



Faster reaction to epidemics: towards predicting outbreaks in Burkina Faso

Maroussia Roelens, Aziza Merzouki, Wessel Valkenburg, Seydou Toguiyeni, Amara Amara

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**UNIVERSITÉ
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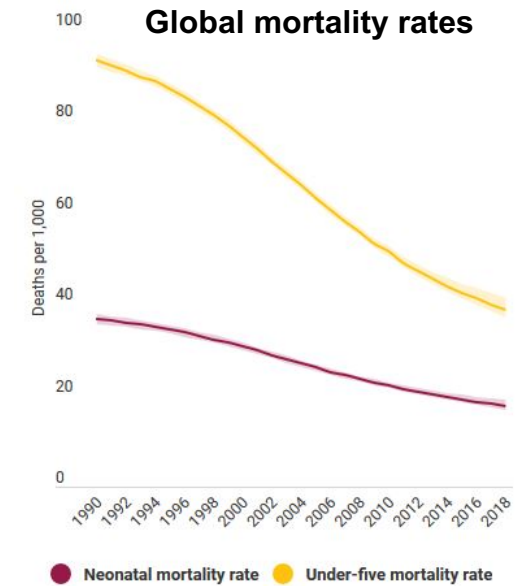


Terre des hommes

Helping children worldwide.

Child health in the world

- **Child mortality:** remarkable progress but...
 - ❖ Burkina Faso: 1 of 10 child dies before the age of five



Source: United Nations Inter-agency Group for Child Mortality Estimation (UN IGME) 2019

- **IMCI = Integrated Management of Childhood Illness**
 - ❖ protocol for diagnosis and treatment of children under five

**ASSESS AND CLASSIFY THE SICK CHILD
AGE 2 MONTHS UP TO 5 YEARS**

Do a rapid appraisal of all waiting children.
ASK THE MOTHER WHAT THE CHILD'S PROBLEMS ARE. Determine if this is an initial or follow-up visit for this problem.
> If follow-up visit, use the follow-up instructions on pages 25-29. > If initial visit, assess the child as follows:

CHECK FOR GENERAL DANGER SIGNS

<p>ASK: Is the child able to drink or breastfeed? Does the child vomit everything? Has the child had convulsions during this illness? (if convulsing now see p. 14)</p>	<p>LOOK: Is the child: > lethargic or unconscious</p>
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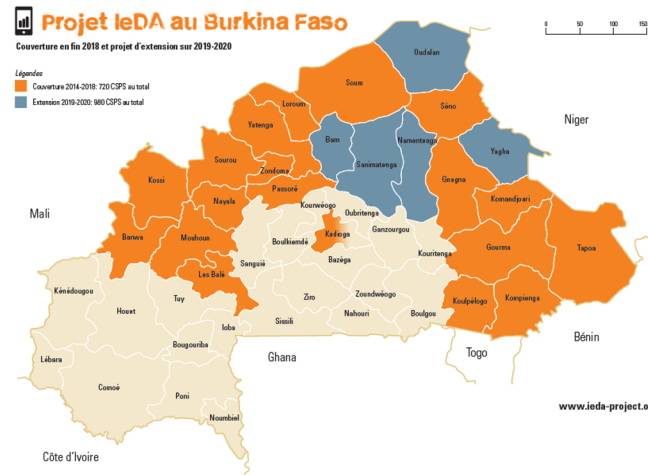
A child with any general danger sign requires urgent attention: complete the assessment, start pre-referral treatment and refer urgently if the child is lethargic or unconscious give oxygen, test for low blood sugar then treat / prevent.

