A Population Based Management Approach to Pandemics and Other Public Health Crises

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Acknowledgement

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Presentation based on:

Overview

- Key Points
- Public Health Approach to Pandemics and Disasters
- Population Based Management Teams
- The Way Forward
Key points

▪ Globally everything needs to change and not in a piecemeal fashion!
▪ What we describe is the framework for global public health which is long overdue!
▪ The World Health Organization (WHO) under UN mandate needs to be in complete control, totally independent, well funded and staffed
▪ Newly trained population-based managers (PBMs) are required and need operational homes in CDCs representing every country equally and coordinated by WHO.
▪ PBMs based at these CDCs will have the responsibility to gather data daily, which will be immediately needed in any population affected crisis
  – Between crises they will use the data base to improve the public health response capacity
▪ Data is the life bread of pandemic management
  – Required data will be continually gathered and stored in the global public health database
  – Data will be controlled by PBMs assigned at the global CDCs
  – PBMs will be in charge once the pandemic occurs boosted by relationships established with multiple healthcare providers within their area of responsibility
Public Health Approach to Pandemics and Disasters
Systems of systems involved in a pandemic

Pandemic response by the public health system is dependent on systems such as these.

Systems such as these may be affected by the public health system’s pandemic response.

Social Determinants of Health

### Maslow Hierarchy of Needs and Impact of COVID-19 Lockdown

<table>
<thead>
<tr>
<th>Goal (Basic Need)</th>
<th>Examples of Requirements</th>
<th>Possible COVID-19 Lockdown Impact on Individuals and Society</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Physiological needs</td>
<td>Breathing, homeostasis, water, sleep, food, sex, clothing, shelter, mobility</td>
<td>Less mobility, food access issues, and for some people shelter may be affected. Increased unemployment, reduced access to resources, and individual stability impacted due to uncertain future. Security issues may increase at household/domestic level.</td>
</tr>
<tr>
<td>2. Safety needs</td>
<td>Employment, resources, property, health, stability, and security</td>
<td>Access to family and friends impacted.</td>
</tr>
<tr>
<td>3. Social needs</td>
<td>Love, affection, family, friends, relationships, and belongingness</td>
<td>Self-worth questioned as people become unemployed and have an uncertain future. Little to no impact.</td>
</tr>
<tr>
<td>4. Esteem needs</td>
<td>Recognition, respect, achievement, self-confident, and self-worth</td>
<td></td>
</tr>
<tr>
<td>5. Self-actualization</td>
<td>Creativity, acceptance of facts, morality, and problem solving</td>
<td></td>
</tr>
</tbody>
</table>

Adapted from Ryan (2018).²⁴
The continuum of global pandemic phases

Effects of the COVID-19 Pandemic on HIV, TB and Malaria

Potential increase in malaria deaths due to malaria service disruption in the context of the COVID-19 pandemic in sub-Saharan Africa

Potential increase in TB deaths due to TB service disruption in the context of the COVID-19 pandemic globally

Potential increase in AIDS-related deaths due to HIV treatment disruption in the context of the COVID-19 pandemic in sub-Saharan Africa

An additional 1.2 million children and 56,700 mothers could die in 6 months due to disruption in basic interventions, based on the worst-case scenario.

Additional projected under-5 deaths, 118 low- and middle-income countries

Additional projected maternal deaths, 118 low- and middle-income countries

Flow-on impacts of the COVID-19 Pandemic

- May push close to 100 million more people into extreme poverty in 2020.

- Border restrictions and lockdowns slowed agricultural production and increased food insecurity worldwide.

- The World Bank estimates a US$10 trillion earning loss over time for the younger generation as a result of school closures and a global recession.

- It would take 500 years to spend as much on investing in preparedness as the world is losing due to COVID-19.

• 20% maximum occupancy in the Chicago metro area cut down predicted new infections by more than 80% (with 42% of overall visits lost).
• 10% of places people visited accounted for 85% of the predicted infections.

In response to the COVID-19 pandemic, our commitment remains to prioritize the safety of our fans, staff and players. Below you will find some of the notable steps being taken to support that effort. Under the guidelines of the National Football League, and with the approval of Kansas City Mayor Quinton Lucas, City of Kansas City Health Director Dr. Rex Archer and City of Kansas City EMS Medical Director Dr. Erica Carney, plans have been finalized for a reduced capacity including important health and safety protocols outlined in consultation with The University of Kansas Health System for fans who will attend games at Arrowhead Stadium.

