefit.
- EU Recommendation 6: Realistic model situations for every country. The US panels felt strongly that specific input data needed to be available so that strategies could be tailored to a wide variety of geographical entities.
- EU Recommendation 7: Comparison between the outcome of the different communication activities (comparison to former results). This was another area that received in-depth discussion from the US panelists, and was an area of concern. There is a need to evaluate the model as to its effects among and within populations, but what are valid measures, how are they defined, and how are they compared longitudinally or cross sectionally? This is a critical area deserving of additional research.
- EU Recommendation 8: GPs' involvement in the planning. The US panels felt that a key strength of the overall TELL ME communication strategy was the recognition that all stakeholders needed to be addressed. Also, communication was defined as multidirectional permitting a feed-back loop and modification as needed in real time.
- EU Recommendations 9 and 10: Expand the number of potential users (a basic version for GPs and other health professionals), and provide more support for potential users, e.g. explanations, code definitions, more user-friendly interface, video support. These recommendations are addressed together to reduce duplicative narrative. The area that received the most extensive discussion among the US panelists revolved around the questions of who the intended users of the model were, and the roles different users played. The following narrative summarizes the US panelists' concerns and observations.

The US panelists, as a whole, questioned who the model was intended for. They felt that this was not clearly defined in the presentation, and needed to be addressed. In synthesizing the various observations and discussions, there was consensus that in different ways the model was intended for use at three different levels :

- At the input phase, the simulation model was most appropriately intended for decision and policy makers who would set objectives and determine inputs to best achieve those objectives.
- The next level would be the health care provider level which would assess different outputs and provide input back to level one (decision and policy makers) to refine and develop communications strategies.
- At the third level, health communication messages would be developed and delivered to the target population(s) through primary care providers and trusted media to influence protective behavior of the population.

The primary care community would be essential to fine-tuning messages in terms of demographics and other population characteristics, as well as translating patient/provider beliefs and best practices into clear and effective messages capable of influencing behavior. Thus, it can be concluded that the US panelists supported the overall TELL ME Framework model in that communications must be multi-directional and all stakeholders, i.e. decision makers, healthcare providers, lay public, need to inform inputs to optimize uptake of public health interventions.

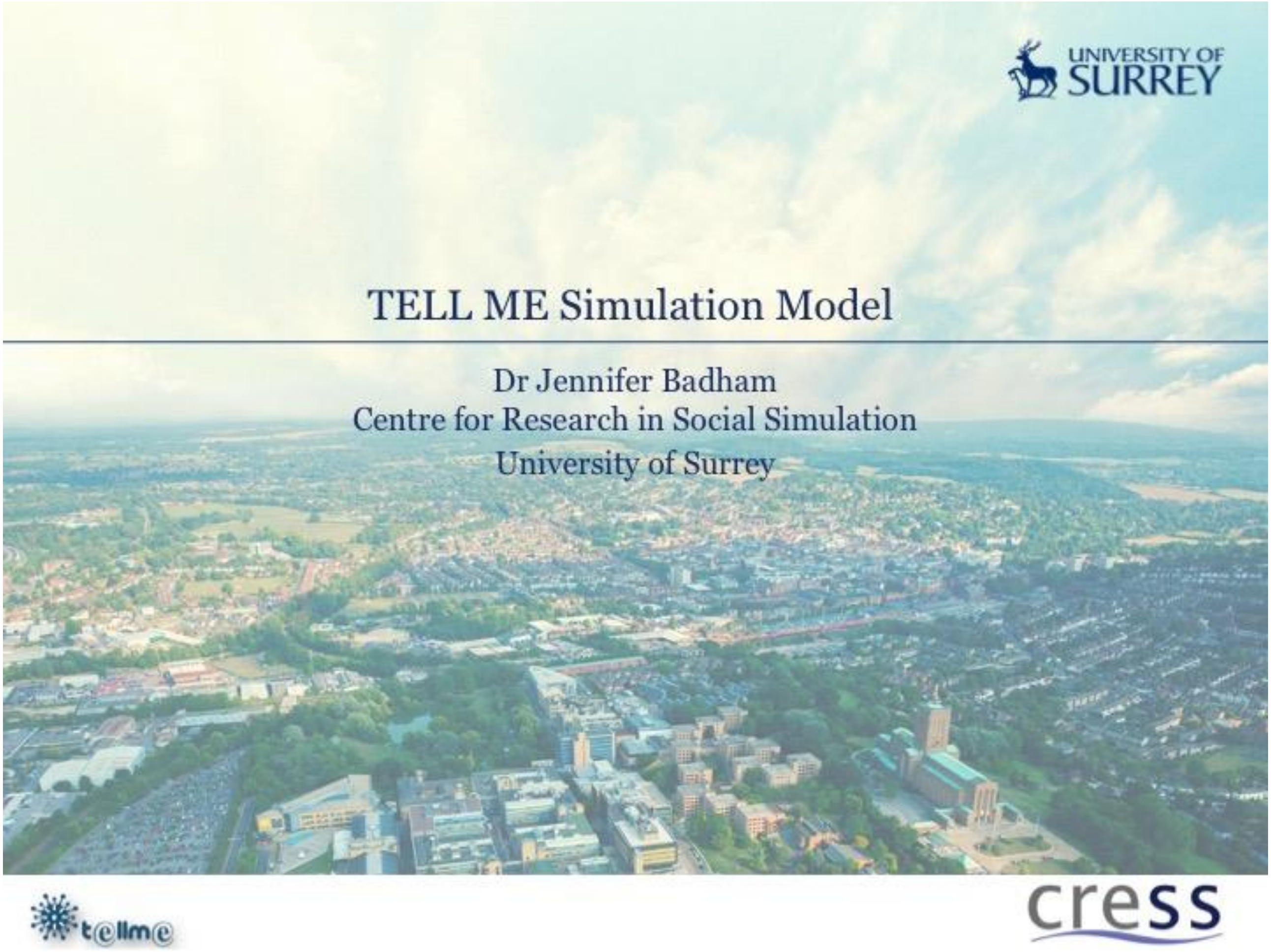
The above seeks to address the recommendations resulting from the EU test panels of health professionals, and discuss those areas where there appeared to be mutual agreement with the US panelists. Although written and expressed differently, of the 15 recommendations given by the US report, 10 are fully consistent and reinforcing of their EU counterparts. The five more or less unique recommendations from the US panelists were :

