A multi-site pilot study of the deployment of cholera rapid diagnostic tests in the Democratic Republic of the Congo

Wendelin Moser[1,2], Anaïs Broban[1,2], Placide Okitayemba Welo[3], Daniel Mukadi[4], Sibylle Gerstl[1,2], Emily Briskin[1,2], Nana Mimbu[1,2], Isabel Amoros Quiles[2], Christopher Mambula[2], Ruwan Ratnayake[5], Andrew Azman[6,7], Flavio Finger[1,2]

[1] Epicentre Paris, Paris, France, [2] Médecins Sans Frontières, Paris, France, [3] National Program for the Elimination of Cholera and the Control of Other Diarrheal Diseases, Kinshasa, DR Congo, [4] National Institute for Biomedical Research, Goma, DR Congo, [5] London School of Hygiene & Tropical Medicine, London, UK, [6] Médecins Sans Frontières, Geneva, Switzerland, [7] Johns Hopkins University, Maryland, USA

Introducing RDTs to overcome limitations of the cholera surveillance system

Laboratory confirmation constraints (culture and/or PCR)

→ *due to logistical constraints and laboratory capacity*

Low specificity of the case definition

→ *Inclusion of other diarrheal diseases*

Short shelf life, supply, cost

→ *No need to test everyone?*

Low specificity of RDT

→ *80% (74%-84%)*

Using the **GTFCC RDT threshold** for detecting a probable outbreak

Number of suspected cholera cases tested by RDT	Number of suspected cholera cases tested positive by RDT	Interpretation
Among 3 to 7 suspected cases tested	At least 3 RDT+	Probable cholera outbreak detected
Among 8 to 10 suspected cases tested	At least 4 RDT+	
Among 11 to 14 suspected cases tested	At least 5 RDT+	
Among 15 to 17 suspected cases tested	At least 6 RDT+	
Among 18 to 21 suspected cases tested	At least 7 RDT+	

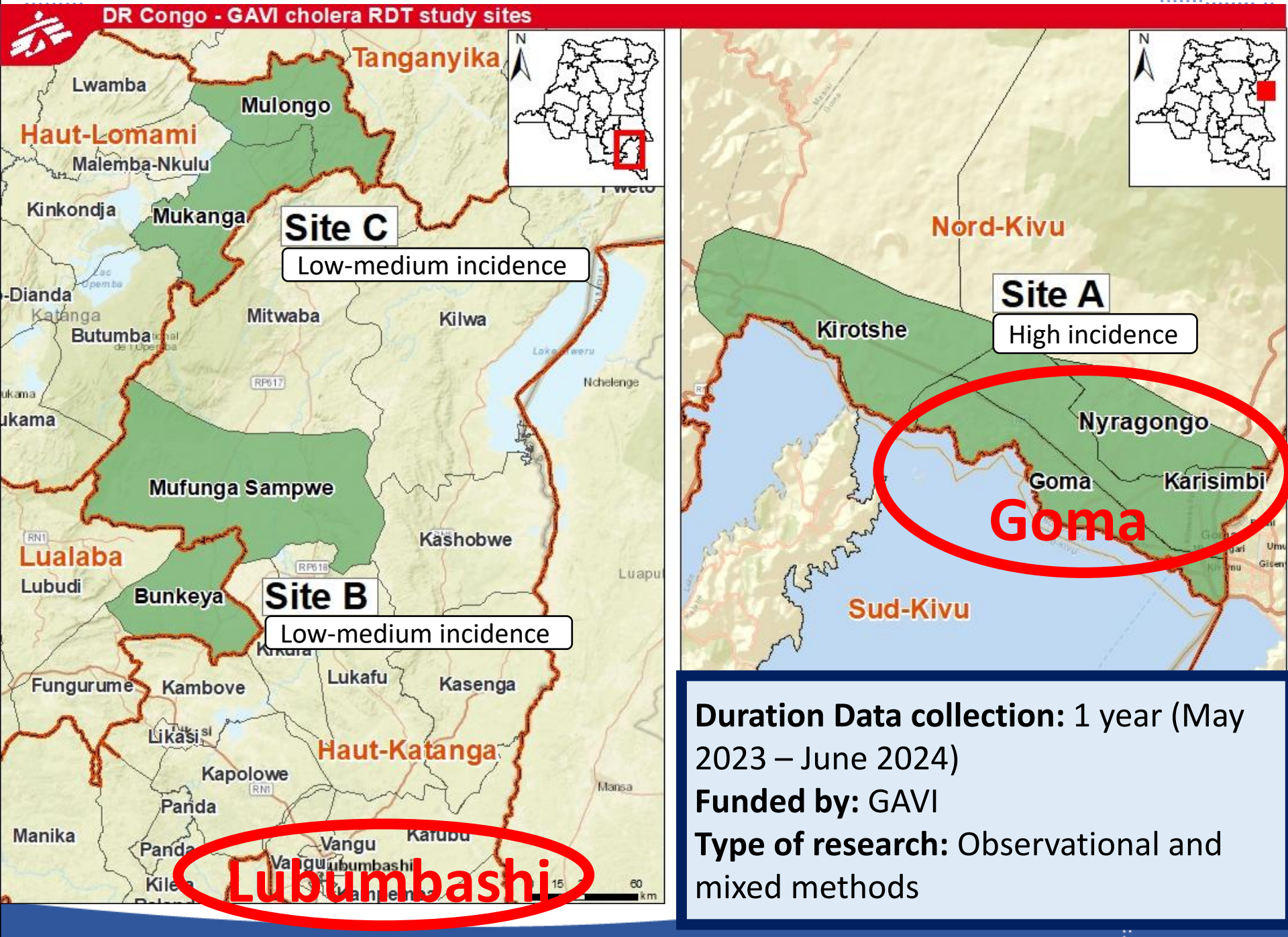
Estimating cholera **incidence using RDTs**

