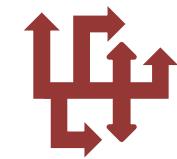


Researching New Approaches to Improved Care

Prof. V. D'Acremont, MD, PhD

SwissTPH Spring symposium, Basel 25 April 2018

The problem: high childhood mortality and unnecessary antibiotic prescription



Practice guidelines

- Quickly outdated
- Format inappropriate



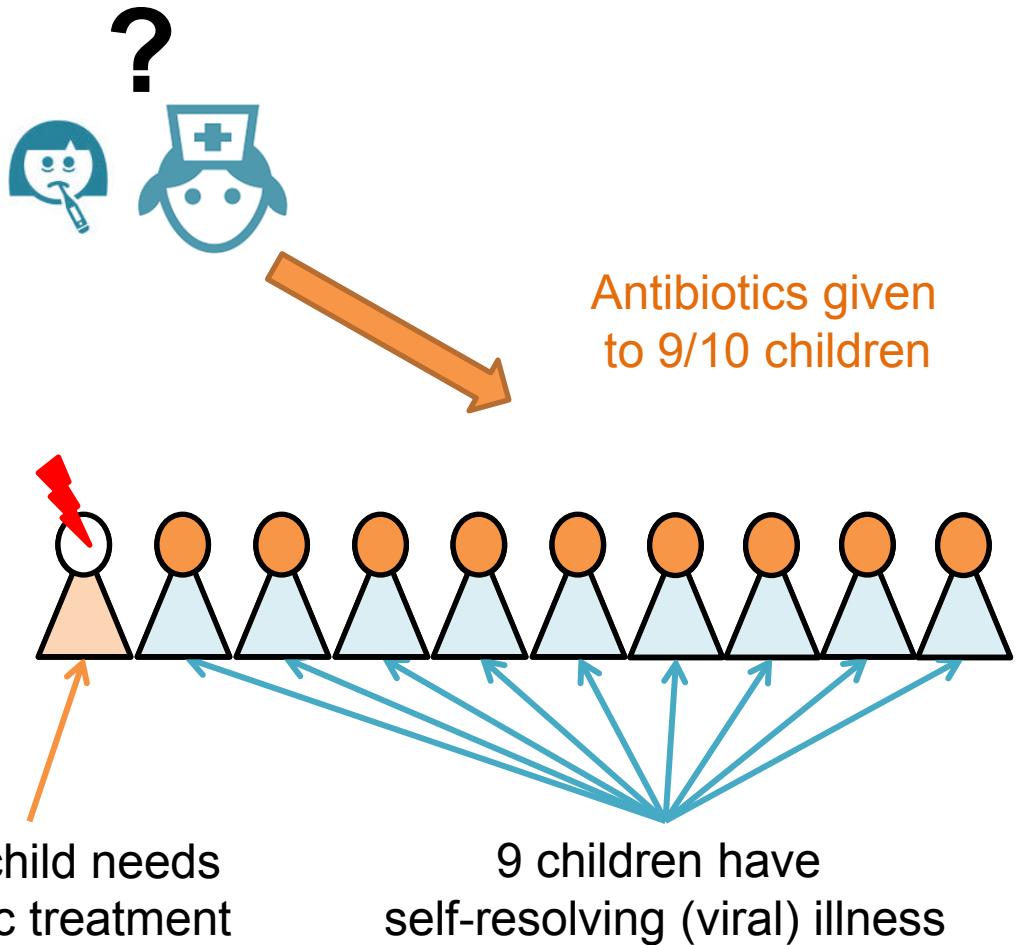
Diagnostic tests

- Not available



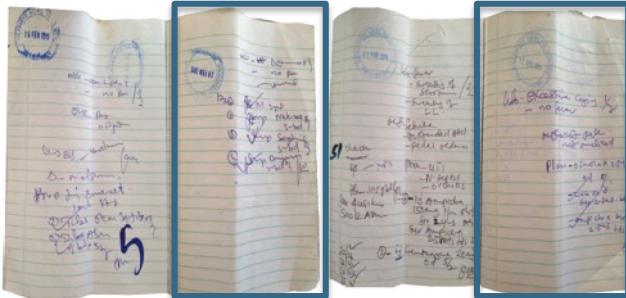
In-service training/ supervision

- Insufficient

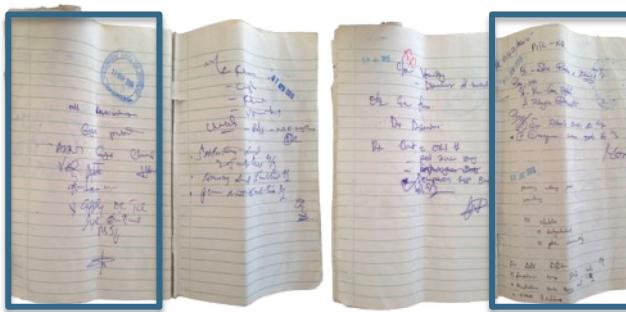


Antibiotic over-prescription at primary care level

18 month old child

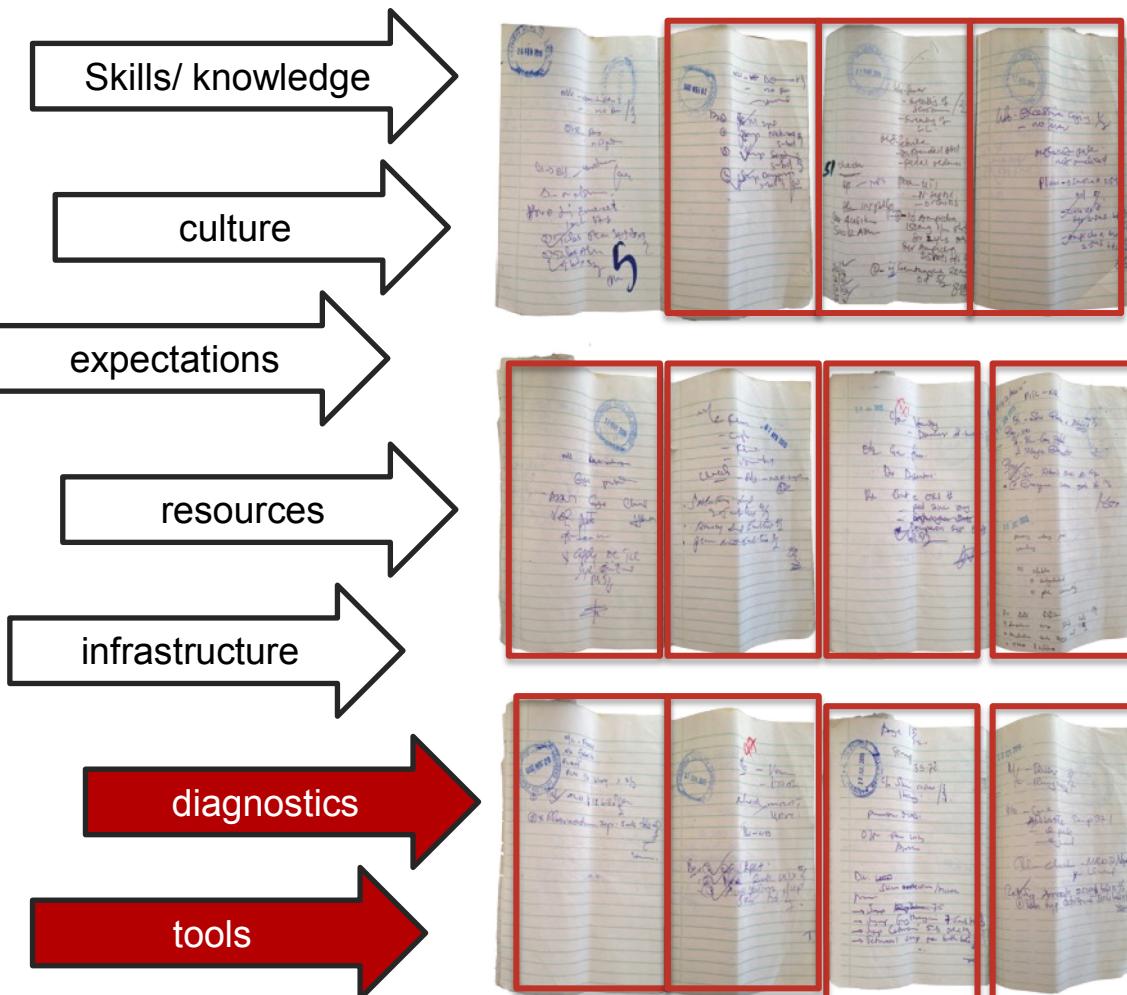


Fever episode



Antibiotic over-prescription at primary care level

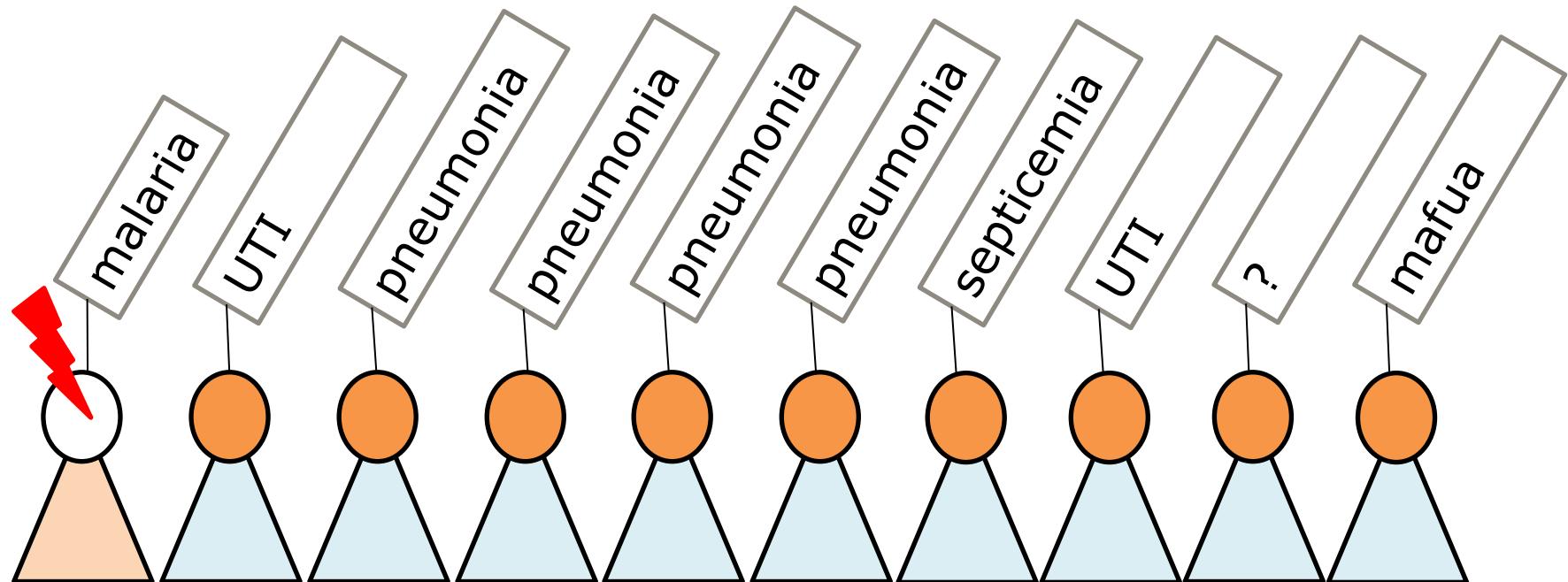
18 month old child



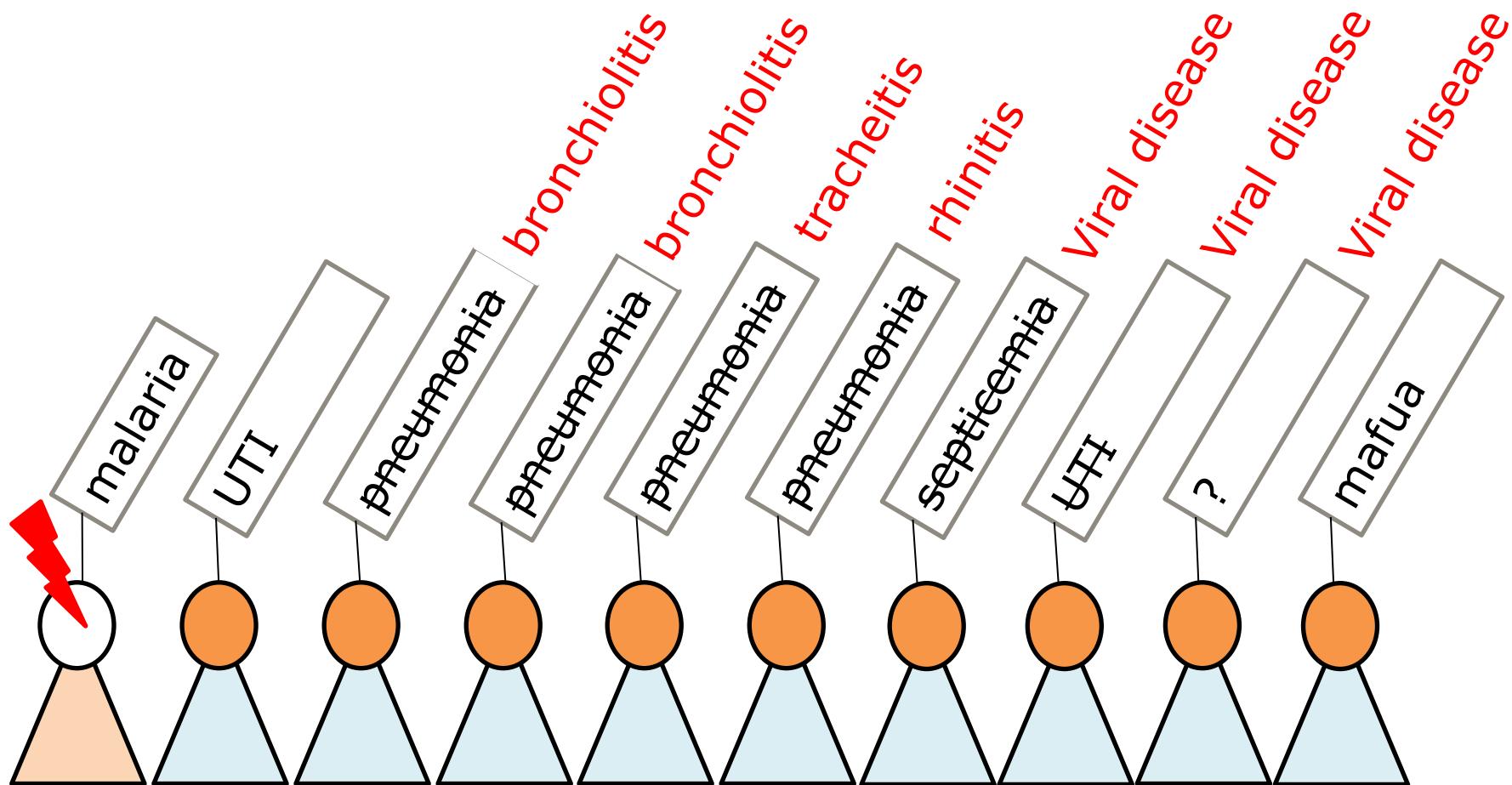
Poor patient outcome:

