Health Ecosystems

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The IOCOM Digest and Dialogue (IDD) is to be recognized as a world class outcome management Journal/Periodical.

IDD Mission
IDD’s Mission is to provide useful, timely and thought-provoking content in outcome management driven disciplines that addresses a broad spectrum of practices for knowledge exchange among academicians, researchers and practitioners.

IDD Objectives
1. Bridge the gap between academicians and practitioners in the discipline of outcome or benefit management
2. Provide a platform to academic researchers and practitioners for disseminating their research work.
3. Promote adoption of innovative outcome or benefit management disciplines
4. Highlight challenges being faced by the outcome managers (practitioners)

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1. The IDD journal will cover application of the cross cutting themes of Outcome management disciplines. No other journal in the world is having such orientation.
2. IDD journal’s main emphasis is on applied research.
3. IDD journal will accommodate articles based on both qualitative and/or quantitative approaches. However, preference will be given to mixed methods and action research.
4. Geographical territory of our journal is the entire globe.
5. Our target audience includes academics and practitioners in outcome or benefit management.
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To create a world where professionals, academia, organizations and networks with a focus and interest in effective outcome or benefit management, collaborate to strengthen the theory and practice of the discipline that benefits society.

IOCOM’s Mission

To promote outcome or benefit management in the world at large through multidisciplinary professional and academic collaboration and contribute to the quest for outcome or benefit management evidence in decision making for business and organizational viability.

IOCOM organizational and individual memberships are free and provide the benefits of professional connectivity worldwide and access to IOCOM’s E-Journal, Digest and Dialogue (IDD).

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Message from the Chair/ President

Greetings from Ottawa, Canada! Welcome to another new issue of IDD: Vol. 05, No. 2.

This issue of IDD focuses on the health ecosystem and sub-systems, the aim of which is to achieve the sustainable development goal (SDG #3 on health), outcomes or benefits. As an example, I have provided a graphic representation of a sub-health ecosystem, the surgical ecosystem. It shows the multi-disciplinary nature of stakeholder engagement required to provide patient-centred surgical care to achieve value-driven outcomes.

In my message in Vol. 05 No. 1, I introduced one of the largest ecosystems -- the United Nations\(^1\). The UN and its partners symbiotic relationships of many inter-related ecosystems and their sub-systems.

In this message, I would like to discuss another major UN ecosystem, the World Health Organization (WHO\(^2\)). The WHO is the global guardian of public health. Its vision is "Together for a healthier world" and its mission, “Promote Health – Keep the world safe– Serve the vulnerable”. It is the directing and coordinating authority on international health within the UN system under the leadership of Director General, Dr. Tedros Adhanom Ghebreyesus.

Dr. Tedros envisions a world in which everyone can live healthy, productive lives, regardless of whom they are or where they live. He believes that “health is a human right. No one should get sick or die just because they are poor, or because they cannot access the services they need.” For

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\(^2\) [https://www.who.int/about/who-we-are/history](https://www.who.int/about/who-we-are/history)
more detail, are striving to move the SDG 2030 agenda. Their success, as measured by the SDG indicators, will depend on the readers can consult the 13th General Programme of Work, 2019–2023, approved by the 71st World Health Assembly in resolution WHA71.1 on 25 May 2018.

When the United Nations was established in 1945, one of the things they discussed was setting up a global health organization. The WHO came into force on 7 April 1948, a date now celebrated every year as World Health Day. WHO is now 7,000 people strong; it works in 150 country offices, and has six regional offices and headquarters in Geneva, Switzerland.

WHO defines health as “a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity”. The WHO is a major player in driving the SDG #3 on health: “Ensure healthy lives and promote well-being for all at all ages”.

The 2019 report of the UN Secretary-General, Special edition: progress towards the SDGs, states that “major progress has been made in improving the health of millions of people, increasing life expectancy, reducing maternal and child mortality and fighting against leading communicable diseases”.

The report found that addressing major diseases, such as malaria and tuberculosis, has stalled or has not been fast enough. It points out that at least half the global population does not have access to essential health services. Many of those who do suffer undue financial hardship, potentially pushing them into extreme poverty.

The report adds that concerted efforts are required to achieve universal health coverage and sustainable financing for health; to address the growing burden of non-communicable diseases, including mental health; and to tackle anti-microbial resistance and determinants of health, such as air pollution and inadequate water and sanitation.

It provides statistical evidence of the status of health outcomes with respect to some of the leading indicators.

**Reproductive, maternal, newborn and child health**

- An estimated 303,000 women around the world died due to complications of pregnancy and childbirth in 2015. Almost all of these deaths occurred in low- and middle-income countries, and almost two-thirds of those were in sub-Saharan Africa.
- The under-five mortality rate fell to 39 deaths per 1,000 live births in 2017, down 6.7 per cent from 2015, and 49 per cent from 2000. Coverage of the required three doses of the vaccine that prevents diphtheria, tetanus and pertussis increased from 72 per cent in 2000 to 85 per cent in 2015, and remained unchanged in 2017.
- An estimated 19.9 million children did not receive the vaccines during the first year of life, putting them at serious risk of these potentially fatal diseases.

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3 https://sustainabledevelopment.un.org/
4 https://www.who.int/about/what-we-do/thirteenth-general-programme-of-work-2019-2023
5 https://sustainabledevelopment.un.org/sdg3
The widespread use of hepatitis B vaccine in infants resulted in the decline in hepatitis B prevalence among children under the age of five, from 4.7 per cent in the pre-vaccine era to 0.8 per cent in 2017.

Globally, the proportion of women of reproductive age (15 to 49) who have their need for family planning satisfied with modern contraceptive methods has continued to increase slowly, from 74 per cent in 2000 to 76 per cent in 2019.

Adolescent fertility declined from 56 births per 1,000 adolescent women in 2000 to 45 births in 2015 and 44 in 2019.

In 2017, 1.58 billion people were reported as requiring mass or individual treatment and care for neglected tropical diseases, down from 1.63 billion in 2015 and 2.03 billion in 2010.

Infectious diseases

- The rate of global human immunodeficiency virus (HIV) incidence among adults aged 15 to 49 declined from 0.44 to 0.40 between 2015 and 2017 and overall by 22 per cent between 2010 and 2017, well short of the declines required to meet 2020 and 2030 targets.
- The incidence HIV in sub-Saharan Africa (among adults aged 15 to 49) has declined by 37 per cent, from 3.39 infections per 1,000 uninfected people in 2010 to 2.49 in 2015 and 2.14 in 2017.
- In 2017, an estimated 10 million people fell ill with tuberculosis a leading cause of death.
- The burden is easing globally: the incidence of tuberculosis has declined from 170 new and relapse cases per 100,000 people in 2000 to 140 in 2015, and 134 in 2017.
- After more than a decade of steady advances in fighting malaria, progress has stalled. Sub-Saharan Africa accounting for more than 90 per cent of the global malaria burden. There were an estimated 3.5 million more malaria cases in the 10 highest-burden African countries in 2017 compared with the previous year.
- In 2015, an estimated 325 million people worldwide were living with hepatitis B virus or hepatitis C virus infection.

Non-communicable diseases, mental health and environmental risks

- The probability of dying from any of the four main non-communicable diseases – cardiovascular diseases, cancers, chronic respiratory diseases and diabetes – between the ages of 30 and 70 was 18 per cent in 2016.
- The global suicide rate fell from 12.9 per 100,000 in 2000 to 10.6 per 100,000 in 2016.
- Suicide remains the second-highest cause of death among people aged 15 to 29 globally, with 79 per cent of suicides found in low- and middle-income countries in 2016.
- The prevalence of tobacco use declined from 27 per cent in 2000 to 20 per cent in 2016.
- The road traffic deaths climbed from 1.31 million in 2013 to 1.35 million in 2016.
- Road traffic injury is the leading cause of death for children and young adults aged five to 29.
- In 2016 air pollution, both ambient and household, and, led to some 7 million deaths worldwide from cardiovascular and respiratory disease.
Inadequate and unsafe drinking water, sanitation and hygiene is linked to 60 per cent of the disease burden from diarrhoea, infections with soil-transmitted helminths and protein-energy malnutrition, the three sources accounted for a total of 870,000 deaths in 2016.

Health systems and funding

- Official development assistance (ODA) for basic health from all donors increased by 61 per cent in real terms since 2010 and reached $10.7 billion in 2017. In 2017, some $2.0 billion was spent on malaria control, $1.0 billion on tuberculosis control and $2.3 billion on other infectious diseases, excluding HIV and acquired immune deficiency syndrome (HIV/AIDS).
- Available data from 2013 to 2018 indicated that close to 40 per cent of all countries had fewer than 10 medical doctors per 10,000 people, and more than 55 per cent had fewer than 40 nursing and midwifery personnel per 10,000 people.
- All least developed countries had fewer than 10 medical doctors and fewer than five dentists and five pharmacists per 10,000 people, and 98 per cent had fewer than 40 nursing and midwifery personnel per 10,000 people.

