Tool for Pandemic Influenza Risk Assessment (TIPRA): Enhancing pandemic preparedness and risk management

Julia Fitzner

Based on slides from Gina Samaan

Pandemic Influenza Risk Management

- Advance planning and preparedness are critical to help mitigate the impact of a pandemic.
- After influenza A(H1N1) 2009 pandemic, WHO updated its guidance for planning and preparedness through the release of *Pandemic Influenza Risk Management* (PIRM).
- PIRM takes an emergency risk management for health approach, which aligns more closely with the disaster risk management structures already in place in many countries.
- PIRM underscores the need for appropriate and timely risk assessment for evidence-based decision-making.
- Risk assessment is critical along the continuum of pandemic influenza phases to decide, clarify and justify public health preparedness, response and recovery actions.

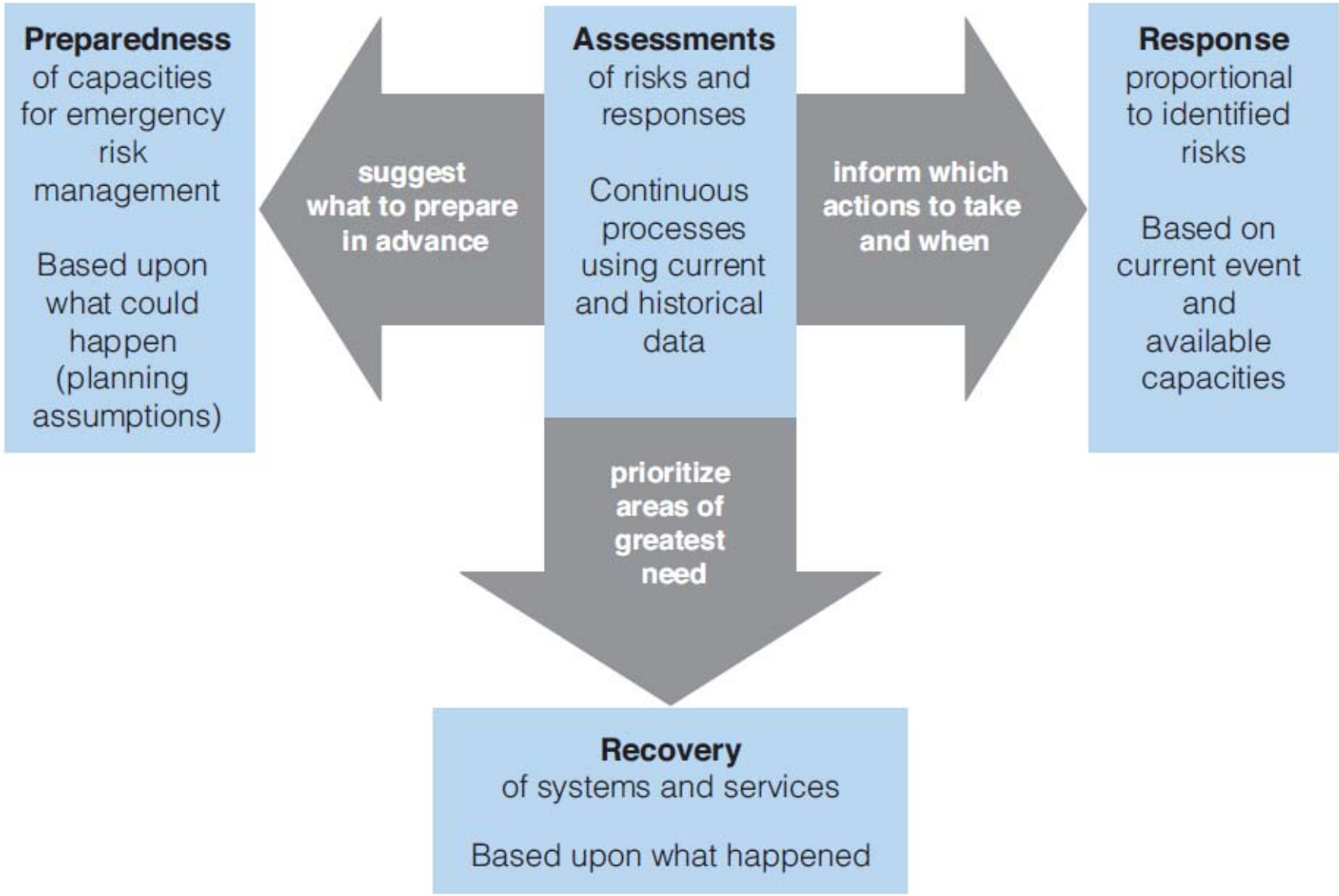


Figure 1: Pivotal role of risk assessment to inform pandemic influenza preparedness, response and recovery

Risk Assessment

- Systematic process for gathering, assessing and documenting information to assign a level of risk so that measures can be taken to reduce risk.

- Risk assessments aim to determine:
  - Likelihood of the event to occur
  - Impact if the event occurred