- Antibiotic side effects
- Destruction of gut flora
- Antibiotic resistance

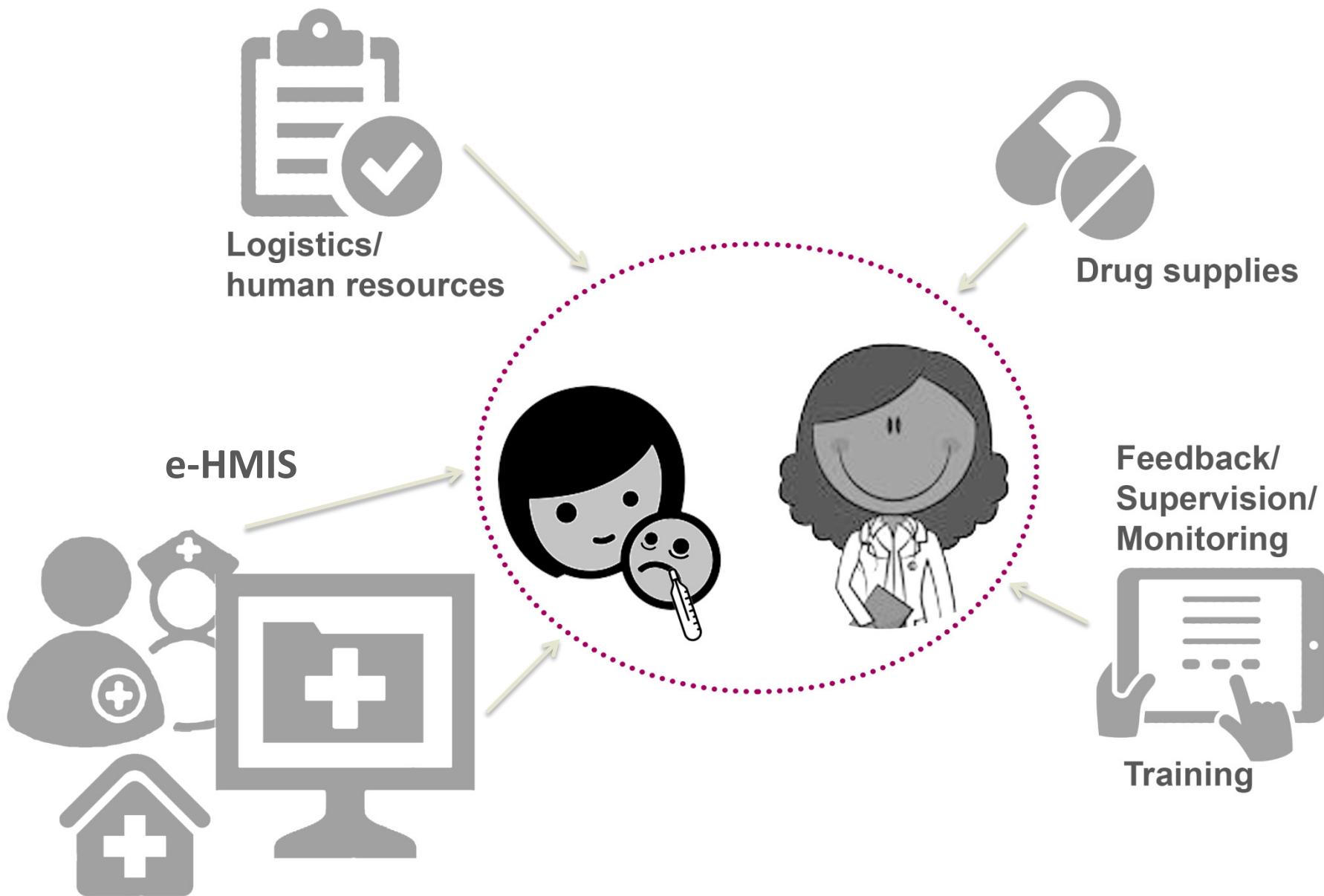
Diagnoses reported in febrile children



Real diagnoses in febrile children



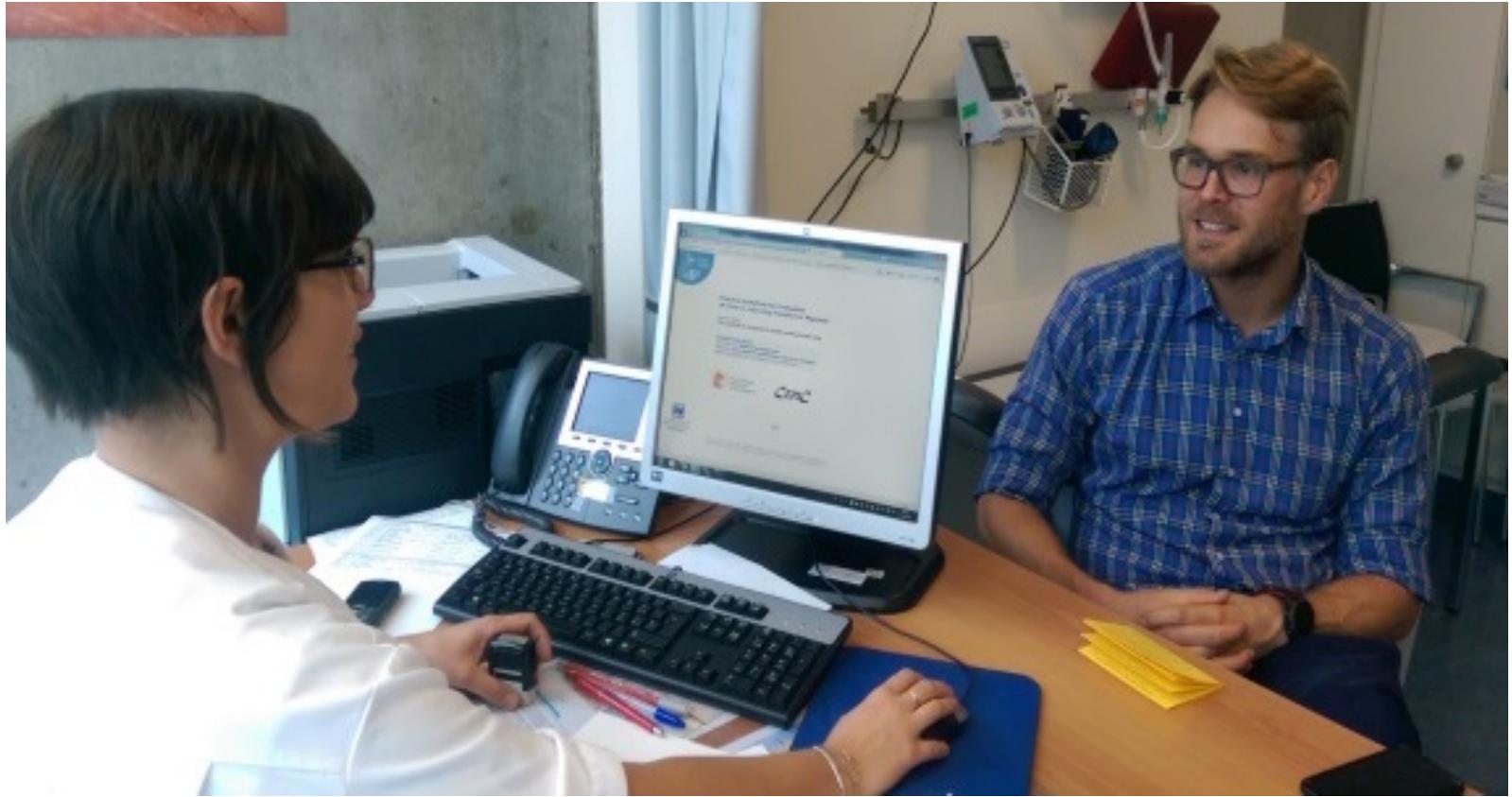
Consequences on patient & health system



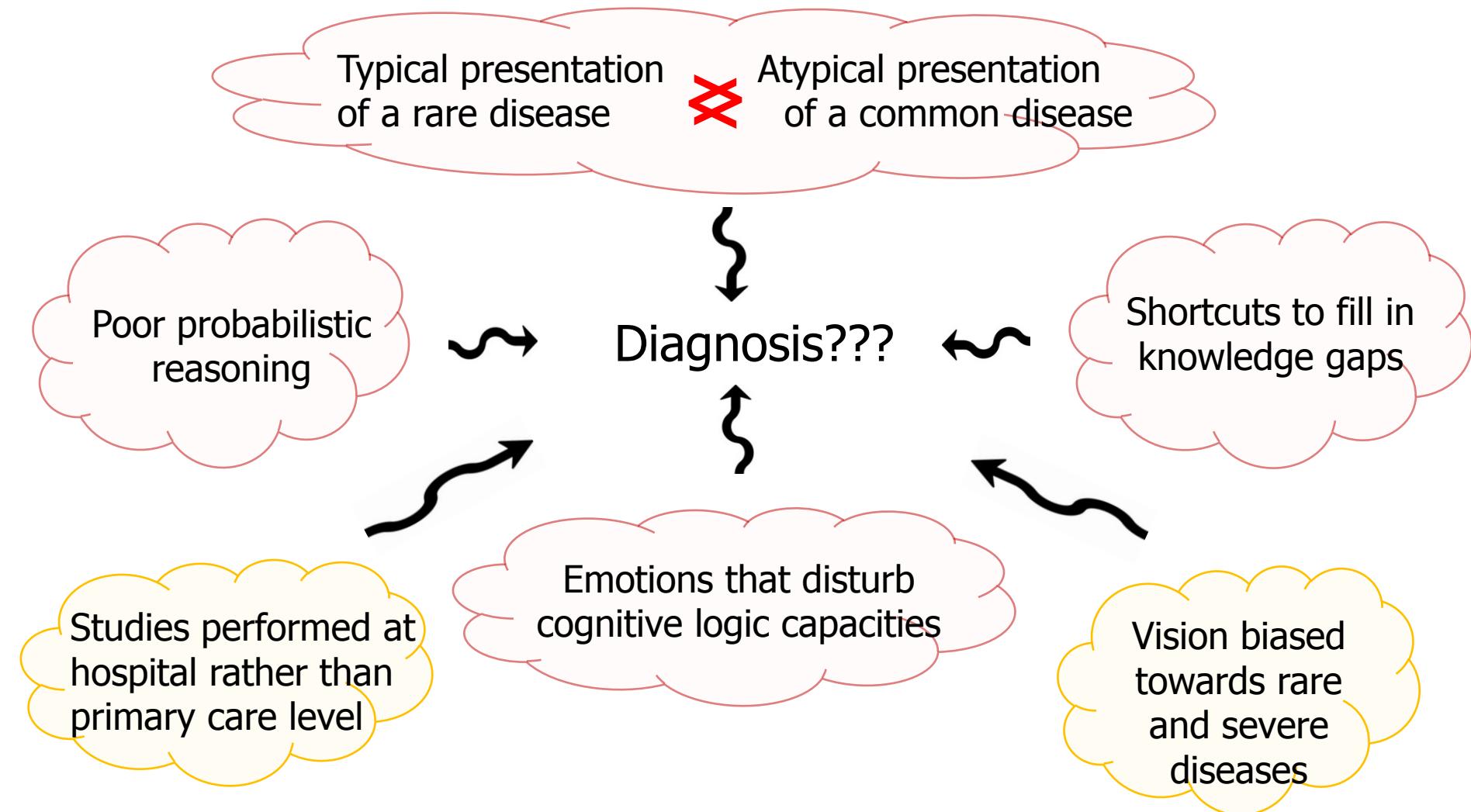


... and in Switzerland?

Swiss TPH

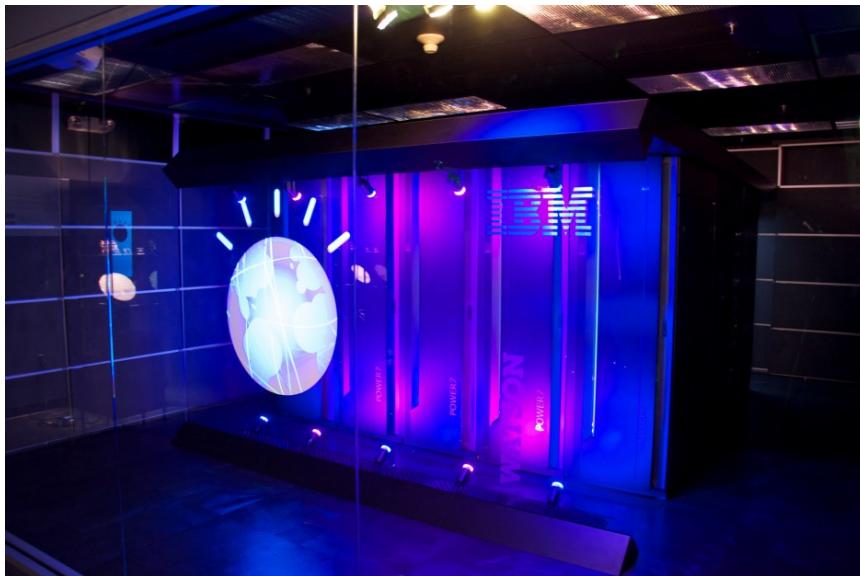


How do clinicians make diagnoses?