In Canada’s recent general election on October 21, 2019, health care was one of the key issues. Canadian voters were promised universal pharmacare, which is a drug plan that would fully cover the cost of drugs on an inclusive list. Other promises included a dental care plan for about 4.3 million Canadians without workplace or private insurance plans, which would cost $800 million CDN. The WHO progress report provides political leaders worldwide with sufficient ammunition to compel making health care spending a priority at home. It also contains ample evidence that they should pledge to increase ODA funding to fight major outbreaks of infectious diseases such as ebola, HIV/AIDS and other health risks from diarrhoea, malaria, tuberculosis and hepatitis B or C virus infection.

In this issue, I have written about WHO’s coordination role in implementation of the International Health Regulations (IHR) (2005) to strengthen global health security through a monitoring and evaluation framework and mechanisms.

My sincere thanks go to the contributors to this issue for their time and effort; I encourage others to join them. IDD needs writers from all outcome management disciplines to maintain a continuous flow of articles, short or long. IDD is your e-journal. Let the world know what you are doing to shape the outcomes of your organization. Help us make the IDD a world class e-journal!

Enjoy reading your e-journal!

Sandiran Premakanthan
Founder President/Chairman

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6 https://www.who.int/news-room/fact-sheets/detail/soil-transmitted-helminth-infections
Editors’ Note

The editors take great pleasure in presenting IDD, Vol. 5 Issue 2, which focuses on the health ecosystem and sub-systems. This issue contains four articles for your reading enjoyment.

Evidence-based decision making in the health sector of Pakistan: Prospects for application: Decision making is the most important function managers perform in organizations. IDD editor Atiq ur Rehman discusses the need for, and prospects of, the application of evidence-based decision making in Pakistan’s health system. He provides an overview of the context, a conceptual framework of the evidence-based decision making, risks and challenges and suggestions.

Strengthening global health security through International Health Regulations monitoring and evaluation mechanisms: A health threat in one part of the world can threaten health anywhere. IOCOM chair Sandiran Premakanthan examines the World Health Organization’s coordination role in implementation of the International Health Regulations (2005) to strengthen global health security. He provides an overview of the IHR (purpose and scope) and its implementation status at country level through a Monitoring and Evaluation Framework.

Artificial intelligence in health care: From diagnosing illness to robotics and 3D printing: Gone are the days when artificial intelligence (AI) was considered the stuff of sci-fi. AI is already a huge part of health care. Advances in AI have accelerated innovation in the health ecosystem, resulting in improved health outcomes for millions, while reducing the cost of providing health care. IDD associate editor John Flanders examines features of AI in health care, its benefits and some hurdles it has to cross.

Driving medication adherence: Using a Big Data and AI healthcare solution: IDD contributors Betty Ann Turpin and co-authors Nicholas James Rumble, and Jack Bryant examine a novel treatment-support method developed by Curaizon™ that utilizes advanced Big Data analytics (DA) and artificial intelligence (AI) to influence patient prescription adherence, leading to three key outcomes: improved patient prescription adherence, efficient delivery of care, and improved patient outcomes.

And, as usual, a reminder: Give us some feedback. Send us an email, or better still, write an article. We need authors who are willing to share new and innovative ways of looking at outcome management. Let’s hear from you.

Editors

Atiq ur Rehman, Susanne Moehlenbeck, and John Flanders
Strengthening global health security through International Health Regulations monitoring and evaluation mechanisms

Sandiran Premakanthan

Introduction

In a world of growing connectivity and expanding transportation systems, humans are closer and more connected every day. A health threat in one part of the world can threaten health anywhere. Currently, the world is watching with anxiety the health emergency of international concern and the response efforts to the deadly Ebola virus outbreak in the Democratic Republic of the Congo (DRC).

The DRC\(^7\) is grappling with the world’s second largest Ebola epidemic on record. More than 2,100 lives have been lost and 3,298 confirmed infections have occurred since the outbreak was declared on 1 August 2018.

Neighbouring countries are taking steps to mitigate the risk of spread. The World Health Organization (WHO) has more than 800 staff on the ground supporting the government-led response together with national and international partners.

On 18 October 2019, the WHO’s director-general convened a meeting\(^8\) of the International Health Regulations (IHR 2005) emergency committee to review the Ebola virus disease outbreak in the DRC. Later that day, the director-general declared the outbreak as a Public Health Emergency of International Concern and issued temporary recommendations under the 2005 IHR aimed at limiting the international spread of the disease.

If the DRC had fully implemented the IHR to build a resilient health system, the country could have prevented the current tragic health crisis happening. As such, it exposed the extent and dangers of “non-compliance”.

This article is about the WHO’s coordination role in implementation of the International Health Regulations (IHR) (2005) to strengthen global health security. It provides an overview of the IHR (purpose and scope) and its implementation status at country level through a Monitoring and Evaluation Framework (MEF). It discusses two complementary MEF components: States Party Annual Report (SPAR), a mandatory quantitative self-assessment process, and the Joint External Evaluation (JEE), a rigorous, voluntary multi-sectoral qualitative process.

\(^7\) https://www.who.int/emergencies/diseases/ebola/drc-2019
Further, this article discusses the results of Canada’s SPAR as well as the JEE, which was conducted in 2018 by an external WHO mission team, composed of international experts. The article also describes the development of a National Action Plan for Health Security to address recommendations from Canada’s JEE. This article is produced mainly from published literature referenced and footnoted, input from subject matter experts, and the author’s personal experience working in health emergency preparedness and response.

**International Health Regulations (2005)**: An overview

The purpose and scope of the International Health Regulations (2005) are “to prevent, protect against, control and provide a public health response to the international spread of disease in ways that are commensurate with and restricted to public health risks, and which avoid unnecessary interference with international traffic and trade”.

They were adopted by the 58th World Health Assembly in May 2005 and came into force in June 2007. A central and historic responsibility for the WHO has been managing the global regime for controlling the international spread of disease.

- The IHR (2005) are an international treaty between the WHO and 196 countries, including Canada, to work together for global health security.
- The regulations are focused on addressing serious public health threats that have the potential to spread beyond a country’s borders to other parts of the world, while preventing unnecessary or excessive traffic or trade restrictions.
- One of the most important aspects of the IHR is the requirement that countries have the capacities to detect, assess, report and respond to events that may constitute a potential Public Health Emergency of International Concern.

The WHO develops guidelines, technical materials and training, and fosters networks for sharing expertise and best practice. The WHO helps support countries in meeting their commitments under IHR to build capacity for all kinds of public health events and emergencies.

The IHR is one of the six leadership priorities of the WHO program of work, the purpose of which is to promote health and well-being.

The IHR (2005) contain a range of innovations, including:

- A scope not limited to any specific disease or manner of transmission, but covering “illness or medical condition, irrespective of origin or source, that presents or could present significant harm to humans”;
- State Party obligations to develop certain minimum core public health capacities;
- Obligations on States Parties to notify the WHO of events that may constitute a public health emergency of international concern according to defined criteria;
- Provisions authorizing the WHO to take into consideration unofficial reports of public health events and to obtain verification from States Parties concerning such events;

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9 [https://www.who.int/ihr/publications/9789241580496/en/](https://www.who.int/ihr/publications/9789241580496/en/)
Procedures for the determination by the director-general of a “public health emergency of international concern” and issuance of corresponding temporary recommendations, after taking into account the views of an emergency committee;  
- Protection of the human rights of persons and travellers; and  
- Establishment of national IHR focal points and IHR contact points of the WHO to foster urgent communications between States Parties and the WHO.

The application of the IHR (2005) is not limited to specific diseases. It is intended that the regulations will maintain their relevance and applicability for many years to come, even in the face of the continued evolution of diseases and of the factors determining their emergence and transmission.

IHR monitoring and evaluation framework

The monitoring and evaluation framework of the IHR aims to provide a comprehensive, accurate, country-level overview of the implementation of requirements under the IHR to develop and monitor capacities to detect, monitor and maintain public health capacities and functions.

It provides an overview of approaches to review implementation of country core public health capacities under the IHR (2005). The framework ensures the mutual accountability of States Parties and the WHO Secretariat for global public health security through transparent reporting and dialogue.

There are 13 core public health capacities under the IHR (2005): legislation; coordination; response; preparedness; risk communication; human resources; laboratory; points of entry; zoonosis; food safety; chemical; and radio-nuclear.

The MEF components

1. States Parties Self-Assessment Annual Reporting (SPAR)
   Under the IHR (2005), all States Parties are required to have or develop and maintain minimum core public health capacities, as stipulated in Article 54.

2. After-Action Review
   An After Action Review (AAR) is a qualitative review of actions taken to respond to an event as a means of identifying best practices, lessons and gaps in capacity as part a process of continuous improvement and learning.

3. Simulation Exercises
   Simulation exercises are training and quality assurance tools, which provide an evidence-based assessment for the monitoring, testing and strengthening of functional capacities to respond to outbreaks and public health emergencies.

10 https://extranet.who.int/sph/ihrmef IHR Monitoring and Evaluation Framework

The JEE is a voluntary, multi-sectoral process to assess country capacity to prevent, detect, and rapidly respond to public health risks.

