Digital Health in the Global South : challenges, opportunities and implementation

Gayo Diallo

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Univ. Bordeaux

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Data Science School in Bénin, 2022

University of Bordeaux – Environment

- La ville de Bordeaux (Sud Ouest France), site classé UNESCO

Source: google®

- 50,000++ students, about 6,000 from abroad
- 6,000 staff members

- Among wide campus in Europe (260 acres)

Bordeaux Population Health INSERM 1219

BORDEAUX POPULATION HEALTH | Research Center - U1219

2022-27 | 10 teams | 15 (dep.) directors

ACTIVE –Team #1
Aging, chronic diseases, technology, disability, and environment
H Amieva

R Thiébaut
SISTM – Team #10
Statistics in Systems Biology and Translational Medicine

GHiGS – Team #2
Global Health in the Global South

O Marcy R Becquet

G Diallo A Pariente
AHeaD – Team #9
Assessing Health in a Digitalizing Real-World Setting: Pharmacoepi and beyond

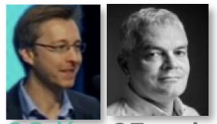
ELEANOR – Team #3
Molecular epidemiology of vascular and brain disorders
DA Tregouet S Debette

A Monnereau I Baldi
EPICENE – Team #8
Epidemiology of Cancer and Environmental Exposures

C Delcourt
LEHA – Team #4
Lifelong exposures, health and aging

C Dufouil
PHARes – Team #7
Population Health trAnslational Research

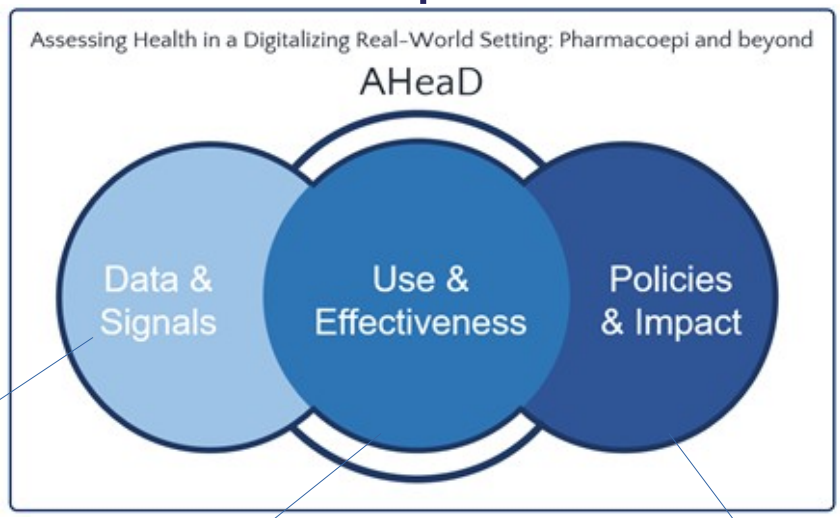
H Jacqmin Gadda
BIOSTAT – Team #5
Biostatistics



C Galéra C Tzourio
HEALTHY – Team #6
Health, wellbeing and achievement in the young

Team AHeaD : Assessing Health in a Digitalizing Real-World Setting : Pharmacopi and beyond

Material: RWS, medico-administrative data, digital data
Methods: traditional epi/pharmacoepi, ML and semantics-driven



-Real Word Data Use
-Signal Detection

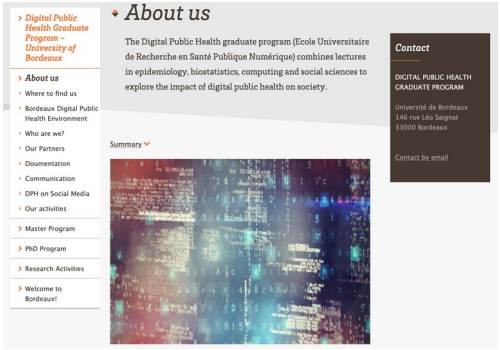
-Use & Misuse of Medical Drugs, Devices & Care in RWS
-Safety & Effectiveness of Medical Drugs, Devices & Care in RWS

-Care policies and mediatisation characteristics and determinants
-Care policies and mediatisation consequences on health and economics

ISPED: Institut de Santé Publique, Epidémiologie et Développement

- Dir.: Pr. Mathoulin-Pelissier
- 2021-22 : ~1000 étudiants
  - 9 majors Master Degrees
  - 22 DU / DIU
  - 20 years Distance Learning

Master in « Public Health Data Science »
interdisciplinary
Épidemiology + Statistics + Informatics (Digital Public Health Graduate Program)



Master 2 Information System and IT Technologies for Health (SITIS)

F. Mougin - fleur.mougin@u-bordeaux.fr

http://www.isped.u-bordeaux.fr/Formation/MasterenSantePublique/M2SITIS.aspx

Digital Health

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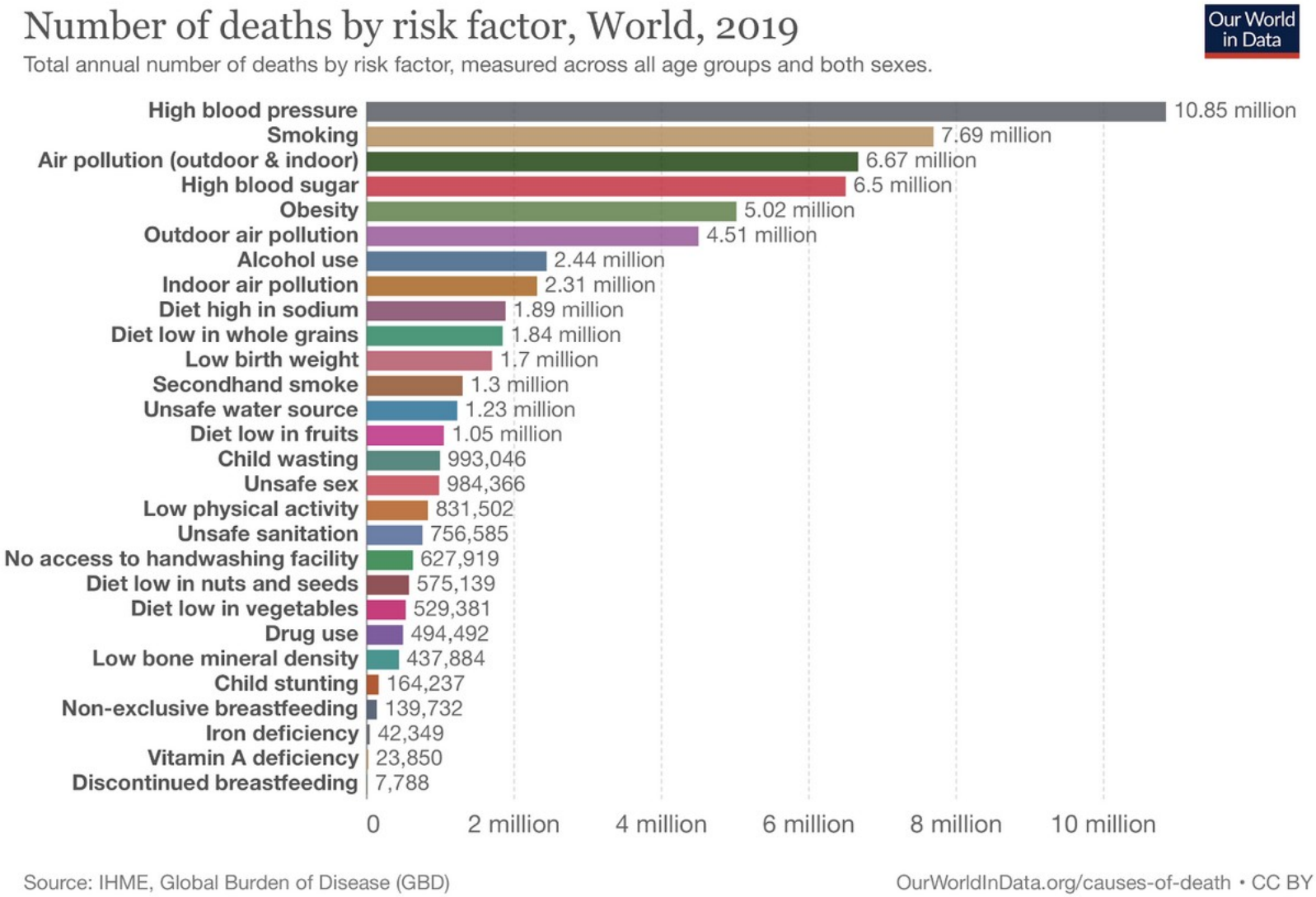
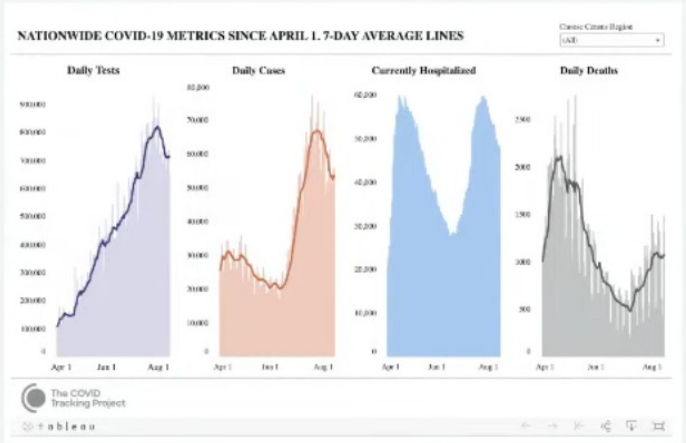
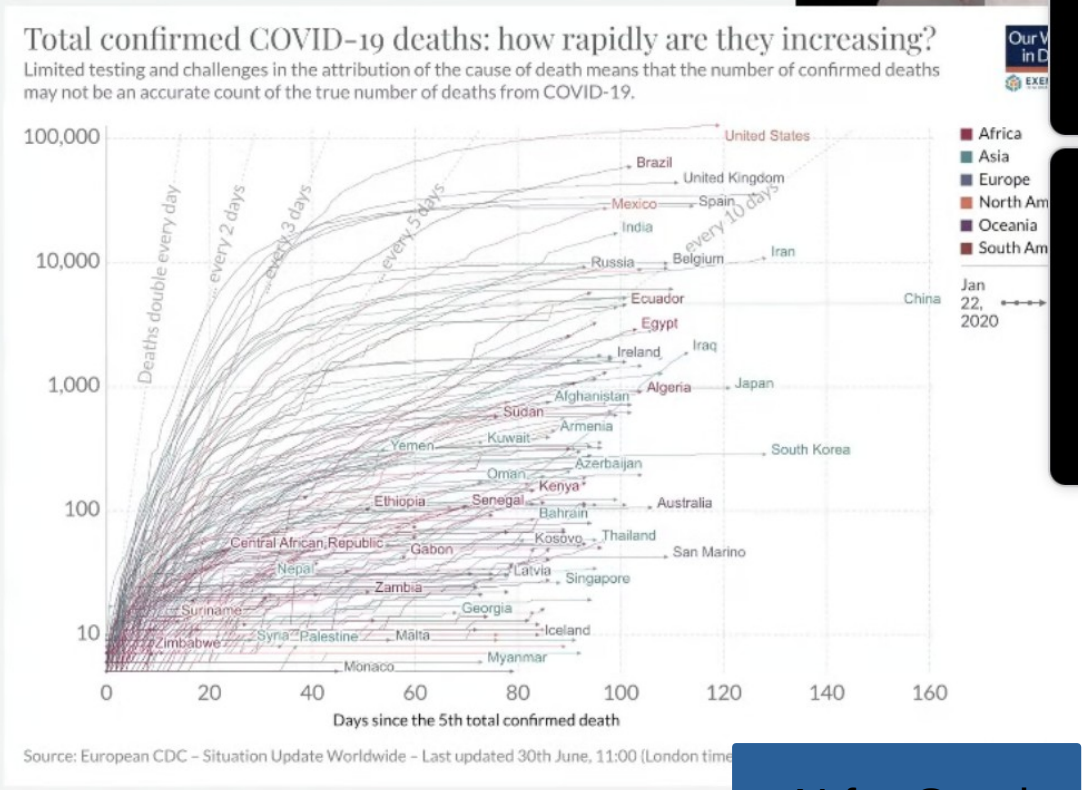
Digital Health : example of indicators



Digital Health : example of indicators

New generation of public health platforms





AI for Good

Digital Health : definition

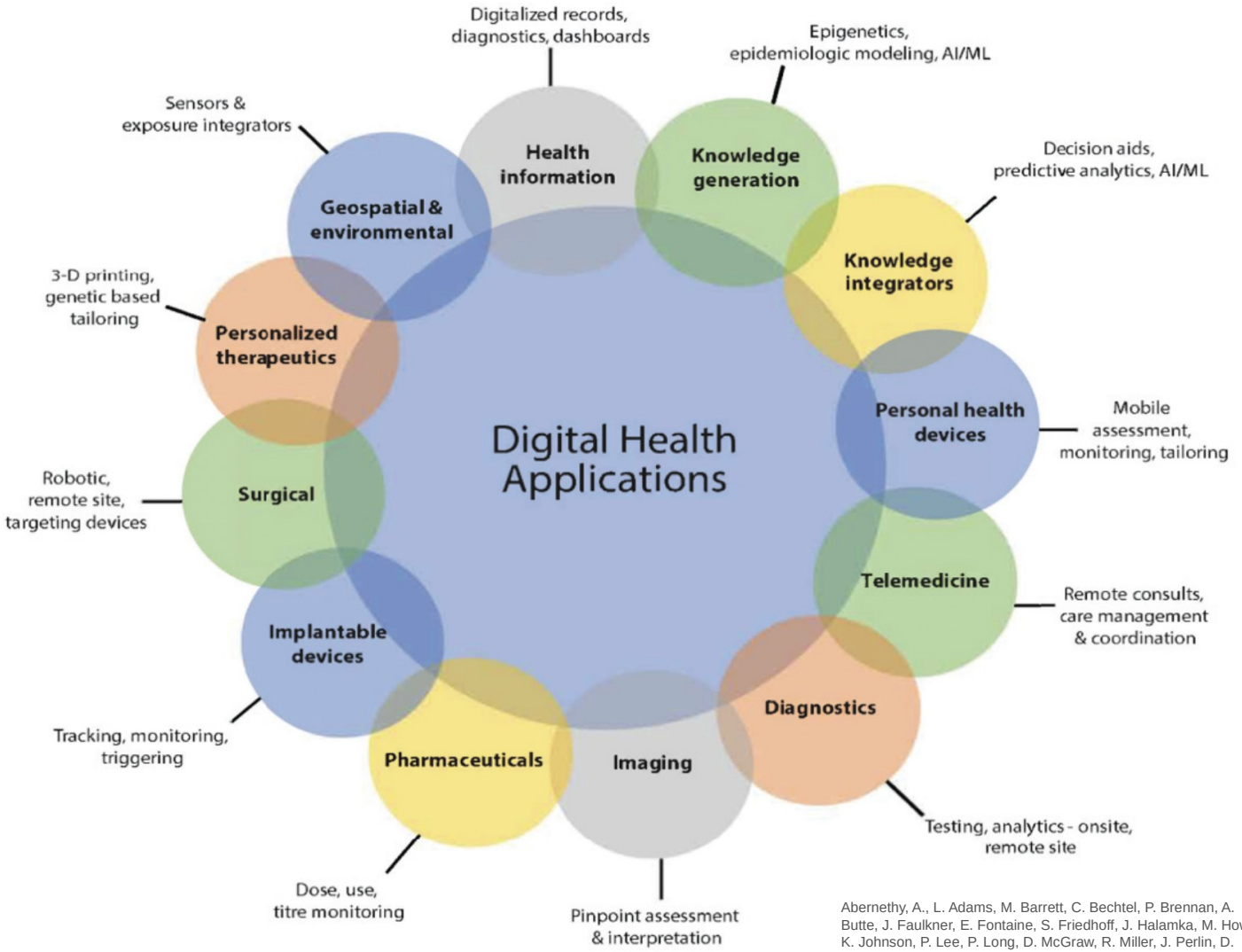
A broad term applied to a range of digital tools to record, organize, store, analyze, link, and share information—text, images, signals—for use in observing, assessing, learning, managing, and improving the healthcare of individuals and populations.

