Expert Model of Vaccination Population Protection

Node Definitions (variable):

Public Health Strategy and Plans (g): The plans by which public health strategies are implemented.

Vaccine Program Design (d): The program, as characterized by its scope, incentives (for different parties), and protections.

Disease surveillance (l): The surveillance measures taken, for monitoring disease outbreaks; observation of disease patterns.

Supply Chain (c): The ability of the supply chain to satisfy the demand for the vaccine.

Screening (s): The activities undertaken to identify and recruit individuals to be vaccinated.

Quality of Vaccine (q): Measures of potency, durability.

Vaccine Effectiveness (n): How well the vaccine protects.

Vaccination Program Coverage (v): Percentage of population (perhaps weighted by group status) that has been vaccinated; the act of vaccinating an individual or group.

Individual Immunity (i): Immune response, such as development of antibodies.

Herd Immunity (w): Presence of a critical level of group or community immunity.

Assessment of Vaccine Safety (r): Perceptions of risk, considering at least probability and consequences, perhaps over multiple dimensions (e.g., different side effects).

Assessment of Vaccine Benefits (b): Perceptions of benefits, considering at least probability and consequences, perhaps over multiple dimensions (e.g., morbidity, mortality, psychological stress).

Personal Values and Belief Systems (m): Value and belief systems potentially related to public health programs, concept of risk in the abstract.

Information/Education (e): Published (print or digital) communications, programs providing information; grass-roots efforts to disseminate information. Characterized in terms of content and coverage.

Healthcare Providers (h): Individuals in a position of providing medical education & information, who will communicate to individuals. Characterized in terms of attitudes and outreach coverage.
Public Health & Government Credibility (u): General level of trustworthiness of the
government and public health institutions, including their recommendations and research.

Disease Threat/Outbreak(o): How great a threat the disease seems to be; increases or
decreases in presence of the disease.

Health (p): General, mostly non-transient health status. In terms of economic effects,
mortality, morbidity, and psychological effects; complications & sequelae of impacts on
health.

Vaccine Availibility (f): The commercial availability of vaccines for use.

Total Dose (j): Total number of shots for a vaccine, or dosage amount within a shot.

Reporting (z): Assistance (e.g., legal) sought due to adverse vaccine events; informal
tracking of apparent adverse vaccine events

Vaccine Safety and Effectiveness Research (k): Research conducted as a surveillance of
the vaccine’s safety and effectiveness.

Multiple Vaccines (x): Other vaccines given in addition to the vaccine of interest;
combination shots.

Identify Reactions (y): After receiving the vaccine, identifying any reactions that may be
a result of that vaccine, especially those that may be informative for future actions.

Treat Reactions (a): Treating specific, immediate vaccination reactions, especially with
an intent to prevent further damage to health.

Link Interpretations (proposed functional relationships)

gd. public health plans and strategies affect the design of the MMR program. e.g., the
government decides what to do about smallpox vaccinations.

gl. public health plans and strategies affect the design of the surveillance program. e.g.,
the CDC puts out notices to watch out for smallpox; the CDC sends out descriptions of
anthrax symptoms to hospitals nationwide.

dc. the MMR program’s design affects the supply chain for vaccines (e.g., by providing
protection and incentives for producers); If a vaccine scope is planned to expand, more of
the vaccine (components) will be pushed into the pipeline.

cf. the supply chain determines vaccine availability; if there are delays in production or
delivery, less vaccine is available.
df. vaccine availability also depends on other effects of the MMR program (e.g., through its impacts on physicians and health plans); if medicare starts or stops coverage of a vaccine, the general availability will change accordingly.

ds. the MMR program’s design affects the routine operation of screening programs; e.g., if the program administers a requirement for day cares to require vaccination, then more day care aged kids will be screened to get the vaccine.

ls. surveillance programs affect screening programs in response to disease outbreaks; e.g., watching for measles outbreaks can lead to screening more people in for MMR in places where outbreaks might start.

qf. the quality of the vaccine affects its availability (in the sense that lower standards can increase availability, in the short run – although the opposite may be true in the long run); diluting the smallpox vaccine allowed more doses to be available.

fs. the greater the availability of vaccine, the greater the set of individuals can be screened into the program.

sv. the broader the screening, the greater the coverage for the program (on the group level); if an individual is "supposed" to get the vaccine, they will likely end up getting it.

qn. the higher the quality of the vaccine, the more effective the administered dose is in protecting recipients; improving quality of the vaccine could improve its effectiveness.

ni. an effective vaccine confers immunity; an ineffective vaccine will not prompt an immune response; if the vaccine doesn't work then people won't develop antibodies to the disease.

nw. the greater the vaccine effectiveness, the greater the herd immunity; an ineffective vaccine won't protect enough people to enable the critical level of group immunity to develop.

vi. getting vaccinated provokes an immune response in the body; body develops antibodies that fight the disease; people who have been vaccinated are immune to the disease in the future.

vw. the greater the program coverage, the greater the herd immunity, or the more likely that a critical level of immunity will exist in the community to protect unvaccinated individuals.

jn. vaccines are more effective when a greater dose is taken; if the dose is too small, it might not work; if not all the shots are taken, the vaccine might not work (as well).

qr. the higher the quality of the vaccine, the fewer the side effects; improvements in vaccine quality might reduce associated risks.
rj. the lower the perceived safety, the smaller the dose individuals will agree to take; if perceived risk is high (e.g., from earlier vaccine reactions, code yr), then people may decline to take the additional doses.