The SPAR is the only mandatory reporting component, while the other three are voluntary. This article discusses only the self-assessment reporting and the joint external evaluation which are focused on public health capacity. The two reporting tools describe performance measurement indicators, with criteria to assess capacity on a scale of one to five.

States Parties Self-Assessment Annual Reporting (SPAR)\(^{11}\)

To build country capacity, the WHO helps review and, if necessary, strengthens their ability to detect, assess and respond to public health event. The WHO developed guidelines, technical materials and training, and fosters networks for sharing expertise and best practice. It supports countries in meeting their commitments under IHR to build capacity for all kinds of public health events.

The SPAR tool consists of 24 indicators for the 13 IHR capacities needed to detect, assess, notify, report and respond, including at points of entry, to public health risk and acute events of domestic and international concern. For each of the 13 capacities, one to three indicators are used to measure the status of each capacity. Each indicator is based on five cumulative levels of capacity. For each indicator, the reporting State Party is asked to select which of the five levels best describes the State Party’s current status. For each indicator, in order to move to the next level, all capacities described in previous levels should be in place.

SPAR Reporting Tool - Structure of the indicator and attributes\(^{12}\)

Under the International Health Regulations (IHR) 2005, all States Parties are required to have or develop and maintain minimum core public health capacities to implement the IHR (2005), as stipulated in Article 54 of the Regulations.

The level of advancement or scoring with colour coding is described in the table below:

<table>
<thead>
<tr>
<th>Level</th>
<th>Indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 1</td>
<td>Policies, and strategies to support and facilitate the development and implementation of IHR capacities are not in place or under elaboration or available on an ad hoc basis.</td>
</tr>
<tr>
<td>Level 2</td>
<td>Policies and strategies to support and facilitate the development and implementation of IHR capacities are in place at the national level.</td>
</tr>
<tr>
<td>Level 3</td>
<td>Policies and strategies to support and facilitate the development and implementation of IHR capacities are in place in all relevant sectors.</td>
</tr>
<tr>
<td>Level 4</td>
<td>Policies and strategies to support and facilitate the development and implementation of IHR capacities are in place at the national, intermediate and local levels by all relevant sectors.</td>
</tr>
</tbody>
</table>


Level 5
Policies and strategies to support and facilitate the development and implementation of IHR capacities are revised and updated on a regular basis.

For example, the core capacity of surveillance (C6) and its associated indicators are described.

**C6. Surveillance**
The IHR end, a sensitive surveillance system, including at points of entry, is needed to ensure the early warning function and provide information for an informed decision-making process during public health events and emergencies.

**Indicators**
C6.1 Early warning function: Indicator – and Event-based surveillance
C6.2 Mechanism for event management (Verification, Risk Assessment Analysis, Investigation)
The 13 core capacities and their descriptions and indicators are detailed in annex 1 - list of capacities and related indicators of the Guidance document for the State Party Self-assessment Annual Reporting Tool.

**Scale Scoring System**

**Indicator level**
The score of each indicator level will be classified as a percentage of performance along the “1 to 5” scale. For example, a country selecting level 3 for indicator 2.1, the indicator level will be expressed as: 3/5*100=60%.

**Capacity level**
The level of the capacity will be expressed as the average of all indicators. For example, for a country selecting level 3 for indicator 2.1 and level 4 for indicator 2.2:
Indicator level for 2.1 will be expressed as: 3/5*100=60%
Indicator level for 2.2 will be expressed as: 4/5*100=80%
Capacity level for 2 will be expressed as: (60+80)/2=70% (average).

**Process for submission of SPAR**
In June of each year, the WHO Secretariat, either through its headquarters or the relevant WHO regional offices depending on specific regional arrangements, will send out a call letter to States Parties, by email through their National IHR Focal Points. This letter outlines their obligation to submit their SPAR to the World Health Assembly in May of the following year, to be submitted by: October of that year.

**IHR State Parties Self-Assessment reports received 2010-2018 (updated on 10 May 2019)**
The WHO stated that the data show that States Parties are making good progress on a number of core capacities, notably in the areas of surveillance, zoonotic diseases, response, coordination, laboratory, legislation policy, and risk communication.

13 [https://extranet.who.int/sph/spar/spar/249](https://extranet.who.int/sph/spar/spar/249) SPAR submissions 2010-2018
2018 Standard Format by WHO REGION: AFRO (47/47 = 100%); AMRO (31/35=89%); EMRO (21/21=100%); EURO (50/55=91%); SEARO (11/11=100%); WPRO (23/27=85%)

2018 State Parties Self-Assessment Annual Reports on IHR Implementation - Score per Capacity by WHO Regions
Reports on SPAR2018 format Global N=183(93%) out of 191(97%) submitted / 196(100%) State Parties - updated on 10 May 2019
European countries (Blue) are leading the way in almost all of the capacities and African countries (AFRO - Red) are lagging in all of the capacities needed to strengthen health security in the region.

**IHR States Parties Score per capacity (2018) for Canada**
Canada received perfect average capacities score of 100 per cent for 12 of the 13 capacities. It received an average capacities score 93 per cent for C1: Legislation and financing. Canada received a score of 80 per cent for indicator C.1.3 Financing mechanism and funds for the timely response to public health emergencies.

IHR States Parties Score per capacity (2018) for countries in the WHO regions of Africa (AFRO), Americas (AMRO), East Mediterranean (EMRO), Europe (EURO), South-East Asia (SEARO) and Western Pacific (WPRO) available on the IHR web site referenced\(^{14}\).

\(^{14}\) ibid SPAR submissions 2010-2018
Voluntary Joint External Evaluation Tool (JEE Tool)\textsuperscript{15}

The JEE is one of the three voluntary processes available for countries to request as needed to evaluate a country’s capacity to prevent, detect and rapidly respond to public health threats independently of whether they are naturally occurring, deliberate or accidental.

The purpose of the external evaluation is to measure country-specific status and progress in achieving the targets. The first external evaluation will establish a baseline measurement of the country’s capacity and capabilities; subsequent evaluations will identify the progress and ensure that improvements in capacity are sustainable. JEEs have a number of important features including: voluntary country participation; a multi-sectoral approach by both the external teams and the host countries; transparency and openness of data and information sharing; and the

The technical areas covered in this voluntary component of the technical framework are grouped into four core areas: – prevent, detect, respond, and IHR related hazards and points of entry.

The JEE in this respect considers:
- preventing and reducing the likelihood of outbreaks and other public health hazards and events defined by IHR;
- detecting threats early to save lives;
- importance of rapid and effective response based on multi-sectoral, national and international coordination and communication; and
- the need for IHR capacities at points of entry, and during chemical events and radiation emergencies.

The JEE tool was developed to provide an external mechanism to evaluate a country’s IHR capacity for ensuring health security and use the expertise of global experts to provide recommendations across the 19 technical areas assessed.

JEE process

The joint external evaluation process takes place roughly once every four to five years. A team of country experts first completes a self-evaluation using the JEE tool that is submitted to the external team prior to the country visit. The external team uses the same tool for their independent evaluation, working together with the country team in interactive sessions.

The first stage of the process is a self-evaluation using the JEE tool and country implementation guide\textsuperscript{16}, completed by the country with multi-sectoral engagement. This information is taken by the JEE team consisting of international subject matter experts. Review and self-validation of data provide the team members with an understanding of the country’s baseline health security capabilities. The JEE team then visits the country for facilitated in-depth discussions of the self-reported data and participates in structured site visits and meetings organized by the host country.


After conducting the evaluation, the JEE team drafts a report to identify status levels for each indicator and presents an analysis of the country’s capabilities, gaps, opportunities and challenges. The key findings are presented as three to five priority actions for each of the 19 technical areas. The draft report is shared with the host country. After the host country concurs with the findings, the final report is published on the WHO website.

**JEE Colour score card**

Each indicator in the JEE tool has attributes that reflect various levels of capacity. These are identified with scores ranging from “1” (indicating that implementation has not occurred) to “5” (indicating that implementation has occurred, is tested, reviewed and exercised, and that the country has a sustainable level of capability for the indicator).

The following describes the level of advancement or scoring with colour coding.

1. No capacity: Attributes of a capacity are not in place. Colour code: Red
2. Limited capacity: Attributes of a capacity are in development stage. Colour code: Yellow
3. Developed capacity: Attributes of a capacity are in place; however, sustainability has not been ensured. Colour code: Yellow
4. Demonstrated capacity: Attributes are in place and sustainable for a few years, and can be measured by the inclusion of attributes or IHR core capacities in the national health sector plan and a secure funding source. Colour code: Green
5. Sustainable capacity: All attributes are functional and sustainable, and the country is supporting one or more other countries in their implementation. This is the highest level of the achievement of implementation of IHR core capacities. Colour code: Green

**JEE International implementation status dashboard**

17 https://extranet.who.int/sph/jee/jee/249 - JEE dashboard
Joint External Evaluation of IHR core capacities of Canada – Mission Report\textsuperscript{18} – Canada’s performance

The JEE mission in Canada took place from 11 to 20 June 2018 in Ottawa and Toronto, Ontario, and Winnipeg, Manitoba; and was based on the first version of the Joint External Evaluation Tool: International Health Regulations (2005).