- WHO will conduct global pandemic influenza virus risk assessments to inform decision-making for each influenza virus with pandemic potential.
  - TIPRA (Tool for Pandemic Influenza Risk Assessment) was developed to support these risk assessments.
  - TIPRA based on US CDC's IRAT (Influenza Risk Assessment Tool).

Objectives of TIPRA

- Provide a timely and updatable risk assessment on emerging influenza viruses;
- Assist countries in influenza pandemic preparedness planning and provide information needed for policy making;
- Transparently document the features of the virus that might pose threats to a human population and to facilitate information sharing;
- Identify knowledge gaps and prompt further investigations including research.

Beneficiaries from TIPRA Outputs

Level	Stakeholders
National	Pandemic planning and policy-making team
	Laboratories such as the National Influenza Center (NIC)
	Public health and animal health surveillance teams
Global	Pandemic planning and policy-making team
	WHO Collaborating Centers and Global Influenza Surveillance and Response System (GISRS)
	Food and Agriculture Organization, and World Organization for Animal Health

TIPRA Questions: Likelihood and Impact

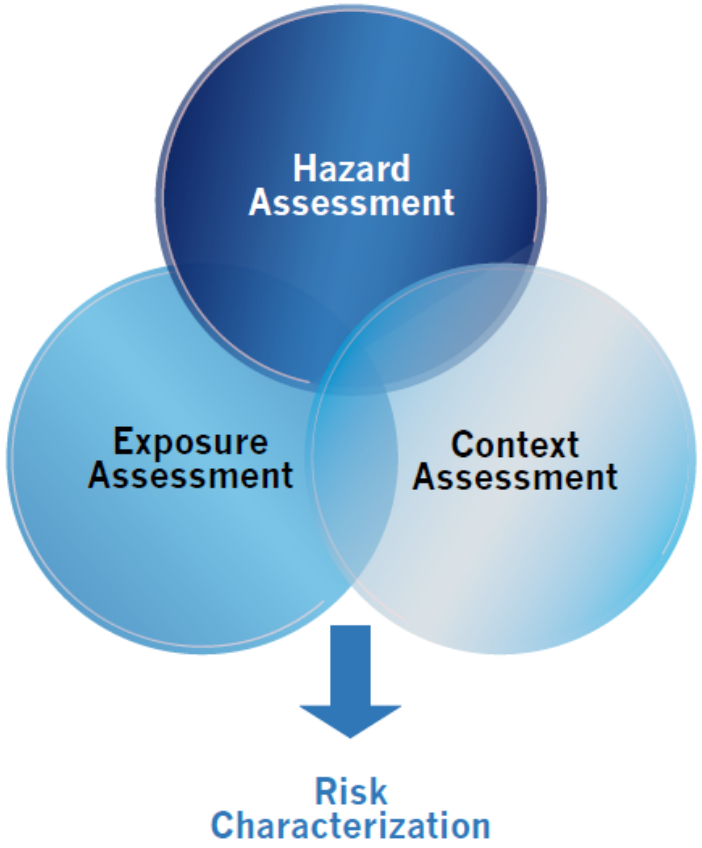
- "Likelihood" = potential of a novel (i.e., new in humans) influenza virus acquiring the ability to spread easily and efficiently in people.