Stay tuned to Chiefs.com for further updates to these guidelines.

SAFETY IS A TEAM SPORT!
Population Based Management Teams
Population based management teams

- Interdisciplinary and multi-disciplinary teams

- Led by public health, the teams would include experts from critical care, infectious disease, epidemiology, environmental health, biostatistics, clinical medicine, nursing and pharmacy

- The team would be assisted by multidisciplinary expertise in anthropology, sociology, the law, industry, and technology
  - Reflecting the reality of current field demands and the society served
  - Health crisis management requirements would define the working relationships and the uncomfortable but real decision making.

- This approach recognizes no one authority or organization possesses all the resources and expertise required to mitigate pandemic risks
  - The rapid 2020 spread of COVID-19 led to singularly independent decision-making efforts of nations and jurisdictions within nations.
Global Public Health System and Population Based Management Teams

WORLD HEALTH ORGANIZATION
INTERNATIONAL HEALTH TREATY
WHO Regional Organizations

CENTERS FOR DISEASE CONTROL & PREVENTION
- ONE Per Nation, or
- ONE Per Region of Smaller Nations

POPULATION-BASED MANAGEMENT TEAMS
- ONE Per Country or Region
- In the United States One for Each of the 10 HHS/CDC Regions
- Multiple PBMTs Per Discretion of the Individual Country
- Concept in practice –

Each US HHS/CDC Regional Office sponsors and supports a population-based management team
Operational Imperatives

- All pandemics share the following:
  - All individuals either have the disease or are susceptible
  - All require shared health care needs
  - All require some intervention
  - Pandemics may require sustained PH operational response lasting 12-24 months

- The cornerstones of PBM are working models in three major technical domains of pandemics:
  - How the virus spreads (e.g., incubation period, reproduction ratio, mitigation measure effectiveness)
  - Resource-management and decisional models providing epidemic data and resource availability (e.g., capture management awareness of available resources and thresholds)
  - Compartment model used to compute the infected population and the number of casualties of the pandemic
Core Databases

▪ Background Information
  – Describes the affected population pre-pandemic—demography, access to essential services, health status, and socioeconomic status

▪ Clinical Case and Virological Data
  – Encompasses case definitions, case identification and outcomes, and clinical dynamics (case-fatality rates, death rates, and time course to death)

▪ Public health control measures and consequences
  – Details of contact tracing, quarantine measures, travel restrictions, and all epidemic modelling
### A. Population at Risk

<table>
<thead>
<tr>
<th></th>
<th>M</th>
<th>F</th>
<th>Total</th>
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<tbody>
<tr>
<td>1. CBSA</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>2. Demography</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. race, ethnicity, religion</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. languages</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>c. Socioeconomic status</td>
<td></td>
<td></td>
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<tr>
<td>d. urban vs rural</td>
<td></td>
<td></td>
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<tr>
<td>e. Average family/household size</td>
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### B. Settlements

1. Locations
   a. community size, geographic separation
   b. access to transportation hubs and communication links
2. Population Mobility
   a. seasonal and occasional occupational travel flows
   b. recreational and tourist travel flows
   c. migration flows
3. Community Diversity
   a. geographic separation of families within the settlement
4. Hazard Exposure (e.g. ongoing seasonal natural hazards)
5. Discrimination and Conflict within the Community
6. Emergency Preparedness
7. Known Coping Mechanisms

### C. Access to Essential Services

1. Public Utilities (infrastructure)
   a. % population with access to improved water
   b. % population with access to improved sanitation
   c. % population with electricity
   d. % population with cell phones
2. Health Services
   a. skilled health care workers (all)/10,000 p
   b. physicians/10,000 p
   c. nurses/10,000 p
   d. midwives/10,000 p
   e. community health workers/10,000 p
   f. % population with provider coverage
   g. consultation/p/p
   h. immunization rates—measles vac 1 y/o
   i. hospital beds/10,000 p
   j. admission/10,000 p
3. Underserved Areas (by location and type of service)