> Digital health technologies encompass a broad range of tools, including "mobile health (Health), health information technology (IT), wearable devices, telehealth and telemedicine, and personalized medicine. Digital health technologies use computing platforms, connectivity, software, and sensors for health care and related uses."

SOURCE: U.S. FDA. n.d. What is Digital Health? https://www.fda.gov/medical-devic-es/digital-health-center-excellence/what-digital-health

Digital Health : ecosystem

Evolving applications of digital technology in health



Abernethy, A., L. Adams, M. Barrett, C. Bechtel, P. Brennan, A. Butte, J. Faulkner, E. Fontaine, S. Friedhoff, J. Halamka, M. Howell, K. Johnson, P. Lee, P. Long, D. McGraw, R. Miller, J. Perlin, D. Rucker, L. Sandy, L. Savage, L. Stump, P. Tang, E. Topol, R. Tuckson, and K. Valdes. 2022. The Promise of Digital Health: Then, Now, and the Future. *NAM Perspectives.* Discussion Paper, National Academy of Medicine, Washington, DC. https://doi.org/10.31478/202206e.

Digital Public Health

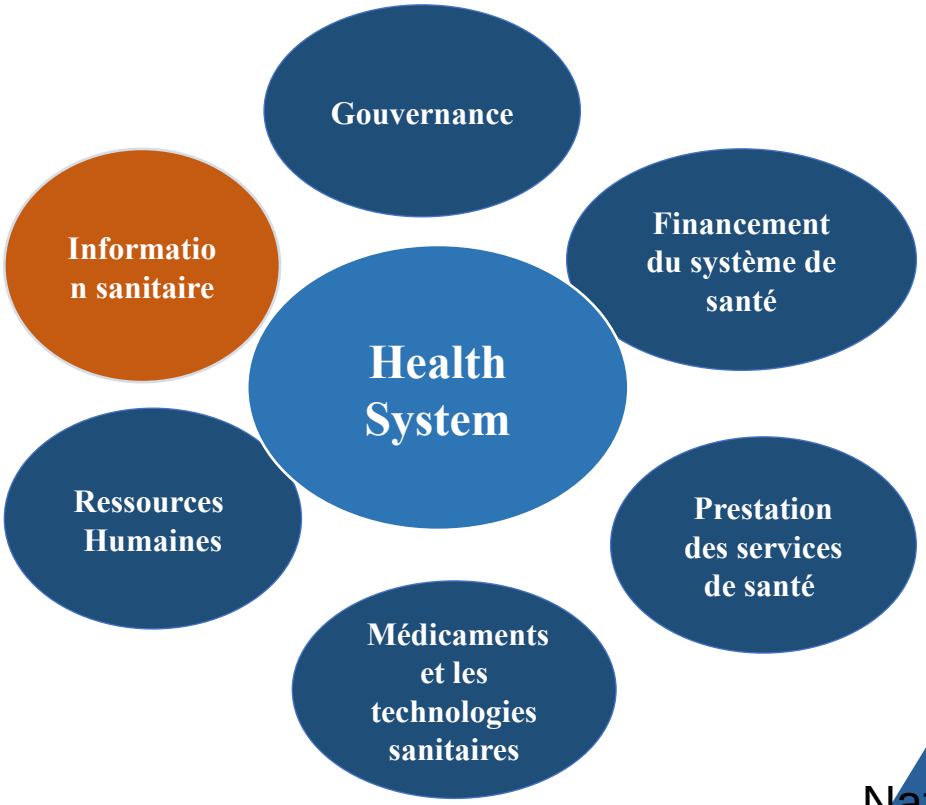
- Context: Public Health
  - Enabling population level health
  - Collecting, processing, analyzing and reporting health related data
  - Manual and repetitive tasks

- Opportunities
  - Increase of digital data availability
  - Standardization of coding systems
  - Advances in Artificial Intelligence and ICT technology

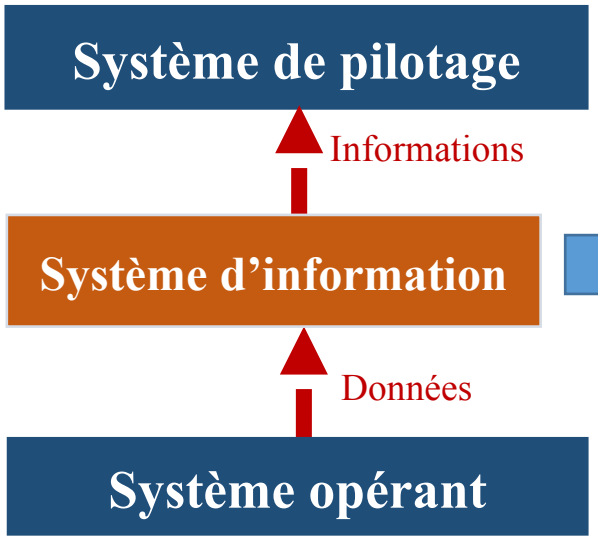
- Issues and Challenges
  - Heterogeneity & about 80% of unstructured data
  - Implicit and imprecise meaning of data
  - Enabling trustworthy public health decision from meaningful data

- ==> Digital Public Health
  - Relying on ICT technology
  - Automated collecting and health data processing
  - Use of Medical Coding Systems and Terminologies: knowledge resources

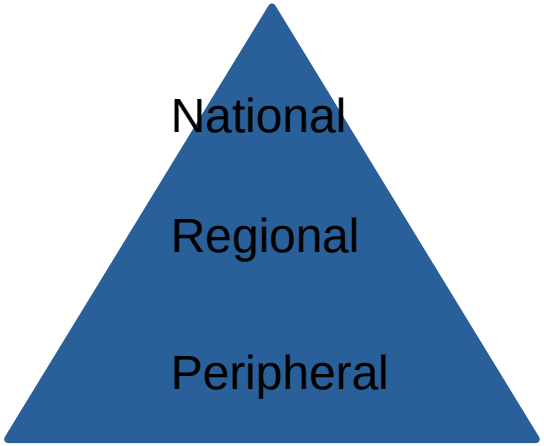
Health Information System in the Health System



Courtesy AP. Koumamba



Aide à la décision



Digital Health in the global south

Health information systems in developing countries: case of African countries

Aimé Patrice Koumamba ✉, Ulrick Jolhy Bisvigou, Edgard Brice Ngoungou & Gayo Diallo

BMC Medical Informatics and Decision Making **21**, Article number: 232 (2021) | Cite this article

Abstract

Background

In developing countries, health information system (HIS) is experiencing more and more difficulties to produce quality data. The lack of reliable health related information makes it difficult to develop effective health policies. In order to understand the organization of HIS in African countries, we undertook a literature review.

Methods

Our study was conducted using the PubMed and Scopus bibliographic sea
inclusion criteria were: (i) all articles published between 2005 and 2019,
in their title the keywords "health", "information", "systems", "system", "
countries", "santé", "pays en développement", "Afrique", (iii) articles that
English or French, (iv) which deals with organizational and technical issu
African countries.

Results

Fourteen retrieved articles out of 2492 were included in the study, of whi
qualitative. All of them dealt with issues related to HIS in 12 African coun
(100.0%) had opted for a data warehouse approach to improve their HIS.
supported by the DHIS2 system, has enabled providing reliable data. Hov
countries (92.0%) frameworks were aligned with funding donors' strategi
national strategy.

Conclusion

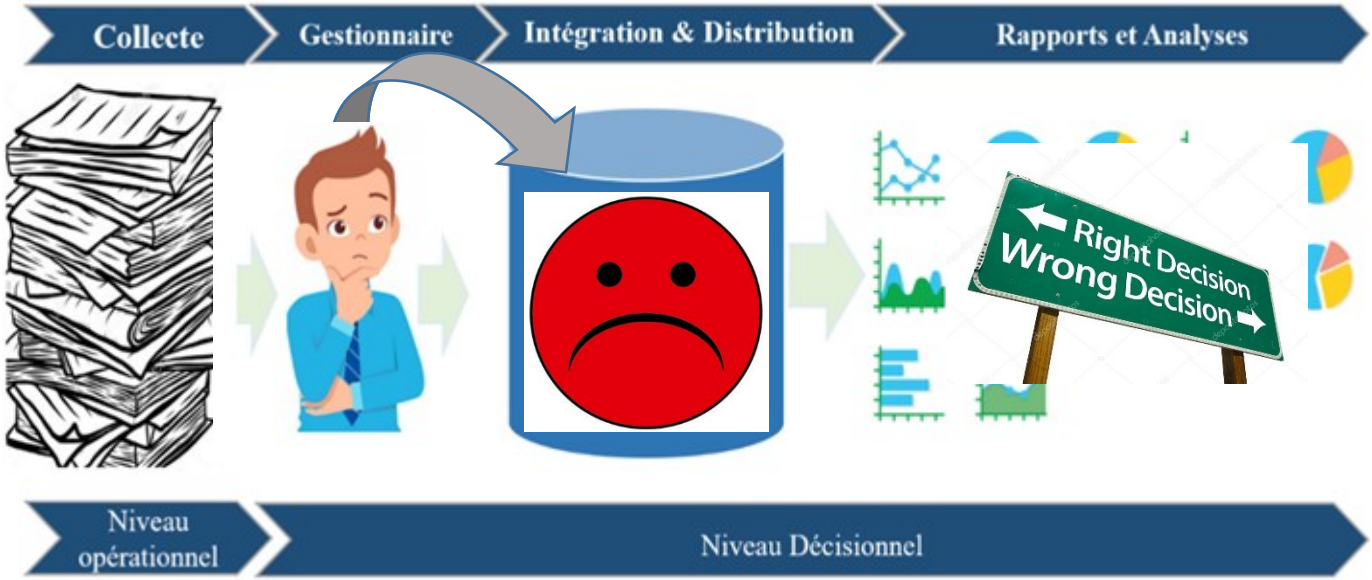
This study suggests that the lack of a national health information management strategy will always be a threat to HIS performance in African countries. Ideally, rigorous upstream thinking to strengthen HIS governance should be undertaken by defining and proposing a coherent conceptual framework to analyze and guide the development and integration of digital applications into HIS over the long term.

AP. Koumamba, PhD thesis in health informatics, Join degree betwee Univ. Bordeaux FR & ED Sciences de la Santé Gabon, 2021

Articles	Themes covered						
First auhor, year	HIS Governance (6/14)	Quality of data	IT (3/14)	HIS Evaluation (2/14)	DHIS (8/14)	Data Warehouse (10/14)	Type
Karuri J et al., 2014	X	X			X	X	Qualitative
Chaulagai CN et al., 2005						X	Qualitative
Abou Zahr C et al., 2005	X						Qualitative
Glèlè Ahanhanzo Y et al., 2014	X	X		X		X	Quantitative
Alwan A et al., 2016					X	X	Qualitative
Amidou B-M et al., 2012	X						Qualitative
Cline GB et al., 2013							Qualitative
Sæbø J et al., 2011	X		X		X	X	Qualitative
Seitio-Kgokgwe O et al., 2015		X			X	X	Qualitative
Aqil A et al., 2009				X			Qualitative
Bakar A et al., 2012					X	X	Qualitative
Braa J et al., 2010	X		X		X	X	Qualitative
Mutale W et al., 2013			X		X	X	Qualitative
Ly O et al., 2018	X	X			X	X	Qualitative

Digital Health in the global south

Poor Data Quality in most of the developing countries



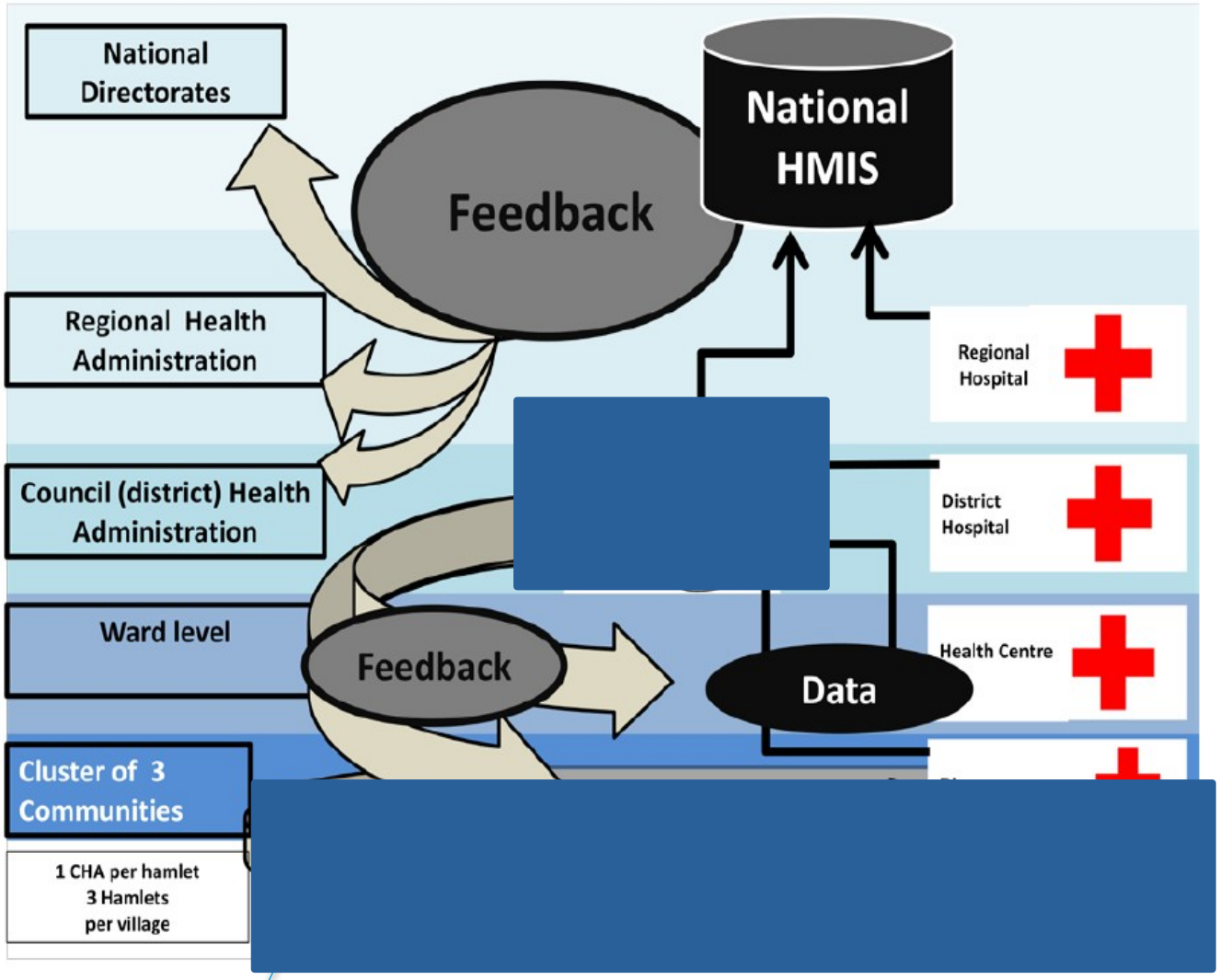
- A lack of digitalised information system in many (French speaking) countries in Africa (Bagayoko, 2010)

