A (personal) vision of personalized medicine from Latin America and Caribbean

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Fiocruz - Brazil
Precision health initiatives

Using Data to Save Lives: The Rockefeller Foundation and Partners Launch $100 Million Precision Public Health Initiative

September 25, 2019

Initiative Aims to Prevent 6 Million Deaths by 2030

Brings Data Science and Machine Learning to Community Health Systems and Frontline Workers

NEW YORK, 25 September 2019 – The Rockefeller Foundation and leading global health partners announced today a $100 million Precision Public Health initiative to empower community health systems and frontline health workers with the latest data science innovations, including more accurate and precise decision-making tools based on large, integrated datasets, predictive analytics, artificial intelligence, and machine learning. The initiative aims to prevent 6 million deaths in 10 countries by 2030, by enabling frontline health workers with simple, inexpensive data analytic tools.
Articles on PerMed with LAC countries as co-authors

Mapping the scientific and policy landscape of permed in the LAC region, including the identification of stakeholders. Innovatec 2019
Precision Public Health beyond public health genomics

Using ICT to:

- Optimize resources allocation;
- Predicting, mapping and monitoring the spread of diseases;
- Monitoring and reporting on adverse events etc.

Wearable sensors and smartphones;
- Validating digital medicine in randomized controlled trials;
- Genomics and multimodal data.
From public health genomics to precision public health: a 20-year journey

<table>
<thead>
<tr>
<th>Tier</th>
<th>Evidence for recommendation</th>
<th>Examples</th>
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<tbody>
<tr>
<td>1</td>
<td>Supported by a base of synthesized evidence for implementation in practice</td>
<td>HBOC, Lynch syndrome, newborn screening, FH</td>
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<tr>
<td>2</td>
<td>Synthesized evidence is insufficient to support routine implementation in practice; may provide information for informed decision making</td>
<td>Many pharmacogenomics tests</td>
</tr>
<tr>
<td>3</td>
<td>Evidence-based recommendation against use; or irrelevant synthesized evidence identified; not ready for routine implementation in practice</td>
<td>Direct-to-consumer personal genetic tests</td>
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</table>

CDC, Centers for Disease Control and Prevention; FH, familial hypercholesterolemia; HBOC, hereditary breast and ovarian cancer.

doi:10.1038/gim.2017.211

Volume 20 | Number 6 | June 2018 | GENETICS in MEDICINE
New clinical trial designs in the era of precision medicine: An overview of definitions, strengths, weaknesses, and current use in oncology

Perrine Janiaud\textsuperscript{a}, Stylianos Serghiou\textsuperscript{a,b}, John P.A. Ioannidis\textsuperscript{a,b,c,d,e,\ast}

Cancer Treatment Reviews 73 (2019) 20–30
New pattern of scientific data production in the health field

**TABLE. Summary of the Three V’s of Big Data and Their Implications**

<table>
<thead>
<tr>
<th>Name</th>
<th>Meaning</th>
<th>Examples</th>
<th>Opportunities and Challenges</th>
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<tbody>
<tr>
<td>Volume</td>
<td>Datasets with more observations</td>
<td>National electronic health record databases, social media datasets</td>
<td>Power to precisely measure unexpected associations, though potentially without substantive relevance</td>
</tr>
<tr>
<td>Variety</td>
<td>Datasets with variables from different sources; more variables per observation</td>
<td>-omics data, neighborhood data added to a phone survey</td>
<td>Capacity to assess complex interactions, but more complicated variable selection</td>
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<tr>
<td>Velocity</td>
<td>Data collected and analyzed in real time</td>
<td>Medication adherence intervention messaging adapted to subject response pattern</td>
<td>Potential to design dynamic intervention</td>
</tr>
</tbody>
</table>
From Personalized Medicine to Precision Public Health

Upstream and Biological Determinants of Population Health

Upstream

Social and economic policies
Institutions
Neighborhoods and communities
Living conditions and social relationships
Individual risk factors