1. The model should aim to be adaptable for other infectious diseases including non-airborne agents.
6. In the US, in particular, the messaging would be valuable to healthcare professionals staffing call centers during a pandemic, so the model could become even more useful through broad collaboration among public health professionals during a pandemic.
7. Consider tools such as Applications for handheld devices to augment the model. Such tools will make it easier for public health planners to use the model, thus supporting widespread adoption.
8. Seek high-level support and funding to advance the model evolution.
14. Develop a robust plan for broad dissemination of the model to facilitate its evolution.

Of these, none are contrary to the recommendations of the EU panelists, and most likely result from the open-ended nature of US data collection versus the use of a questionnaire for the EU panels.

APPENDIX II : TELL ME Simulation Model

Dr Jennifer Badham
Centre for Research in Social Simulation
University of Surrey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TELL ME Simulation Model
Dr Jennifer Badham
Centre for Research in Social Simulation
University of Surrey
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What is TELL ME?

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TELL ME: European funded project about communication during influenza epidemics

- runs Feb 2012 to Jan 2015
- 12 project partners with epidemiology, medical professional, communication expertise

Three major outputs:

- Communication guide and other resources assist agencies to deliver the selected messages in the most effective way
- Online training courses for healthcare professionals
- Simulation model for planning

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What is the TELL ME simulation model?

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The simulation model is intended to (eventually) help health agencies plan communication to minimise impact of influenza epidemics

- enter details of epidemic scenario
- try out communication plans (packages of messages)
- see the potential effect on personal behaviour and epidemic impact

The model is to be a prototype:

- capture the way in which communication connects to behaviour
    - excellent models about epidemic spread
    - few models connecting personal behaviour
    - no models connecting communication
- limited data to calibrate, so no forecasting power