→ *Real time outbreak monitoring e.g. for vaccination decision taking*

RDT sampling scheme change after GTFCC threshold reached

→ *Testing first 3 suspected cases per day per health facility*

Enrichment with Alkaline Peptone Water?



Duration Data collection: 1 year (May 2023 – June 2024)

Funded by: GAVI

Type of research: Observational and mixed methods

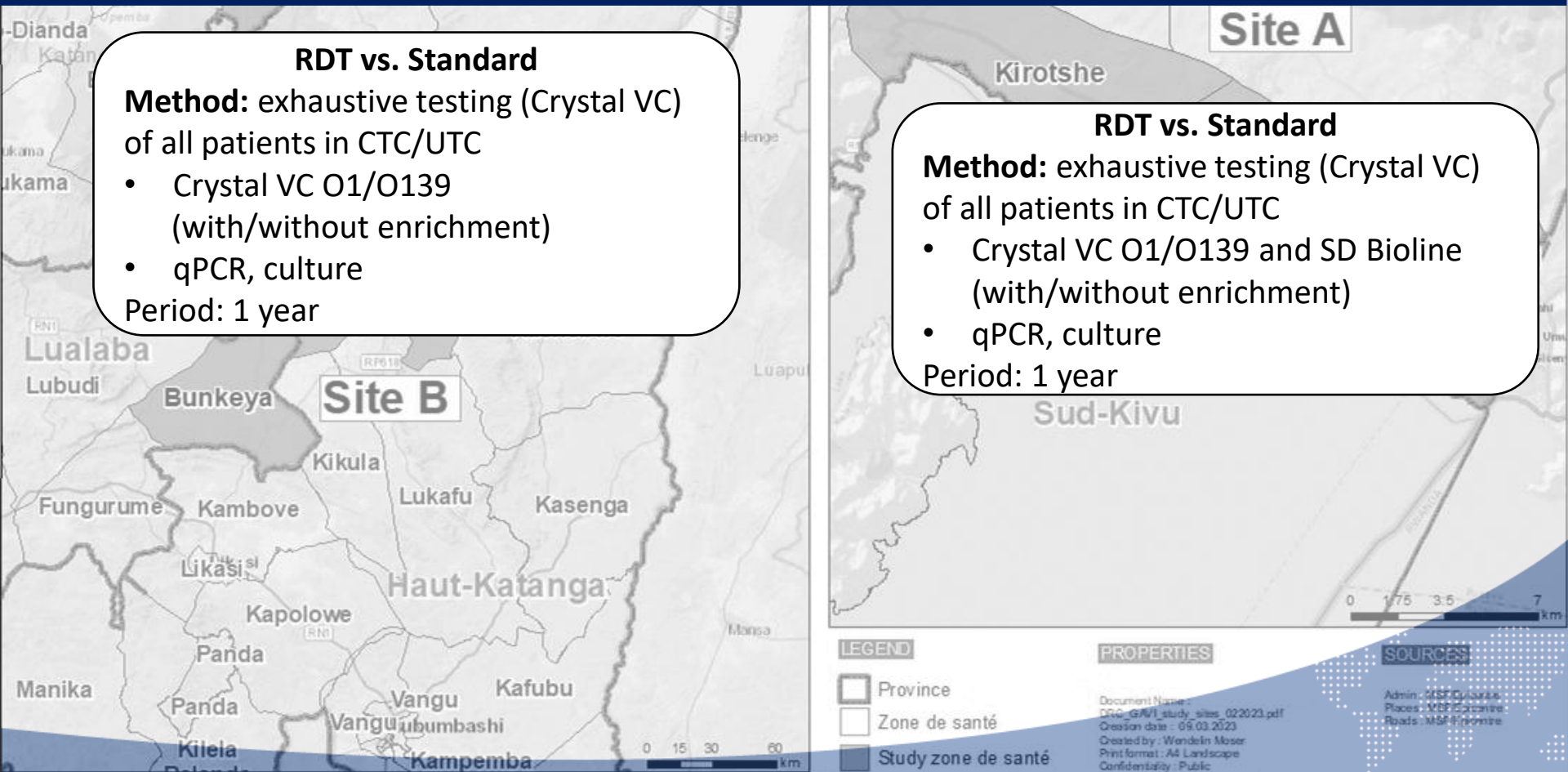
Primary objective

Compare the incidence based on different RDT sampling scheme to the true clinical incidence of cholera.