- Only 6.6% of countries in Africa have a digitalised Electronic health record (Palé, 2018)

- Relying heavily on manual data processing and integration

Digital Health in the global south

Illustration of the collecting and integration of data: implementation of DHIS2 in Tanzania



Digital Health in global south: challenges

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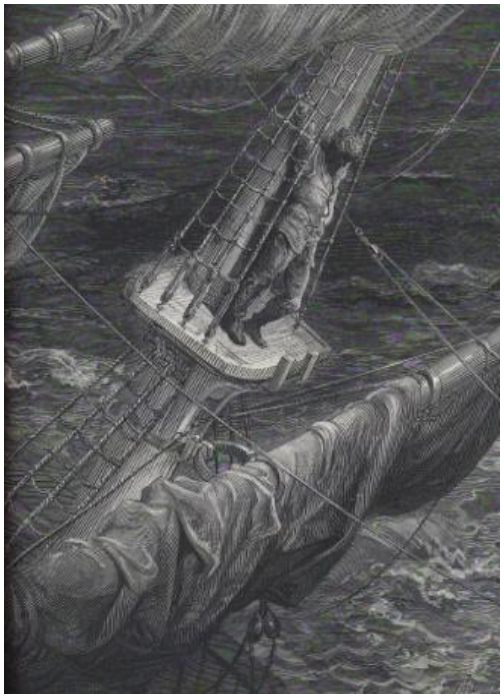
Lack of appropriate IT infrastructure and digitalized data

Samuel Taylor Coleridge, *The Rime of the Ancient Mariner*. It contains the famous verse, “Water, water, everywhere, nor any drop to drink



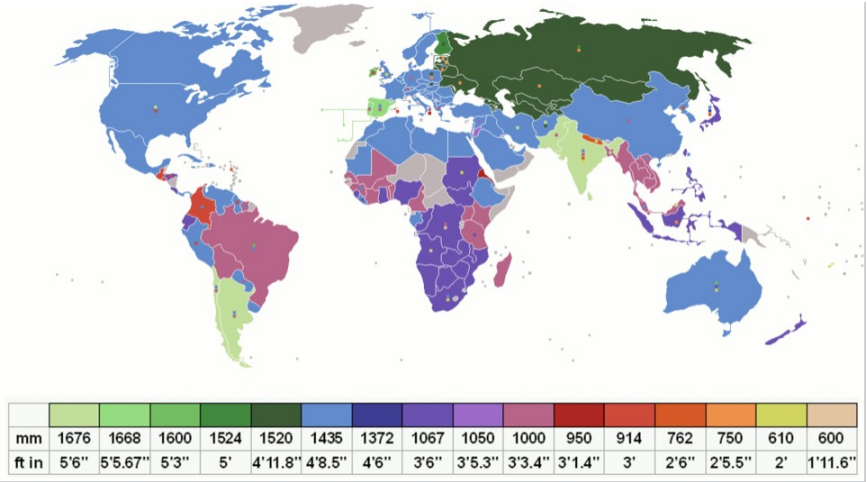
Samuel Taylor Coleridge

Coleridge in 1795

Born	21 October 1772 Ottery St Mary, Devon, Great Britain
Died	25 July 1834 (aged 61) Highgate, Middlesex, United Kingdom
Occupation	Poet · critic · philosopher
Alma mater	Jesus College, Cambridge
Literary movement	Romanticism
Notable works	*The Rime of the Ancient Mariner*, *Kubla Khan*, *Christabel*, Conversation poems, *Biographia Literaria*
Spouse	Sara Fricker
Children	Hartley Coleridge Berkeley Coleridge Sara Coleridge Derwent Coleridge

Signature

Interoperability Issues



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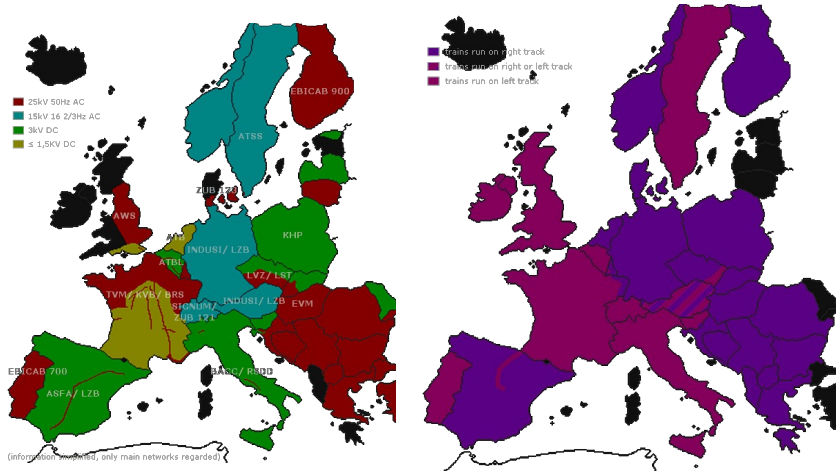
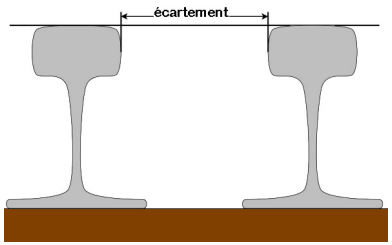
ft in	5'6"	5'5.67"	5'3"	5'	4'11.8"	4'8.5"	4'6"	3'6"	3'5.3"	3'3.4"	3'1.4"	3'	2'6"	2'5.5"	2'	1'11.6"



Source: http://www.bueker.net



Standard: 1 435 mm

Source: https://www.pexels.com/

Source: https://www.euspa.europa.eu

Interoperability Issues

Handling and integrating health data from the peripheral systems

Defining and computing national key health indicators

Dealing with private and other side health systems

From real-world individuals' data to national health indicators: a pilot study in Gabon

Aimé Patrice Koumamba; Edgard Brice Ngoungou; Jean Engohang-Ndong; Euloge Ibinga;
Raymond Ondzigue Mbenga; Gayo Diallo

ABSTRACT

Background:

Effective health information systems support decision-making. In some sub-Saharan African countries, including Gabon, there is a problem with data quality. Indeed, the tools supporting the data collection process in health facilities are limited and tend to favour manual data processing.

Objective:

This study presents the conceptual approach of an information system model for health decision support in resource-limited countries and the results of the evaluation's model.

Methods:

The study was conducted in three phases. First, the design and development of a platform based on the analysis of the different processes of data production and indicator generation. Secondly, the implementation of the platform in the health structures in Gabon. Finally, an evaluation of the platform with users.

Results:

A total of 14 users were interviewed, with an average experience of 12 years in health data management. The results show that the use of the proposed model significantly improves the completeness, timeliness and accuracy of data compared to the traditional system. Respectively, 93% versus 12% ($p<0.0001$), 96% versus 18% ($p<0.0001$) and 100% versus 18% ($p<0.0001$).

Conclusions:

The proposed model contributes significantly to the improvement of health data quality in Gabon.

Koumamba AP, Ngoungou EB, Engohang-Ndong J, Ibinga E, Ondzigue Mbenga R, Diallo G From Real-world Individuals' Data to National Health Indicators: Multiphase Pilot Study in GabonJMIR Formative Research. 24/08/2022:35176 (forthcoming/in press)

Dealing with lack of Health Literacy and Fake News

Health literacy implies the achievement of a level of knowledge, personal skills and confidence to take action to improve personal and community health by changing personal lifestyles and living conditions [World Health Organization]

It is recognized that access to healthcare information is possibly the single most cost effective and achievable strategy for sustainable improvement of healthcare (R. Smith.1997)

Literacy rate for sub-Saharan Africa was 65 % in 2017. One third of the people aged 15 and above were unable to read and write (UNESCO,2018)

How to Deal with the many Local Languages?

Ismaila, . O., SOME , B. M. J. ., BENEDIKTER, R. ., & DIALLO , G. . (2022). Improving health literacy in rural Africa through mobile phones: a systematic literature review. Journal of Health Informatics in Africa, 8(1), 26–31. https://doi.org/10.12856/JHIA-2021-v8-i1-312

Accessing to Evidences and Recommendations

West African Health Organization
Promoting better health through regional integration

Epidemiological bulletins

Epid Week 10 (28/02/2022 au 06/03/2022)
Contents
- overview of health threats;
- Monkeypox Epidemiological situation
- Lassa Fever Epidemiological situation
- Covid-19 pandemic: update

Download +

Epid Week 9 (21/02/2022 - 27/02/2022)
Contents
- overview of Epidemiological situation;
- Covid-19 pandemic: update;
- Epidemiological situation of Lassa fever;
- Epidemiological situation of measles.

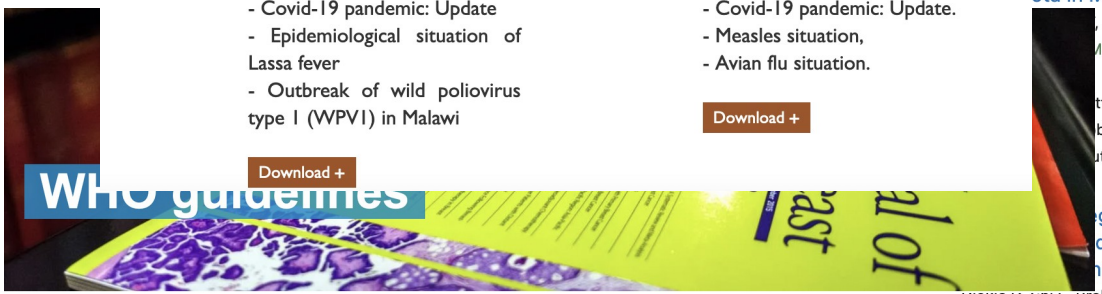
Download +

Epid Week 8 (14/02/2022 - 20/02/2022)
Contents
- Overview of epidemiological situation
- Covid-19 pandemic: Update
- Epidemiological situation of Lassa fever
- Outbreak of wild poliovirus type 1 (WPV1) in Malawi

Download +

Epid Week 7 (07/02/2022 - 13/02/2022)
Contents
- Overview of epidemiological situation.
- Covid-19 pandemic: Update.
- Measles situation,
- Avian flu situation.

Download +



Log in

c risk factors

Search

alert Create RSS User Guide

Send to Sorted by: Best match Display options

Page 1 of 1,113

and **Cardiometabolic Risk Factors**: From Childhood to Adulthood.
Alvarez-Pitti J, Wójcik M, Borghi C, Gabbianelli R, Mazur A, Herceg-Čavrak V, Lopez-BG, Brzeziński M, Lurbe E, Wühl E.
2021 Nov 22;13(11):4176. doi: 10.3390/nu13114176.
336431 **Free PMC article.** Review.
as become a major epidemic in the 21st century. It increases the **risk** of dyslipidemia, ion, and type 2 diabetes, which are known **cardiometabolic risk factors** and nts of the metabolic syndrome. ...In this review, we will discuss ...

tent Fasting Improves **Cardiometabolic Risk Factors** and Alters Gut ota in Metabolic Syndrome Patients.
Yin S, Fan J, Xia M.
Metab. 2021 Jan 1;106(1):64-79. doi: 10.1210/clinem/dgaa644.
Clinical Trial.
ttent fasting (IF) is an effective strategy to improve **cardiometabolic** health. bjective of this work is to examine the effects of IF on **cardiometabolic risk** ut microbiota in patients with metabolic syndr ...

getarian Diet on **Cardiometabolic Risk Factors**, Gut d Plasma Metabolome in Subjects With Ischemic Heart ndomized, Crossover Study.
Djekic D, Shi L, Brolin H, Carlsson F, Särnqvist C, Savolainen O, Cao Y, Bäckhed F, Tremaroli V, Landberg R, Frøbert O.
J Am Heart Assoc. 2020 Sep 15;9(18):e016518. doi: 10.1161/JAHA.120.016518. Epub 2020 Sep 6

Meta-Analysis
Randomized Controlled
Share

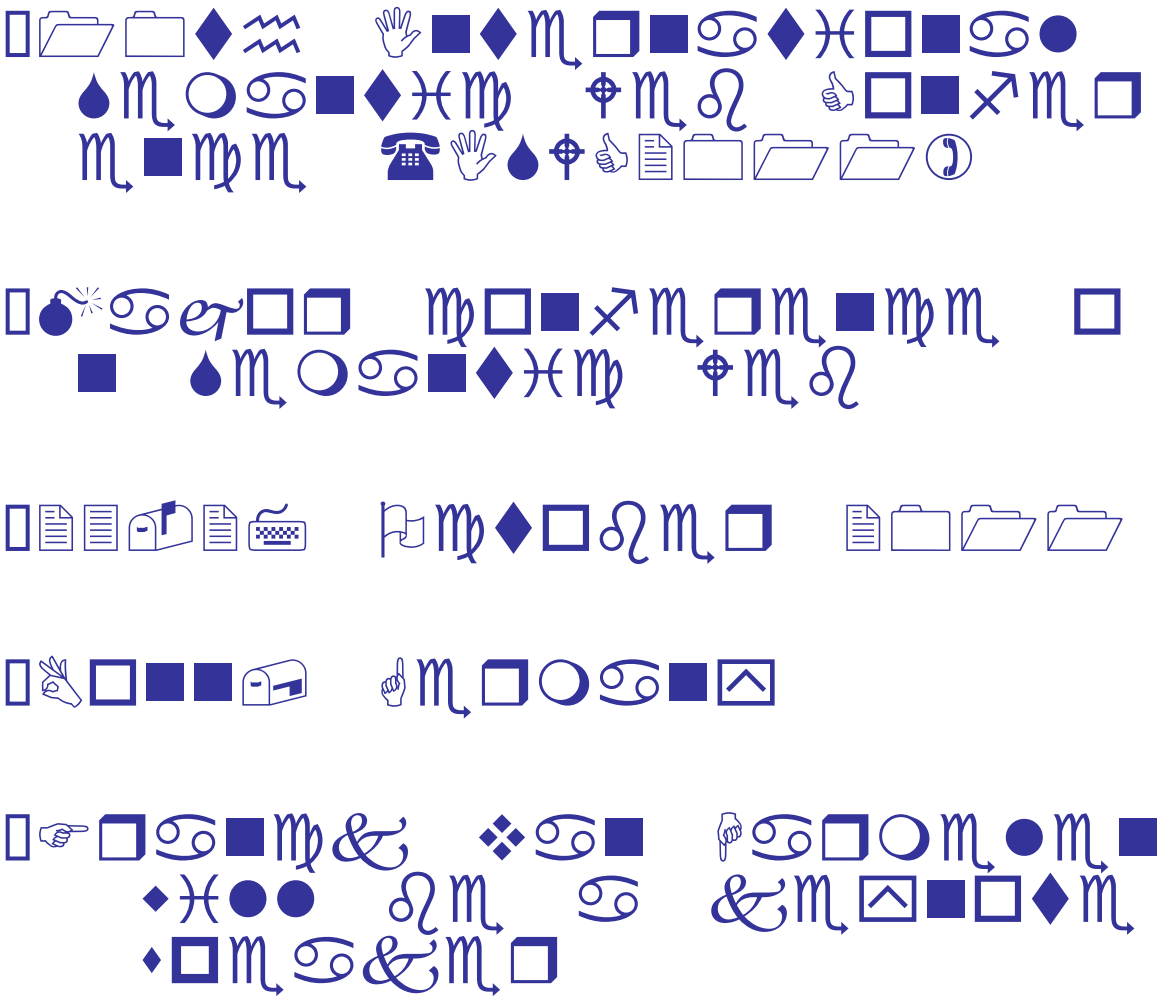
Accessing to Evidences and Recommendations

COVID-19: Transmission, prevention, and potential therapeutic opportunities

Abstract

The novel coronavirus disease (COVID-19) pandemic, caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), remains a global challenge. Despite intense research efforts worldwide, an effective vaccine and viable treatment options have eluded investigators. Therefore, infection prevention, early viral detection and identification of successful treatment protocols provide the best approach in controlling disease spread. In this review, current therapeutic options, preventive methods and transmission routes of COVID-19 are discussed.