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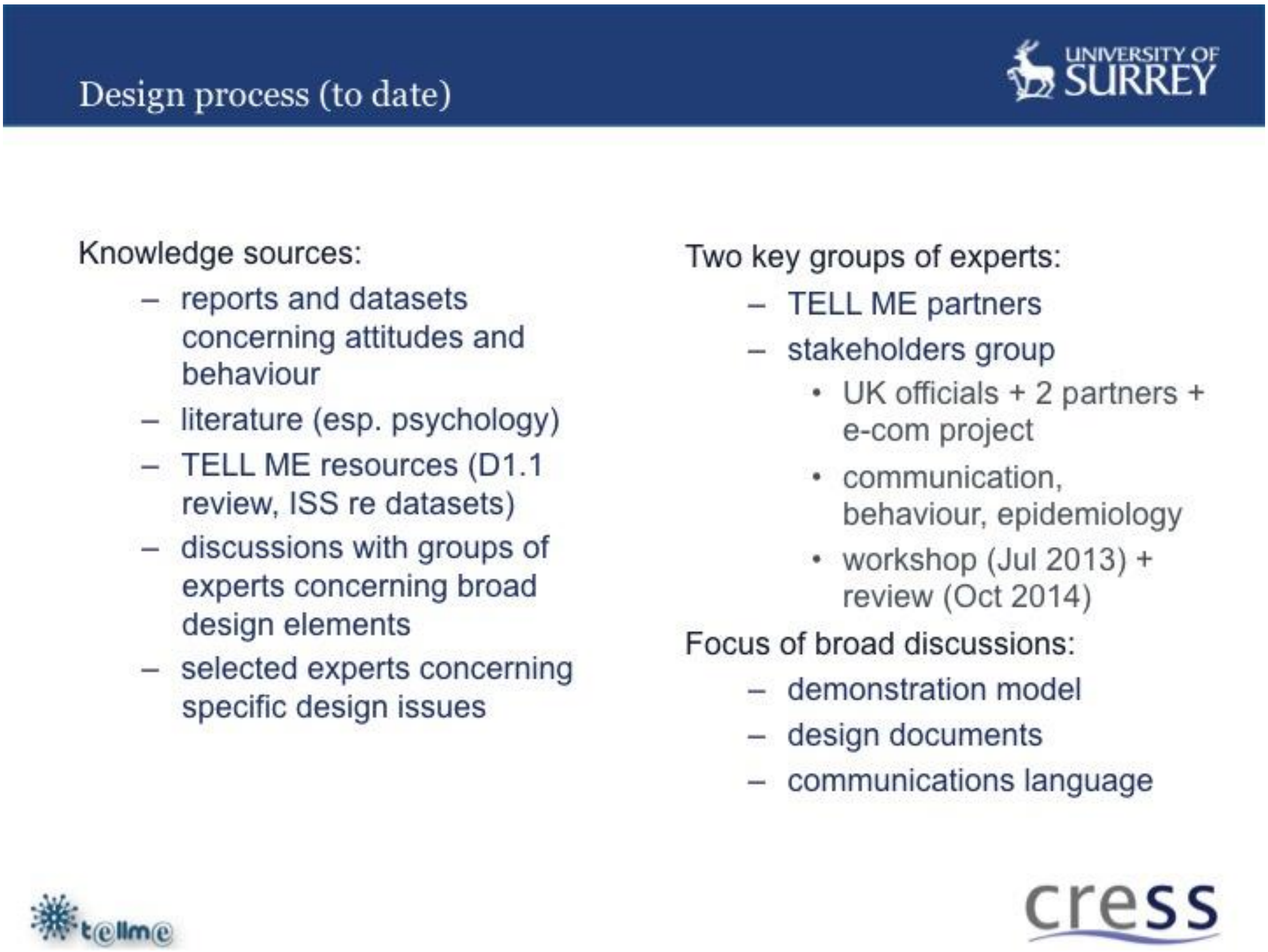
Design process (to date)
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Knowledge sources:
– reports and datasets concerning attitudes and behaviour
– literature (esp. psychology)
– TELL ME resources (D1.1 review, ISS re datasets)
– discussions with groups of experts concerning broad design elements
– selected experts concerning specific design issues
Two key groups of experts:
– TELL ME partners
– stakeholders group
• UK officials + 2 partners + e-com project
• communication, behaviour, epidemiology
• workshop (Jul 2013) + review (Oct 2014)
Focus of broad discussions:
– demonstration model
– design documents
– communications language
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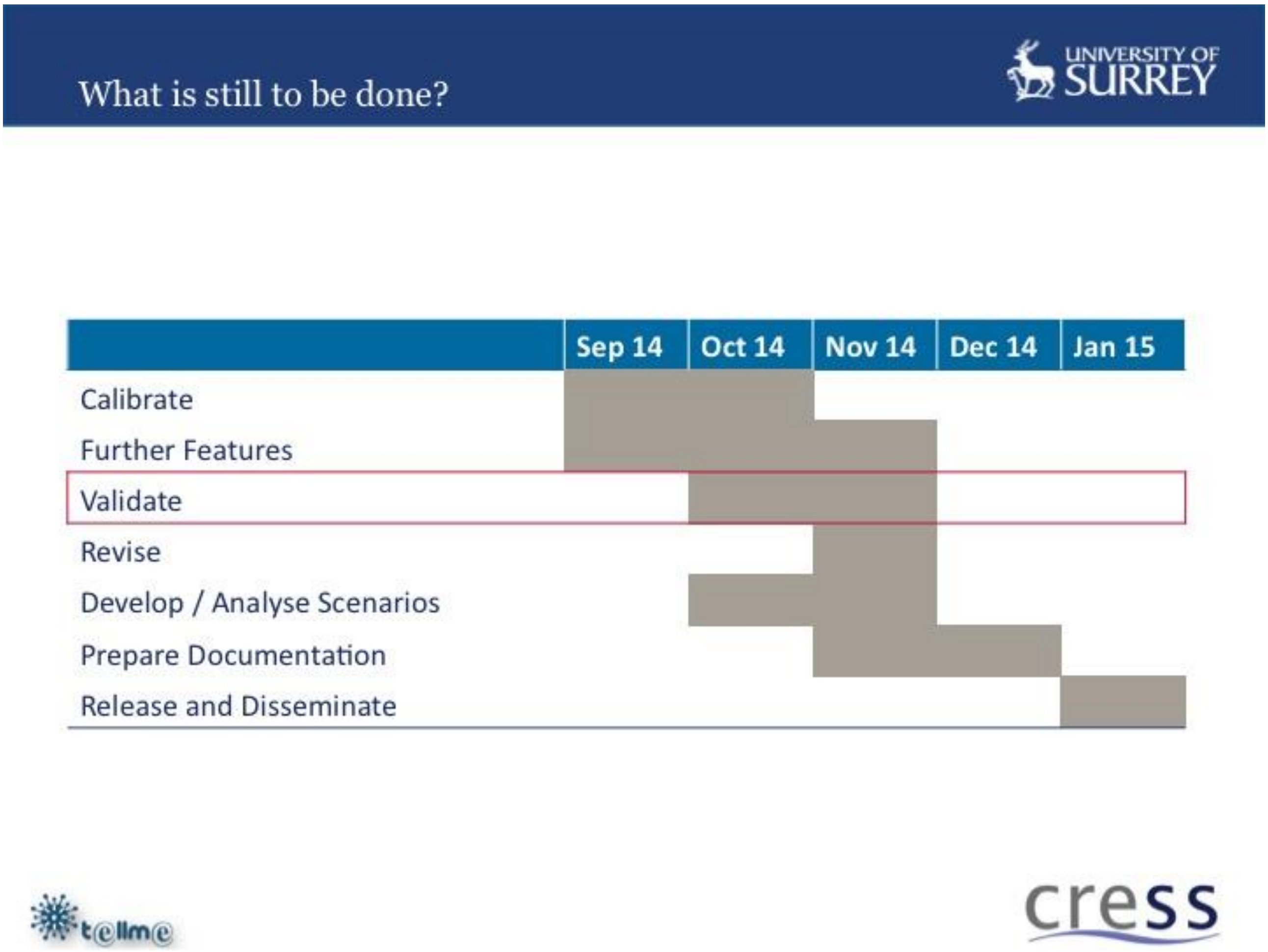