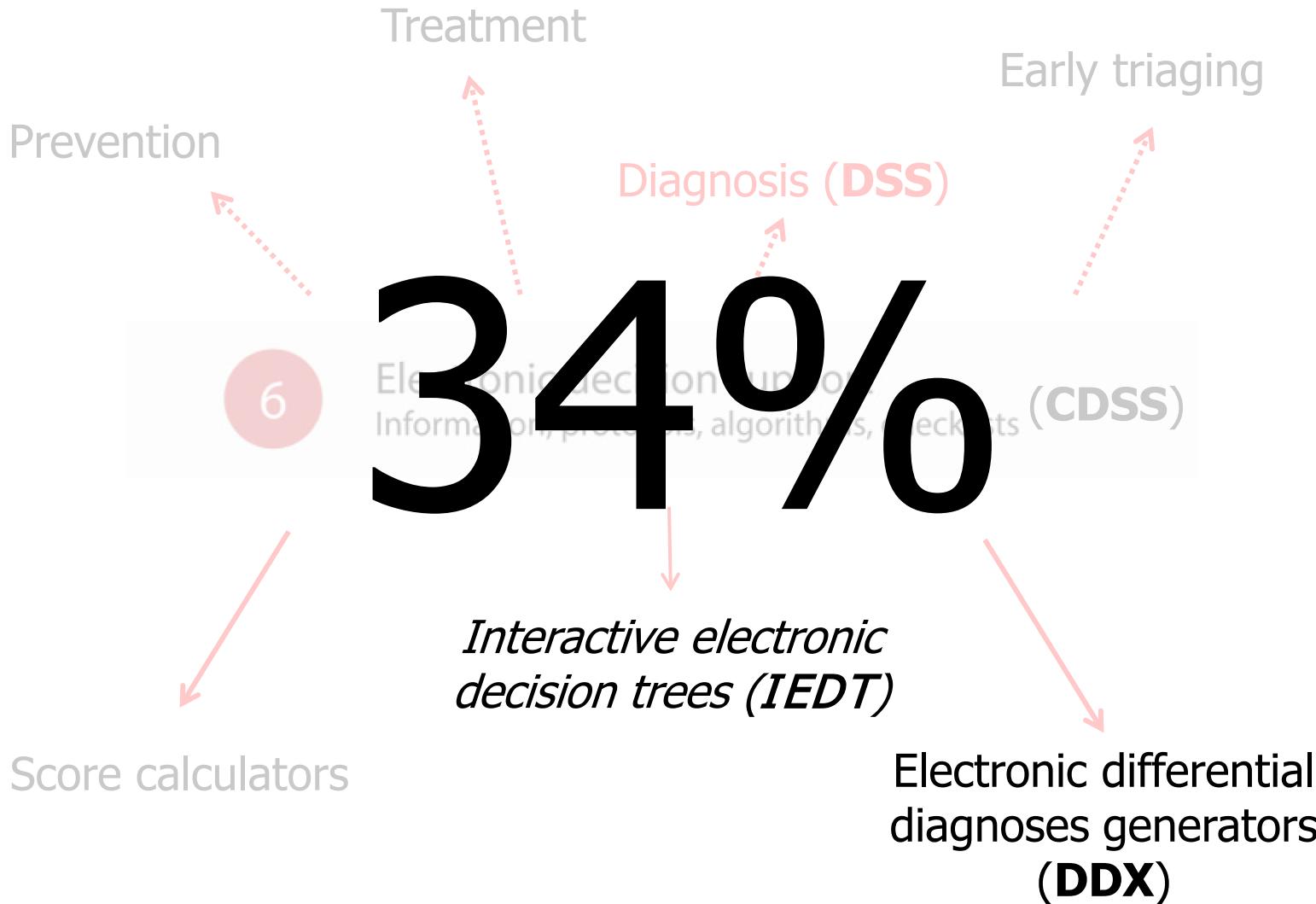


The times have passed when a single human mind could even pretend to know all that might be useful in aiding patients.

L.C. Payne, The role of the computer in refining diagnosis, The lancet **1964**



- | | | | |
|---|---|----|---|
| 1 | Client education & behaviour change communication (BCC) | 7 | Provider-to-provider communication
User groups, consultation |
| 2 | Sensors & point-of-care diagnostics | 8 | Provider workplanning & scheduling |
| 3 | Registries / vital events tracking | 9 | Provider training & education
(CDSS) |
| 4 | Data collection and reporting | 10 | Human resource management |
| 5 | Electronic health records | 11 | Supply chain management |
| 6 | Electronic decision support
Information, protocols, algorithms, checklists | 12 | Financial transactions & incentives |