Secondary objectives

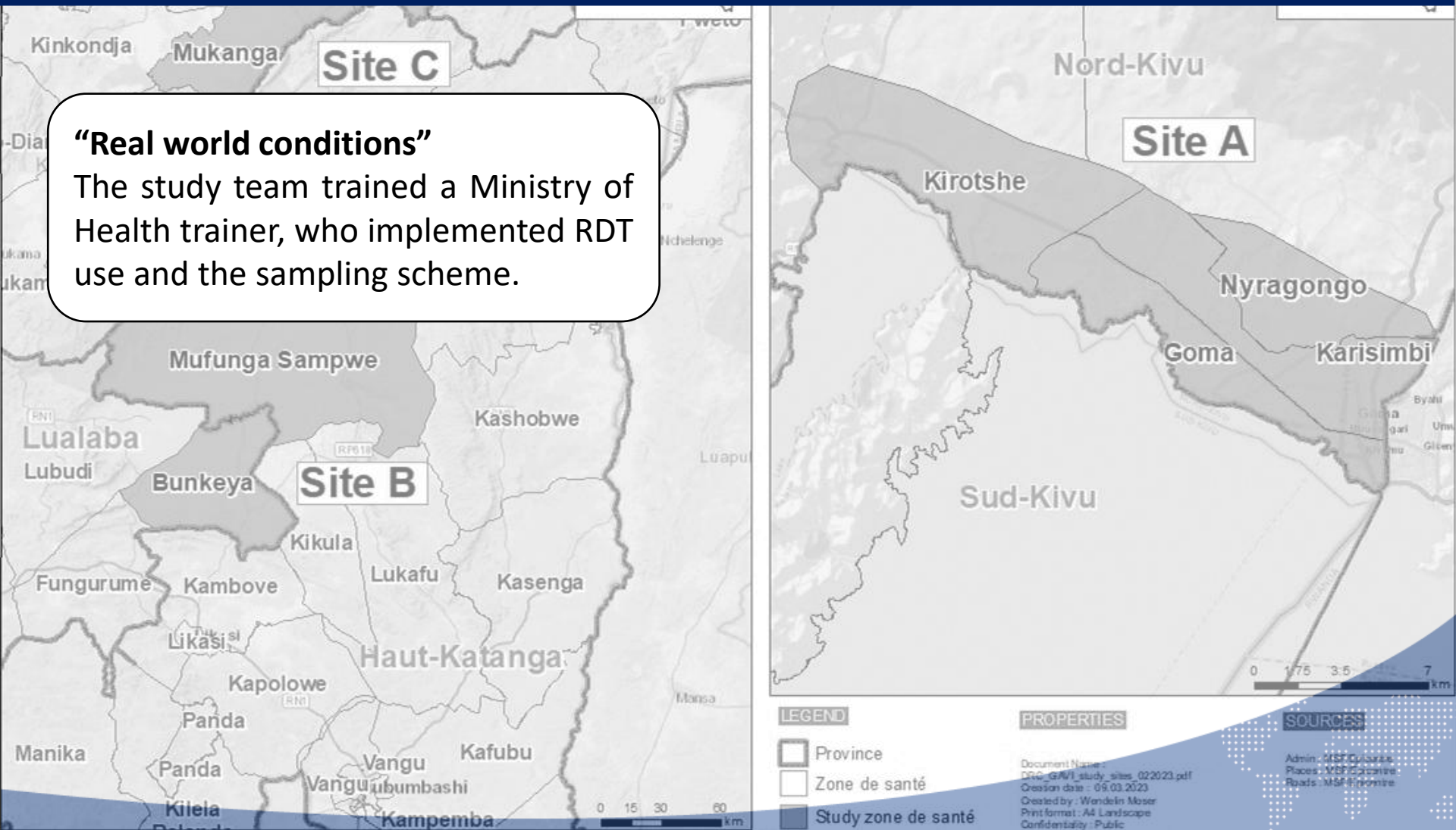
Evaluate the practical use of RDTs for surveillance: compliance, timeliness, reporting, consumption, supply, cost

Evaluate the performance of different cholera RDTs with and without enrichment



Secondary objectives

Implement a specific predefined sampling scheme in a setting with minimal study team support and evaluate compliance to application, timeliness of reporting, consumption, supply, and cost.



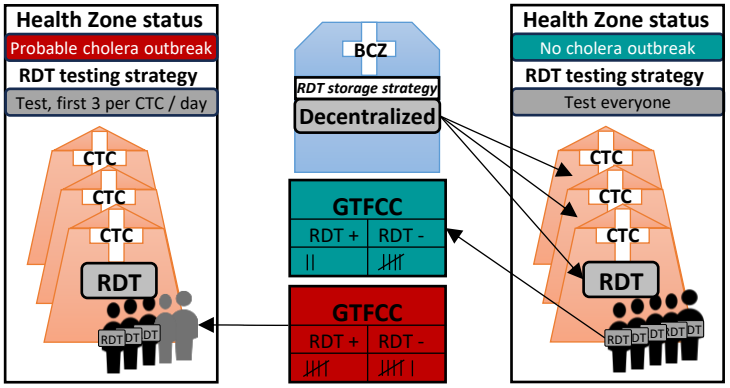
"Real world conditions"

The study team trained a Ministry of Health trainer, who implemented RDT use and the sampling scheme.