What is still to be done?
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Sep 14
Oct 14
Nov 14
Dec 14
Jan 15
Calibrate
Further Features
Validate
Revise
Develop / Analyse Scenarios
Prepare Documentation
Release and Disseminate
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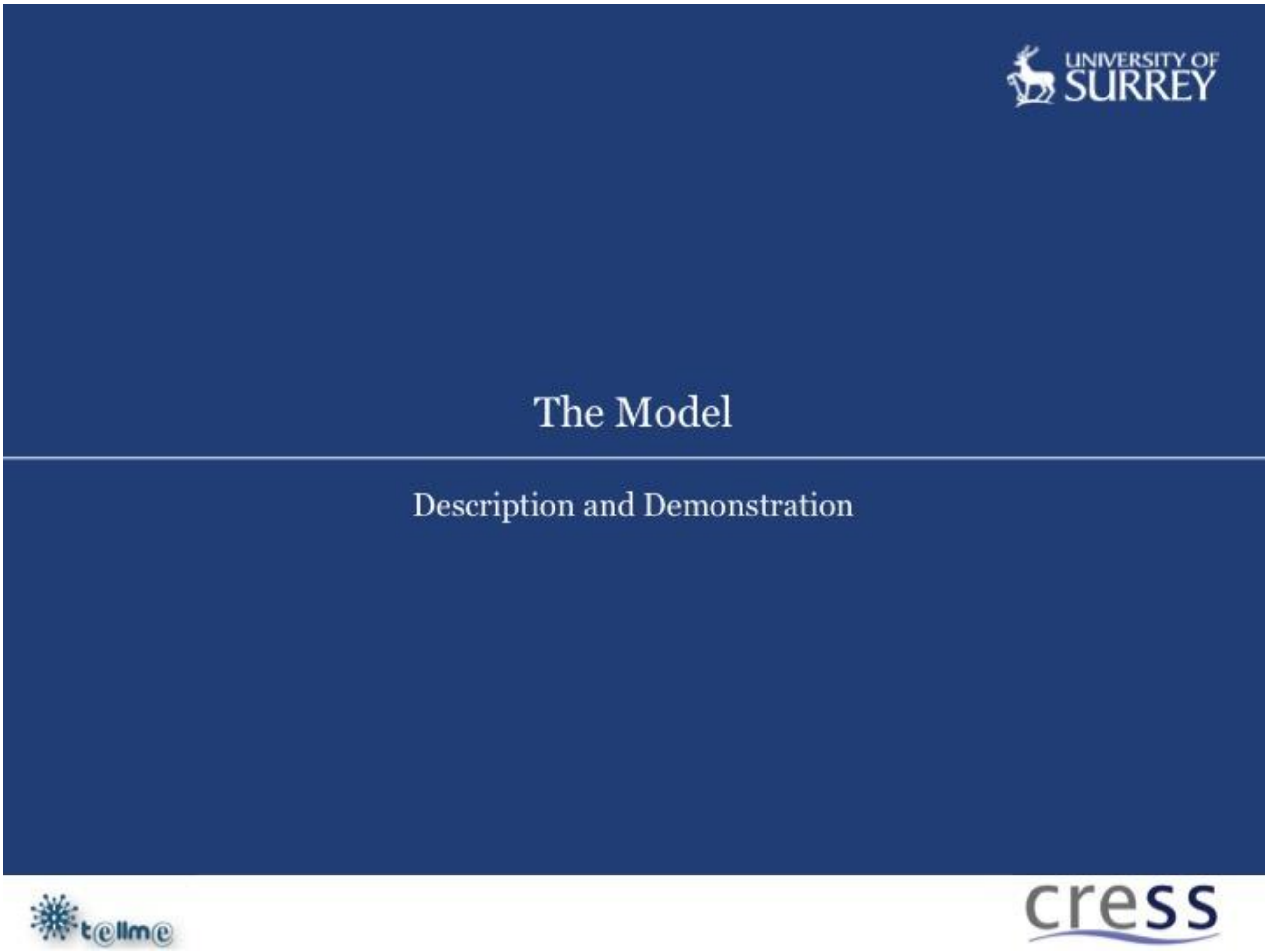
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The Model
Description and Demonstration
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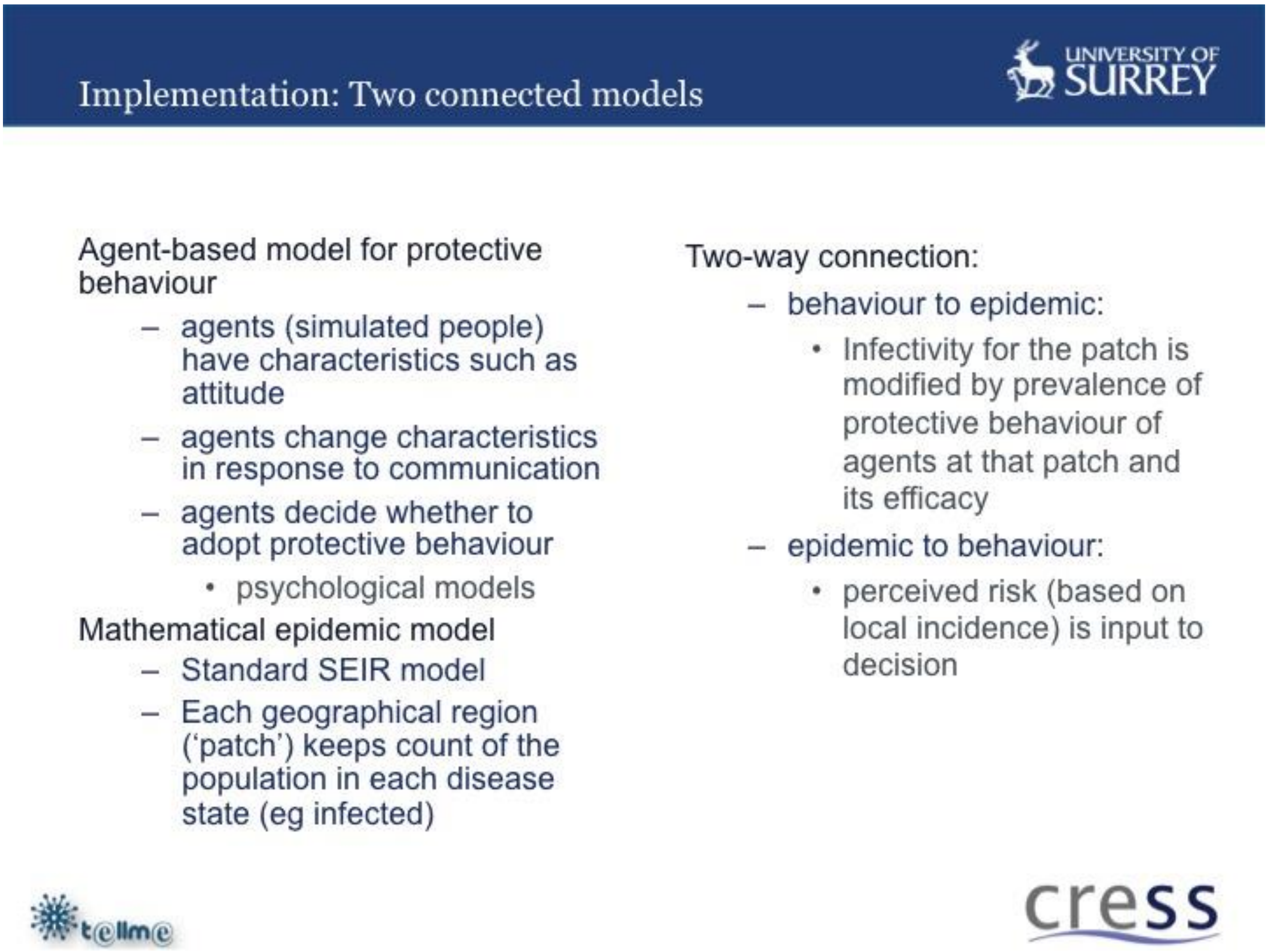
Implementation: Two connected models
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Agent-based model for protective behaviour
– agents (simulated people) have characteristics such as attitude
– agents change characteristics in response to communication
– agents decide whether to adopt protective behaviour