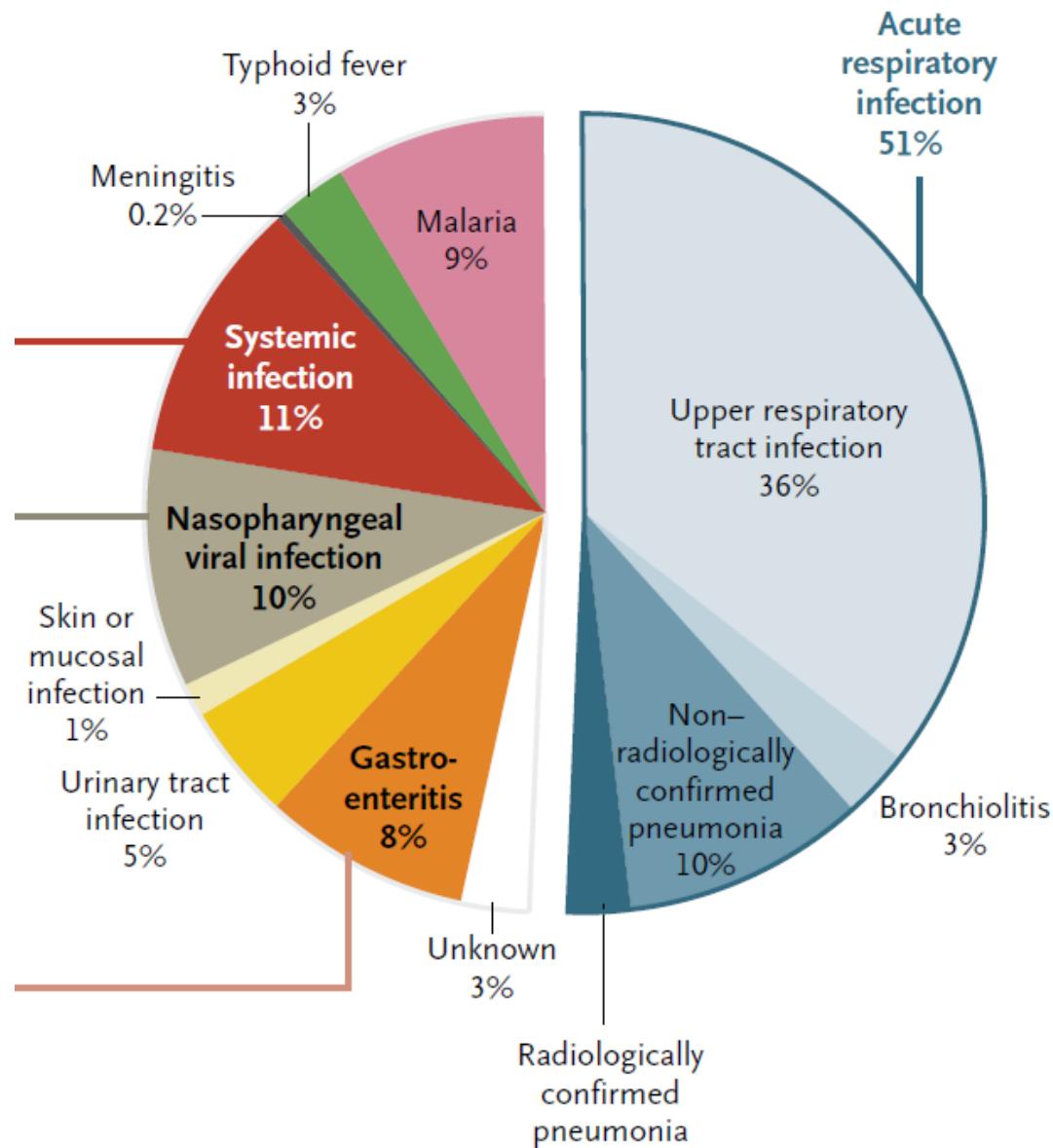


First step: Structured review of the literature

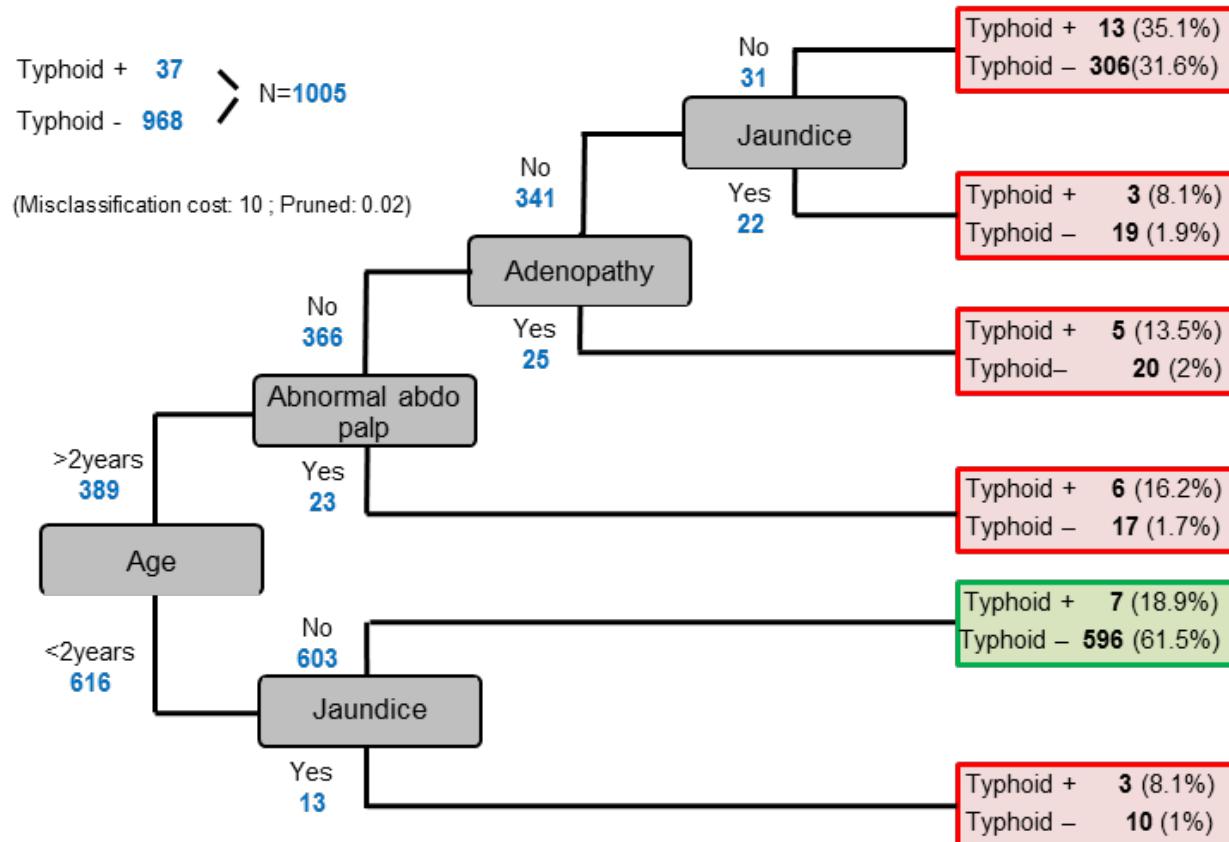
Search	PubMED	Embase
infections	<p>OR "Shock, Septic"[Mesh] OR "Status Asthmaticus"[Mesh] OR "Meningitis"[Mesh>NoExp] OR "Meningitis, Bacterial"[Mesh] OR "Arthritis, Infectious"[Mesh] OR "Bone Diseases, Infectious"[Mesh] OR "Cellulitis"[Mesh] OR "Skin Diseases, Bacterial"[Mesh>NoExp] OR "Skin Diseases, Infectious"[Mesh>NoExp] OR "Ecthyma"[Mesh] OR "Erysipelas"[Mesh] OR "Staphylococcal Skin Infections"[Mesh] OR "Soft Tissue Infections"[Mesh] OR "Diarrhea, Infantile"[Mesh] OR "Dysentery"[Mesh] OR "Urinary Tract Infections"[Mesh] OR "Pyelonephritis"[Mesh>NoExp] OR "Typhoid Fever"[Mesh] OR "Fever of Unknown Origin"[Mesh] OR bacterial infection*[tiab] OR serious infection*[tiab] OR severe infection*[tiab] OR invasive infection*[tiab] OR (death[tiab] OR bronchiolitis[tiab] OR dehydration[tiab] OR urinary tract infection*[tiab] OR rickettsia*[tiab] OR bacteremia[tiab] OR ("Signs and Symptoms" AND "Abdominal Pain"))[tiab] OR "Jaundice"[Mesh]) OR "Vital Signs"[Mesh>NoExp] OR "Dyspnea "[Mesh>NoExp] OR "Vital Signs"[Mesh] OR "Tachycardia"[Mesh>NoExp] OR "Diagnostic Tests, Routine"[Mesh] OR "Physical Examination"[Mesh>NoExp] OR "Diagnosis"[Mesh>NoExp] OR "Clinical Decision-Making"[Mesh] OR "Medical History Taking"[Mesh>NoExp] OR "Symptom Assessment"[Mesh] OR "Odds Ratio"[Mesh] OR "Sensitivity and Specificity"[Mesh>NoExp] OR "Predictive Value of Tests"[Mesh] OR "ROC Curve"[Mesh] OR "Severity of Illness Index"[Mesh] OR "Decision Trees"[Mesh] OR "C-Reactive Protein"[Mesh] OR "Anemia"[Mesh>NoExp] OR clinical sign*[tiab] OR clinical syndrome*[tiab] OR "syndromic diagnosis"[tiab] OR clinical variable*[tiab] OR clinical predictor*[tiab] OR vital sign*[tiab] OR clinical feature*[tiab] OR "signs and symptoms"[tiab] OR red flag*[tiab] OR danger sign*[tiab] OR "abnormal mental status"[tiab] OR "altered mental status"[tiab] OR convulsion*[tiab] OR "stiff neck"[tiab] OR meningeal sign*[tiab] OR prostration[tiab] OR "chest wall retraction"[tiab] OR "chest indrawing"[tiab] OR stridor[tiab] OR tachypnoea[tiab] OR "fast breathing"[tiab] OR tachypnoea[tiab] OR "respiratory rate"[tiab] OR tachycardia[tiab] OR "fast heart rate"[tiab] OR "capillary refill time"[tiab] OR vomiting[tiab] OR pallor[tiab] OR fever[tiab] OR algorithm*[tiab] OR decision tree*[tiab] OR prediction rule*[tiab] OR imci[tiab] OR "integrated management of childhood illness"[tiab] OR "severe anemia"[tiab] OR "severe anaemia"[tiab] OR procalcitonin[tiab] OR "C-reactive protein"[tiab] OR "urine dipstick"[tiab] OR "urine nitrite"[tiab] OR "urine leucocyte"[tiab])</p>	<p>infection/exp OR 'pyonephrosis'/exp OR 'rickettsiosis'/exp OR 'Staphylococcus infection'/exp OR 'Streptococcus