- "Public health impact" = severity of human disease caused by the virus (e.g., deaths and hospitalizations) as well as the burden on society (e.g., missed workdays, strain on hospital capacity and resources, and interruption of basic public services) if a novel influenza virus began spreading efficiently and sustainably among people.

TIPRA Focuses on Hazard Assessment

9 risk elements to explain what we know about the hazard (influenza virus).

Figure 2: The risk assessment process



Nine Risk Elements in TIPRA

Category	Risk Elements	Expertise
Public Health	Human infections	Public Health Epidemiologists, WHO, CDC
	Disease severity	Public Health Epidemiologists, WHO, CDC
	Population immunity	Public Health Epidemiologists, WHO, CDC, Immunologists
Animal Health	Global distribution in animals	Epidemiologists/Veterinarians, FAO
	Infections in animals	Epidemiologists/Ecologists/Virologists/ Veterinarians, FAO
Virology	Receptor binding	Virologists
	Transmission in laboratory animals	Virologists/Veterinarians
	Sensitivity to antiviral treatment	Virologists/Pharmacologists
	Genomic characteristics	Molecular Virologists/Phylogeny Scientists

TIPRA Process

11 steps to conduct risk assessment using TIPRA:

- Outline what we know about the virus (per risk element) = **virus profile**
- Share this knowledge with experts
- Ask experts to **score** the level of risk and impact
- **Characterize** risk
- Document and feedback

Guidance (Steps 1-5)

Step 1

- Determine the risk question(s) and the influenza virus that will be assessed.

Step 2

- Confirm the risk elements and weighting to be used if not utilizing the tool's standard elements/weights.

Step 3

- Select and invite relevant technical experts to conduct the assessment, and confirm the schedule of the risk assessment.

Step 4

- Prepare the virus profile document and solicit input from the technical experts. Share the finalized virus profile document, the risk element guide sheets and blank risk assessment scoring sheets with the technical experts.

Step 5

- Technical experts fill in risk assessment scoring sheets to provide a risk point estimate score, range estimates, confidence scores and justification per risk element.