ASSESS	CLASSIFY AS:	TREATMENT (Urgent pre-referral treatments are in bold)															
<p>THEN ASK ABOUT MAIN SYMPTOMS: Does the child have cough or difficult breathing?</p> <p>IF YES, ASK:</p> <p>LOOK, LISTEN, FEEL:</p> <ul style="list-style-type: none"> • For how long? • Count the breaths in one minute. • Look for chest indrawing. • Look and listen for stridor or wheeze. <p style="text-align: center;">} CHILD MUST BE CALM</p> <p>AND IF WHEEZE, ASK:</p> <ul style="list-style-type: none"> • Has the child had a wheeze before this illness? • Does the child frequently cough at night? • Has the child had a wheeze for more than 7 days? • Is the child on treatment for asthma at present? <p>FAST BREATHING If the child is: 2 months up to 12 months 50 or more breaths per minute 12 months up to 5 years 40 or more breaths per minute</p> <p>AND if WHEEZE Classify</p>	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="background-color: #f0f0f0;">• Any general danger sign or • Chest indrawing or • Stridor in calm child</td> <td style="background-color: #f0f0f0;">SEVERE PNEUMONIA OR VERY SEVERE DISEASE</td> <td style="background-color: #f0f0f0;"> <ul style="list-style-type: none"> > Give first dose of ceftriaxone IM (p. 15) > Give first dose cotrimoxazole (p. 10) > Give oxygen (p. 18) > If stridor: give nebulised adrenaline and prednisone (p. 15) > Test for low blood sugar; then treat or prevent (p. 16) > Keep child warm, and refer URGENTLY </td> </tr> <tr> <td style="background-color: #e0ffe0;">• Fast breathing</td> <td style="background-color: #e0ffe0;">PNEUMONIA</td> <td style="background-color: #e0ffe0;"> <ul style="list-style-type: none"> > Give amoxicillin for 5 days (p. 10) > If coughing for more than 14 days, consider TB (p. 9) > Soothe the throat and relieve the cough (p. 14) > Advise mother when to return immediately (p. 24) > Follow-up in 2 days (p. 20) </td> </tr> <tr> <td style="background-color: #e0ffe0;">• No signs of pneumonia or very severe disease</td> <td style="background-color: #e0ffe0;">COUGH OR COLD</td> <td style="background-color: #e0ffe0;"> <ul style="list-style-type: none"> > If coughing for more than 14 days, consider TB (p. 9) > Soothe the throat and relieve cough (p. 14) > Advise mother when to return immediately (p. 24) > Follow up in 5 days if not improving (p. 26) </td> </tr> </table>	• Any general danger sign or • Chest indrawing or • Stridor in calm child	SEVERE PNEUMONIA OR VERY SEVERE DISEASE	<ul style="list-style-type: none"> > Give first dose of ceftriaxone IM (p. 15) > Give first dose cotrimoxazole (p. 10) > Give oxygen (p. 18) > If stridor: give nebulised adrenaline and prednisone (p. 15) > Test for low blood sugar; then treat or prevent (p. 16) > Keep child warm, and refer URGENTLY 	• Fast breathing	PNEUMONIA	<ul style="list-style-type: none"> > Give amoxicillin for 5 days (p. 10) > If coughing for more than 14 days, consider TB (p. 9) > Soothe the throat and relieve the cough (p. 14) > Advise mother when to return immediately (p. 24) > Follow-up in 2 days (p. 20) 	• No signs of pneumonia or very severe disease	COUGH OR COLD	<ul style="list-style-type: none"> > If coughing for more than 14 days, consider TB (p. 9) > Soothe the throat and relieve cough (p. 14) > Advise mother when to return immediately (p. 24) > Follow up in 5 days if not improving (p. 26) 	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="background-color: #fff2cc;">• Yes to any question</td> <td style="background-color: #fff2cc;">RECURRENT WHEEZE</td> <td style="background-color: #fff2cc;"> <ul style="list-style-type: none"> > Give salbutamol and prednisone if referring for a severe classification (p. 15) > Give salbutamol via spacer for 5 days (p. 11) > Give oral prednisone for 7 days (p. 11) > Refer non-urgently for assessment </td> </tr> <tr> <td style="background-color: #fff2cc;">• All other children with wheeze</td> <td style="background-color: #fff2cc;">WHEEZE (FIRST EPISODE)</td> <td style="background-color: #fff2cc;"> <ul style="list-style-type: none"> > Give salbutamol if referring for a severe classification (p. 14) > Give salbutamol via spacer for 5 days (p. 11) > Follow-up in 5 days if still wheezing (p. 26) </td> </tr> </table>	• Yes to any question	RECURRENT WHEEZE	<ul style="list-style-type: none"> > Give salbutamol and prednisone if referring for a severe classification (p. 15) > Give salbutamol via spacer for 5 days (p. 11) > Give oral prednisone for 7 days (p. 11) > Refer non-urgently for assessment 	• All other children with wheeze	WHEEZE (FIRST EPISODE)	<ul style="list-style-type: none"> > Give salbutamol if referring for a severe classification (p. 14) > Give salbutamol via spacer for 5 days (p. 11) > Follow-up in 5 days if still wheezing (p. 26)
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Source: WHO

leDA: e-diagnostic tool for child care in Burkina Faso

- leDA = Integrated eDiagnostic Approach
⇒ Digitization of IMCI



2.5 million patients registered

+5 million consultations

- Impact of leDA (compared to paper-based IMCI)?