infection'/exp OR 'community acquired infection'/exp OR 'sepsis'/de OR 'bacteremia'/de OR 'septic shock'/de OR 'septicemia'/de OR 'respiratory tract infection'/exp OR 'pneumonia'/de OR 'bronchopneumonia'/exp OR 'asthmatic state'/exp OR 'meningitis'/de OR 'bacterial meningitis'/exp OR 'Haemophilus meningitis'/exp OR 'pneumococcal meningitis'/exp OR 'bone infection'/de OR 'bacterial arthritis'/exp OR 'soft tissue infection'/exp OR 'cellulitis'/exp OR 'bacterial skin disease'/de 'erysipelas'/de OR 'impetigo'/exp OR 'skin abscess'/exp OR 'staphylococcal skin infection'/exp OR 'urinary tract infection'/exp OR 'urinary tract infection'/exp OR 'urinary tract infection'[NEXT/1 infection*) OR (serious infection NEXT/1 infection*) OR (invasive infection NEXT/1 malaria) OR (severe infection NEXT/1 sepsis OR meningitis OR pneumonia OR respiratory infection NEXT/1 tract NEXT/1 infection*) OR rickettsia* OR osteomyelitis OR septicemia OR (otitis NEXT/1 media)):ab,ti) OR (pallor/exp OR 'seizure'/de OR 'convulsion'/de OR 'abdominal pain'/de OR 'vomiting'/de OR 'jaundice'/de OR 'abnormal respiratory sound/exp OR 'dyspnea'/de OR 'tachypnea'/de OR 'vital sign'/exp OR 'heart rate'/de OR 'breathing rate'/de OR 'oxygen saturation'/exp OR 'tachycardia'/de OR 'diagnostic accuracy'/de OR 'diagnostic test accuracy study'/de OR 'classification algorithm'/exp OR 'practice guideline'/de OR 'predictive value'/exp OR 'diagnostic value'/de OR 'diagnostic accuracy'/de OR 'C reactive protein'/exp OR 'procalcitonin'/exp OR 'anemia'/de OR ((clinical NEXT/1 sign*)) OR (clinical NEXT/1 syndrome*) OR (clinical NEXT/1 variable*) OR (clinical NEXT/1 predictor*) OR (vital NEXT/1 sign*) OR (clinical NEXT/1 feature*) OR "signs and symptoms" OR (red NEXT/1 flag*) OR (danger NEXT/1 sign*) OR "abnormal mental status" OR "altered mental status" OR convulsion* OR "stiff neck" OR (meningeal NEXT/1 sign*) OR prostration OR "chest wall retraction" OR "chest indrawing" OR stridor OR tachypn*a OR "fast breathing" OR "respiratory rate" OR tachycardia OR "fast heart rate" OR "capillary refill time" OR vomiting OR pallor OR fever OR algorithm* OR (decision NEXT/1 tree*) OR (prediction NEXT/1 rule*) OR imci OR "integrated management of childhood illness" OR "severe an*emia" OR procalcitonin OR "C-reactive protein" OR "Urine dipstick" OR (Urine NEXT/1 leucocyte*) OR (Urine NEXT/1 nitrite*) OR</p>

12'124 articles

Second step: studies to measure disease prevalence

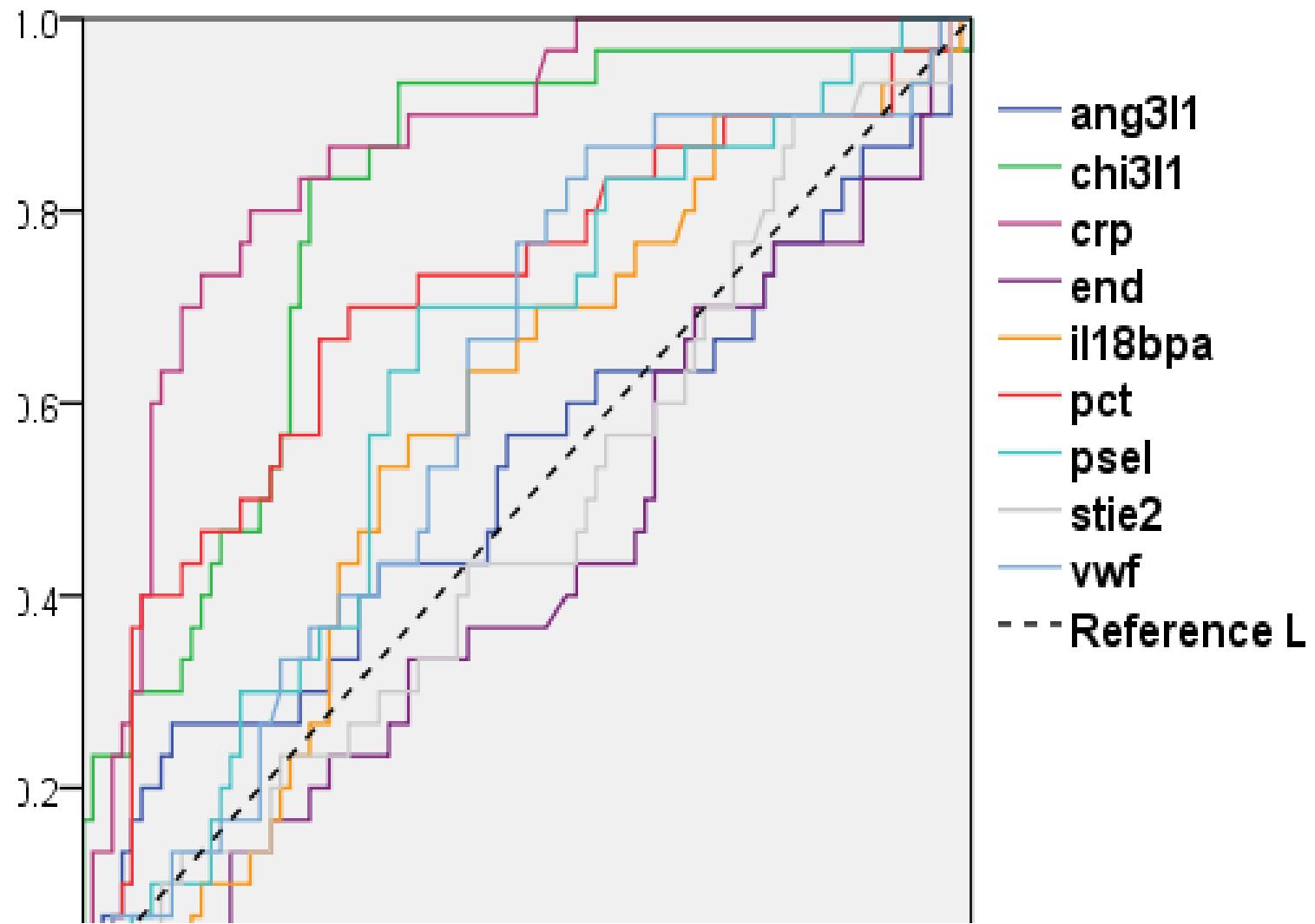


TYPHOID FEVER



Sensitivity	Specificity	LR+	LR-
0.46	0.93	6.57	0.58

Four step: find new host biomarkers



Combining CRP and CHI3I1 to diagnose radiological pneumonia

Patients to which test is applied*	N=	Sensitivity	Specificity	PPV	NPV
Temp. >38°C + cough + fast breathing	155	93%	81%	54%	98%