• psychological models
Mathematical epidemic model
– Standard SEIR model
– Each geographical region ('patch') keeps count of the population in each disease state (eg infected)
Two-way connection:
– behaviour to epidemic:
• Infectivity for the patch is modified by prevalence of protective behaviour of agents at that patch and its efficacy
– epidemic to behaviour:
• perceived risk (based on local incidence) is input to decision
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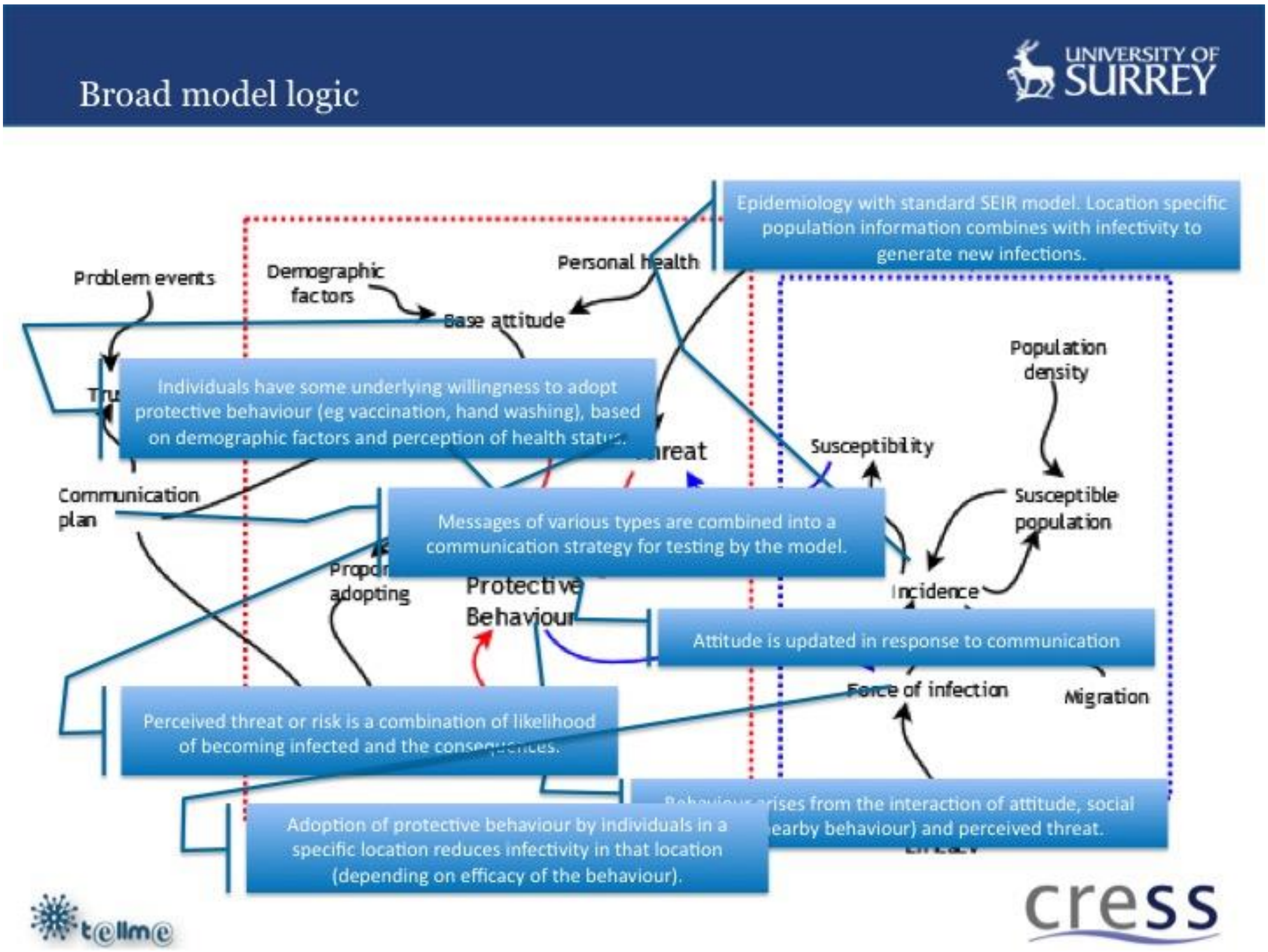
Broad model logic
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Epidemiology with standard SEIR model. Location specific population information combines with infectivity to generate new infections.
Problem events
Demographic factors
Personal health
Base attitude