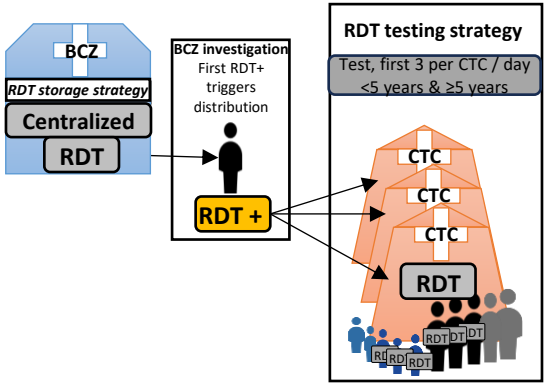
Strategies in DRC: ZS Mulongo and ZS Mukanga

1. Strategy: Storage of RDTs
2. Strategy: RDT testing

ZS Mulongo



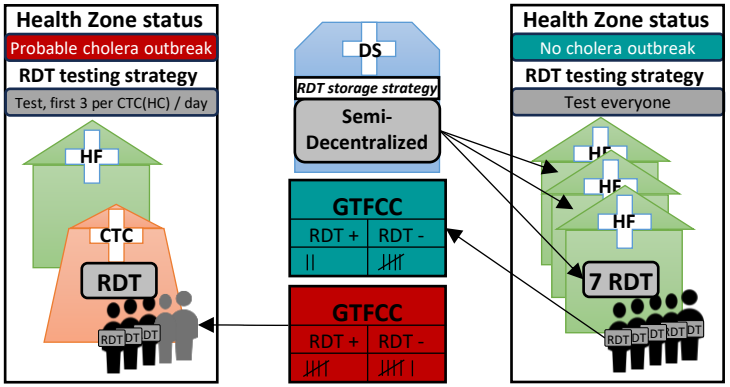
ZS Mukanga



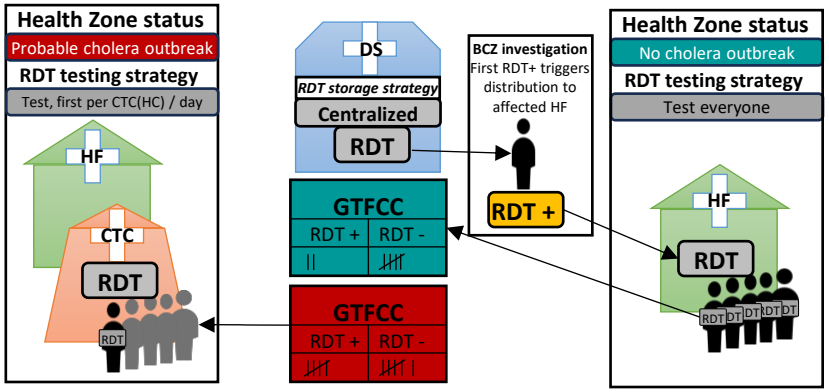
Replication: DRC site C strategy - in the province Maradi, Niger