Canada’s Indicator scoring percentage

\begin{figure}
\centering
\includegraphics[width=\textwidth]{chart.png}
\caption{Average percentage per category}
\end{figure}

The appraisal of Canada’s level of capacities by the JEE mission team was fully consistent with the status of core capacities portrayed by the State Party annual report regularly submitted by Canada to the World Health Assembly, from 2011 to 2018, pursuant to Article 54 of the IHR. The Mission team concluded that at present, Canada complies with all IHR provisions.

The JEE mission complimented the leadership role of Canada in the global public health arena both as a pathfinder and as a partner that devotes efforts and resources to support other countries in their efforts to attain sustainability in essential public health functions as part of strengthening their health systems.

Readers may consult the web link [https://extranet.who.int/sph/jee/jee/249](https://extranet.who.int/sph/jee/jee/249) for Canada’s scores (on-line scorecard)\(^{19}\) for the technical elements and associated indicators. Canada is preparing a **National Action Plan** by engaging its federal, provincial and territorial partners, across sectors and jurisdictions to prioritize and address the 60 recommendations of the JEE Mission Report for continuous improvement.

**Public health in Canada**

In Canada, the Public Health Agency of Canada (PHAC) is the main federal government agency responsible for public health. Its primary goal is to strengthen Canada's capacity to protect and improve the health of Canadians and to help reduce pressures on the health-care system.

\(^{19}\) ibid
To do this, PHAC is working to build an effective public health system that enables Canadians to achieve better health and well-being in their daily lives by promoting good health, helping prevent and control chronic diseases and injury, and protecting Canadians from infectious diseases and other threats to their health. The Agency is also committed to reducing health disparities between the most advantaged and disadvantaged Canadians.

The agency, was established in September 2004, in part as a response to the outbreak in 2003 of severe acute respiratory syndrome (SARS). Since that time, Canada has progressed well. Canada’s JEE self-assessment results demonstrated that Canada’s public health core capacities ecosystem is one of the best in the world. It is driven by innovation and a deep-rooted culture of continuous quality improvement. PHAC is the IHR focal point for Canada. The agency is one of five departments and agencies that make up the federal government's Health Portfolio; it reports to Parliament through the minister of health. The Chief Public Health Officer is the lead health professional of the Government of Canada in relation to public health.

Conclusion

Like millions of Canadians, the author is very fortunate to be assured of the nation’s health security through IHR compliance.

The SPAR and JEE monitoring and evaluation methodologies are vital to sustain a global health security system under the umbrella of the WHO and the IHR. The successful implementation of IHR is the way forward to ensure global health security by the timely detection, prevention and response to national, regional and international health emergencies and events such as SARS (2003) and Pandemic Influenza H1N1 (2009) virus of the past and the current Ebola virus outbreak in DRC.
Evidence-based decision making in the health sector of Pakistan: Prospects for application

Atiq ur Rehman

Introduction

Decision making is the most important function managers perform in organizations. Mintzberg (1990) explains it this way: “No job is more vital to our society than that of the manager. The manager determines whether our social institutions will serve us well or whether they will squander our talents and resources”. Good decisions pay off, while poor decisions cost the organization. Poor quality of evidence results in: a) bad decisions; b) poor outcomes; and c) little understanding of why things go wrong (Barends & Rousseau, 2018).

In the public sector, the cost of poor decisions is much bigger in scale and has multiplier effects. Public sector decision making, especially in the developing world, often suffers from a variety of biases. These includes anchoring bias, availability heuristic, confirmation bias, escalation bias, framing bias, hindsight bias, overconfidence bias and representativeness heuristic (Fraser, Tobin, McRobbie, Eds., 2011; Murata, Nakamura & Karwowski, 2015). The remedy lies in gathering and using quality evidence in decision making.

This article discusses the need for, and prospects of, the application of evidence-based decision making in Pakistan’s health system. It provides an overview of the context, a conceptual framework of the evidence-based decision making, risks and challenges and suggestions.

The Context

Pakistan’s health sector is largely a provincial matter. Every provincial government has its independent health policy and health service delivery infrastructure. However, there are some common features, which include:

1) The administrative head of the health department of each province is the Secretary, who is also the principal accounting officer of the department. He/she is the principal authority for approving financial and administrative decisions. He/she also chairs the committee responsible for approving development projects of the department. However, the highest approving limit of this forum varies from province to province. For example, in Punjab this forum can approve any project up to Rs. 400 million (equivalent to US$2.5 million).

2) The health service delivery system in any province typically consists of three tiers of health care units. Primary health units, which include Basic Health Units (BHUs) and Rural Health Centres (RHUs), are set up in rural areas; each unit is meant to cover one or more villages. Secondary health care units, which include Tehsil Headquarter Hospitals

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20 A “tehsil” is an administrative sub-division of some countries of South Asia. A district typically consists of 2-7 tehsils.
(THQs) and District Headquarter Hospitals (DHQs), are located in cities – at the tehsil and district level. On the other hand, tertiary health care units are situated in only big cities. All tertiary health care units are teaching hospitals and each hospital is attached to a medical college or a medical university.

3) Primary and secondary health care units suffer from a variety of issues, including resource constraints and institutional inefficiencies. Eventually, tertiary health care units become overloaded. People who can afford the fees usually prefer private hospitals or private clinics, while those who can’t afford these fees usually prefer to visit tertiary hospitals. That is why people with even minor issues seek treatment in tertiary hospitals.

4) Resources are quite scarce. During 2017-18, the federal and provincial governments in Pakistan spent about PKR 336.29 billion (equivalent to US$2.78 billion with exchange rate of Rs. 121 as of June 2018, GoP, 2019, p. 172). This represents a per capita health expenditure of just US$13.43 per annum.

5) Data systems exist. However, the quality of some data is not reliable. For example, no one has reliable data for all diseases. Hepatitis, dengue fever and HIV are considered to be current major health issues in Pakistan. However, the exact prevalence of any such diseases is unknown. Similarly, among mental health diseases, depression is said to be prevalent. However, no reliable data on the prevalence of any such disease are available with any provincial government. Even the World Health Organization (WHO) website (https://www.who.int/countries/pak/en/) contains data about the prevalence of diseases in Pakistan that are many years old -- as old as 2013. Eventually, proactive health planning seems missing. Usually disease specific programs are launched through foreign funding.

6) Pakistan failed to achieve the targets set under Millennium Development Goals (MDGs). Now the country is struggling to achieve the targets set under Sustainable Development Goals (SDGs). A number of such targets are related to the health sector. However, the inadequacy of quality data is a big challenge here, too.

7) Women comprise a large number of medical graduates. However, a majority of them don’t go into practice and end their career as housewives. This is a waste of public money and human capital. However, no reliable data about such individuals are available.

8) It is encouraging to note that some efforts are underway to improve the quality of data. The Government of Punjab has tried to automate the health management system. The Health Management Information System (HMIS) is being established in the province. Earlier the BHUs and RHCs used to send reports to THQs, which in turn transmitted consolidated reports to their respective DHQs. Subsequently, the DHQs used to submit the consolidated reports to the provincial government (Fozia, et al., 2015). Now automation is expected to result in improvements. It would be interesting to study the impact of automation on the quality of services.
Evidence-based decision making

Evidence-based decision making is driven by data, both qualitative and quantitative. Key components of evidence are: 1) data, which come from research, monitoring and evaluation, organizational process assets and organizational and individual experiences; 2) analytical argumentation, which is used to solve jigsaw puzzles by using hard data; and 3) opinions of stakeholders (UNICEF, 2008, p. 35).

Evidence can be used in many ways, including: 1) identifying and/or gaining recognition of a policy issue; 2) informing the design and choice of policy; 3) forecasting; 4) monitoring policy implementation; and evaluating policy impact.

Evidence helps in making decisions in efficient and effective ways. It can improve allocative and productive efficiencies. In addition, it can help the poor, that is, by reducing the burden of diseases on the poor and by improving the longevity of life. However, its application at the macro-level in countries like Pakistan is a big challenge.

Most worrying is the population explosion, which is increasing the gap between the demand and supply of health services. Other issues include growing problems of fiscal imbalances (due to the rising burden of debt serving, increasing losses being incurred by state enterprises and ballooning circular debt), sluggish growth of revenue and the high inflation rate.

Everyone uses evidence to inform decision making. However, outcomes of such decisions are linked to the quality of evidence. Quality is monitored at two levels: 1) quality of data; and 2) quality of decision making. Evidence comes from many sources, such as scientific research, monitoring and evaluation report, organizational facts and data, best practices, personal experience, intuition, and so on.

Evidence-based decision making model

Quality evidence alone is not enough; it has to be used in a systematic and structured way to yield desired outcomes. Bowen & Pieren (2019) suggest: “Evidence-based decision making requires developing new skills, such as the abilities to find, critically appraise, and correctly apply current evidence from relevant research to decisions made in practice so that what is known is reflected in the care provided”. Hence, there is need of a model for guiding the process of evidence-based decision making.