Individuals have some underlying willingness to adopt protective behaviour (eg vaccination, hand washing), based on demographic factors and perception of health status.
Population density
Susceptibility
Communication plan
Messages of various types are combined into a communication strategy for testing by the model.
Susceptible population
Protective Behaviour
Incidence
Attitude is updated in response to communication
Force of infection
Migration
Perceived threat or risk is a combination of likelihood of becoming infected and the consequences.
Adoption of protective behaviour by individuals in a specific location reduces infectivity in that location (depending on efficacy of the behaviour).
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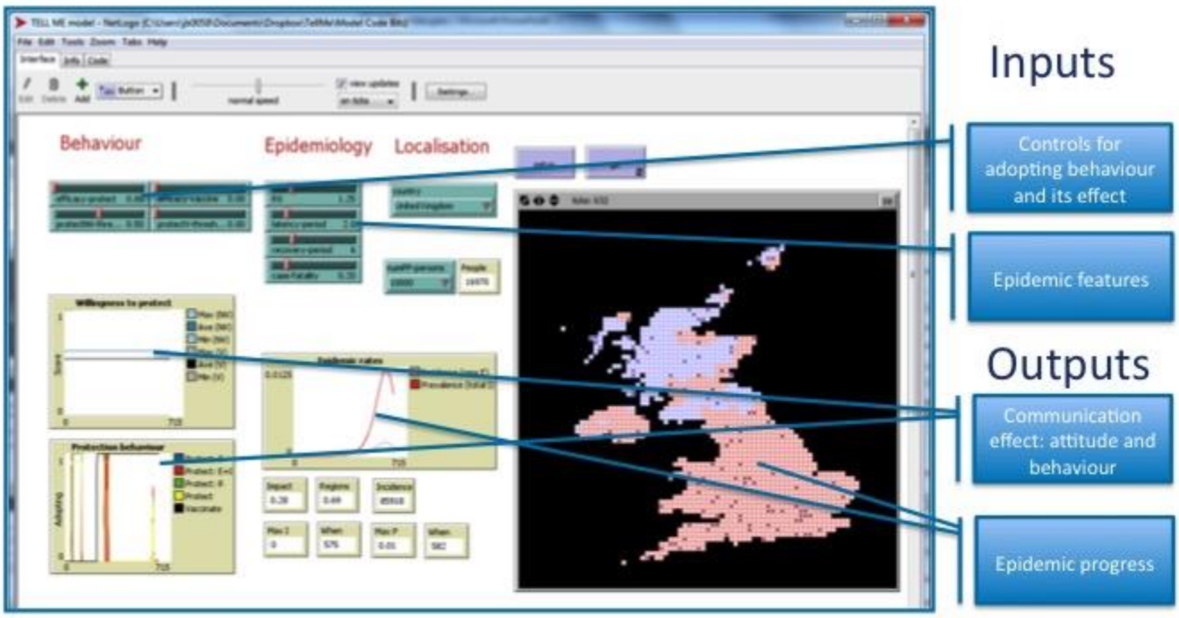
Demonstration model: main screen