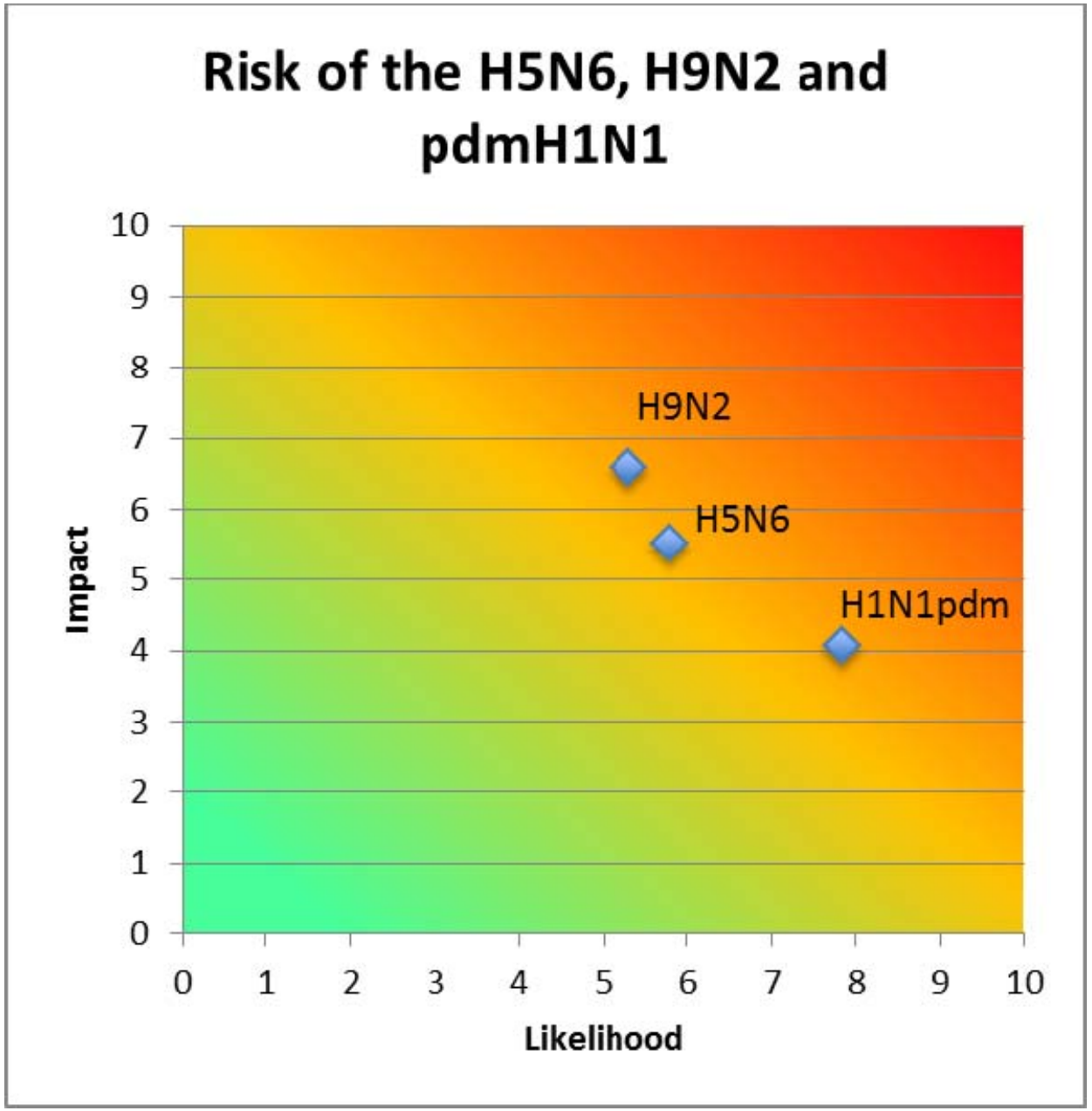
Guidance (Step 6-11)

Step 6	• Collect risk assessment scoring sheets from technical experts to summarize risk point estimates, range estimates, confidence scores and justifications.
Step 7	• Discuss summary scores and justifications with the technical experts to confirm initial results.
Step 8	• Calculate overall virus risk and confidence scores, and categorize risk using descriptive definitions.
Step 9	• Interpret and contextualize risk assessment outputs to develop recommendations.
Step 10	• Prepare risk assessment report and share findings with stakeholders.
Step 11	• Decide if and when a repeat risk assessment is needed.

TIPRA Pilot Tests

- China (2014), A(H7N9) virus
- Bangladesh (2015), A(H9N2) virus
- Egypt (2015), A(H5N1) virus
- Global WHO (2016), A(H5N6) virus

Outputs: Virus Risk Scores Comparable



TIPRA Potential Benefits

- Enables comparison of risk characterized for different viruses or for the same virus assessed at different points of time:
  - Helps decision-makers consider and justify actions needed on a virus relative to other viruses;
- Can be used globally or nationally;
- Flexible so that other risk questions can be designed and assessed;
- Can be used to characterize risk even when data are not available on all risk elements or when there are gaps in information;
- Captures confidence in the risk characterized.

TIPRA Cautions of Use

- Early in the virus emergence, a mix of quantitative and qualitative data is likely to be used during the assessment process as comprehensive numerical data may not yet be available.
  - Degree of quantification possible depends on factors such as the data available, how quickly the assessment is required and the complexity of the issues.

- To take into consideration the gaps in information available at the time of the risk assessment, a confidence score is assigned to the level of risk characterized for the virus.
  - Over time and as more information becomes available about the virus, confidence may increase and the level of risk assigned to that virus may change.
  - Risk assessments are iterative: consider repeating when new info emerges.

- TIPRA focuses on assessment of the hazard, the emerging influenza virus:
  - Exposure and context assessment are outside the scope of TIPRA but are critical to understand risk and to enable evidence-based risk management.
  - TIPRA is a tool that supports risk assessment processes but it should be contextualized in the broader risk assessment and risk management cycle.