Source: PubMed



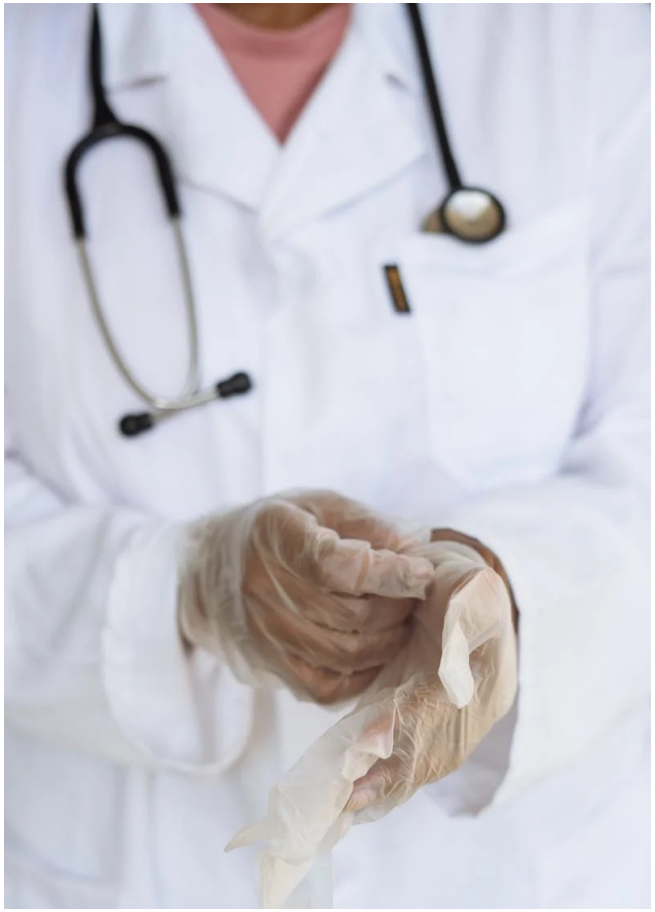
==> Needs for Natural Language Processing methods and tools for meaningful information extraction

Health Professional Capacity Building

Continuing professional development (CPD)

Computer survival Kit for health professional

Dedicated advanced courses in health informatics for future experts of the field



Dealing with Biases, Privacy and Ethical Issues

Do we have right processing the data?

How to take into account missing/in-balanced data

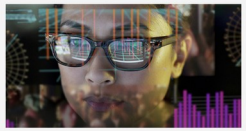
Are data representative of the population under study? Ex. The MIMIC-III database

How to respect/protect patient privacy/will

Data access and maintenance ?

Case of international projects

Dealing with Biases, Privacy and Ethical Issues



Les États membres de l'UNESCO adoptent le tout premier accord sur l'éthique de l'intelligence artificielle

Celui-ci protégera et promouvra les droits humains et la dignité humaine. Il constituera une boussole éthique et une base normative globale permettant de faire respecter l'État de droit dans le monde numérique. Plus d'information

ARTICLES
https://doi.org/10.1038/s41591-020-01192-7

nature medicine

Check for updates

An algorithmic approach to reducing unexplained pain disparities in underserved populations

Emma Pierson[1,2], David M. Cutler[3], Jure Leskovec[4], Sendhil Mullainathan[5] ✉ and Ziad Obermeyer[6]

Underserved populations experience higher levels of pain. These disparities persist even after controlling for the objective severity of diseases like osteoarthritis, as graded by human physicians using medical images, raising the possibility that underserved patients' pain stems from factors external to the knee, such as stress. Here we use a deep learning approach to measure the severity of osteoarthritis, by using knee X-rays to predict patients' experienced pain. We show that this approach dramatically reduces unexplained racial disparities in pain. Relative to standard measures of severity graded by radiologists, which accounted for only 9% (95% confidence interval (CI), 3–16%) of racial disparities in pain, algorithmic predictions accounted for 43% of disparities, or 4.7× more (95% CI, 3.2–11.8×), with similar results for lower-income and less-educated patients. This suggests that much of underserved patients' pain stems from factors within the knee not reflected in standard radiographic measures of severity. We show that the algorithm's ability to reduce unexplained disparities is rooted in the racial and socioeconomic diversity of the training set. Because algorithmic severity measures better capture underserved patients' pain, and severity measures influence treatment decisions, algorithmic predictions could potentially redress disparities in access to treatments like arthroplasty.

Science

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HOME > SCIENCE > VOL. 366, NO. 6464 > DISSECTING RACIAL BIAS IN AN ALGORITHM USED TO MANAGE THE HEALTH OF POPULATIONS

RESEARCH ARTICLE

Dissecting racial bias in an algorithm used to manage the health of populations

ZIAD OBERMEYER, BRIAN POWERS, CHRISTINE VOGELI, AND SENDHIL MULLAINATHAN Authors Info & Affiliations

SCIENCE · 25 Oct 2019 · Vol 366, Issue 6464 · pp. 447-453 · DOI: 10.1126/science.aax2342

5,043 558 GET ACCESS

Racial bias in health algorithms

The U.S. health care system uses commercial algorithms to guide health decisions. Obermeyer *et al.* find evidence of racial bias in one widely used algorithm, such that Black patients assigned the same level of risk by the algorithm are sicker than White patients (see the Perspective by Benjamin). The authors estimated that this racial bias reduces the number of Black patients identified for extra care by more than half. Bias occurs because the algorithm uses health costs as a proxy for health needs. Less money is spent on Black patients who have the same level of need, and the algorithm thus falsely concludes that Black patients are healthier than equally sick White patients. Reformulating the algorithm so that it no longer uses costs as a proxy for needs eliminates the racial bias in predicting who needs extra care.

Science, this issue p. 447; see also p. 421

Digital Health in global south: opportunities

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Increase of Computation Power and Storage

$5 million vs. $400

Price of the fastest supercomputer in 1975[1]
and an iPhone 4 with equal performance

320 TO at IMSP !!!

Development and Adoption of Mobile Technologies

Smartphone owners, has almost doubled between 2016 (336 million) and 2020 (660 million) in Sub-Saharan Africa (SSA)

Various level of connection
2G, 3G, ...5G

Data Vs Metadata : Ontology & Linked Open Data

- ➔ Data need to be contextualised in order to be understood and reusable
- ➔ It is achieved by using some standardised resources: (meta)data, data that describe other data

➔Talk about things not strings: annotate the data

Ontology: a formal and shared conceptualisation
expressed in machine processable language, OWL, RDF/RDFS

Knowledge Graph

mainly describes real world entities and their interrelations, organized in a graph… covers various topical domains [Paulheim, 2016]

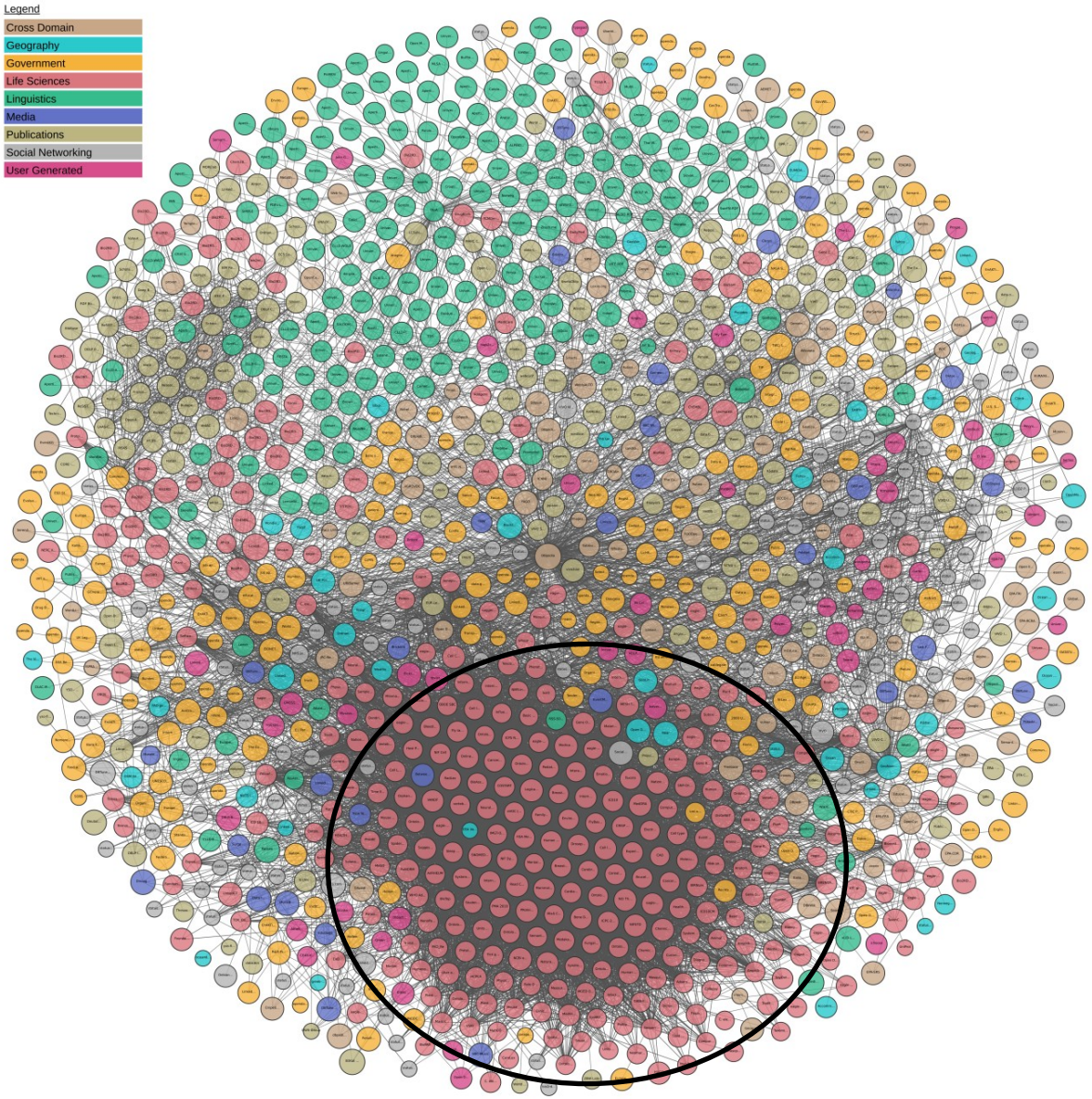
yago
select knowledge

DBpedia

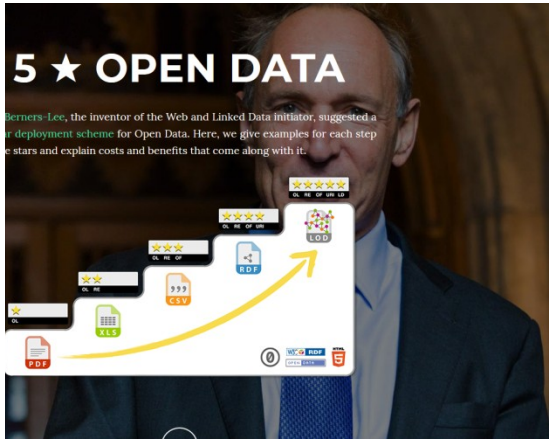
WIKIDATA

Google Knowledge Graph

Data Vs Metadata : Ontology & Linked Open Data



The Linked Open Data Cloud from lod-cloud.net



Data Vs Metadata : Ontology & Linked Open Data

Various Coding systems and vocabularies: ATC, MeSH, ICD9, ICD10, etc
Online repositories: BioPortal, UMLS, OBO

➔ Available at https://schema.org/docs/full.html

Example

MedicalEntity

Defined in the health-lifesci.schema.org extension.
Canonical URL: http://schema.org/MedicalEntity

Thing > MedicalEntity

The most generic type of entity related to health and the practice of medicine.

Usage: Between 100 and 1000 domains

[more...]

Property	Expected Type	Description
Properties from MedicalEntity		
code	MedicalCode	A medical code for the entity, taken from a controlled vocabulary or ontology such as ICD-9, DiseasesDB, MeSH, SNOMED-CT, RxNorm, etc.
guideline	MedicalGuideline	A medical guideline related to this entity.
legalStatus	DrugLegalStatus or MedicalEnumeration or Text	The drug or supplement's legal status, including any controlled substance schedules that apply.
medicineSystem	MedicineSystem	The system of medicine that includes this MedicalEntity, for example 'evidence-based', 'homeopathic', 'chiropractic', etc.
recognizingAuthority	Organization	If applicable, the organization that officially recognizes this entity as part of its endorsed system of medicine.
relevantSpecialty	MedicalSpecialty	If applicable, a medical specialty in which this entity is relevant.
study	MedicalStudy	A medical study or trial related to this entity.
Properties from Thing		
additionalType	URL	An additional type for the item, typically used for adding more specific types from external vocabularies in microdata syntax. This is a relationship between something and a class that the thing is in. In RDFa syntax, it is better to use the native RDFa syntax - the 'typeof' attribute - for multiple types. Schema.org tools may have only weaker understanding of extra types, in particular those defined externally.
alternateName	Text	An alias for the item.
description	Text	A description of the item.