1. Strategy: Storage of RDTs
2. Strategy: RDT testing

DS Madarounfa

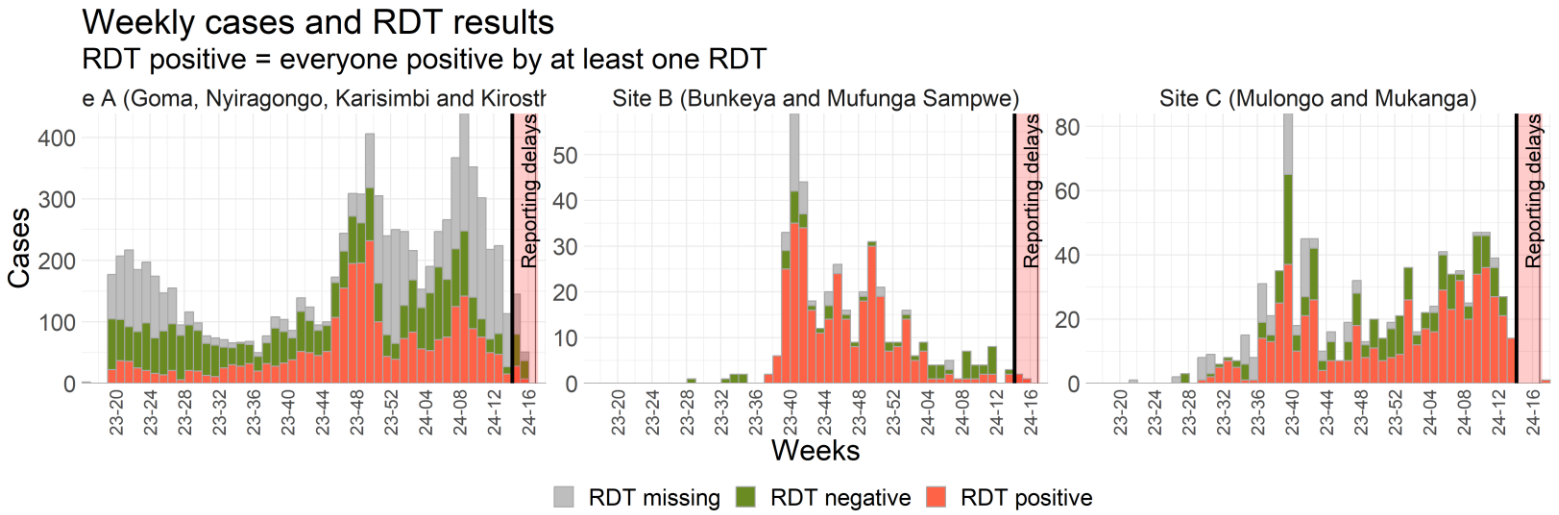


DS Maradi



RESULTS - Overview

(Data collection in progress [data analysed up to the 29.04.2024]: Preliminary and Incomplete Results)



	Site A	Site B	Site C
Study start (2023)	Week 20	Week 26	Week 25
Nb participants enrolled	8’841	412	925
Crystal VC 01/0139	5’499	374	802
Positivity	47.1%	80.2%	70.1%

Incidence based on RDT sampling schemes

Objective

Compare incidences based on :

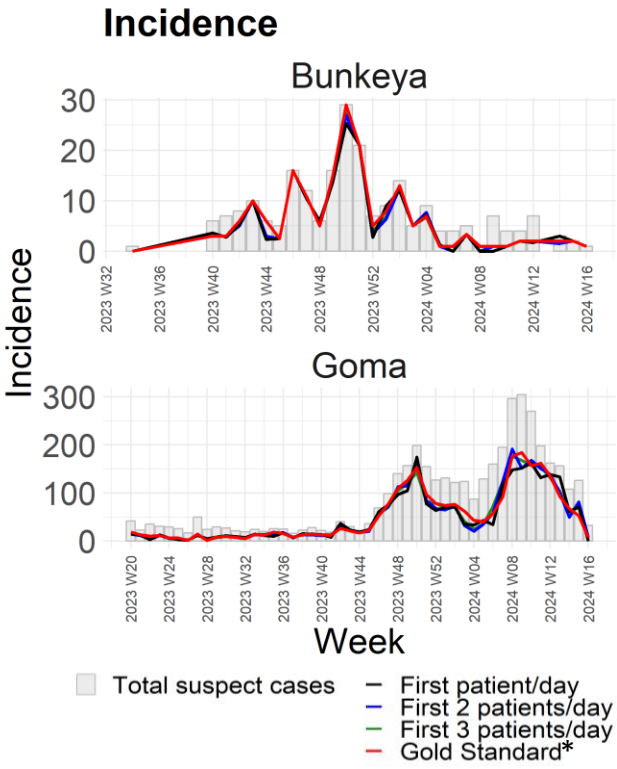
- **Gold standard** (qPCR and/or culture) *versus* different **RDT sampling schemes**
- **High** (Site A) *versus* **low-medium** (Site B) **incidence settings**

Sampling Schemes Examples

1. First arriving suspect cases per day (First: 1, 2, 3 a day)
2. First arriving suspect cases stratified by age group (< 5 and ≥5 years) and by day (First: 1, 2, 3, 4, 5 a day)
3. First arriving suspect cases by week (first 5, 10, 15, 20)
4. Etc….