Adherence to IMCI: 32% → 90%

Dysentery diagnosis accuracy:
44% → 83%



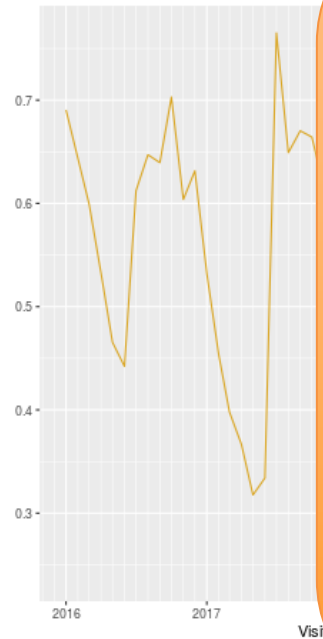
AI4Health: data science with leDA to improve child health

- leDA generated a national datamine of millions of consultations, labelled by time and geographic location

Covering key diseases regarding child mortality...

but also important symptoms as epidemic indicators...

% of consultations



(one of the)

Aim of AI4Health:

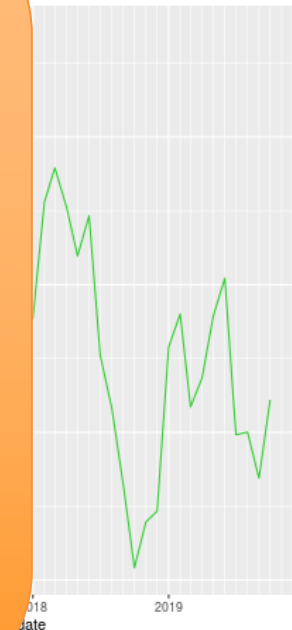
Early identification of emerging epidemics

