

TELL ME Simulation Model

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Excellent existing models about epidemic spread

- some models connect personal behaviour (exogenous)
- no models connect communication

TELL ME prototype connects theory about:

- communication
- personal behaviour
- epidemic spread



GLEAMviz: http://www.gleamviz.org/simulator/





Design process



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:

- communication, behaviour, epidemiology
- TELL ME partners
- stakeholders group
 - UK officials + 2 partners + e-com project

Focus of broad discussions:

- demonstration model
- design documents
- communications language



Prototype: main interface



cress

(Eventually) help health agencies plan communication to minimise epidemic impact





Detailed input screens



> TELL ME model - NetLogo (C:\Users\jb0058	\Documents\Dropbox\TellMe\Model Cc	ode Bits}	1000 - W W 2				
File Edit Tools Zoom Tabs Help							
Interface Communications Plan Policy Context	TELL ME model - NetLogo	{C:\Users\jb0058\Documents\Dropbox\TellN	Me\Model Code Bits}	412000-			
Trigger	File Edit Tools Zoom Tabs	Help					
Trigger (m1) Day / Level (m1)	Interface Communications Plan Policy Context Advanced Parameters Info						
NONE • 0	Encourage voluntary (or compu	ulsory) self-isolation of those infected	File Edit Tools Zoom Tabs Help				
Trigger (m2) Day / Level (m2)	Isolation?	0	Interface Communications Plan Policy Context Advanced Pa	rameters Info Code			
NONE • 0		U Reduction in travel (proportion)	Travel for contacts elsewhere	Respond to communication	Inpu	uts to behaviour decisions	
Trigger (m3) Day / Level (m3)		0					
NONE V		U Reduction in local contacts (proportion)	Travel rate 0.30	See mass media		ration of norms bonus 5 days	
Trigger (m4) Day / Level (m4)		· · · · · · · · · · · · · · · · · · ·		Γ Γ			
NONE - 0	Restrictions on access to vacci	ne (delay or eligibility)	Travel proportion short 0.85	See social media	0.60 Bon	nus for vaccination 0.20	
Trigger (m5) Day / Level (m5)	Restrictions on vaccine?	Eligible population				0	
NONE 0		All	Operational parameters	Healthcare worker sees health media	0.80 Bon	nus for other protective behaviour 0.40	
Trigger (m6) Day / Level (m6)		Target group Healthcare workers	Prevalence at which epidemic declared			[
			0.0010	Go to doctor during campaign	0.10 Dail	ly discount for past incidence 0.080	
Trigger (m7) Day / Level (m7)							
NONE 0	Misperception of risk: prevalen	ce and threat	U See distance 3	Effect of communication	Thre	eat perception multiplier (1 = H1N1) 1.0	
Trigger (m8) Day / Level (m8)	Risk misperceived?		Population represented by person				
NONE		Perceived risk of infection	5000 V	Lattitude of acceptance	0.40 Weig	ghts in behaviour decisions	
Triance (m0)		U				[
Trigger (m9) D y / Level (m9) NONE O		Perceived severity (1 = H1N1)	Randomise?	Change: mass media	0.10 Vac	cination: attitude weight 0.40	
			-1262456798				
Trigger (m10) Day / Level (m10) NONE • 0		rotective behaviour		Change: social media	0.20 Vac	cination: norms weight 0.30	
	Frenzy occurs?		Attitude structure	Change: media for healthcare worke s	0.40	O	
		Adopt nonvaccination behaviour			Non	nvaccination: attitude weight 0.30	
	Loss of trust in health communi	ication	Initial attitude bonus for target group 0.10	Change: healthcare advisor	0.60	nvaccination: norms weight 0.40	
\ \	Trust lost?					Vaccination, norms weight	
1	Indsciose?	Average trust at start of epidemic	Daily return to initial attitude 2.0 %	Trust bonus from information	0.05		
1		Average ouscatistation epidemic	<u> </u>				
1		Trust level once recovered	1.00				
1		Trust level once recovered	1.00				
1							_
	Communic	ation plans	Situation elemen	ts (eg	C	Customisation as data	
	(messag	ge sets)	isolation, trus	st)		available	
							-
						Cro	СС
						cre	
Allma							



Two connected models





Agent-based model for protective behaviour



cress

Thousands of individual heterogeneous agents (simulated people)

- properties based on population structure
 - location, healthcare worker, ...
- behaviour relevant characteristics
 - attitude, media access, ...

Agents change characteristics in response to communication messages

Agents decide whether to adopt protective behaviour based on psychological models

- consider own situation
- based on own characteristics



Connection from

mathematical

epidemic model

UNIVERSITY OF

Well established models from psychology about the influences on behaviour

- Theory of Planned Behaviour
- Health Belief Model
- Protection Motivation Theory
- TELL ME model uses hybrid
 - those factors that have large effect size and char
 - factors selected are:
 - attitude (score 0 to 1)
 - perceived norm: proportion of nearby agents who have adopted behaviour
 - susceptibility: discounted visible cumulative incidence
 - today's new cases count more than yesterday's, which count more than the previous day's and so on
 - severity / worry: multiplier on weight for threat component

Behaviour decision: compare weighted average of factors to a threshold





Communication plans



Communication plans described as package of messages with five properties









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Message content

Target group

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Messages act on simulated people (agents) who are exposed (target, media)

If content promotes benefits

- attitude increases 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





Mathematical model for epidemic spread





Spatially explicit difference equations keep count of the population in each disease state





Broad model logic



Putting all the pieces together







Demonstration

Predefined scenario





Problem: Calibration



Large number of parameters

- Communication effect: trust, attitude proportionality, latitude size, ...
- Behaviour model: weights, incidence discount, ...

Parameters specific to:

- infection (SARS, H1N1...)
- type of behaviour (vaccination, hygiene, masks...)
- culture (Europe, Asia,...)

Some longitudinal data

- 9 studies with both prevalence and behaviour
 - 3 diseases in 5 countries
 - mix of behaviours

No longitudinal communication data

Prototype is NOT suitable for prediction





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

- Communication
- Personal protective behaviour
- Epidemic progress

Will deliver: model + documentation + predefined scenarios

Initial uses:

- Identify gaps in the theoretical understanding of behaviour
- Understand the important of effective communication
- Guide data collection to support future models that compare communication options