Figure 1 contains a proposed model based on the model of Kinicki and Fugate (2016) and recommendations of Dobrow Goel & Upshur (2004). The model suggests that the starting point is the identification of a problem or an opportunity. It is followed by gathering of internal evidence – available within the organization. Decision makers evaluate the evidence on the criteria of relevance and validity. If validity and reliability are not established, the manager goes back to step 2. Otherwise he/she moves to step 4 (gathering of external evidence). Then views of stakeholders are gathered. Finally, all pieces of evidence are integrated to make decisions.
Evidence in the health sector of Pakistan

Multiple types and sources of health data are available in Pakistan. Sources include: the Pakistan Bureau of Statistics, Ministry of Health, Planning Commission, provincial health departments, medical research universities and research institutes and hospitals.

Other databases are being maintained by international development agencies, such as the World Health Organization (WHO), private hospitals and NGOs. These databases lack integration. However, some efforts have been made in recent years to integrate all evidence available in the system.

Hospitals (tertiary, secondary and primary) generate a wealth of data on a daily basis. Data are of two types: routine and non-routine data. These datasets need to be used in decision making. Data analytics can be used to draw useful inferences.

Challenges in the implementation of evidence-based decision making

Evidence-based decision making in Pakistan’s health sector is confronting many challenges. The biggest is the size of population, which according to the 2017 Census hit 207 million. Building a database covering the entire population is not easy.

A second big challenge is the lack of accessibility to the entire population. For example, Balochistan province accounts for almost half of the geographical area (equivalent to the size of Germany). But it comprises less than 6 per cent of the total population of Pakistan. The population is scattered throughout the province. Its population density is just 36 people per square km, with meagre road and communication infrastructure.

A third challenge is that demand for evidence is weak. Demand for evidence can be measured by the number of points discussed in the parliaments. This is primarily because people who work in parliament and policy-making corridors rarely visit any government hospital for their medical treatment or treatment for any of their family members.
**Conclusion and recommendation**

Evidence-based decision making in the health system of Pakistan is the need of the day. It offers solutions to many health sector challenges, especially in overcoming barriers to achieving the targets set under SDGs. A key challenge is how to create demand for evidence. Parliaments (especially specialized committees of the parliaments), the Supreme Audit Institution (the Auditor General of Pakistan), Planning Commission, statistical institutions and provincial planning departments have to play their roles in creating demand for evidence.

Evidence can come through integrating databases of all hospitals (private and public), health surveys/studies conducted by government and non-government agencies and evaluation of development interventions. Quality of evidence is an important area that needs attention, as data of poor quality can prove to be counter-productive. However, quality is not something that can come automatically. It involves deliberate efforts. Quality of evidence can be improved through regular reviews and tests of evidence. Above all, the capacity of relevant departments in the processes of evidence collection, appraisal, application and evaluation is crucial.

**References**


Driving Medication Adherence: Using a Big Data and AI Healthcare Solution**

Nicholas James Rumble; Betty Ann M. Turpin, Ph.D.; Jack Bryant

** "The views, thoughts, and opinions expressed in the text belong solely to the authors; IOCOM does not endorse the products referred to in the article".

This article presents a novel treatment-support method developed by Curaizon™ that utilizes advanced Big Data analytics (DA) and artificial intelligence (AI) to influence patient prescription adherence\(^{21}\), leading to three key outcomes\(^{22}\): improved patient prescription adherence, efficient delivery of care\(^{23}\), and improved patient outcomes.

This article discusses:

- The scope and effects of prescription drug non-adherence and resulting impacts of non-adherence upon global healthcare systems;
- Challenges healthcare professionals face due to non-adherence;
- Benefits and implications Curaizon™’s Big Data and AI offer for treating long-term and chronic conditions;\(^{24}\)
- An ecosystem solution approach to effective treatment resulting in an immediate and measurable improvement in patients’ lives.

Background

Medicines are our most cost-efficient health intervention tool and represent the first line of defense against chronic and long-term conditions. Chronic disease and long-term illness account for 90 percent of total healthcare spending [5]. Hundreds of millions of people take prescribed drugs every day to treat serious chronic conditions, such as diabetes, asthma, heart/cardiovascular disease, hypertension, cancer, thyroid disease and many more.

\(^{21}\) This article defines adherence as: “The extent to which the patient’s behaviour matches agreed recommendations from the prescriber.”

\(^{22}\) The ecosystem focus herein leads to both contribution and attrition outcome management based on a theory of change. That is, the ecosystem method and supporting processes and activities are designed to induce positive change (benefits) in individuals and the health care system. While there are several immediate and potential longer term spin-off benefits (as listed below) to adopting this ecosystem the authors presently claim that the system can demonstrate attribution to these three outcomes. (Contribution means that one can infer causality to the ecosystem in being response for the benefits that arise, largely due to lack of control over the system influence on change; attribution means that one can both isolate and estimate accurately the particular influence the systems has on change; and a theory of change explains how the system intervention can contribute to a chain of results that lead to the intended or observed benefits).

\(^{23}\) Certain statements, estimates and financial information contained herein, constitute forward-looking statements or information. Such forward-looking statements or information involve known and unknown risks and uncertainties, which may cause actual events or results to differ materially from the estimates of the results implied or expressed in such forward-looking statements. This article presents secondary research, as well as limited primary research.

\(^{24}\) Curaizon™ does not guarantee and does not accept legal responsibility of any nature, for any indirect, special, incidental, consequential or other losses of any kind, in short, contract or otherwise (including but not limited to loss of revenue, income or profits, and loss of use or data), arising from or related to the accuracy, reliability, relevance or completeness of any material.
As we all know, medicines improve our quality of life and, most critically, keep us alive. The effectiveness of medicine, however, is predicated upon patients adhering to their prescribed medication(s) regimen. When they do not, the costs are staggering. It is estimated that half of all adults in the developed world are now on some kind of long-term medication. Despite a worldwide acknowledgment of the seriousness of the issue and efforts around the globe to improve medication adherence, there has been no significant change for the last 30 years.

Currently, it is estimated that only 25-50 percent of people in developed countries take their medications as prescribed [25, 31]. Most importantly, non-adherence leads to unmanaged illness and a higher rate of avoidable, premature death [13, 21]. And it is not solely the patient’s health that is impacted. Drug non-adherence directly results in outsized costs to the healthcare system because:

- Drug non-adherence accounts for over 50 percent of visits to a doctor, 40 percent of long-term care admissions, and more than 50 percent of hospital readmissions [17];
- The cost of treating a patient with low adherence is twice that of a patient with high adherence [26];
- Estimates are that approximately 125,000 deaths per year in the United States are due to medication nonadherence [15];
- Medication non-adherence is the source of an estimated $700 billion in “otherwise avoidable healthcare expenditure annually” [25]. It results in additional healthcare costs [13, 28], 26 lost revenues (pharmaceutical companies lost $630 billion in 2017) [10], increased payments by insurance companies [13], higher costs for national healthcare providers and higher premiums for businesses/employers [13], and many other direct and indirect costs to the overall economy [18].

The World Health Organization recently stated: “Increasing the effectiveness of adherence interventions may have a far greater impact on the health of the population than any improvement in specific medical treatments” [30]. Research further suggests that those with high adherence to their medication are 45 percent more likely to achieve control over their condition than patients with lower adherence rates [28].

A reasonable question regarding drug non-adherence might be: “Why don’t patients just take their prescribed medications? Seems like the solution is fairly straightforward and easily addressed.” The reasons behind patient non-adherence, however, are complex. Patients managing chronic, non-chronic and long-term conditions reveal some of the following principal reasons for not adhering to their prescribed medicine treatment. They are:

- Forgetfulness;
- Recollection and misunderstanding of prescribing instructions (Studies suggest that patients are able to recall less than 50 percent of the prescription information presented);
- Limited education about the medications and inadequate counselling practices;

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25 This represents the number of patients in more than 40 countries covered by national health services around the globe.
26 For example, hospitalizations due to non-adherence alone cost the USA between US$100-$300 billion; and suboptimal prescribing, drug administration ($259 billion), and diagnosis are estimated at $290 billion; in the United Kingdom, prescription costs were £16 billion to the National Health Service (2016-17 calendar year) [20, 21, 23].
• Complicated regime(s);
• Frequent change to drug regime;
• Failure to fill even the first prescription;
• Failure to refill prescriptions;
• Suboptimal dosing (patients not taking the required amount of drugs) [1, 2].

Healthcare professionals work as effectively as they can in managing treatment while overcoming the reasons mentioned above in myriad ways. For long-term treatments, there can sometimes be straightforward solutions, such as simplifying the dosage regimen. If that is possible, more complex methods include:

• Combinations of more thorough patient instructions and counselling
• Close/personalized follow-up
• Rewards for success
• Couple-focused therapy
• Crisis intervention

• Postal reminders
• Supervised self-monitoring
• Family therapy
• Psychological therapy
• Manual telephone follow-up

These are all highly expensive and lack the scalability and distribution levels needed to cost-efficiently manage patients’ prescription adherence.