rv. the safer the vaccine seems, the greater the program’s coverage will be; if the vaccine seems unsafe to my child, then I may decide not to vaccinate my child at all; I vaccinated my child because I think it's safe.

mv. people opposed to public health will be less likely to participate in programs; vaccinating your child is something that good parents do

bv. individuals who see greater benefit to the vaccine will be more likely to participate; if I think it works then I will vaccinate; I won't vaccinate if I don't see a benefit to it.

ob. the greater the (perceived) threat of the disease, the greater the (perceived) benefit of the vaccine; if the disease is no longer around then there's no need to vaccinate against it

eb. educational programs may increase perceived vaccine benefits directly, by showing how effective it is; information may undermine the perceived benefits of vaccinating.

eo. educational programs may increase the perceived risk of the disease (and, thus, indirectly, increase perceived vaccine benefits, code ob); information may suggest that diseases are less (or more) of a threat than previously thought

hb. health care providers may affect perceived vaccine benefit; they may tell parents that a vaccine will help their kid

eh. educational programs may affect the beliefs and communications of health care providers; doctors go to conferences and learn about vaccinations; doctors may see other information suggesting good or bad things about vaccination.

er. educational programs may affect perceived vaccine safety; information may suggest that vaccines are risky

uh. the credibility of the government and public health system will affect health care providers' beliefs and behavior, vis-à-vis the vaccine; doctors may seek out information from the CDC, if they have high trust; doctors may trust their own (anecdotal) observational evidence more than what the government (or medical school) is telling them (esp if they have never seen some of these diseases before).

ur. the credibility of the public health system can affect perceived vaccine safety; the government has lied before, so why should we believe them when they say vaccines are safe; the CDC is trying to protect our health, so they wouldn't recommend a vaccine that wasn't safe

hr. health care providers may affect perceived vaccine safety; my doctor told me that the vaccine was safe
ub. the credibility of the public health system might affect perceptions of vaccine benefit; if the CDC says this vaccine works, then I trust that it does

mb. those who see less value in public health, will see less benefit from the vaccine (in the sense of setting less value on protecting others who do not protect themselves – although perhaps there is no difference in the value of protecting those who cannot protect themselves); I don't believe in medicine, so vaccination wouldn't have any effect

um. the credibility of the public health system may affect the salience of personal values; e.g., the government lies about things, so people need to follow their own principles

mr. people with values contrary to public health may be more likely to believe that the vaccines are unsafe; attitudes about risk can affect assessment of vaccine risk, e.g., there is risk in anything, so you will have to accept some risk, however small, in vaccination

iw. the more people become immune to a particular disease, the closer we get to a critical level of community (or herd) immunity that will protect unvaccinated individuals

io. greater individual immunity will protect people from disease

wo. greater herd immunity will reduce the potential of natural outbreaks because fewer people will be potential vectors to bring disease into the community

ip. greater immunity will protect people's overall health, perhaps in the abstract not mentioning the relevant disease

wp. greater herd immunity will improve population health.

op. reduced outbreak potential will improve population health; increased disease threat will lead to worse overall health; increased disease threat perception will reduce population health by increasing psychological stress

og. changes in outbreak potential will lead to changes in public health plans and strategies; observed increases in the threat of particular diseases may lead the government/public health officials to change their plans in regard to those diseases

pz. any occurrence where an adverse vaccination experience is reported, whether to VAERS (Vaccine Adverse Event Reporting System) or to private citizen groups; doctors may report to the government when they see a patient with an adverse reaction; parents may tell activist groups about negative consequences of vaccinations

zg. reports of adverse events can affect the Public Health Strategy. Also, concerned organizations can use these reports to call for change in the Public Health Strategy; increasing reports about a particular vaccine may lead the government to think they address what might be a problem.
ze. reports of adverse events lead concerned organizations to start education campaigns about vaccine safety; if there are lots of reports of negative effects then activist groups might try to education the public about it

gk. the public health sector (e.g., the CDC) can request certain vaccine safety research to be conducted and request analysis what has already been done; vaccine safety (and efficacy) research will be carried out if the government requests or funds it

kq. if the vaccine is found to be problematic by scientific research, the vaccine itself may be improved; research may be conducted to improve the vaccine

kr. surveillance of a vaccine’s side-effects and safety data can affect the perceived safety of the vaccine; if not enough research has taken place then parents may not trust the vaccine to be safe; if lots of research has been done then parents are likely to trust that the vaccine is safe

dx. the MMR Program Design prescribes what other vaccines can be taken along with the MMR Vaccine and also if single vaccines for Measles, Mumps and Rubella should be given; the three shots should [not] be given together

xr. giving other, or multiple vaccines can affect the perceived safety of the vaccine; giving 3 antigens at once is too risky; giving the shots individually would be safer; giving all 3 shots at once is not a problem

vy. following a vaccine, one might notice reactions that follow in time, which may or may not be caused by the vaccine; signs of problems following vaccination should be looked for

yr. having identified reactions to a previous vaccine can affect your assessment of the safety of a vaccine; if my kid had a bad reaction before, then I think the vaccine is not safe for him

vp. the vaccine reaction that was identified can lead to overall effect on health; long term (usually negative) effects on health that are NOT a function of resistance to the drug in question; vaccinations cause autism; vaccines are bad for the body

ya.: identifying the reactions, can lead to treatment; if you notice a reaction you should try to do something about it (before bigger problems occur, code ap)

ap: treatment of a reaction can lead to an overall effect on health; reducing a post-vaccine fever can prevent seizures and brain damage

**Link Interpretations** (proposed functional relationships), in alphabetical order

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