Plans for TIPRA Use

- For each influenza virus with pandemic potential, WHO will conduct global risk assessments in collaboration with the affected Member State(s), to inform decision-making for risk management.

- While WHO will communicate these global assessments and the uncertainties that surrounds them throughout the event, each Member State is strongly advised to assess national risk related to pandemic influenza in the context of their local experience, resources and vulnerabilities.

- Member States are also encouraged to share their risk assessments through networks or multilateral arrangements and to utilize regional resources for risk assessment.

- Each Member State is encouraged to conduct its own risk assessments, which will determine the timing, scale, emphasis, intensity and urgency of the actions required at their national and local levels.

Thank you

For more TIPRA information:

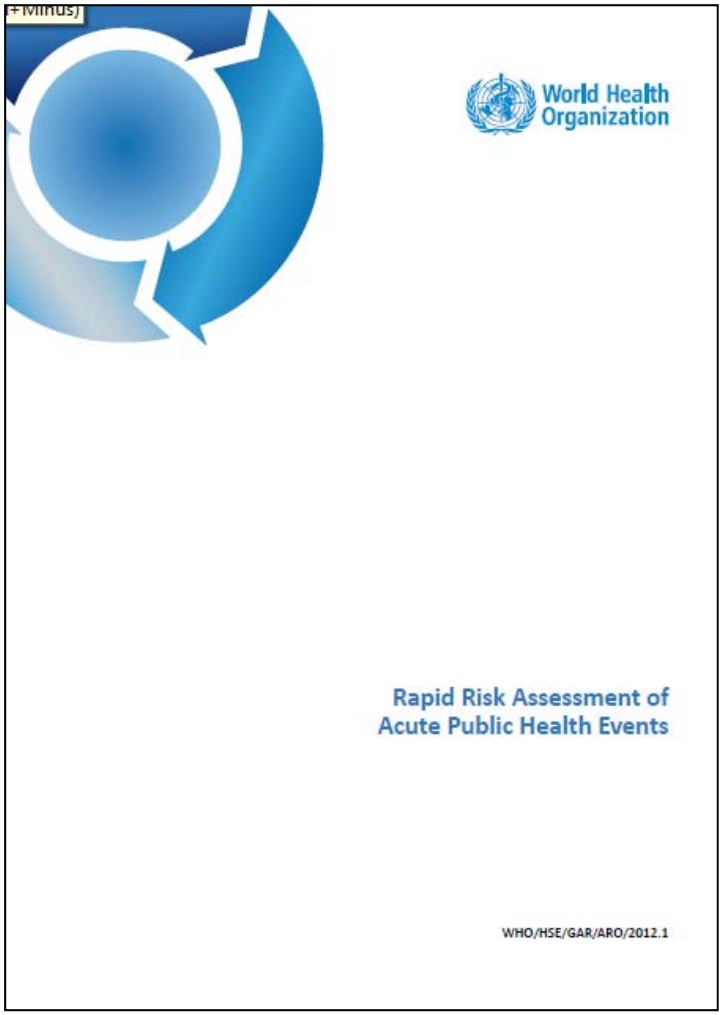
- See WHO Global Influenza Program website
- Contact Dr Kaat Vandemaele vandemaelek@who.int

Extra Slides

Why use risk assessment tools?

- Defensible decision-making
- Implementation of appropriate and timely control measures
- More effective operational communication
- More effective risk communication
- Improved preparedness.

Generic Risk Assessment Tool



Guideline released in 2012 “Rapid Risk Assessment of Acute Public Health Events.”

Focuses on designing a risk question (e.g. what is the public health risk of A(H5N6) human cases occurring in Vietnam?).

To answer it, you look at **likelihood** (potential that event will occur) and the **impact/consequences** it would have on public health.