Source: schema.org

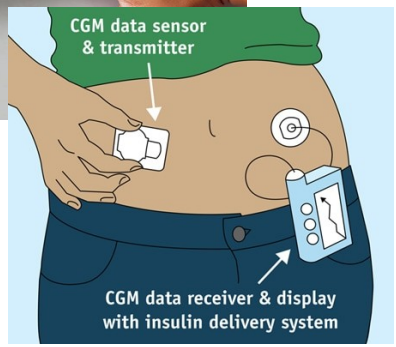
Data Vs Metadata : Ontology & Linked Open Data

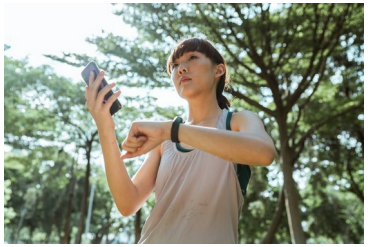
- Unified Medical Language System (UMLS)
- Integration of more than 160 biomedical resources: terminologies and ontologies, more than 2 millions concepts
  - A Metathesaurus, a Semantic Network and a Specialist Lexicon
  - Each concept of the metathesaurus has a unique identifier, the CUI (e.g., *C3192263* is the cui of *vemurafenebid*)

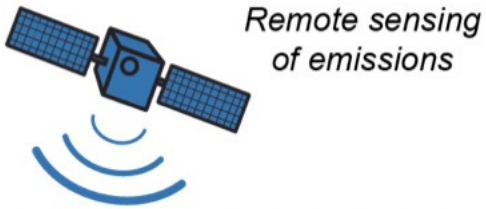
- NCBO BioPortal
  - Biomedical Ontologies Repository
  - 775 Ontologies, 9,408,786 Classes (concepts)
  - Some mappings between classes are handled

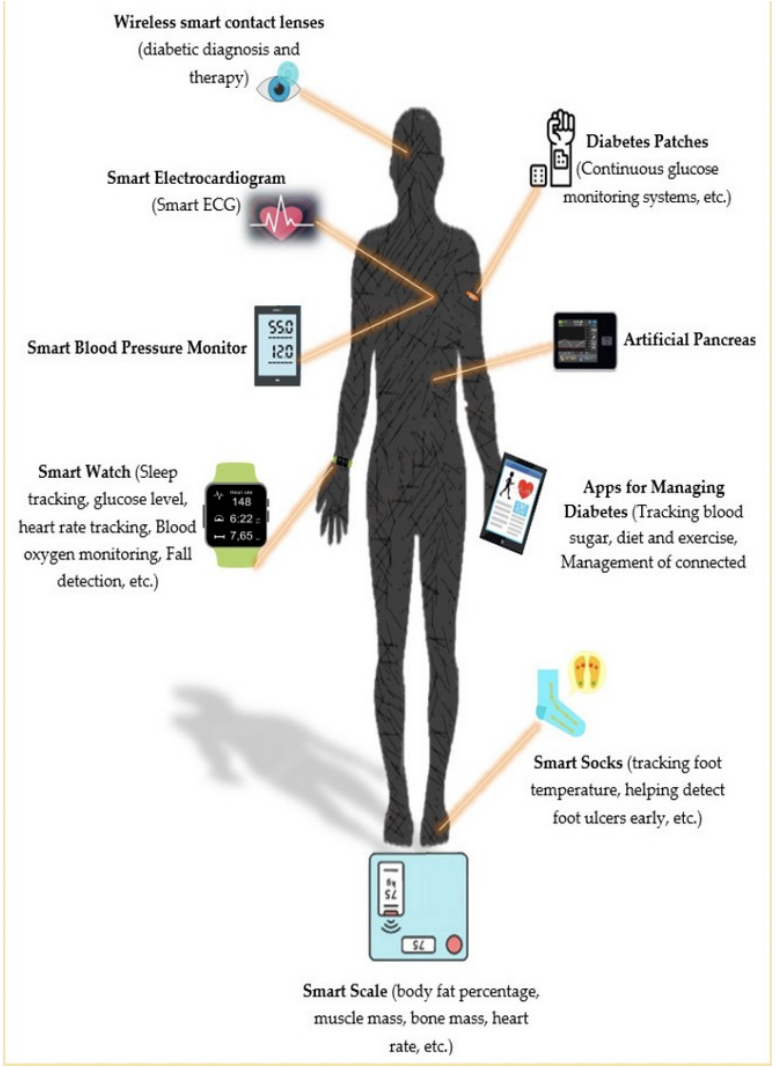
Social Networks and Online Information

Wearable Sensors for Health and Telehealth









Digital Health in global south: implementation

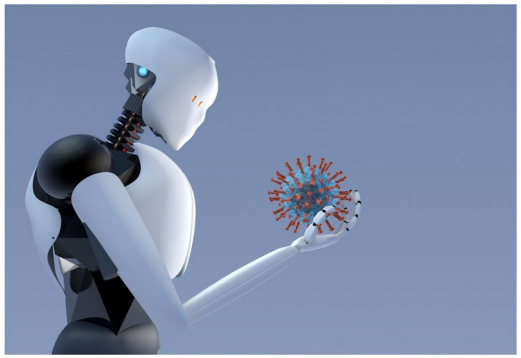
université de BORDEAUX

“Recent AI” Development and increasing interest

How did the world get the Covid-19 vaccine so fast?

How scientists are leveraging artificial intelligence to solve the pandemic

Catriona Campbell Follow
Feb 5 · 3 min read



Bloomberg

Business

BioNTech and InstaDeep Announce Strategic Collaboration and Form AI Innovation Lab to Develop Novel Immunotherapies

25 November 2020, 13:45 CET

Artificial intelligence in cancer research, diagnosis and therapy

Olivier Elemento, Christina Leslie, Johan Lundin & Georgia Tourassi

Nature Reviews Cancer **21**, 747–752 (2021) | Cite this article

4987 Accesses | **111** Altmetric | Metrics

Artificial intelligence and machine learning techniques are breaking into biomedical research and health care, which importantly includes cancer research and oncology, where the potential applications are vast. These include detection and diagnosis of cancer, subtype classification, optimization of cancer treatment and identification of new therapeutic targets in drug discovery. While big data used to train machine learning models may already exist, leveraging this opportunity to realize the full ence in both the cancer research space and the clinical ficant obstacles to be surmounted. In this Viewpoint article, eir opinions on how we can begin to implement artificial standards are maintained so as transform cancer diagnosis ment of patients with cancer and to drive biological

Deep Learning Models For Medical Image Analysis And Processing

For applications like segmentation and disease detection

Editorial | The Research Nest Follow
May 11, 2020 · 6 min read

Source:https://medium.com/

AI-based Digital Health Solutions

Prédire les comportements suicidaires chez les étudiants grâce à l'intelligence artificielle

Des chercheurs, notamment du centre de recherche Bordeaux Population Health ont identifié, grâce à l'intelligence artificielle, un ensemble restreint d'indicateurs de santé mentale qui prédisent avec précision les comportements suicidaires des étudiants. Les résultats sont publiés le 15 juin 2021 dans la revue Scientific Reports.*

15/06/2021

© Ben Blennerhassett – Unsplash

Contacts scientifiques :

CHRISTOPHE TZOURIO
Directeur du centre de recherche BPH

Contacter par courriel

MÉLISSA MACALLI
Doctorante de l'université de Bordeaux au centre de recherche BPH

Contacter par courriel

Référence bibliographique :

A machine learning approach for predicting suicidal thoughts and behaviours among college students Melissa Macalli, Marie Navarro, Massimiliano Orri, Marie Tournier, Rodolphe Thiébaut, Sylvana M. Côté, Christophe

Bordeaux : Une étude montre l'intérêt d'une intelligence artificielle pour faire gagner du temps aux régulateurs du Samu

SANTE Pendant le premier confinement, un nouvel outil pour analyser les appels passés au Samu a été testé en Gironde et pourrait permettre d'ébaucher un système de surveillance de santé publique à une plus grande échelle

Elsa Provenzano | Publié le 15/04/21 à 07h05 — Mis à jour le 15/04/21 à 07h05

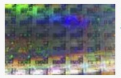
2 COMMENTAIRES 70 PARTAGES

Illustration Samu au CHU Bordeaux — *Mickaël Bosredon/20 Minutes*

- Un outil basé sur une IA a été testé en Gironde pendant le premier confinement pour analyser les appels passés au Samu.
- L'étude menée conjointement par le CHU de Bordeaux et l'Inserm permet d'imaginer la mise en place d'un système de surveillance de problèmes de santé publique (accidents de voitures, abus d'alcool etc.)
- L'IA pourrait aussi permettre d'alléger le travail des régulateurs du Samu en les délestant des tâches les plus rébarbatives

À LIRE AUSSI

03/03/21 | MALADIES
Méfiez-vous, les chats pourraient être les futurs vecteurs de coronavirus



14/01/21 | INTELLIGENCE ARTIFICIELLE
Les limites de l'intelligence artificielle sont-elles provisoires ?

01/03/21 | INTELLIGENCE ARTIFICIELLE
Comment rendre les IA plus rapides… et plus écologiques

✚ D'ACTU

DANS LA RÉGION

03:25 | MÉTÉO
Météo Bordeaux : Prévisions du mardi 7 décembre 2021

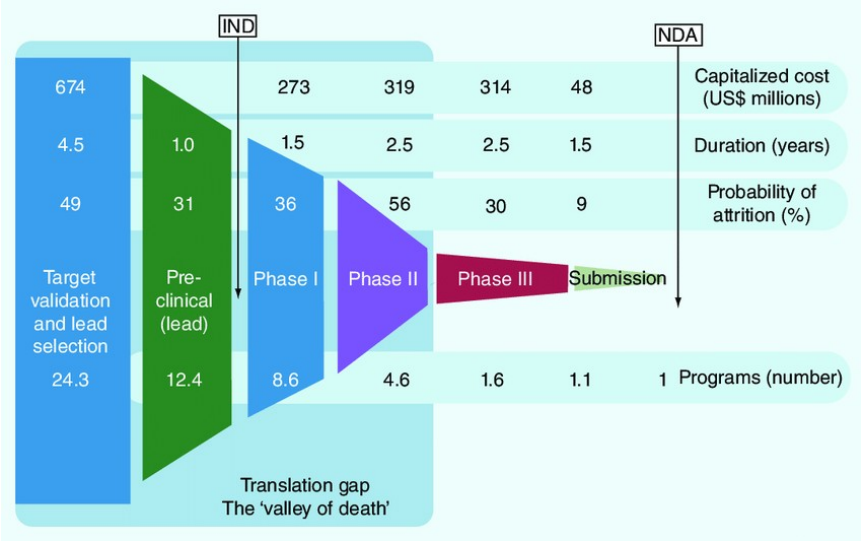
06/12/21 | BIOTECHNOLOGIE
Contre Parkinson, la thérapie cellulaire n'est plus de la science-fiction

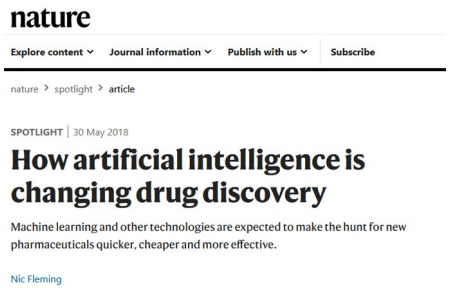
06/12/21 | FOOTBALL
« On a retrouvé des vertus »… Oui, il y a encore une équipe aux Girondins

Drug Development Using Data Science

- Drud dev is a costly process both financially and in terms of time
- Bringing a new drug to market takes 10 to 15 years or more ~2 billion € for a treatment
- 3 phases pour le processus et une phase post-market
- Drug repositioning is a promising alternative

1. Finding new uses for existing drugs
2. With Covid-19, we observe that this avenue has been exploited
3. Emblematic example: Sildenafil (anti hypertension) repositioned against sexual disorders (Viagra)




nature

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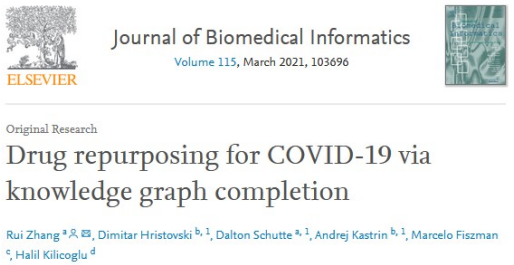
nature › spotlight › article

SPOTLIGHT | 30 May 2018

How artificial intelligence is changing drug discovery

Machine learning and other technologies are expected to make the hunt for new pharmaceuticals quicker, cheaper and more effective.

Nic Fleming


ELSEVIER

Journal of Biomedical Informatics

Volume 115, March 2021, 103696

Original Research

Drug repurposing for COVID-19 via knowledge graph completion

Rui Zhang [a], Dimitar Hristovski [b, 1], Dalton Schutte [a, 1], Andrej Kastrin [b, 1], Marcelo Fiszman [c], Halil Kilicoglu [d]

Drug Development Using Data Science

MIT News
ON CAMPUS AND AROUND THE WORLD

SUBSCRIBE

Machine learning uncovers potential new TB drugs

Computational method for screening drug compounds can help predict which ones will work best against tuberculosis or other diseases.