Prototype: multiple screens

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Communication plans

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Communication plans described as package of messages

Each message has five properties:

- When the message occurs
  - controls timing and coordination
  - frequency or trigger based
- Channel (eg mass media, delivered by health care workers)
  - who is exposed to the message
- Target (eg all, health care workers)
  - whether agent exposed acts on the message
- Behaviour: vaccinate and/or other protective
- Content (eg promote benefits, epidemic status)
  - controls the effect that the message has on the agent

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Communication effect

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Messages act on simulated people (agents)

If content promotes benefits

- attitude increases
- has an effect only if the message is not too far away from the person's current attitude score
  - technically - proportional within latitude of acceptance (SJIT)

If content emphasises responsibility

- for the next few timesteps, the agent adds a bit to their calculated behaviour score (through the norms component)

If content provides epidemic status information

- future messages are more trusted

If content recommends adoption of some behaviour

- for the next few timesteps, the agent recalculates their behaviour score with a high risk component

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Demonstration

Alternative scenarios of same epidemic: add one element at a time

- compare maximum incidence, when it occurs, and impact
- changes in attitude and behaviour curves

Scenario	Added element (s)
1. Epidemic curve	Baseline (random): no communication or behaviour adoption
Low behaviour thresholds – easy to adopt	
2. Ineffective	Behaviour, but with no efficacy
3. Effective	Behaviour that has effect
High behaviour thresholds – hard to adopt, effect of communication exaggerated	
4. Unresponsive	Higher behaviour thresholds (adoption less likely)
5. Basic communication + high thresholds	Regular messages about benefits of vaccination (attitude) plus once-off emphasis of responsibility (norms)
6. Communication plan	Combination of messages with different media and effects