### D. Health Status

1. Mortality and Other Rates
   a. CBR (10 - 50)
   b. CSMR (5 - 25)
   c. AGR (%)
   d. IMR (1 - 20)
   e. U5MR (3 - 30).
   f. SMMR (5 - 2,100)

2. Nutritional Status
   a. % infants with low birth weight (LBW) (< 2.5 kg)
   b. % U5 with growth faltering (60%)
   c. % with micronutrient deficiencies (vitamin A-D, Fe, I)

3. Infectious Diseases and Comorbidities
   a. Chronic Illnesses and Conditions
     1. Hypertension
     2. Diabetes
     3. Obesity
     4. Disability
   b. Infectious Diseases
     1. HIV prevalence
     2. TB prevalence
   c. Other Major Diseases

4. Routine/Baseline Disease Surveillance Data
   a. Baseline infectious incidence rates
   b. Baseline hospital admission rates
   c. Baseline death rates ratios

5. Health Beliefs and Traditions

6. Sources of Care
   a. Health infrastructure
   b. Referral system

### E. Macroeconomic Status

1. Labor force occupations
2. Unemployment rate
3. GNI per capita (SUS) ($700 - $70,000)
4. Inflation rate
5. % population in extreme poverty (< $1.90/day)
6. Current health expenditures per capita ($50 - 30,000)

### F. Educational Status

1. Adult literacy rate
2. Female literacy rate
3. Adolescent literacy rate
Clinical Case and Virological Data

Clinical and Virological Data:

A. Clinical Data

1. Case Definitions (suspected, probable, confirmed)
2. Severe Cases (admissions, ICU cases, ventilated cases)
   a. Age/gender/race data
   b. Comorbidities
   c. Clinical course, complications, and outcomes
   d. Data on use of antivirals, antibodies, and vaccines
   e. Discharge diagnoses
   f. Causes of death
3. Clinical Dynamics—population morbidity and mortality rates, age & gender-specific CFRs, time course to death
4. Hotspot Definitions—cases linked temporally or geographically triggering further outbreak investigation and/or control measures

B. Virological Data

1. Sentinel Site Testing
2. Confirmatory testing for new cases in the community meeting the surveillance definition (before sustained community transmission is identified)
   a. daily new positive cases
   b. 14 day running average
3. Confirmatory testing for hospital admissions and unexplained deaths that are compatible with the disease
4. Community seroprevalence testing once community transmission is established
5. On-demand individual testing (depending on resource availability, may be targeted at vulnerable groups)
6. Antiviral Sensitivity Testing
Modelling, Control Measures, and Impact:

A. **Epidemic Modelling Data**
   1. Population sizes and subgroups at risk
   2. Compartment models
   3. Spot maps (geolocated plots of disease outbreaks)
   4. Kinetics models of transmission dynamics—incubation period, reproduction ratio, contacts per case
   5. Epidemic curves
   6. Epidemic projections showing impact of non-pharmaceutical mitigation measures

B. **Public Health Control Measures**
   1. Travel restrictions
   2. Arrival testing
   3. Contact tracing effectiveness
   4. Quarantine requirements (site specification, duration, monitoring), social acceptance of quarantine measures, overall adequacy of quarantine
   5. Social distancing recommendations
   6. Mask recommendations
   7. Restrictions on social gatherings
   8. Lockdown onset, duration
   9. Population sizes & community densities of populations affected

C. **Socio-Economic Impact Data**
   1. Displacements
   2. Unemployment rates
   3. Evictions
   4. Business closures
   5. Direct costs in health care
   6. Indirect costs of business losses
   7. Government expenditures for unemployed persons and distressed businesses
<table>
<thead>
<tr>
<th>Function</th>
<th>Technology</th>
<th>Early Adopters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infection Screening</td>
<td>Digital thermometers, infrared thermal cameras, web-based tools</td>
<td>China, Iceland, Singapore, Taiwan</td>
</tr>
<tr>
<td>Contact Tracing</td>
<td>GPS, mobile phone apps, facial recognition technology</td>
<td>China, Germany, Singapore, South Korea</td>
</tr>
<tr>
<td>Quarantine and Isolation</td>
<td>GPS, mobile phone apps, surveillance of mobile devices for voluntary or involuntary tracking</td>
<td>China, Iceland, South Korea, Taiwan, Australia</td>
</tr>
<tr>
<td>Clinical Management</td>
<td>Lab test pooling, telemedicine, videoconferencing, AI algorithms for clinical outcome prediction</td>
<td>Australia, Canada, China, USA</td>
</tr>
<tr>
<td>Medical Logistics</td>
<td>Mobile apps for transactions, barcode scanners for commodities, robotics, and drones for delivery</td>
<td>US, China</td>
</tr>
<tr>
<td>Epidemic/Pandemic Tracking</td>
<td>Data dashboards, real-time data transmitted by smartphones and PDAs</td>
<td>China, Singapore, Sweden, USA</td>
</tr>
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Local Case Study
Baylor University, chartered in 1845 in Waco, Texas, United States