⇒ Analysing data as it arrives, in the light of historical data

- health related data: leDA
- non health related data: 3rd party sources

⇒ With proper reporting and visualization, to trigger efficient interventions

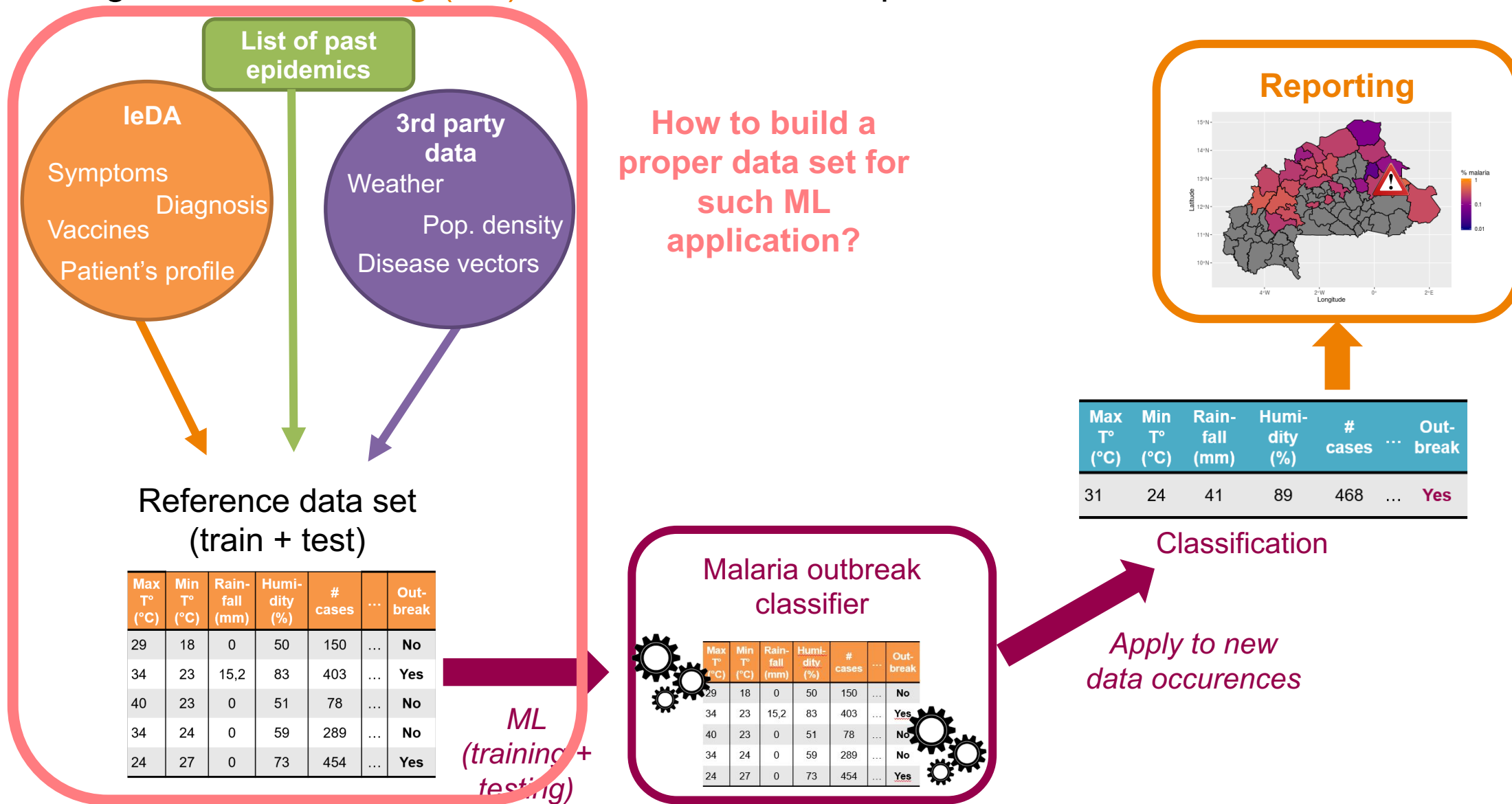
cases with diarrhea



vaccines, malnutrition etc...

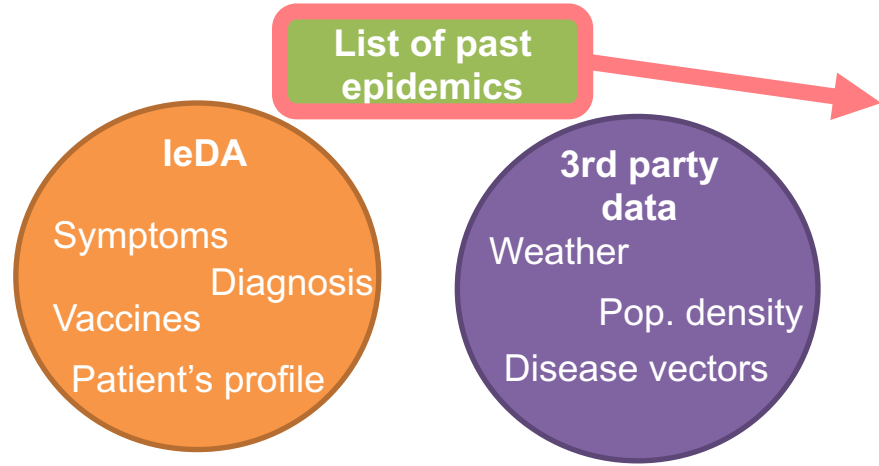
Towards early epidemics detection with leDA

- Using machine learning (ML): the illustrative example of malaria



Towards early outbreak detection with leDA

- Using **machine learning (ML)**: required prior data processing steps



How to define an epidemics?

⇒ idea: thresholds on indicators (e.g. incidence)

⇒ Depends on:

- the disease:
measles ↔ rare ≠ malaria ↔ endemic
- the country: healthcare structure, national/local policy, resources etc...