Conclusion

Design features still to be implemented

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Multiple tabs for interface

Severity / worry

Additional context choices for scenarios
- rumour
- vaccine problems
- false alarm
- initial alarm or complacency

Country specific parameters

Preset scenarios

Implementation of some communication triggers:
- local prevalence
- first death

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Summary: progress

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Broad knowledge captured by the model:

- Theoretical connections from literature
- Empirical data (where available)
- Expert input to participatory development process

Still to implement preset scenarios:

- different epidemic settings
- example communication plans

Expected Jan 2015:

- Prototype model
- AND supporting materials to assist dissemination (such as a user guide and example scenarios)

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Summary: potential uses

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First model to link three inherently connected components of the system of an influenza epidemic:

- Communication
- Personal protective behaviour
- Epidemic progress

Initial uses:

- Assess the adequacy of theoretical understanding of behaviour
- Assist planners to assess the role of effective communication in epidemic management
- Guide future data collection to allow more predictive model development

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Conclusion

Thank you for your attention

Questions?

Contact: j.badham@surrey.ac.uk

Validation questions

NOT a predictive model: insufficient data to calibrate connections between epidemic status, communication and behaviour

Qualitative behaviour
- do epidemics spread in a realistic way?
- do epidemics and personal behaviour respond to each other appropriately?
- do different communication plans have the expected impact?

Model usability
- can communication plans of interest be input to the model?
- what other inputs would be useful?
- does the model report the appropriate information?
- are model users able to interpret the model output?


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Detailed Design
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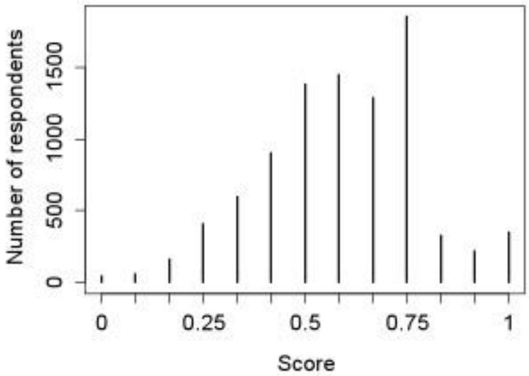
Attitude distribution: source

Combine 4 questions from Hong Kong 2009 H1N1 surveys (Cowling et al 2010):

- cover mouth when sneeze or cough
- wash hands after sneezing or coughing
- liquid soap when wash hands
- preventative measures when touch common objects

Never to Always so scale 4-16

- Rescaled to [0,1]



Attitude distribution: implementation

Initial attitude drawn from triangular distribution with mode 0.75

For vaccination, second triangular distribution with mode 0.25

- probability of using the second distribution given by anti-vaccination proportion

Adjusted to introduce difference in mean attitude for 'in-target' and not 'in-target' group

- the in-target group is a potential audience for communication

No specific adjustment for demographic and other factors:

- Such factors do not change behaviour
- Instead, the triangular distribution is expected to provide diversity equivalent to that in the population

Protective behaviour: source

Well established theories from psychology about the influences on behaviour

Three most relevant:

- Theory of Planned Behaviour
  - behaviour is a function of attitude, perceived norm, perceived control and is mediated by intention
- Health Belief Model
  - protective health decisions are governed by motivating factors (susceptibility and severity) and the benefits and barriers for each potential action
- Protection Motivation Theory
  - related to HBF, but recognises fear as an additional motivation and that perceived lack of control can lead to denial or other maladaptive behaviour

Protective behaviour: implementation

Hybrid of TPB and HBM / PMT

- retained factors with large effect size, dynamic
- factors are:
  - attitude (score 0 to 1)
  - perceived norm
    - proportion of visible agents who have adopted behaviour
  - threat
    - susceptibility as discounted visible cumulative incidence
    - severity modifier (multiplier for weight)

Behaviour is adopted / dropped if the weighted average is above / below a threshold

$$P_i = \alpha A_i + \beta N_r + (1 - \alpha - \beta) S \left(I_{t,r} + \delta I_{t-1,r} + \delta^2 I_{t-2,r} + \ldots \right)$$

Epidemic updating

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$$\frac{dS_r}{dt} = -\beta_r S_r I_r$$

$$\frac{dE_r}{dt} = \beta_r S_r I_r - \lambda E_r$$

$$\frac{dI}{dt} = \lambda E_r - \gamma I_r$$

$$\frac{dR}{dt} = \gamma I_r$$

$$\beta_r = \beta\left(1 - P_r e\right)$$

S, E, I, R are properties of region

- prop population in each state
- *r* is region indicator

β, λ, γ, *e* given by scenario

Travel permits epidemic to spread

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