Anne Trafton | MIT News Office
October 15, 2020

Cell

Volume 180, Issue 4, 20 February 2020, Pages 688-702.e13

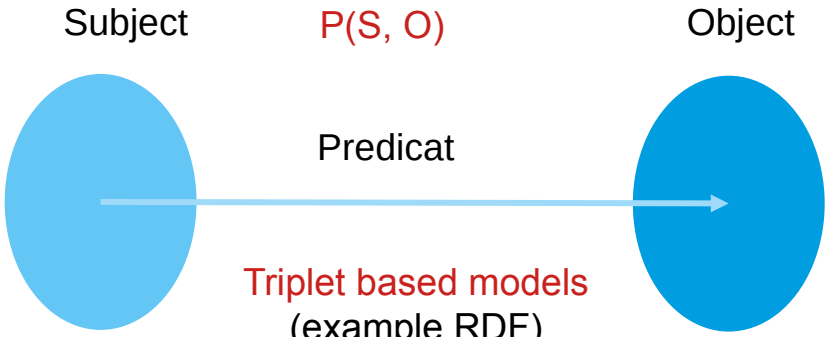
CellPress

Article

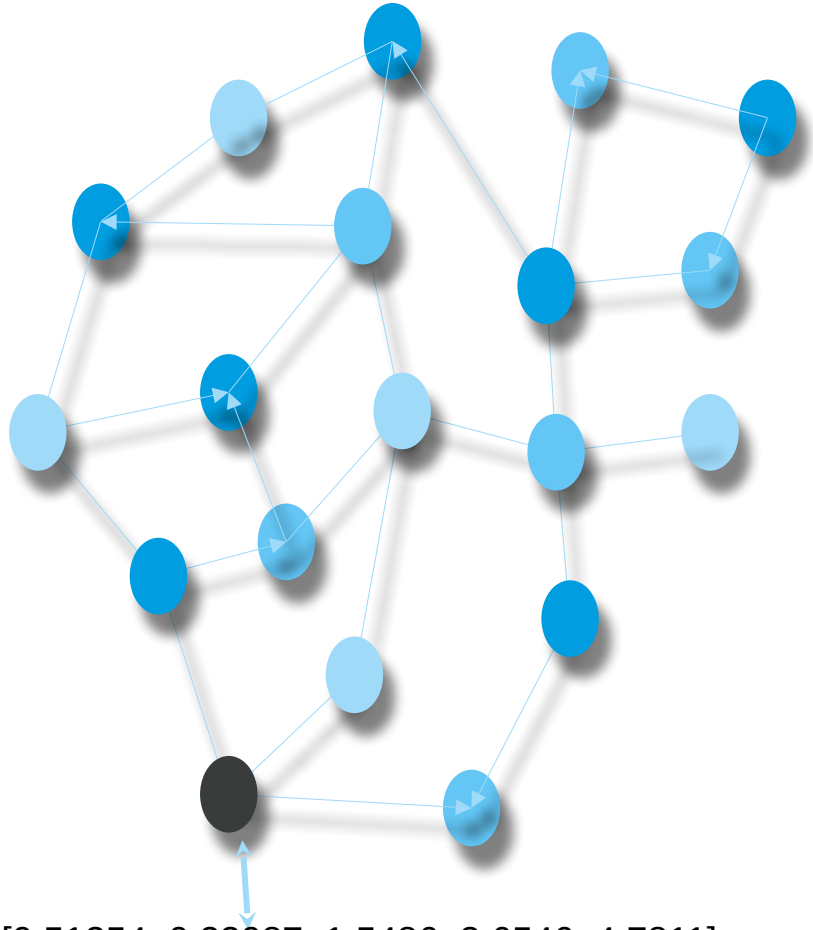
A Deep Learning Approach to Antibiotic Discovery

Jonathan M. Stokes [1, 2, 3], Kevin Yang [3, 4, 10], Kyle Swanson [3, 4, 10], Wengong Jin [3, 4], Andres Cubillos-Ruiz [1, 2, 5], Nina M. Donghia [1, 5], Craig R. MacNair [6], Shawn French [6], Lindsey A. Carfrae [6], Zohar Bloom-Ackermann [2, 7], Victoria M. Tran [2], Anush Chiappino-Pepe [5, 7], Ahmed H. Badran [2], Ian W. Andrews [1, 2, 5], Emma J. Chory [1, 2], George M. Church [5, 7, 8], Eric D. Brown [6], Tommi S. Jaakkola [3, 4] ... James J. Collins [1, 2, 5, 8, 9, 11]

Drug Development using data science



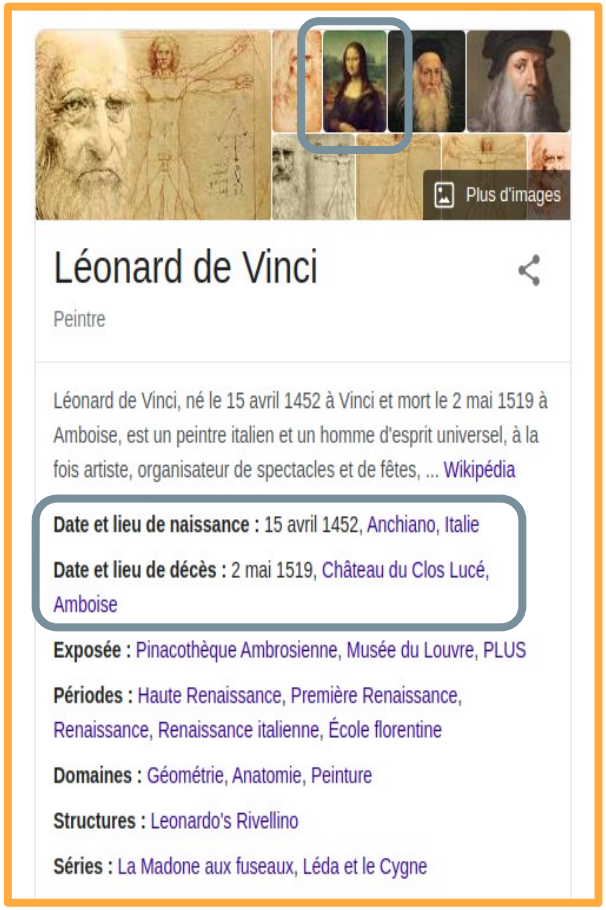
Triplet based models
(example RDF)



[0.51354 ,0.23987 ,1.5486 ,3.6546 ,4.7811]

Drug Development using data science

Example of the Google Knowledge Graph



Drug Development using data science

Neuro-symbolic XAI for Computational Drug Repurposing

In

Proceedings of the 13th International Joint Conference on Knowledge Discovery, Knowledge Engineering and Knowledge Management - KEOD

Authors: Martin Drancé ; Marina Boudin ; Fleur Mougin and Gayo Diallo

Affiliation: Inserm U1219, Bordeaux Population Health Research Center, Team ERIAS, University of Bordeaux, France

Keyword(s): Artificial Intelligence, XAI, Drug Repurposing, Knowledge Graph, Bioinformatics.

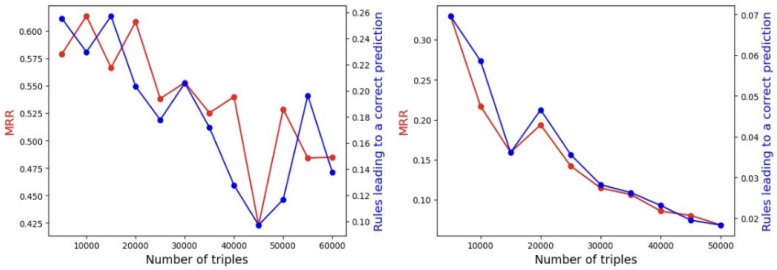
Abstract: Today in the health domain, the challenge is to build a more transparent artificial intelligence, less affected by the opacity intrinsic to the mathematical concepts it uses. Among the fields which use AI techniques, is drug development, and more specifically drug repurposing. DR involves finding a new indication for an existing drug. The hypotheses generated by DR techniques must be validated. Therefore, the mechanism of generation must be understood. In this paper, we describe the use of a state-of-the-art neuro-symbolic algorithm in order to explain the process of link prediction in a knowledge graph-based computational drug repurposing. Link prediction consists of generating hypotheses about the relationships between a known molecule and a given target. More specifically, the implemented approach allows to understand how the organization of data in a knowledge graph changes the quality of predictions.

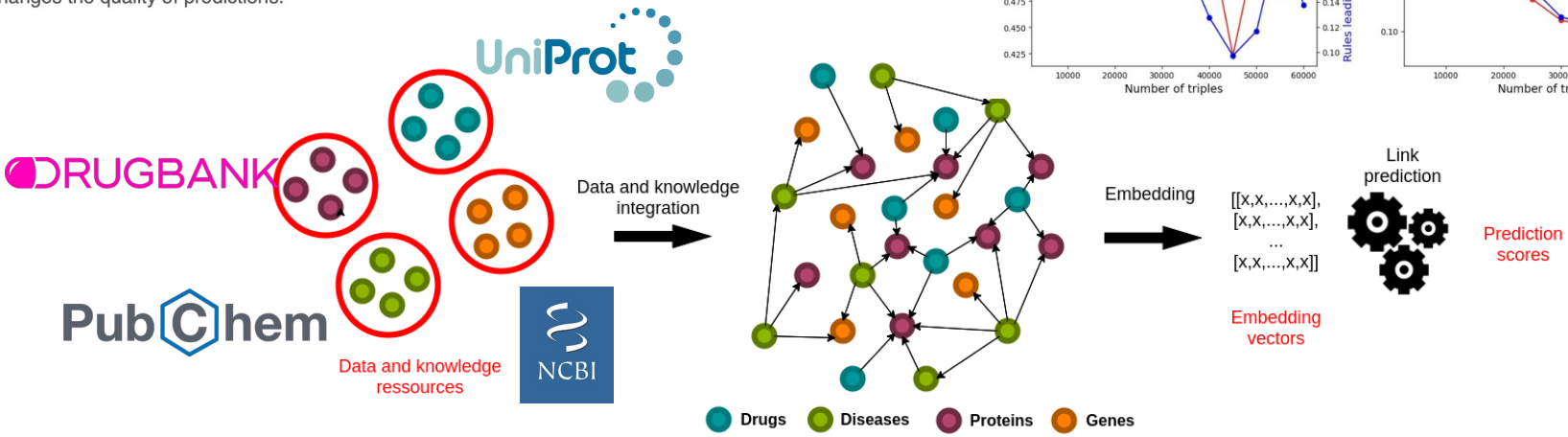
Computational Approaches for Drug Repositioning: Towards a Holistic Perspective based on Knowledge Graphs

Author: Marina Boudin Authors Info & Claims

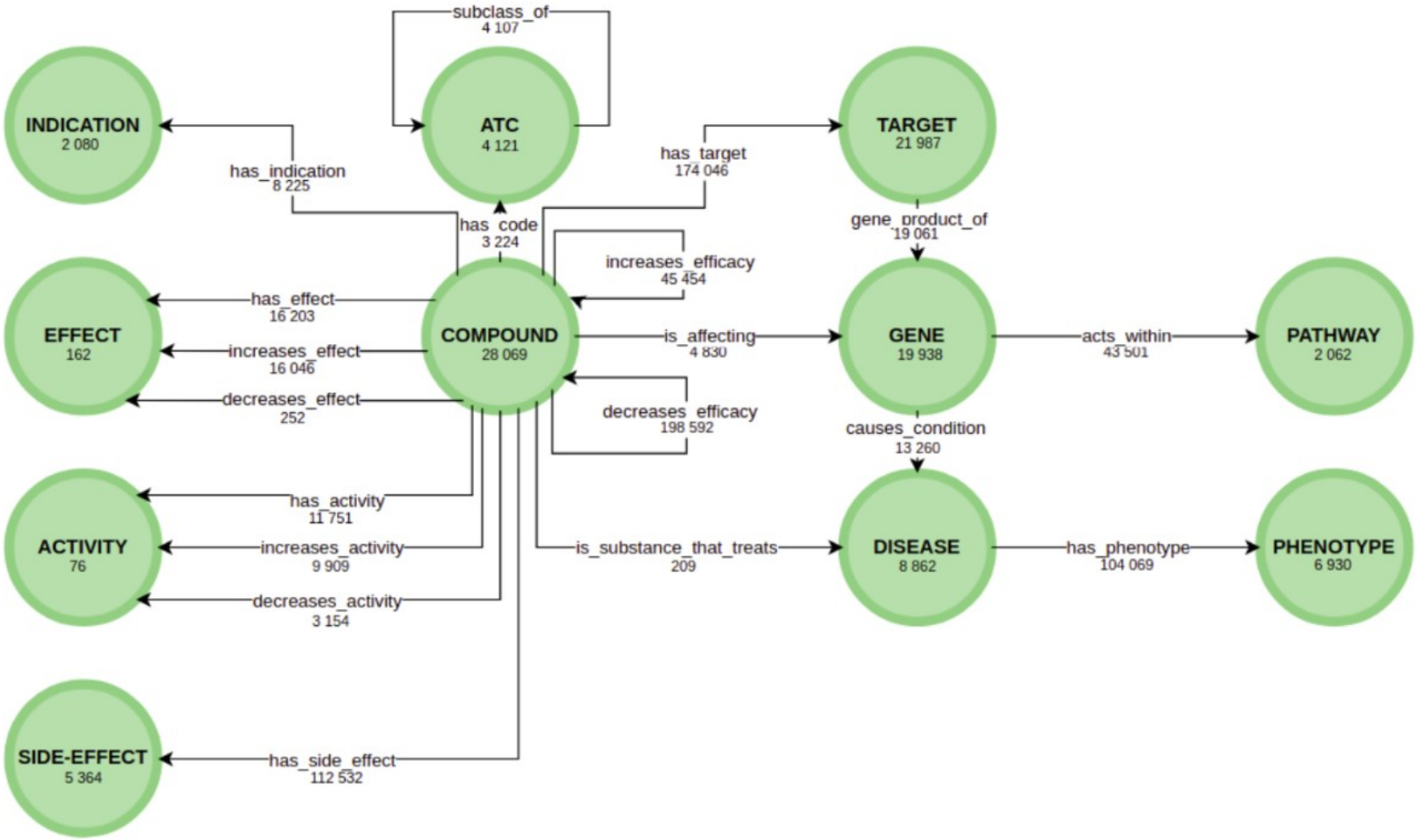
CIKM '20: Proceedings of the 29th ACM International Conference on Information & Knowledge Management • October 2020 • Pages 3225–3228 • https://doi.org/10.1145/3340531.3418510

Published: 19 October 2020





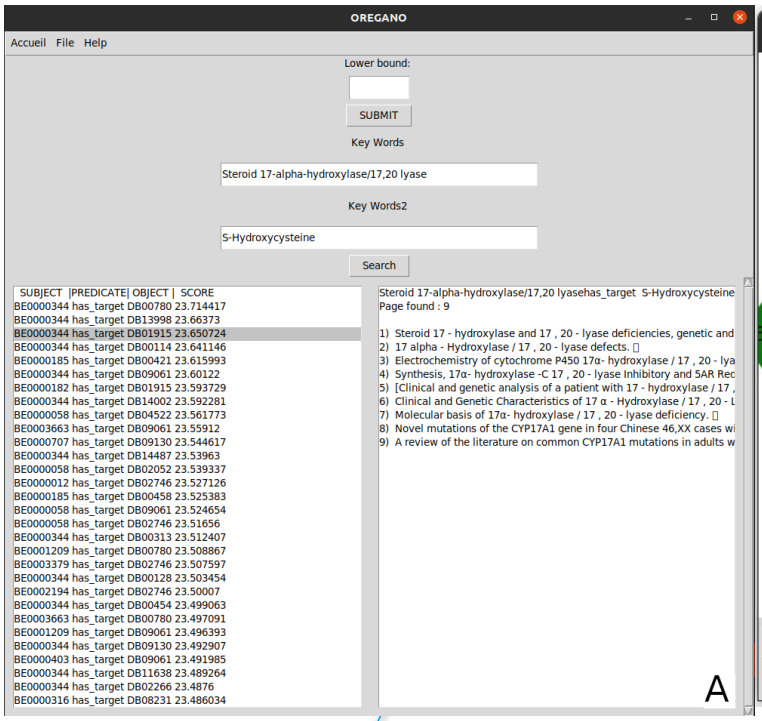
Drug Development using data science : the OREGANO KG