*excluding patients with a positive malaria test

Point-of-care C-reactive protein testing to reduce inappropriate use of antibiotics for non-severe acute respiratory infections in Vietnamese primary health care: a randomised controlled trial

Nga TT Do, Ngan TD Ta, Ninh TH Tran, Hung M Than, Bich TN Vu, Long B Hoang, H Rogier van Doorn, Dung TV Vu, Jochen WL Cals, Arjun Chandna, Yoel Lubell, Behzad Nadjm, Guy Thwaites, Marcel Wolbers, Kinh V Nguyen, Heiman F L Wertheim

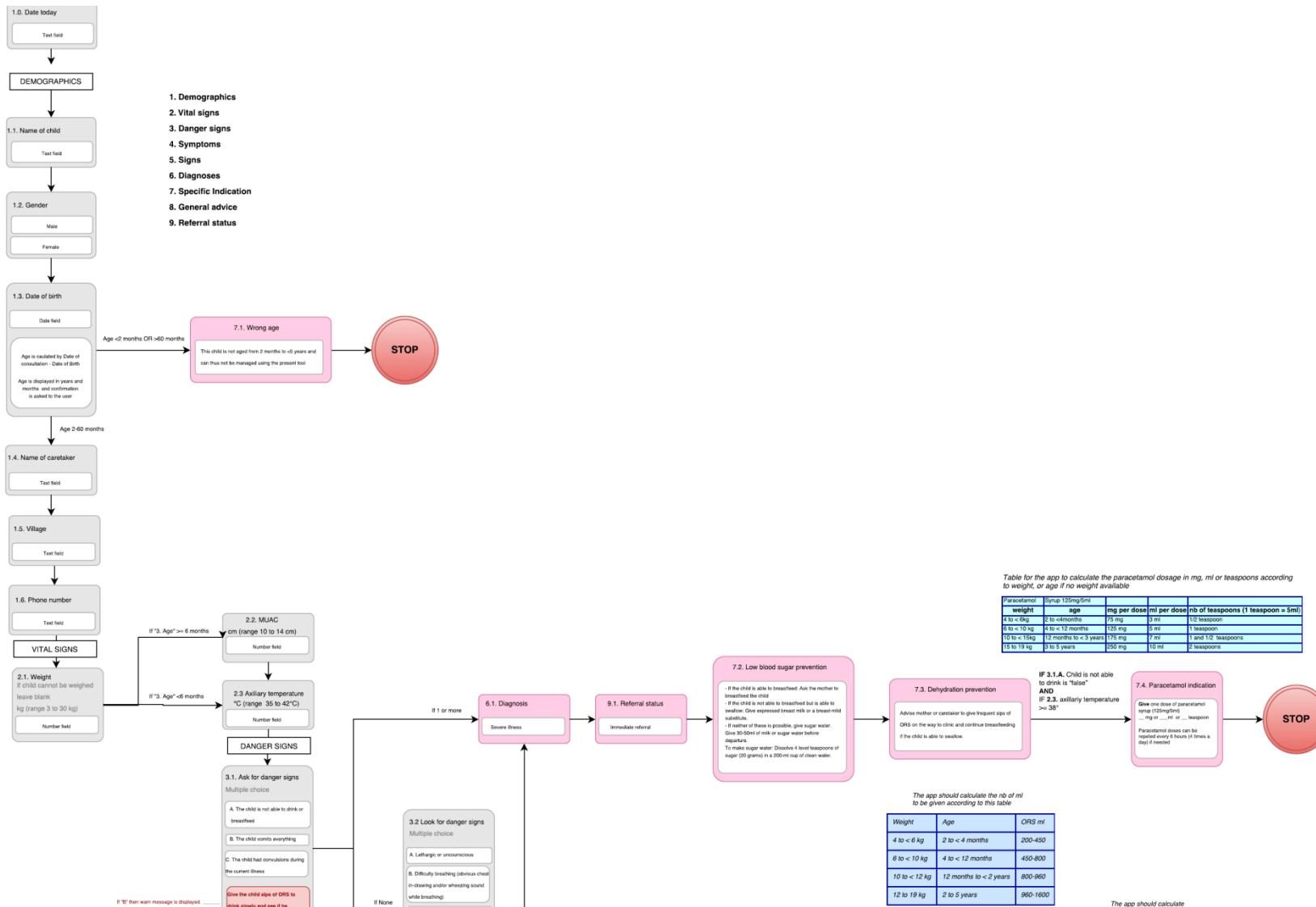
Lancet Global Health 2016

	CRP	Control	OR (95% CI)	p value
Children (1–15 years)	66%	77%	0·55 (0·41–0·75)	0·0001

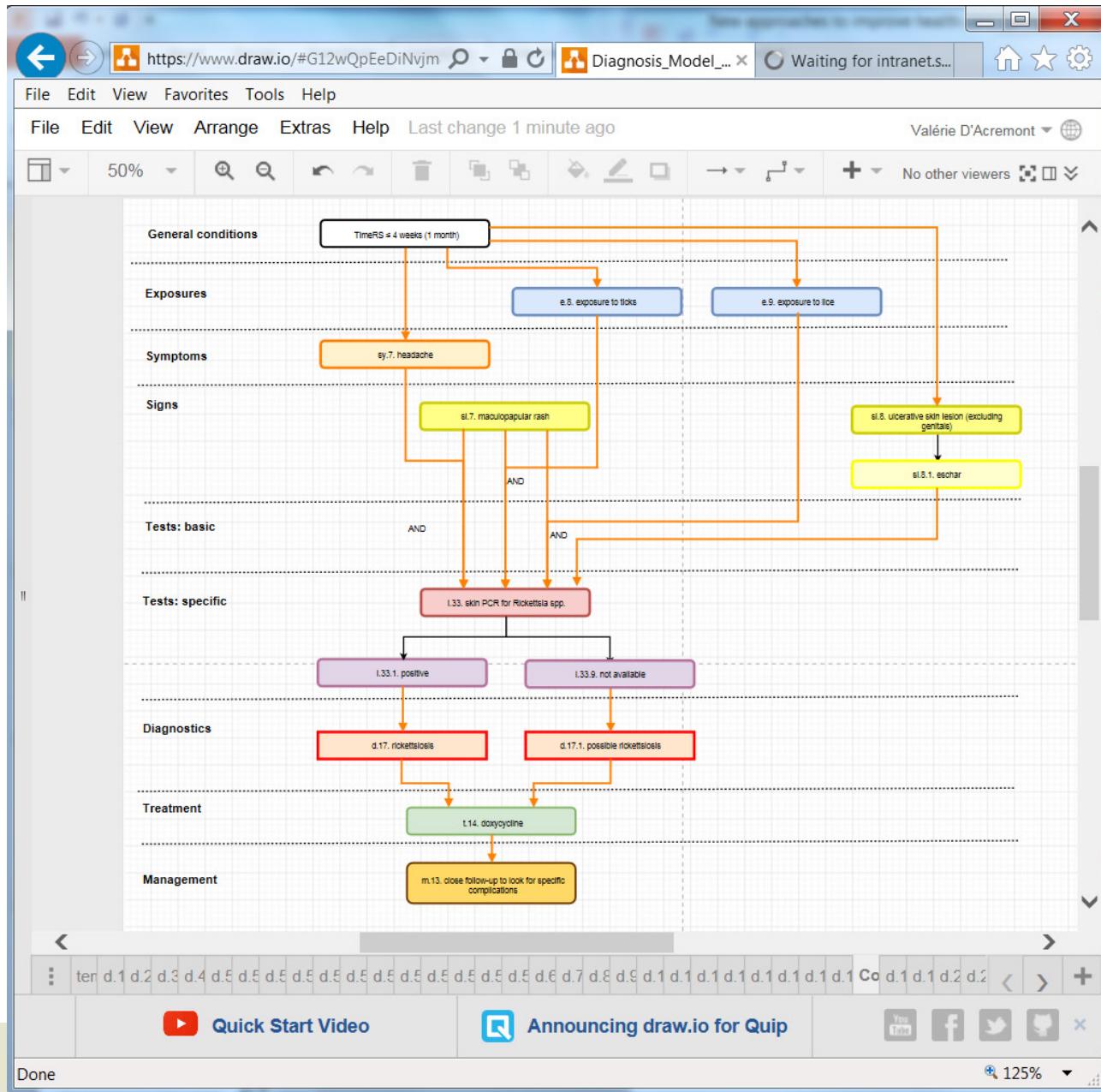
Table 2: Patients receiving any antibiotics within 14 days of follow-up