Identifying sampling schemes

(Data collection in progress [data analysed up to the 29.04.2024]: Preliminary and Incomplete Results)

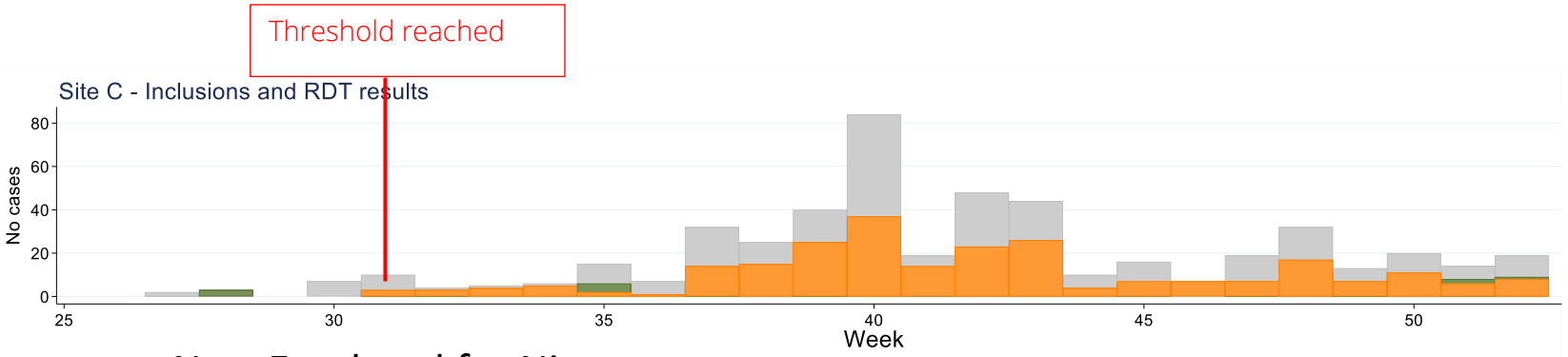


ZS	Sampling scheme	Weekly average incidence difference (SD)	Relative incidence difference	No cases	No RDT used	RDT saved (%)
Bunkeya	First/day	0.7 (1.1)	9.5%	229	131	43%
	First 2/day	0.4 (0.8)	6.0%	229	182	20%
	First 3/day	**0.3 (0.7)**	**4.8%**	**229**	**210**	**8%**
Goma	First/day	8.9 (13.4)	11.2%	4'248	560	87%
	First 2/day	6.5 (10.9)	8.2%	4'248	979	77%
	First 3/day	**4.9 (8.2)**	**7.1%**	**4'248**	**1'295**	**70%**

*Gold standard: Exhaustive RDT testing

Testing of the GTFCC probable outbreak threshold in a real-world setting

(Data collection in progress [data analysed up to the 29.04.2024]: Preliminary and Incomplete Results)