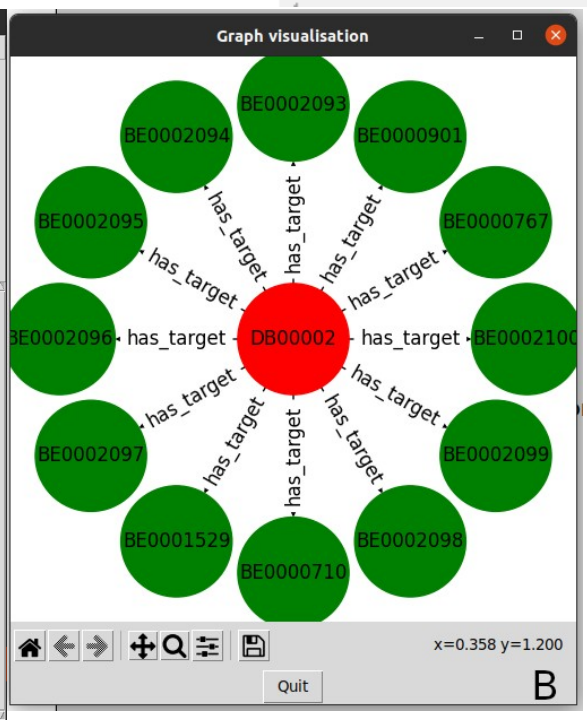


Drug Development Using Data Science

- Couples of drug-target
- Need to verify the results in a lab
- Preliminary results:
  - 20% of hit@10: *Spironolactone* and *Gluthatione Synthetase*

name_compound	name_target
ascorbate	dna
ascorbic acid	dna
ascorbate	amyp_human
ascorbic acid	amyp_human
ascorbate	pancreatic alpha-amylase
ascorbic acid	pancreatic alpha-amylase
ascorbate	a4_human
ascorbic acid	a4_human
ascorbate	amyloid beta a4 protein
ascorbic acid	amyloid beta a4 protein





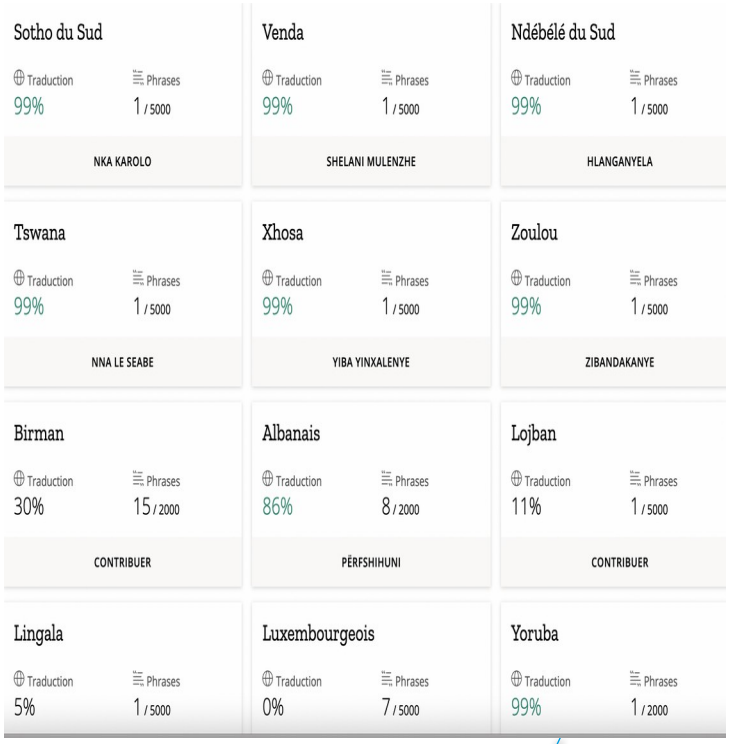
Mobile Technology and Voice Processing for Health

Example of resource

Mozilla Common Voice project

More than 20,000 hours of voice recording

https://commonvoice.mozilla.org/



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TOTAL D'HEURES	1 006
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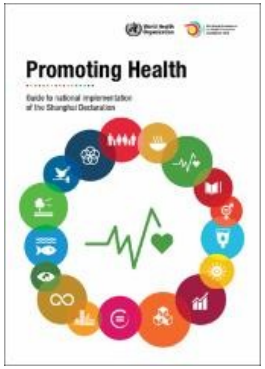
NOMBRE DE VOIX	16 785
FORMAT AUDIO	MP3
RÉPARTITION	Âge **17%** 19 - 29, **16%** 30 - 39, ... **61%** Masculin, **10%** Féminin

Mobile Technology and Voice Processing



Example of initiative for global south

The Viamo 3 2 1 service
https://viamo.io/

Fake News Detection in Online Sources

Detecting Medical Misinformation on Social Media Using Multimodal Deep Learning

Publisher: IEEE | Cite This | PDF

Zuhui Wang ; Zhaozheng Yin ; Young Anna Argyris All Authors

Aim: to develop an automatic detector for anti-vaccine messages to counteract the negative impact that anti-vaccine messages have on the public health

Method:

A deep learning network that leverages both visual and textual information. A new semantic- and task-level attention mechanism was created to help our model to focus on the essential contents of a post that signal anti-vaccine messages. The proposed model, which consists of three branches, can generate comprehensive fused features for predictions

Dataset:

A real-world social media dataset that consists of more than 30,000 samples was collected from Instagram between January 2016 and October 2019

Results: 97% testing accuracy and outperforms other relevant models, demonstrating that it can detect a large amount of anti-vaccine messages posted daily

Z. Wang, Z. Yin and Y. A. Argyris, "Detecting Medical Misinformation on Social Media Using Multimodal Deep Learning," in IEEE Journal of Biomedical and Health Informatics, vol. 25, no. 6, pp. 2193-2203, June 2021, doi: 10.1109/JBHI.2020.3037027.

NLP Based Digital Health Solution

Electronic Health Record data processing using NLP technics

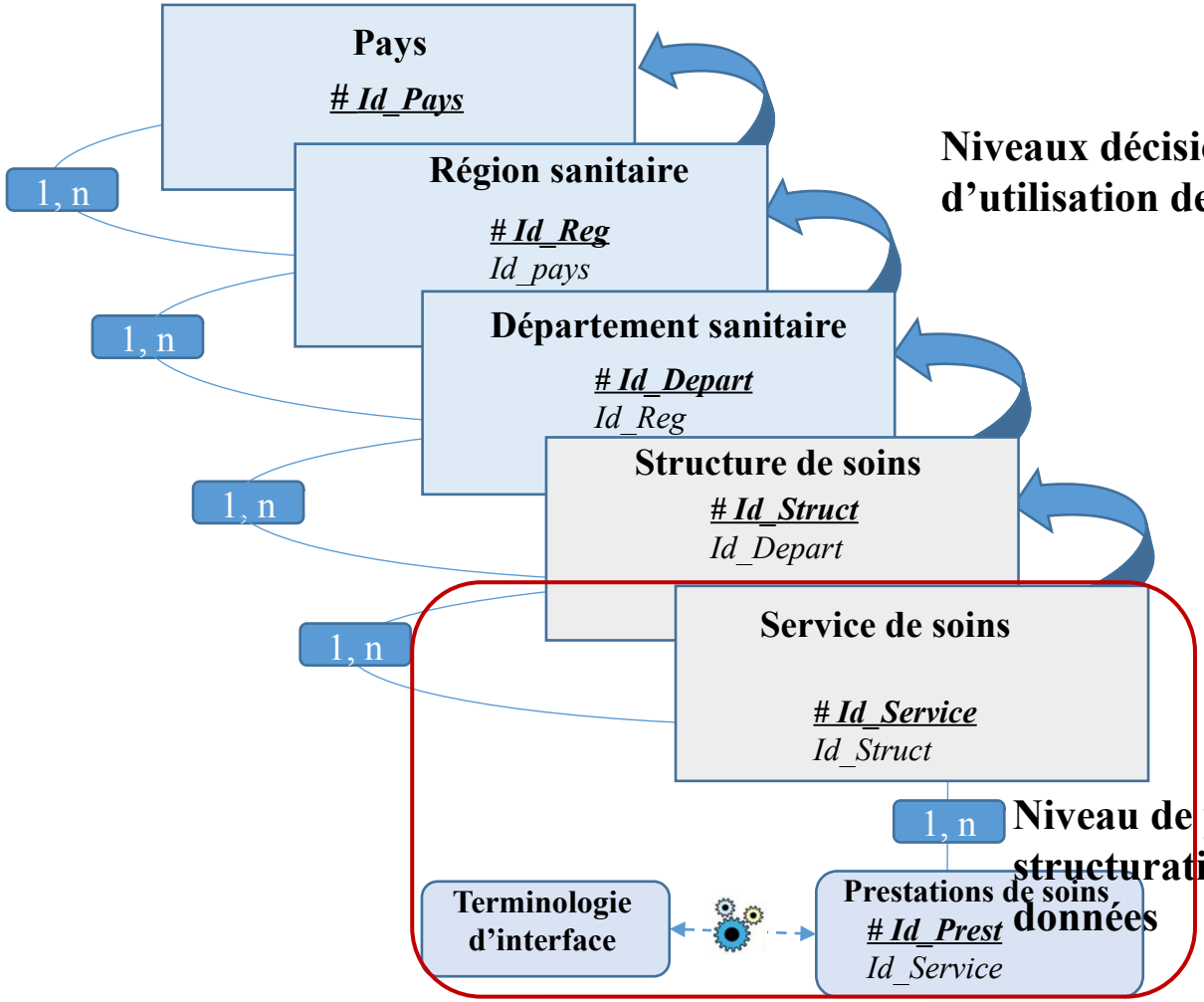
Example of a recent development at Google

Medical Natural Language Processing

https://www.youtube.com/watch?v=oyhpIWa9w1Y&ab_channel=GoogleCloudTech

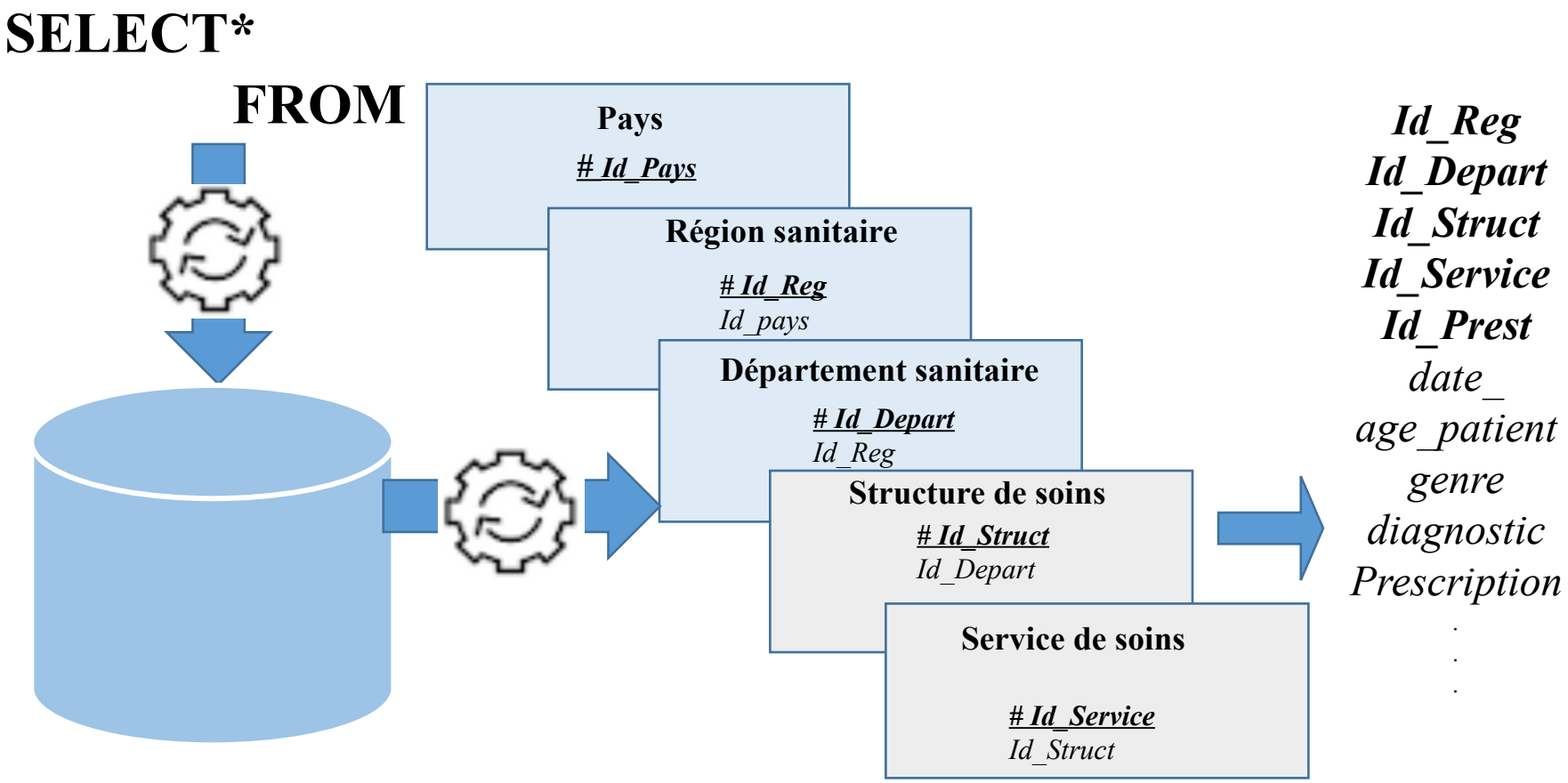
From Individual Data to National Indicators : pilot study in Gabon

From PhD thesis of A.P. Koumamba

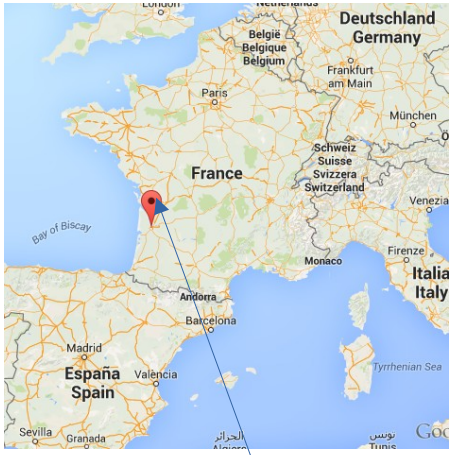


From Individual Data to National Indicators : pilot study in Gabon

From PhD thesis of A.P. Koumamba



PATIENT-Covid19 : Pré diAgnostic eT suIvi dE coNTacts de Covid-19



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Université Assane Seck de Ziguinchor, Sn