e risk difference of -12·5% (95% CI -16·6 to -8·6), p<0·00001

Last step: Interactive electronic decision tree



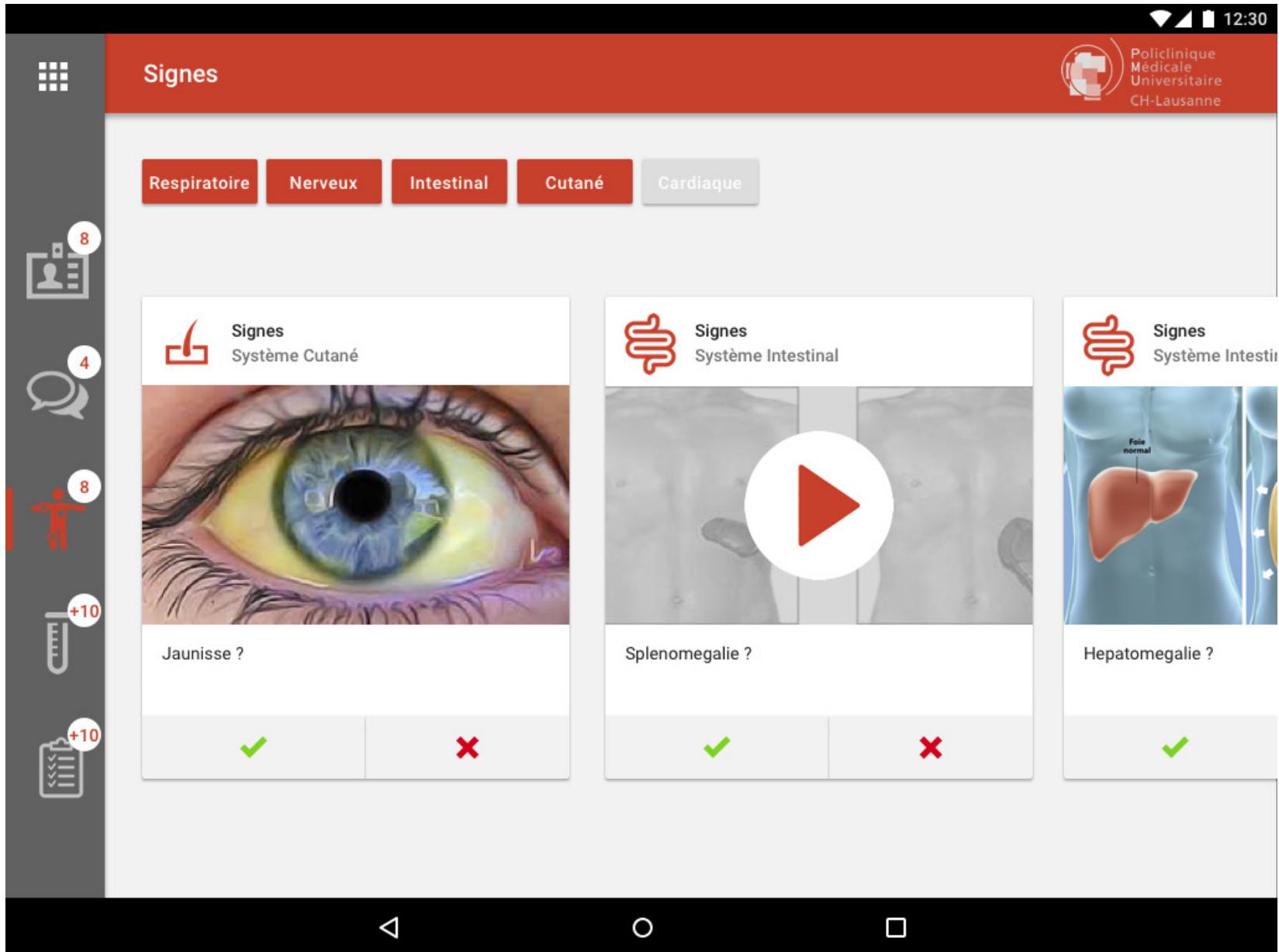
Tool to allow lay (IT) people to create clinical algorithms



Appropriate software user interface



Appropriate software user interface



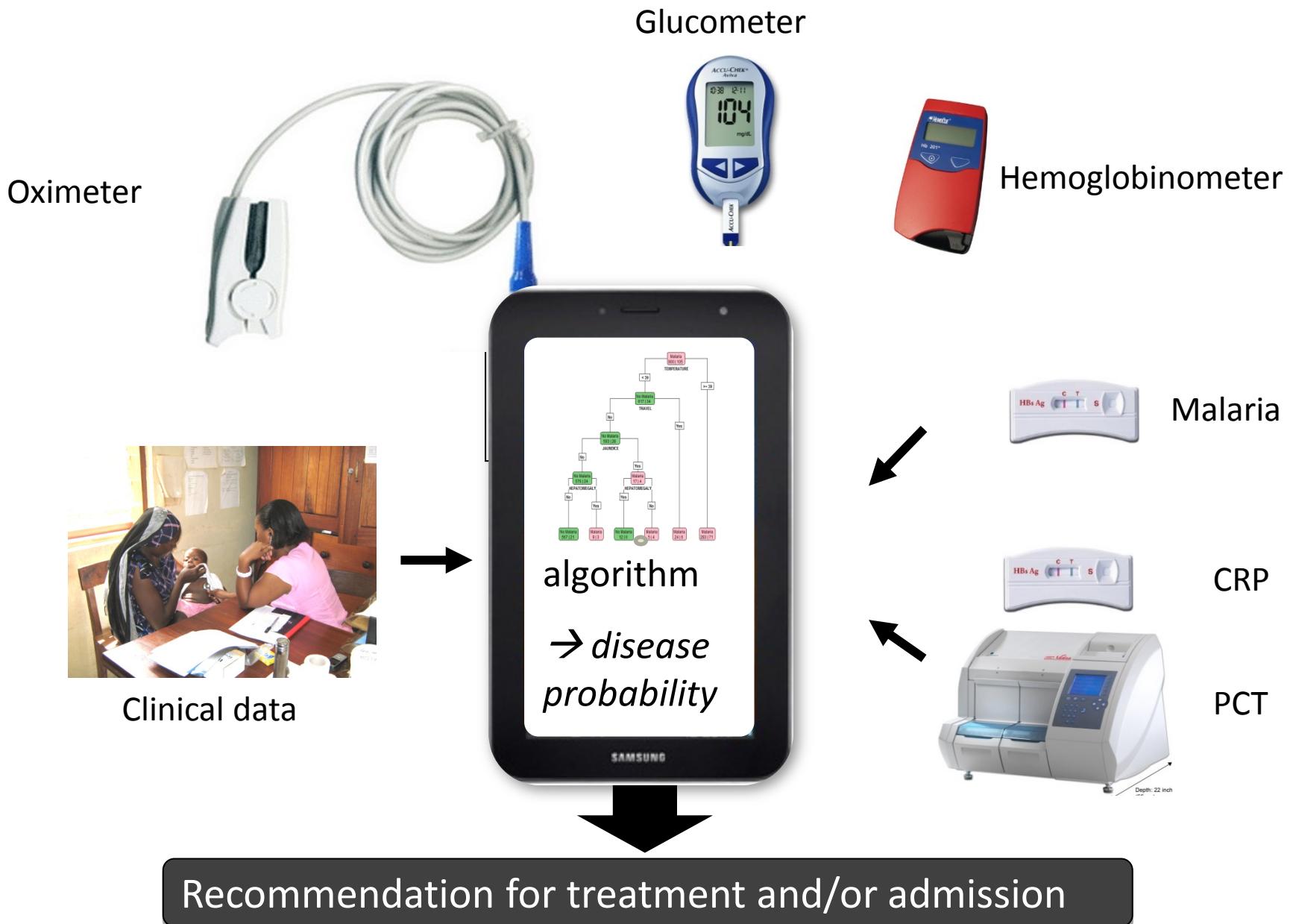
The screenshot shows a mobile application interface for medical sign assessment. The top navigation bar is orange with the title "Signes". Below it is a horizontal menu bar with five categories: "Respiratoire" (red), "Nerveux" (red), "Intestinal" (red), "Cutané" (light gray), and "Cardiaque" (light gray). On the left side, there is a vertical sidebar with icons for patient management, messaging, clinical notes, and a clipboard, each with a red notification badge indicating the count of pending items: 8, 4, 8, and +10 respectively.

The main content area displays three cards, each representing a different system:

- Signes Système Cutané**: Shows a close-up image of a human eye. The question "Jaunisse ?" is displayed below the image. At the bottom, there are two buttons: a green checkmark and a red X.
- Signes Système Intestinal**: Shows a grayscale image of a person's abdomen with a play button overlay. The question "Splénomégalie ?" is displayed below. At the bottom, there are two buttons: a green checkmark and a red X.
- Signes Système Intestinal**: Shows a 3D anatomical model of the human torso focusing on the liver area. The label "Foie normal" points to a healthy-looking liver. The question "Hépatomegalie ?" is displayed below. At the bottom, there is a single green checkmark button.

The top right corner of the screen shows the time as 12:30 and the location as "Policlinique Médicale Universitaire CH-Lausanne".