Challenges healthcare professionals face due to non-adherence

Doctors, nurse practitioners, nurses, pharmacists and clinicians, when speaking about managing patients’ drug non-adherence, note that there are:

• Increasingly too little time for patients as finite resources and professionals are under pressure to deliver high-quality care to more patients[27];
• Inadequate/outdated resources helping to provide proactive quality care and follow-up[28]; and
• Depending on the severity of a patient’s disease (e.g. leukemia), it is imperative that they know their patient’s adherence (or lack thereof) to critical, prescribed medications.[29]

According to The Cochrane Collaboration [8, 22] a correlation exists between the frequency of patient interaction and their drug adherence levels. It has been documented via clinical trials that the method of communication with patients, specifically with respect to improving medicine

29 Source: Erin Ruppe, Nurse Practitioner at the University of California, Davis, 2019.
adherence, has been proven to drive an increase in adherence of between 30 percent and 37 percent [26].

Further, “the majority of physicians (76 percent) thought that reminders improved quality of care.” Another study investigating hypertension observed “an increase of patients’ compliance with pharmacotherapy, from 50% to 93%” [26]. There is also substantial evidence of the benefits of periodic prompts and reminders as stand-alone interventions for health-related behavior which this article outlines [26].

Figure 1 shows the relative annual costs of treating non-adherent patients versus adherent – [27].

Benefits and implications of this health ecosystem for treating long-term and chronic conditions

The total number of potential beneficiary users of this health ecosystem is estimated at more than 2 billion patients and growing [16]. The following 17 disease classes have been identified as key beneficiaries of this technology (Table 1).

<table>
<thead>
<tr>
<th>Table 1: 17 Disease Classes</th>
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<tr>
<td>Asthma</td>
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<td>Atrial Fibrillation</td>
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<tr>
<td>Cancer</td>
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<tr>
<td>CHD (Chronic Heart Disease)</td>
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<td>CKD (Chronic Kidney Disease)</td>
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<td>CDPP (Cardiovascular Disease</td>
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<td>Primary Prevention)</td>
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<td>Hypertension</td>
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<td>Heart Failure</td>
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<td>Hyper/Hypothyroidism</td>
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<td>Mental Health</td>
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<td>Obesity</td>
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<td>Stroke</td>
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Below are key benefits that can be gained by adopting this Curaizon™ AI-based healthcare ecosystem:

1. Reduced hospitalizations and readmissions – One of the best ways to curb healthcare costs is to keep patients from entering the hospital system in the first place which is intended to be attributable to reaching cost-efficiency outcomes. Curaizon’s™ data analytics tools send automatic alerts to healthcare providers when patients are about to fall into a pre-frailty state. While playing a vital role in reducing patient deaths, the data can provide advanced warning of patients at risk, thus reducing healthcare costs through fewer doctor and emergency room visits, hospitalizations and readmissions.

2. Faster time to treatment - Curaizon’s™ Big Data analytics tools expedite the process by factoring in unique circumstances, such as adherence, lifestyle choices and demographics, along with the patient’s symptoms. This helps providers make more accurate diagnoses and to formulate the best treatment regimen in real-time attributing to patient health outcomes. Curaizon’s™ Big Data is analyzed using artificial intelligence and neural network systems that generate behavioral modeling and early intervention tools that can be used by those engaged in the patient’s care. By modeling the data, the system outputs a first-of-its-kind advanced analytics of patient life cycles.

3. Identification of best practice – The ability to capture and analyze a patient’s adherence data, where a correlation exists between quality of care and adherence levels, means we are able to highlight poor performance, but also identify best-practices across patient groups contributing to a better healthcare delivery. These data are having a major impact in optimizing patient outcomes, while reducing healthcare costs. Healthcare providers are able to access the system and view the patient’s adherence. They are thus enabled to identify best and worst practice across the network of doctors. They can highlight issues that can be resolved with the correct application of resources that would otherwise be unknowable and employ early interventions and proactive responses to medical events that could become unsafe or even deadly to the patient.

4. Risk stratification – Our data analytics tools help track and identify the sickest and most at-risk patients in a proactive way. This in turn will ensure the activities within the system can be attributed to better patient health outcomes. In addition, this predictive tool analyzes other patient risk factors, such as drug efficacy and poor blood sugar control, in addition to drug adherence.

5. Improved medication therapy management (MTM) – Curaizon’s™ Big Data analytics help clinicians and clinical pharmacists better co-manage drug therapies by identifying drug interactions, adverse side effects and additive toxicity, all in real time. This in turn can ensure the system activities can be attributed to reaching patient health outcomes. Healthcare providers benefit from Big Data if they take a more holistic, patient-centric approach to value, one that focuses equally on healthcare spending and treatment outcomes. The system can quantify the attrition related to the efficacy and sustainability of each drug a patient takes on
an individual basis. This information can be used to create an optimum drug regimen and dramatically improve patient outcomes, while also saving health services tens of billions of dollars.

6. Reduced healthcare costs - One example of the estimated savings the system can provide is within the UK’s NHS and is as follows: The NHS spends £10 billion per year on diabetes care *£8.8 billion for type-2, with 80 percent of this being wasted as a result of complications allied to drug non-adherence [7a]. By delivering a 10 percent increase in adherence levels, the technology would deliver savings of between £709 million and £2.67 billion per annum. The British government instigated a directive in 2010 to save £20 billion per annum from the burgeoning NHS budget by 2015. These savings were never achieved; budgets exceeded £135 billion in 2018.

Through the advanced data and machine learning analytics, Curaizon™ will deliver technologies that will help speed up drug trials and development and provide information that will dramatically improve patient outcomes, while reducing the avoidable waste that occurs as a result of low adherence to medications.

The societal benefits of this Big Data and associated technologies are unmatched. They will lead to significant demand from pharmaceutical companies and biotech researchers, as well as healthcare services, resulting in patients better understanding their own health.

Methodology: An ecosystem approach

How it Works: Once patients are prescribed a medication, the doctor enrolls them in CuraServe™. Patients then receive reminders to take their medication, which is captured in CuraData™. Healthcare professionals and patients can view all their own records in CuraView™. A unique feature of CuraServe™ is that it has a built-in safety net that notifies the patient’s emergency contact if they fail to take their medication30. Figure 2 depicts the relationship among the three components.

30 The patient’s partner and family are happy that he is supported by CuraServe™ because it enhances their efforts toward his well-being and improves the chances he will remain healthy and out of the hospital.
The Curaizon™ health ecosystem enables the ability to collect, analyze, and present a performance-based dashboard. Access to this information is intended to increase adherence, lower healthcare costs, and advance medical research (Table 2).

Table 2: Methodology Components

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<tr>
<th>Curaserve™</th>
<th>Curaview™</th>
<th>Curadata™</th>
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<tr>
<td>Communicates with patients using non-intrusive reminders.</td>
<td>Integrates with health services legacy systems.</td>
<td>Collects unique and valuable data.</td>
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<tr>
<td>Enables family members to support patients.</td>
<td>Ensures that all patient data are current.</td>
<td>Holds only demographic and adherence data. Patient identifiers held by health service.</td>
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<tr>
<td>Supports healthcare providers with a real-time view into patient behavior.</td>
<td>Provides real-time feedback to electronic medical record.</td>
<td>Offers real-time and predictive analytics on patient behaviour and drug optimization.</td>
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CuraServe™ quantifies efficacy and sustainability of each drug a patient takes on an individual basis; the data are in a fully anonymous form. The data collected are analyzed using artificial intelligence and neural network systems that generate behavioral modeling and early intervention tools that can be used by those engaged in the patient’s care. The protocol enables connections among patients, healthcare providers and medical researchers located anywhere in the world, regardless of the systems used.

CuraView™ is a high-level reporting and informatics platform for health services. The platform offers three stakeholder dashboards (patient, doctor and healthcare provider) that provide an in-depth overview of their adherence levels and successes and failures that lay within the system.

CuraData™ is repository for real-time compliance data collected through CuraServe™. As patients and health services engage with the technology, the database grows in both functionality and utility.

**Conclusion**

The next generation of Big Data and analysis tools that power Smart Health innovation will not necessarily be about more research, but better data. What is needed is a qualitative approach. CuraData™ provides precisely this kind of information. We are able to measure the efficacy of one drug over another, and highlight efficiencies in treatment based upon actual responses and behavior by patients across multiple disease classes, drugs, gender, age, demographics and multimorbidity. This represents an infinitely valuable dataset that will improve patient outcomes, deliver better research and treatments and save billions of dollars.

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Artificial intelligence in health care: From diagnosing illness to robotics and 3D printing

John Flanders

Gone are the days when artificial intelligence (AI) was considered the stuff of sci-fi, like HAL 9000, the villainous onboard computer and main antagonist in Stanley Kubrick’s classic 1968 epic 2001: A Space Odyssey.