Compatibility?
⇒ Case definition (lab. Confirmation)
⇒ Pop. Covered (children VS general)

Reconstruct list with leDA

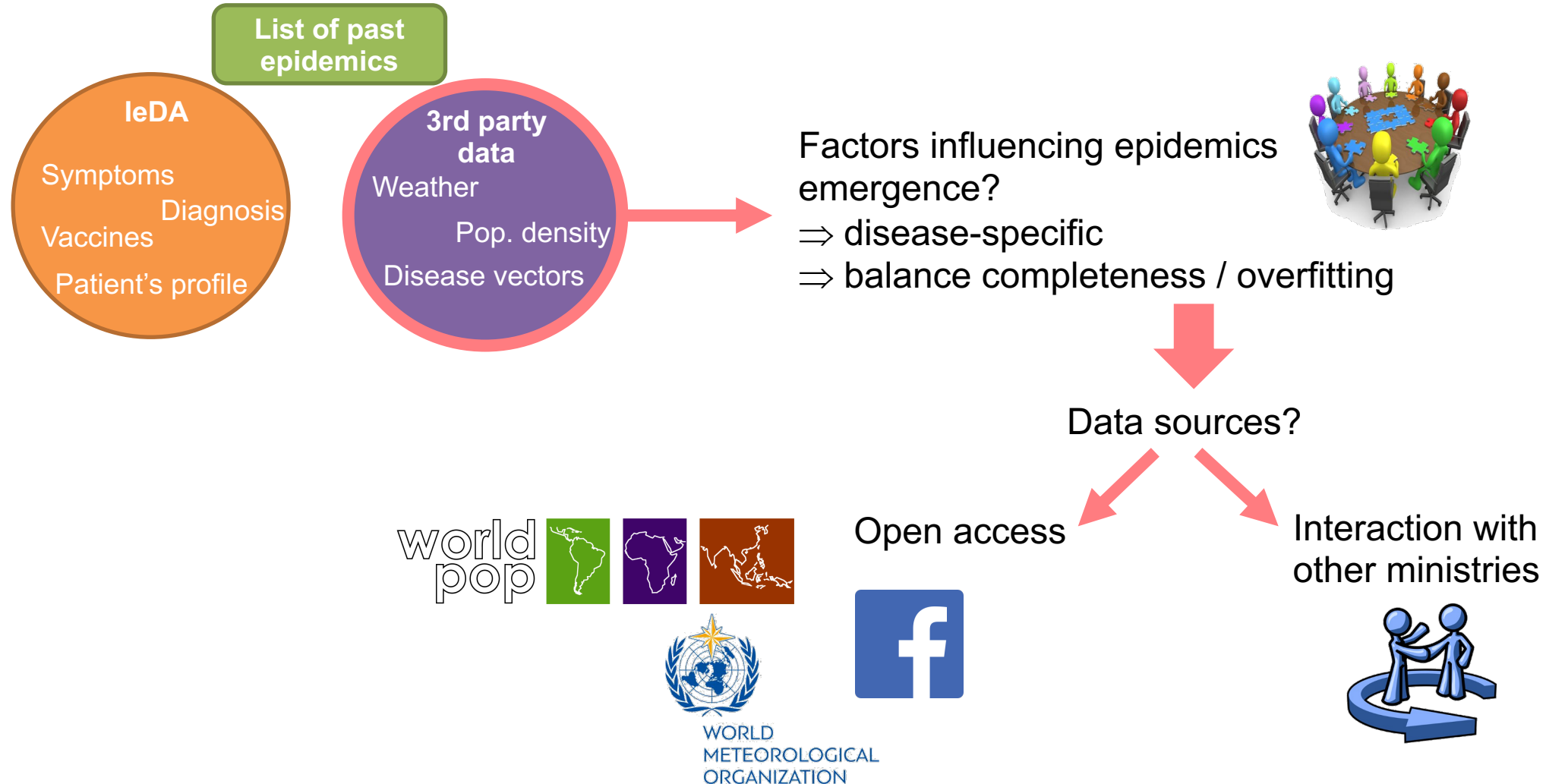
Interaction with MoH



Pre-existing list
⇒ quality? format?

Towards early outbreak detection with leDA

- Using machine learning (ML): required prior data processing steps



Conclusion

- leDA: unique datamine of health data
 - ⇒ Great opportunities, particularly for **epidemics identification**
 - ⇒ Room for machine learning approaches
- But it is **not as simple as: data + ML = magic!**
 - ⇒ Understand disease dynamics, implications in terms of public health intervention etc...
 - ⇒ Variables and extra data source selection
 - ⇒ Data ingestion and cleaning
- Goal: inclusion in the routine epidemics alert system of Burkina Faso
 - ⇒ **Crucial role of health authorities**
 - ⇒ Expected to make a large impact on child health



Contact:

maroussia.roelens@unige.ch



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