Second generation algorithm: ePOCT

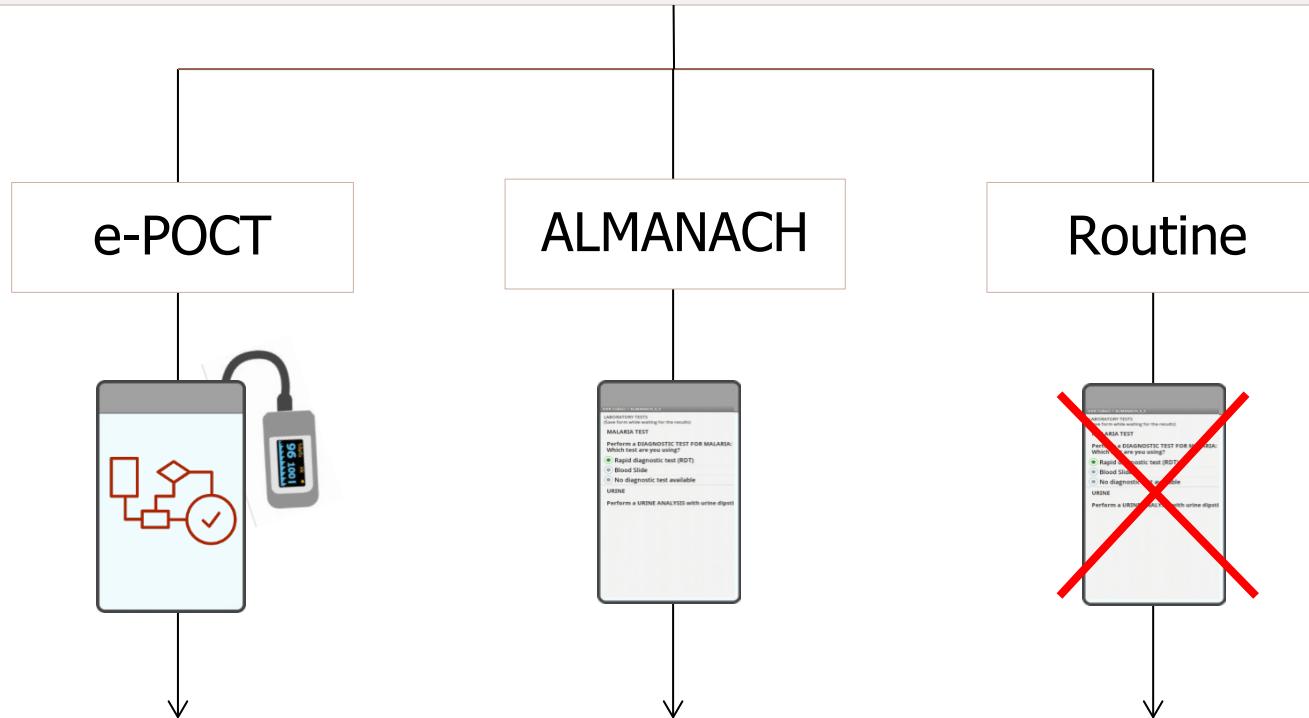


Second generation algorithm: ePOCT



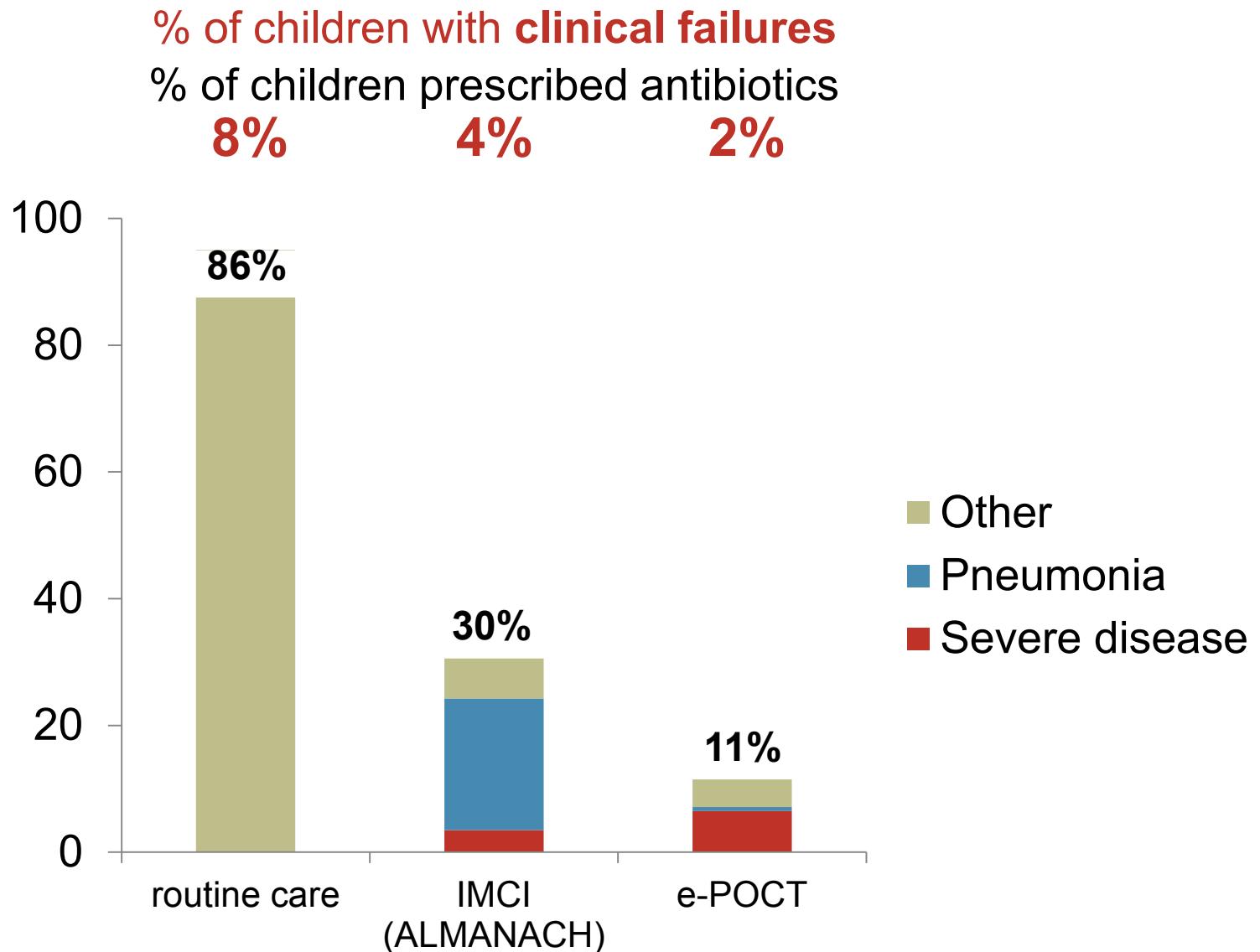
Randomized clinical trial of e-POCT

3739 children 2 months to 5 years (9 facilities, Dar es Salaam)

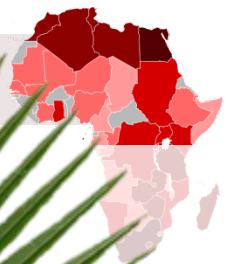


Follow-up at day 3, 7 and 30

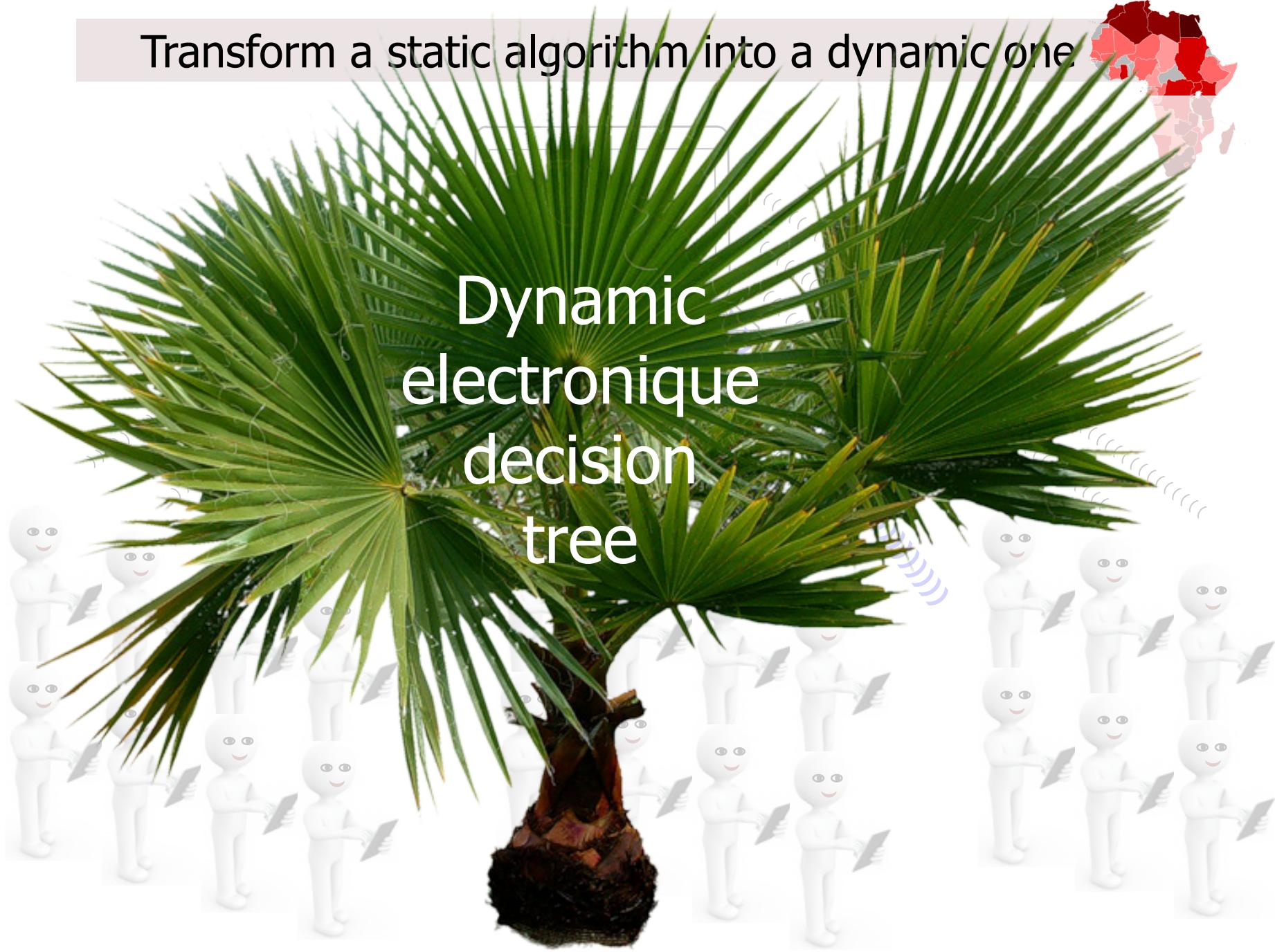
Impact of e-POCT implementation on antibiotic failures



Transform a static algorithm into a dynamic one



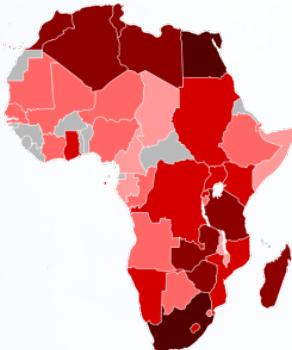
Dynamic electronique decision tree



Impact of algorithms beyond health



Collaborating institutions



 IFAKARA HEALTH INSTITUTE
research | training | services



Tanzanian
Ministry of
health and
Welfare



Dar es Salaam
City Medical
Office of Health

 UNIVERSITY OF
TORONTO

Funding





Swiss Agency for Development
and Cooperation SDC




HUG
Hôpitaux Universitaires de Genève


Swiss TPH


Polyclinique
Médicale
Universitaire


CHUV


World Health
Organization


FIND
Because diagnosis matters


EMORY
UNIVERSITY

BILL & MELINDA
GATES foundation