This is done by describing:

- Hazard (in this case, A(H5N6) virus)
- Exposure (are people exposed to this virus in Vietnam? Where? Are some people already immune? If known!)
- Context (social, economic, health of people, environment)

Present what you know about Hazard-Exposure-Context

The vector-borne disease, Japanese encephalitis, has been used to illustrate possible sources of information for assessment of the hazard, exposure and context (Table 5).

Table 5: Information sources used in assessing hazard, exposure and context of Japanese encephalitis

Characteristic being assessed		Information sources
Hazard assessment		
Viral factors	Genotypes Neurovirulence Antigenicity Proliferation	Published literature on research in humans and animals E.g. Database of nucleotide sequences (Genbank) Reference laboratory data
Clinical factors	Clinical presentation Clinical progression Severity	Medical records (ICD-10[5]), hospital-based sentinel surveillance systems, laboratory surveillance systems
Exposure assessment		
Vector factors	Distribution, density and host preference of competent mosquito vectors	Published data (e.g. entomological surveys), vector control programme data (e.g. entomological surveillance systems including mosquito trapping, detection methods for JE virus in pooled mosquitoes, pesticide susceptibility data)
Host factors	Epidemiology of infection and disease in humans and other mammals (dead-end hosts)	Published research, including seroepidemiological studies and outbreak investigations Indicator-based and event-based surveillance systems in endemic and epidemic-prone areas (human and animal) Medical records, hospital-based sentinel surveillance systems, laboratory surveillance systems International event-based surveillance systems, including the media aggregators Biocaster, GIDEON, GPHIN, HealthMap, EMM MediSys, ProMED Mail, RSOE EDIS, among others. Surveys of permanent neurological impairment in endemic areas Official data and reports from WHO, FAO and OIE, other UN agencies, non-governmental organizations (e.g. PATH), foundations, charities (e.g. SciDevNet), national government websites of endemic countries. WHO sites reporting outbreaks include the Disease Outbreak News, Weekly Epidemiological Record and the password protected Event Information Site for IHR National Focal Points and ShareGOARN Participatory epidemiology systems Case reports of illness in returning travellers
	Distribution and susceptibility of amplifying hosts (pigs and aquatic birds)	Aquatic bird population, density and distribution of domesticated and feral pigs close to human populations Sentinel pig surveillance data
	Susceptibility (age, population immunity, vaccination status, protection from cross-reacting antibodies e.g. dengue)	Medical records and chart audits (ICD-10[5], acute neurological syndrome, etc.)