- Approximately 17,000 students who live on campus and in the community
- Baylor University is considered one of the major employers in the city of Waco and McLennan County
- In March 2020, there was recognition the university needed to find a way to safely reopen for the Fall 2020 semester
- This was to help students, staff, faculty, contractors and the Waco community navigate the challenges presented by COVID-19
- Established multidisciplinary teams
- This population-based team approach allowed small clusters to be rapidly addressed through testing, surveillance, tracing, isolation, and quarantine.
  - Supported by health protocols including face coverings, social distancing, and compliance monitoring
- As a result, in-person operations have been sustained from 1 August, 2020.
Population based approach at Baylor


Figure 1 – Multisectoral systems approach to sustaining operations.
Baylor University COVID-19 Dashboard

CURRENT STATUS
- Currently Active Cases: 7
- Isolation Beds Available: 100.0%

Last 7 Days
- Cases: 5
- Tests: 203
- Positivity: 2.5%

Since 08/01/2020
- Cases: 1,733
- Estimated Recoveries: 1,726
- Tests: 65,225
- Positivity: 2.7%

Community Rate of Transmission
- McLennan County R(t): 0.96
- Texas R(t): 1.17

Select Semester for Charts
- All

Useful Links
Data Definitions

Total Active Cases
- Active Cases by Status
- Cumulative Reported Cases

Testing Results (Daily)
- New Cases by Status
- Daily New Reported Cases

Hover over a chart and click the Focus Mode icon to enlarge
Last Updated: 1/1/2021 2:17:48 PM
The Way Forward
Priorities for hospitals and public health systems

• Improve capabilities and capacities in surveillance and discovery at the local level

• Develop triage and management systems (with clear lines of authority) based on public health and epidemiologic requirements, capability, and capacity
  – Triage teams, categories, tags, rapid response, established operational priorities, resource-driven responsible management process
  – Link local-level surveillance systems with those at the national or regional level

• Use a triage and management system that reflects the population (cohort) at risk

• Develop an organizational capacity that uses lateral decision-making skills
  – Prehospital out-patient centers for triage-specific treatments, health information systems and resource-driven hospital-level protocols for a surge

• Standards of care should be set at the local to federal levels and spelled out in existing incident-management system protocols
WHO, Germany launch new global hub for pandemic and epidemic intelligence

5 May 2021 | Joint News Release | Geneva/Berlin | Reading time: 2 min (567 words)

- The WHO Hub for Pandemic and Epidemic Intelligence will be a global platform for pandemic and epidemic intelligence, creating shared and networked access to vital multi-sectoral data, driving innovations in data analytics and building the communities of practice needed to predict, prevent, detect, prepare for and respond to worldwide health threats.
- The WHO Hub will be a new global collaboration of countries and partners worldwide, driving innovations to increase availability and linkage of diverse data; develop tools and predictive models for risk analysis; and to monitor disease control measures and infodemics.
- The WHO Hub will enable partners from around the world to collaborate and co-create the tools and data access that all countries need to prepare, detect and respond to pandemic and epidemic risks.

The World Health Organization (WHO) and the Federal Republic of Germany will establish a new global hub for pandemic and epidemic intelligence, data, surveillance and analytics innovation. The Hub, based in Berlin and working with partners around the world, will lead innovations in data analytics across the largest network of global data to predict, prevent, detect, prepare for and respond to pandemic and epidemic risks worldwide.
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Questions / comments?

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