Nowadays, AI refers to the simulation of human intelligence processes by machines, especially computer systems. These processes include learning (the acquisition of information and rules for using the information), reasoning (using rules to reach approximate or definite conclusions) and self-correction.31

AI is already a huge part of health care. Advances in AI have accelerated innovation in the health ecosystem, resulting in improved health outcomes for millions, while reducing the cost of providing health care. For example:

In Bangalore, a city of 10 million in southern India, a leading hospital network uses AI to enable oncologists to make cancer diagnoses. IBM’s Watson computer system analyzes information to recognize evidence-based treatment choices, assisting oncologists to give cancer patients individualized medicinal services. India sees an incidence of more than 1 million new cases of cancer every year. But it has barely 2,000 pathologists experienced in oncology.

In the American state of Texas, a non-profit medical services provider uses Jvion’s Cognitive Clinical Success Machine to enable doctors to foresee a patient’s health condition 30, 60, 90, and 365 days from the point of starting. The mechanism can convey a full representation of the patient that is as near the genuine future condition of a patient’s risk and wellbeing as could reasonably be expected.

In the United States, a Google Health team has built an AI system that outperforms human radiologists in diagnosing lung cancer. According to Time Magazine, after being trained on more than 45,000 patient CT scans, Google’s algorithm detected 5 per cent more cancer cases and had 11 per cent fewer false positives than a control group of six radiologists.

On a much smaller scale, in Canada, Dr. Ivar Mendez, Chair of the Department of Surgery at the University of Saskatchewan, has set up a network of “remote presence” robotics systems in various locations across widespread, northern areas of the western Canadian province.

31 The Academy of Royal Medical Colleges, London

32 CT stands for computed tomography. The CT scan can reveal anatomic details of internal organs that cannot be seen in conventional X-rays. The X-ray tube spins rapidly around the patient and the X-rays strike numerous detectors after passing through the body. These detectors are connected to sophisticated computers that produce cross-sectional images.
“Rosie the robot”, as the robots are known, is a self-wheeling machine with a television monitor at human height. Rosie allows Dr. Mendez (pictured) to appear on screen remotely from his office. He can interview his patients and perform examinations while a healthcare worker attaches monitoring equipment to the patient to measure vital signs.

Dr. Mendez, a native of Bolivia, told a Canadian Senate committee recently: “This morning I activated one of the robots in Saskatoon from my hotel room and saw six of my patients I had operated on last week and decided that three should go home. I was able to talk to my resident and to the nurses to make decisions about the treatment and the disposition of these patients. “This innovation allows a remotely located specialist to examine and diagnose, and potentially treat, patients, which can save the cost and disruption of transporting them to urban centres.”

Medical organizations say there is little doubt that the emerging confluence of health information and other technologies is going to radically reshape the delivery of health care. With the rising number of patients and subsequent demands for quality and affordable treatment, healthcare organizations are realizing the benefit of adopting technology.

This article examines features of AI in health care, its benefits and some hurdles it has to cross.

**The rise of AI in health care**

AI has only recently begun to take a leading role in health care. The complexity and rise of data in health care, as well as global economic and demographic factors, are putting pressure on healthcare providers around the world. The need for innovative solutions in health care is clear. AI is praised as having the potential to help address important health challenges, such as meeting the care needs of an ageing population. According to the United Nations, the global population aged 60 or over hit 962 million in 2017, more than twice the level in 1980. By 2050, this number is projected to reach nearly 2.1 billion.

As the population expands, the shortage of healthcare workers becomes more acute. According to the World Health Organization, the world will be short of 13 million healthcare workers by
2035. AI has been breaking grounds in the healthcare sector by assisting doctors, hospitals, pharmaceutical companies and others in tackling practical challenges.

Moreover, training physicians and health workers has been challenging, as the demand for qualified trainers remains largely unmet in various countries. Several types of AI are already being employed by payers and providers of care, and life sciences companies. The key applications involve diagnosis of diseases and recommendations for treatment and administrative activities.

AI is also being used to help improve patient experience. AI health apps have the potential to empower people to evaluate their own symptoms and care for themselves when possible.

Despite the enormous potential that rests with these technologies, there may be unintended consequences of integrating them into healthcare delivery, for example numerous ethical considerations. Health care decisions have been made almost exclusively by humans in the past; the use of smart machines to make or assist with them raises issues of accountability, transparency, permission and privacy.

In Canada, the Senate committee summarized a fundamental dilemma this way: “Imagine being examined for a possible health condition by a medically ‘trained’ robot and examined immediately afterwards by a physician. The physician disagrees with the robot’s diagnosis. Who or what do you believe?”

Other concerns include fears that machines will take over jobs in health care, difficulties in commercializing innovations, needed adjustments to training and education, and updating regulatory frameworks for medical devices.

There are also issues such as cybersecurity. There has been particular concern about “ransomware,” a malicious software (malware) that is used to take over a computer system and deny access to data unless a ransom is paid. In May 2017, the malware virus called Wannacry attacked hospitals and other organizations in almost 100 countries, particularly in England.

The roles of AI in health care

AI broadly refers to systems and computers that have been designed to provide solutions to problems without the need for human inference. With the concept of AI gaining popularity in the recent years, health care has been able to cope with some of the current challenges.

In a recent report titled The Future of Technology in Health and Health Care: A Primer, the Canadian Medical Association (CMA) subdivides AI into three main branches: virtual care, big health data and technological developments.

Virtual care

“Virtual care” refers to the use of electronic means to reduce or replace face-to-face interaction. It has been defined as any interaction between patients and/or members of their circle of care,
occurring remotely, using any forms of communication or information technologies with the aim of facilitating or maximizing the quality and effectiveness of patient care.

There are many administrative applications of AI. While most Canadian physicians are now using electronic medical records, electronic communication with patients remains limited.

The CMA points to at least four types of barriers to the uptake of virtual communication between patients and physicians and between physicians and other providers:

- **Governance of compensation mechanisms:** In Canada at least, provincial physician payment systems are still based primarily on face-to-face encounters between the patient and physician.
- **Regulatory barriers:** For example, a requirement for an original signature has impeded electronic prescribing, hence the continued reliance on the facsimile machine, or alternatively printing the prescription generated by the electronic medical record, signing it and handing it to the patient.
- **Security of personal information:** This refers to concern with the security of email communications, particularly between physicians and patients.
- **Digital divide and access to technology:** This refers to social and cultural inequalities in access to new health-related technologies.

The CMA concludes: “There is little doubt that these barriers will be overcome in time. In the future most physicians will be engaged in the provision of virtual care through some means.”

**Big health data**

Big Data in health care refers to collecting, analyzing and leveraging consumer, patient, physical, and clinical data that are too vast or complex to be understood by traditional means of data processing. Instead, Big Data are often processed by machine learning algorithms and data scientists. Data collection in health care can encourage efficient communication between doctors and patients, and increases the overall quality of patient care.

In an April 2018 study titled *Artificial Intelligence in Healthcare*, the Australian AI advisory firm Mindfields points out that analytics and AI can go hand in hand to make work more simple and efficient.

“Analytics relies on combined capabilities of computer programming, statistics and operations research to quantify performance,” the study says. “It is used to interpret large amounts of data and draw meaningful conclusions out of the available data. When analytics is coupled with AI, it can play a crucial role in data mining of medical records and become an effective platform in the healthcare sector.”

Along with data mining, analytics can be used with AI to develop predictive models that can help doctors diagnose diseases at an early stage. To achieve these outcomes, analytics and AI need to work in conjunction, which would not only improve, but revolutionize, the healthcare sector.
One of the more recent applications for AI in health care is drug research and discovery. AI solutions are being developed to identify new potential therapies from vast databases of information on existing medicines, which could be redesigned to target critical threats, such as the Ebola virus.

**Technological developments**

This is perhaps the most visible aspect of AI. The field encompasses everything from health apps that run applications on smartphones and blockchain technology to robotics, three-dimensional (3D) printing, virtual and augmented reality, nanotechnology and the Internet of Things (connected devices).

“Assisting surgeries, disinfecting rooms, dispensing medication, keeping company: believe it or not, these are the tasks medical robots will soon undertake in hospitals, pharmacies, or your nearest doctor’s office,” the magazine Medical Futurist reports. “These new ‘colleagues’ will definitely make a difference in every field of medicine.”

Health apps are closely linked to the concept of mHealth, defined by the World Health Organization as “medical and public health practice supported by mobile devices, such as mobile phones, patient monitoring devices, personal digital assistants (PDAs), and other wireless devices.”

Health apps serve many different functions, including promoting physical fitness and health living, facilitating remote monitoring, providing medication and appointment reminders, and serving as diagnostic aids and as reference tools.

While science fiction movies portray robots as human-like machines, a robot is more generally defined as “a machine capable of carrying out a complex series of actions automatically, especially one programmable by a computer.”

According to the CMA, the field of robotic surgery has been dominated by the da Vinci Surgical System (da Vinci), currently in its fourth generation, which has almost 4,000 installations worldwide. The da Vinci system has four arms that are controlled by a surgeon using joysticks on a console. In 2016 it was reported that da Vinci had been used in 563,000 operations in the United States, of which 44 per cent were in gynecology, 33 per cent in general surgery and 19 per cent in urology.