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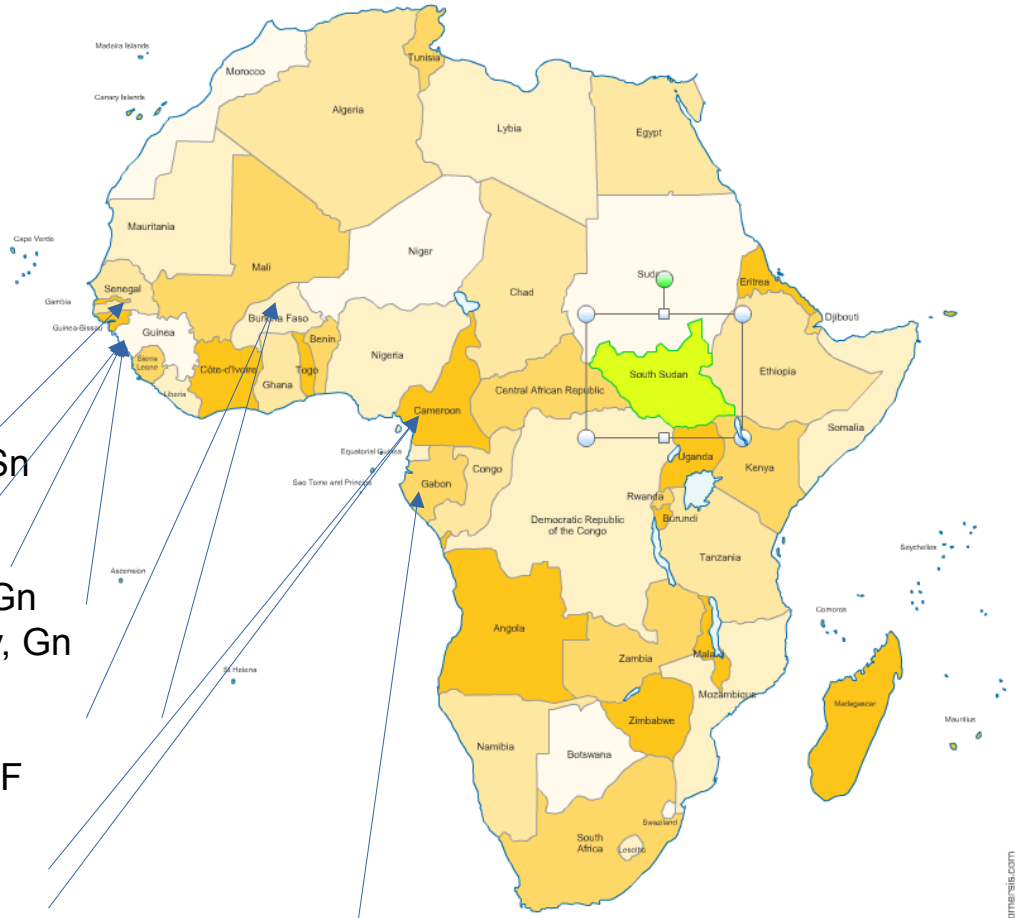
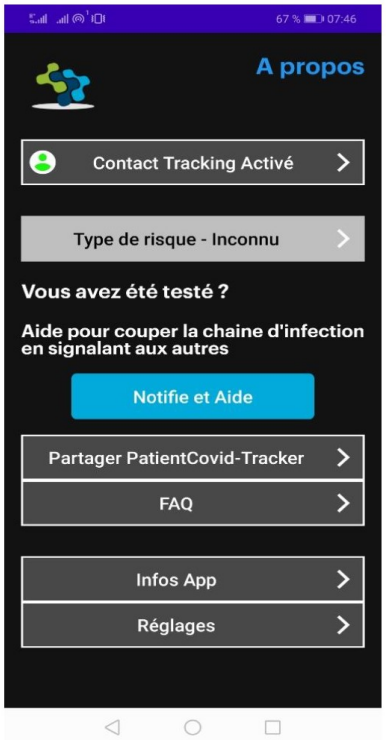
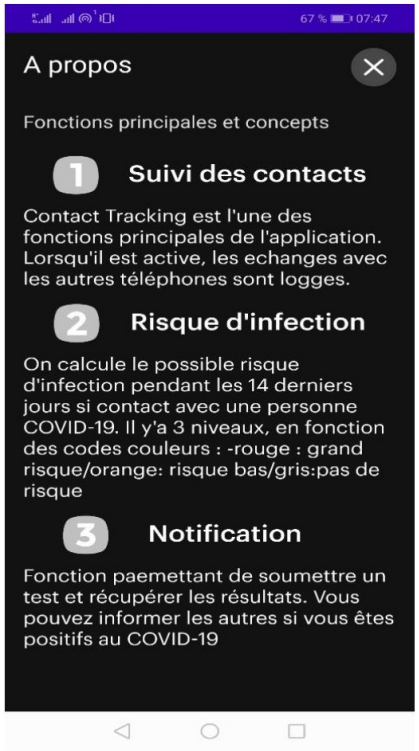


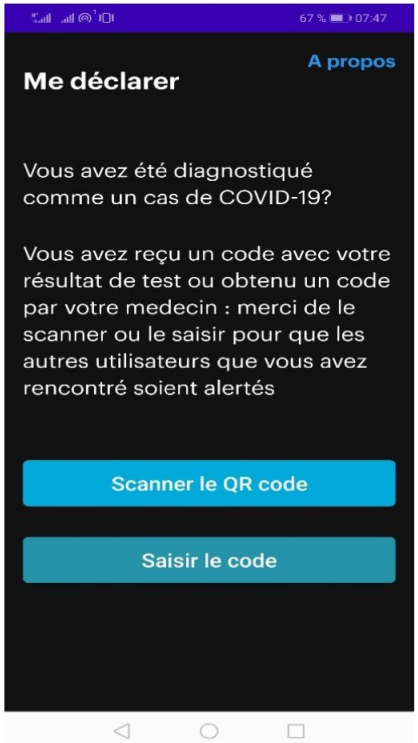
PLAN AUF
SPÉCIAL PANDÉMIE COVID-19
AUF

PATIENT-Covid19 Mobile Apps (Android)

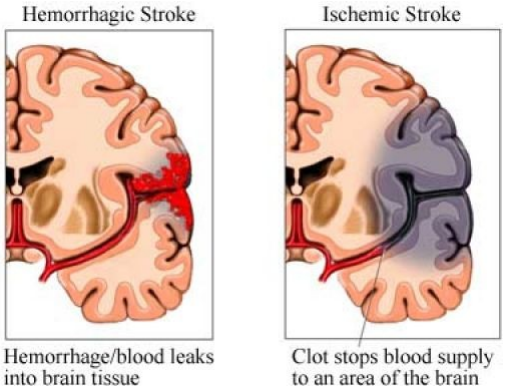
Technology and AI methods: intelligent chatbot (NLP), local languages, etc.





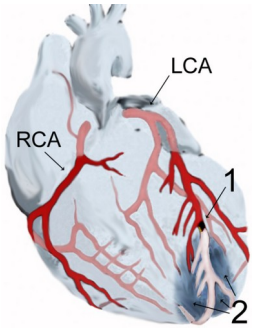


Enabling Public Health Decision Making: Stroke & Myocardial infarction emergency case

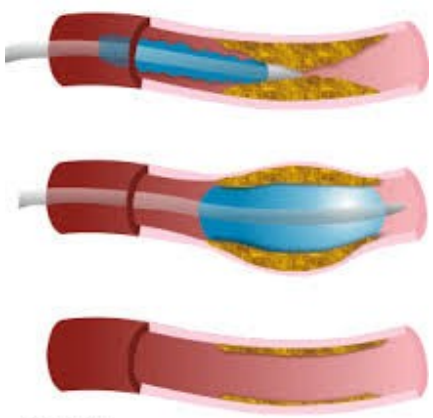


180 min

thrombolysis



90 min



Myocardial Infarction

percutaneous coronary intervention

Enabling Public Health Decision Making: Emergency Case

Anonymised data from 9 million mobile customers in Senegal

Dataset 1
One year of site-to-site traffic for 1666 sites on an hourly basis

Dataset 2
Fine-grained mobility data (antenna) on a rolling 2-week basis for about 300,000 randomly sampled users

Dataset 3
One year of coarse-grained (123 arrondissement level) mobility data for about 150,000 randomly sampled users

General Census Data

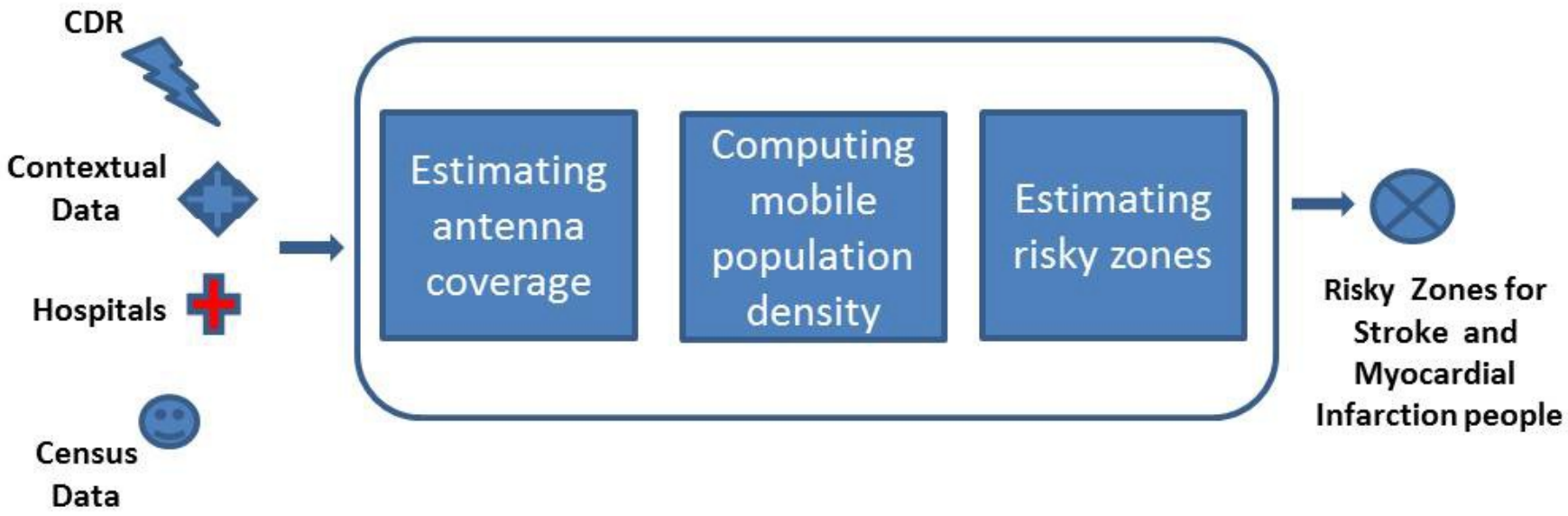
Senegal Geolocalised Hospital Directory

Contextual Data

user_id,	timestamp,	site_id
1,	2013-03-18 21:30:00,	716
1,	2013-03-18 21:40:00,	718
1,	2013-03-19 20:40:00,	716
1,	2013-03-19 20:40:00,	716
1,	2013-03-19 20:40:00,	716
1,	2013-03-19 20:40:00,	716
1,	2013-03-19 21:00:00,	716
1,	2013-03-19 21:30:00,	718
1,	2013-03-20 09:10:00,	705
1,	2013-03-21 13:00:00,	705

Incidence Rate of the Ermergency Diseases

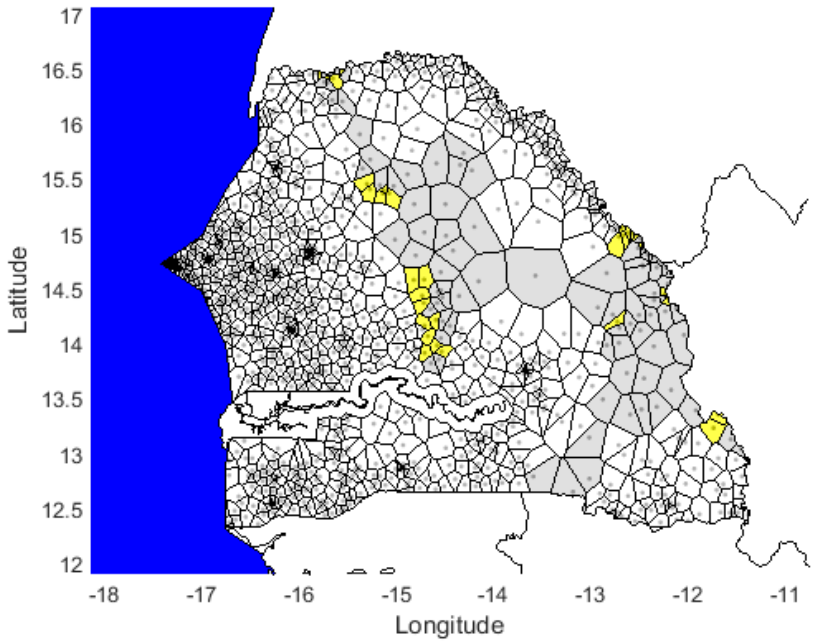
Enabling Public Health Decision Making: emergency case



Enabling Public Health Decision Making: emergency case

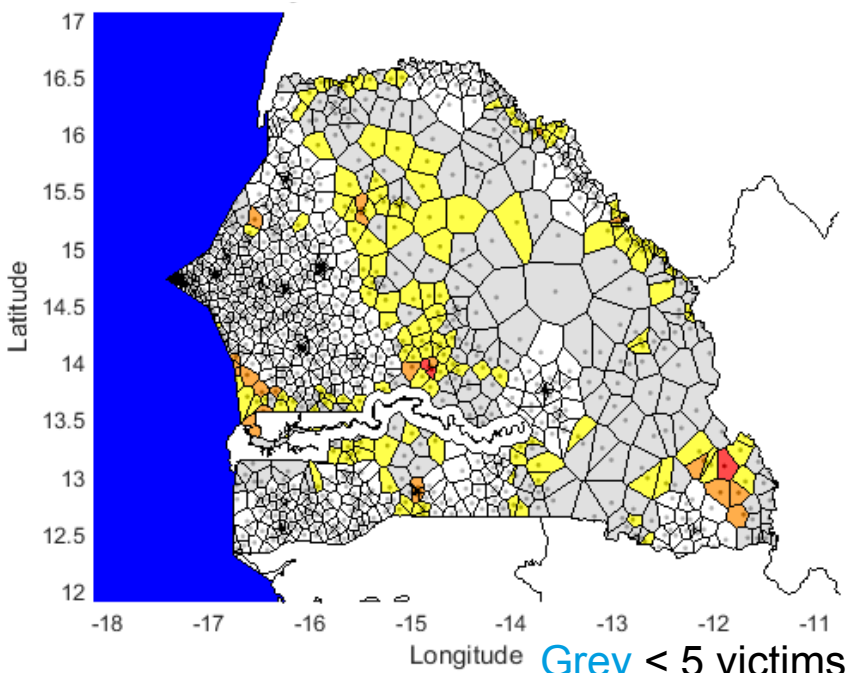
Highlighting risky zones: areas where people are at high risk in case of Stroke or Myocardial Infarction

Estimated incident cases of strokes from different areas (432)



Grey < 5 victims,
Yellow 5 to 25

Estimated incident cases of Myocardial Infarction from different areas (4241)



Grey < 5 victims,
Yellow 5 to 25,
Orange 26 to 50,
Red 51 to 100

Digital Health in global south: Take Home Messages

université de BORDEAUX

Some Key Points to Take into Account

Enabling digital health needs accessing to patient data

Requires ethical approval and consent

Collect data ones and reuse them

Standardize/contextualize data (coding systems, terminologies, etc.)

Take into account local context: languages, literacy, technology, etc.

Co-design solutions to increase their adoption by end-users

For global south: GUI adapted to “low tech”

Digital Health is by definition Multidisciplinary

Digital Health in the Global South : challenges, opportunities and implementation

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