More integration

Organ systems
Cellular processes
Proteome and metabolome
Epigenome and transcriptome
Genome

Biological

https://pophealth.ucsf.edu/precision-population-health
Opportunities for better health stratification

Understanding common pathways in pathologies

Improved cancer surveillance

Precision public health in several fields

Precision epidemiology for infectious disease control

Jason T. Ladner, Nathan D. Grubaugh, Oliver G. Pybus and Kristian G. Andersen

Cardiovascular outcomes associated with use of clarithromycin: population based study

Angel Y S Wong, Adrian Root, Ian J Douglas, Celine S L Chui, Esther W Chan, Yonas Ghebremichael-Weldeselassie, Chung-Wah Siu, Liam Smeeth, Ian C K Wong

Administrative Data Linkage in Brazil: Potentials for Health Technology Assessment

Precision Health in Disaster Medicine and Global Public Health


So beyond the essential steps of event surveillance and case management, on which the prevention and control of diseases are based, if we are to truly advance health and eliminate diseases, a case can be made for a tailored approach and the advent of precision-style global health. ■ The Lancet Global Health
An example of data integration for public health in Brazil

- **Integrating data and knowledge** to answer scientific health related questions;
- Integration of large data bases using statistical and econometric methods - **Causal Inference**;
- **Prediction** using mathematical models and **machine learning**;
- Evaluation of impact of social protection policies in health. e.g. "**Cohort of 100 million Brazilians**”
- A resource for evidence based studies on the social determinants of health and the effects of social and environmental policies on different health outcomes.
CIDACS group: examples of evaluation performed

Effect of a conditional cash transfer programme on childhood mortality: a nationwide analysis of Brazilian municipalities

Davide Rasella, Rosana Aquino, Carlos A T Santos, Rômulo Paes-Sousa, Mauricio L Barreto

Impact of primary health care on mortality from heart and cerebrovascular diseases in Brazil: a nationwide analysis of longitudinal data

BMJ 2014;348:g4014 doi: 10.1136/bmj.g4014 (Published 3 July 2014)

Monitoring and Evaluating Progress towards Universal Health Coverage in Brazil

Precision public health in several fields

A Platform for Monitoring Regional Antimicrobial Resistance, Using Online Data Sources: ResistanceOpen

Derek R. MacFadden,1,2 David Fisman,1 Jeff Andre,2 Yuki Ara,2 Maimuna S. Majumder,2,4 Isaac I. Bogoch,1 Nick Daneman,1 Annie Wang,1 Marianna Vavitsas,2 Lucas Castellani,1 and John S. Brownstein2,3

1Division of Infectious Diseases, University of Toronto, Canada; 2Boston Children’s Hospital; 3Harvard Medical School, Boston, and 4Massachusetts Institute of Technology, Cambridge

Towards an integrated framework for air quality monitoring and exposure estimation—a review
Digital determinants of health

Progress towards improving health ...by empowering the individual to make informed choices by providing and enabling environment, strengthening health literacy through education...

The appropriate use of digital health takes ... into consideration: safety, ethical use, cost-effectiveness and affordability. It should be people-centered, evidence-based, effective, efficient, sustainable, and contextualized.
Legal aspects of using personal data in research

**Law 13,709, 14 August 2018.**

Disposes on the protection of personal data ...

Art. 13. In the performance of studies in public health, research institutions may have access to personal databases ... strictly to studies and research and maintained in a safe and controlled environment ... including, when possible, anonimization ... and considering ethical patterns ...
"At a given score, Black patients are considerably sicker than White patients, ... Remeding this disparity would increase the percentage of Black patients receiving additional help..."
Precision health in a LAC perspective

• A major effort in capacity building in all levels, from undergraduates to professionals in the health services;

• Advance citizens’ empowerment - patients, families...;

• Focus of increasing precision on public health - prevention and surveillance;

• Reinforce the discussion of legal and ethical aspects.