The concept of 3D printing is harder to visualize. 3D printing is defined as “the process of making a physical object from a three-dimensional model, typically by laying down many thin layers of a material in succession.” It was invented in the 1980s and research and development have been ongoing.

But there has been an explosion of interest in health care applications over the past several years. At some point in the future, it is anticipated that 3D bioprinting might be used to build replacement organs such as kidneys, the CMA says.
The future of AI

The potential impact of AI in health care on the economy is stunning. PwC Global estimates that AI could contribute up to US$15.7 trillion to the global economy by 2030, more than the current output of China and India combined. Of this, $6.6 trillion is likely to come from increased productivity and $9.1 trillion is likely to come from consumption-side effects. PwC figures the greatest economic gains from AI will be in China (26 per cent boost to GDP in 2030) and North America (14.5 per cent boost), equivalent to a total of $10.7 trillion and accounting for almost 70 per cent of the global economic impact.

In a June 2019 analysis, the College of Physicians in the United Kingdom took a cautious, but optimistic, stand on AI in health care. It concluded:

- AI has an important role to play in the healthcare offerings of the future. In the form of machine learning, it is the primary capability behind the development of precision medicine, widely agreed to be a sorely needed advance in care.

- The greatest challenge to AI in health care is not whether the technologies will be capable enough to be useful, but rather ensuring their adoption in daily clinical practice. For widespread adoption to take place, AI systems must be approved by regulators, integrated with current electronic records, standardised to a sufficient degree that similar products work in a similar fashion, taught to clinicians, paid for by public or private payer organisations and updated over time.

- It seems increasingly clear that AI systems will not replace human clinicians on a large scale, but rather will augment their efforts to care for patients.

Medical futurists such as Dr. Bertalan Mesko (pictured) firmly believe that automation, especially AI, robotics and 3-D printing are essential in making health care sustainable, “because health care today is not sustainable,” he says.

Dr. Mesko, director of The Medical Futurist Institute, sums up the situation this way: “I think with automation, we could finally create an ecosystem in health care in which, first, we could
utilize the brain power of physicians instead of pushing them towards repetitive tasks that could be automated.”

“(Physicians) could prevent, predict and treat diseases like never before — an ecosystem in which first we empower patients to take proactive care about their health and disease; second, with the swarm of available health sensors, we have momentum now that we can finally put their data into their own hands to empower them further; and third, an ecosystem in which we can allow start-ups developing innovative technologies to go through the regulations quickly in order to reach patients,” he says. “Otherwise, patients will find their own solutions in the jungle of digital health care solutions.”

AI’s impact on health care is truly life-changing, and a bit frightening given its potential. It is expected that AI will eventually affect all aspects of health care. From drug development to clinical research, AI has helped improve patient outcomes at reduced costs. Hopefully it won’t ever replace doctors. But it should help them make better decisions. In certain areas, it can replace human judgement entirely.

Fortunately, it’s a long way from the calmly homicidal voice of HAL the computer.

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Dear Sir/Madam

The IOCOM Digest and Dialogue (IDD) is an e-journal of the International Organization for Collaborative Outcome Management (IOCOM). It is web-based openly accessible periodical published on a quarterly basis. Its readers include members of the IOCOM present in more than 80 countries with a distribution of about 5000 active readers. Readers tend to be (managers, directors, consultants etc.,) with an interest in exploring how to improve the delivery of outcomes across diverse societal sectors.

The editorial team invites you to write 2000-2500 word articles on any of the outcome management ecosystems and sub-themes. Articles on a chosen sub-theme should address the impact or influence on targeted populations in society. Please e-mail your interest to write an article indicating the title and an abstract of about 100 words.

Outcome management ecosystems

This concept of business ecosystems could be adopted to develop a tree of outcome management ecosystems. Here are some examples of outcome management ecosystems:

- Leadership and people management ecosystem and subsystems: Leadership development, leaders & managers, union-labour management, strategic planning and management, facets of human resources management; building & leading teams, negotiation and conflict resolution, complex employee behaviours in the workplace; motivating people, recruitment, retention, staff/employee appraisals, career & professional development, building employee capabilities, stress management, work-life balance, women & gender studies, organizational justice, participatory management.

- Financial, accounting and banking ecosystem and sub-systems: corporate finance, international finance, forensic accounting and fraud investigation, financial economics; cost-benefit analysis, contribution analysis, banking ecosystems: money laundering, digital currency, fintech, cryptocurrency, financial inclusion, innovative financial solutions for poor (micro financing); financial insurance; financial risk management: risk & loss control management.

- Business Management/Administration ecosystem and subsystems: business economics; business law, organizational behaviour, business ethics; business continuity, management reporting.

- Oversight management ecosystem and interconnected sub-systems: Audit, evaluation, total quality management (TQM) and ISO family of standards; continuous improvement, auditing ecosystems: Auditing Environmental and Occupational Health & Safety (OH&S) Management Systems.
Government and Non-government organizations management ecosystem and sub-systems; Good governance, open government, public management/administration, NGOs contribution to social and economic development, Indigenous people and governments, provincial/state and municipal and local governments, organizational diversity, gender and minority issues at workplaces, cultural diversity, diversity and talent management, social and functional categorization, diversity and ethical issues.


Information technology and information management ecosystems and sub-systems: Information resource management; information and communication technology (ICTs); digital preservation, cybersecurity, internet, data ecosystem including big data, data analytics; artificial intelligence, blockchain, machine language.

Learning and innovations ecosystem, and sub-systems management of Innovation; Learning ecosystem, learning culture, learning fit, measurement, innovation ecosystem, start-ups ecosystem, technology eco-system; innovation, law, and technology.

Industrial/Manufacturing management ecosystems and sub-systems: product design and development, Production management; Plant maintenance; Statistical Quality Control, Quality Assurance; Productivity sciences ecosystems: Industrial Engineering/Work study (Motion & Time Study), Method Study (Process Re-engineering), Work Measurement, Ergonomics and Workplace design; Operations management; Robotics, Marketing and distribution.

Supply chain management ecosystem and sub-systems: logistics, procurement, product life cycle management, asset management, supply chain planning, supply chain enterprises applications; supply chain visibility, green supply chain, risk and supply chain resilience, integrated logistics hubs, One Belt One Road (OBOR).

Engineering management ecosystems and sub-systems: civil engineering; mechanical engineering, electrical and electronics engineering, aeronautical engineering, architectural engineering, computer & software engineering, environmental science engineering.

Agricultural management ecosystem and sub-systems: agricultural policies, agricultural management services, food security and environment, sustainable agriculture, gender in agriculture, trade of agricultural commodities, World Trade Organization (WTO) agreement on agriculture, use of digital technology in agriculture, land grabbing, natural disasters and resilience;

Health management/administration ecosystem -Sub-systems: patient care, health outcomes and quality of life; health information systems ecosystem: eHealth: informatics, innovations and information systems; occupational health & safety: law & regulations; occupational hygiene;
health law, ethics, & policy; health administration, health education and promotion, health risk communication, patient outcome management, midwifery, indigenous medicine, specialized health ecosystems – cardiovascular, quality of life, health emergency response management, health services research, health insurance, medicare system, dental care and dental hygiene, pharmacare and pharmaceutical outcome research management and policy.

- Criminal justice administration ecosystem and sub-systems: criminal law; Law enforcement (law & order), legal administration, offender (correctional) management; parole system, crime & socio-Legal Studies, e-justice.

- Education management ecosystem and sub-systems: Educational administration; e-educational environments; Educating citizens of the 21st century; collaborative learning culture; collective intelligence; emotional education (social and emotional well-being); ecology of learning ecosystem: families, schools, community, networks and society.

Four possible levels of outcome management ecosystems and sub-systems:

- Those driven by clusters of management and technical disciplines;
- Those driven by sector agendas: agriculture, education, health, social services and so on;
- Those driven by national (country) level results agendas (political agendas); and
- Those driven by international and global agendas: climate change, sustainable development goals, World Health Organization (WHO) and other United Nations (UN) agendas.

With kind regards,

Editorial Team
Volume 5, No 3 July – Sept 2019

Issue 5.3: Health management/administration ecosystem

Sub-systems: patient care, health outcomes and quality of life; health information systems ecosystem: eHealth: informatics, innovations and information systems; occupational health & safety: law & regulations; occupational hygiene; health law, ethics, & policy; health administration, health education and promotion, health risk communication, patient outcome management, midwifery, indigenous medicine, specialized health ecosystems – cardiovascular, quality of life, health emergency response management, health services research, health insurance, medicare system, dental care and dental hygiene, pharmacare and pharmaceutical outcome research management and policy.

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Issue 5.4 Education management ecosystem

Education management ecosystem and sub-systems: Educational administration; e-educational environments; Educating citizens of the 21st century; collaborative learning culture; collective intelligence; emotional education (social and emotional well-being); ecology of learning ecosystem: families, schools, community, networks and society.

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