5 http://www.who.int/classifications/icd/en/

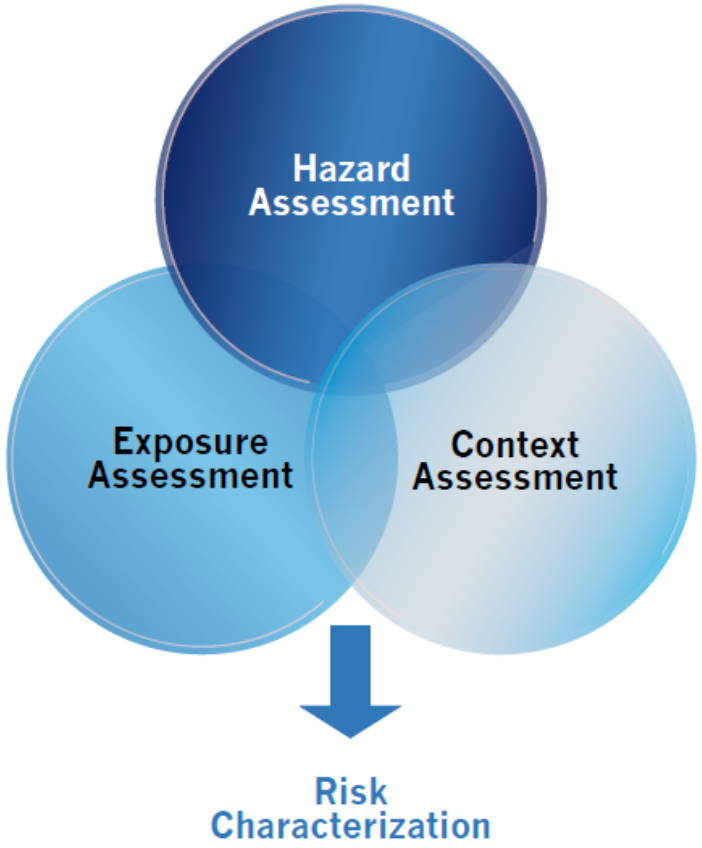
Table 5 *continued*

Characteristic being assessed		Information sources
CONTEXT ASSESSMENT		
Socio-economic factors	Size of population at risk Agriculture and livestock management	Vital statistics Demographic data including household income data (e.g. census) – access to personal protective equipment to prevent mosquito bites Maps of population density Economic analyses of pig farming in endemic areas
	Human behaviour	Surveys and studies on community awareness of Japanese encephalitis virus transmission; prevention and control; cultural practices regarding pig farming; acceptability and uptake of Japanese encephalitis vaccination etc. International transport (vectors, live pigs)
Ecological factors	Climate	Meteorological data (rainfall, temperature, wind) Modelling data on climate variability, climate change (e.g. World Meteorological Organization)
	Mosquito breeding sites	Entomological surveys; maps of standing water sources; town plans, reports on environmental engineering controls of breeding sites Remote sensing data of vegetation coverage, e.g. NASA Earth Observatory, Global Observing Systems Information Center (GOSIC)
	Amplifying bird hosts	Mapping data on bird migration patterns, seasonality and size of wetlands
	Feral pigs	Wildlife monitoring systems; data from culling programmes etc.
Program-matic factors	Strength of the health system (access to acute care services, intensive care units, diagnostic capacity, surveillance systems, Japanese encephalitis vaccination programme, vector control programme, financial and human resources, political support for control programmes including coordination with agriculture, livestock and wildlife sectors etc.)	National health indicator data Routine programmatic data, annual reports, programme evaluation reports etc. Vaccination coverage data (published and rapid assessment, public and private health-care facility data etc.)

So, why make disease specific risk assessment tools?

- Generic tools: good for undefined events (e.g. is it an outbreak of a virus, a chemical event etc?)
- Specific tool: May make more rigorous approach to assess the different components.
- TIPRA focuses on HAZARD component

Figure 2: The risk assessment process



IRAT (CDC) and TIPRA (WHO)

- Influenza Risk Assessment Tool (IRAT)
  - Developed by CDC
  - Multi-element tool used to look at emerging influenza viruses detected in animals or humans
  - Helps decide on actions needed re vaccine development (should we develop a candidate vax? Should we go into trials? Should we stockpile?)

Intention of IRAT

"It is hoped that use of the IRAT will advance pre-pandemic preparedness and would also allow time for the studies to fill knowledge gaps and develop communication packages for high scoring viruses.

The ultimate goal is to identify an appropriate vaccine candidate virus and prepare a human vaccine targeting the emerging virus before the virus adapts to infect and efficiently transmit in susceptible human populations.

This pre-pandemic preparation would allow production of ample vaccine to offer to the public in a timely manner, a strategy that could save lives and mitigate illness, benefiting both animal and public health."

*Trock S , Burke S, and Cox N. Development of an Influenza **Virologic** Risk Assessment Tool. Avian Diseases, 56(4s1):1058-1061. 2012.*

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- Tool for Pandemic Risk Assessment (TIPRA)
  - Based on IRAT
  - One less element (9). Tool used to assess risk of emerging influenza viruses that have infected ≥1 human case.
  - Needed as per WHO Pandemic Influenza Risk Management (PIRM) Guidance. Guides decisions on pandemic preparedness and scale up of response (more broadly than IRAT)
  - Piloted: China, Bangladesh and Egypt. HQ pilot on H5N6 virus just finalized on 4 March 2016.

- Bill James devised a method he coined “sabermetrics” to select and predict winning baseball teams based on empirical data.
- Sabermetrics = “the search for objective knowledge about baseball”.
- It worked – watch the film!
- Risk assessments are moving towards similar evidence-based criteria so that decisions are based on objective risk elements rather than subjective opinions.