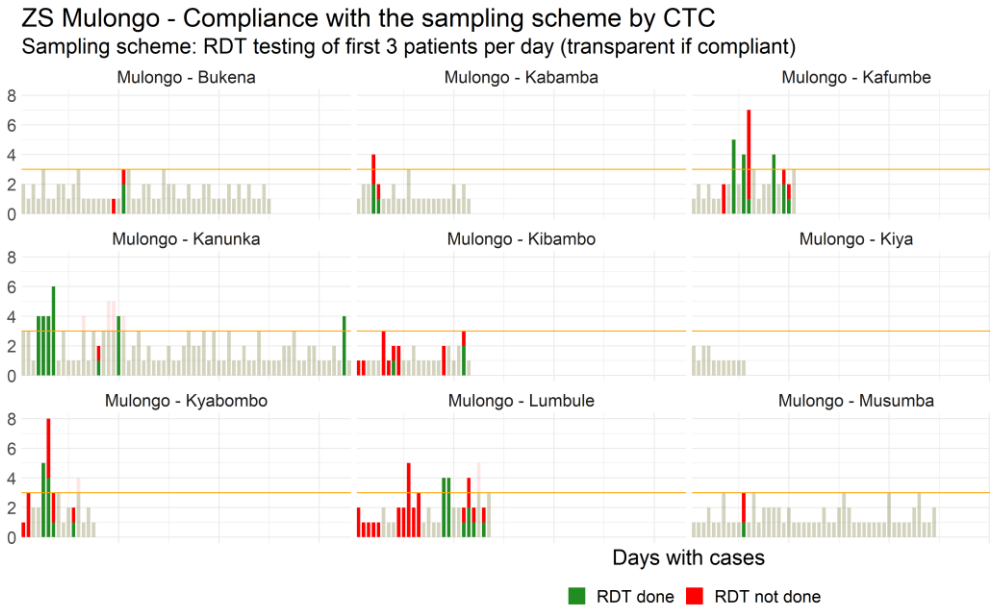
New Excel tool for Niger

			D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	A
1																												
2			Mai 24																									
2			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	2
3	Action quotidienne nécessaire	**Indicateurs**	Mer	Jeu	Ven	Sam	Dim	Lun	Mar	Mer	Jeu	Ven	Sam	Dim	Lun	Mar	Mer	Jeu	Ven	Sam	Dim	Lun	Mar	Mer	Jeu	Ven	Sam	
4	A remplir	Nombre des cas suspect																										
5	Automatique	Nombre des TDRs fait	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
6	A remplir	Nombre des TDR positive																										
7	A remplir	Nombre des TDR négative																										
8	**Calculation automatique: Total pour les 14 derniers jours**																											
9	Automatique	Total cas suspect pendant les dernières 14 jours	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
10	Automatique	**Total** cas suspect avec **TDR fait** pendant les dernières 14 jours	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
11	Automatique	**Total** cas suspect avec **TDR positive** pendant les dernières 14 jours	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
12	Automatique																											
13	Automatique	**Le seuil de l'épidémie probable de choléra est atteint**	Non	Non	Non	Non	Non	Non	Non	Non	Non	Non	Non	Non	Non	Non	Non	Non	Non	Non	Non	Non	Non	Non	Non	Non	Non	N
14	Automatique	**Le district est en Epidémie choléra** (fin d'épidémie: après 4 semaines sans cas TDR positive)	Non	Non	Non	Non	Non	Non	Non	Non	Non	Non	Non	Non	Non	Non	Non	Non	Non	Non	Non	Non	Non	Non	Non	Non	Non	
15	**GTFCC: Seuil d'épidémie probable du choléra**																											

	Total cas suspect avec **TDR fait** pendant les dernières 14 jours	**Total** cas suspect avec **TDR positive** pendant les dernières 14 jours	**Interprétation**
16			
17	Parmi les 3 à 7 cas suspects testés	Au moins 3 RDT positive	**Le seuil de l'épidémie probable est atteint**
18	Parmi les 8 à 10 cas suspects testés	Au moins 4 RDT positive	
19	Parmi les 11 à 14 cas suspects testés	Au moins 5 RDT positive	
20	Parmi les 15 à 17 cas suspects testés	Au moins 6 RDT positive	
21	Parmi les 18 à 21 cas suspects testés	Au moins 7 RDT positive	

Testing of RDT sampling schemes in a real-world setting

(Data collection in progress [data analysed up to the 29.04.2024]: Preliminary and Incomplete Results)



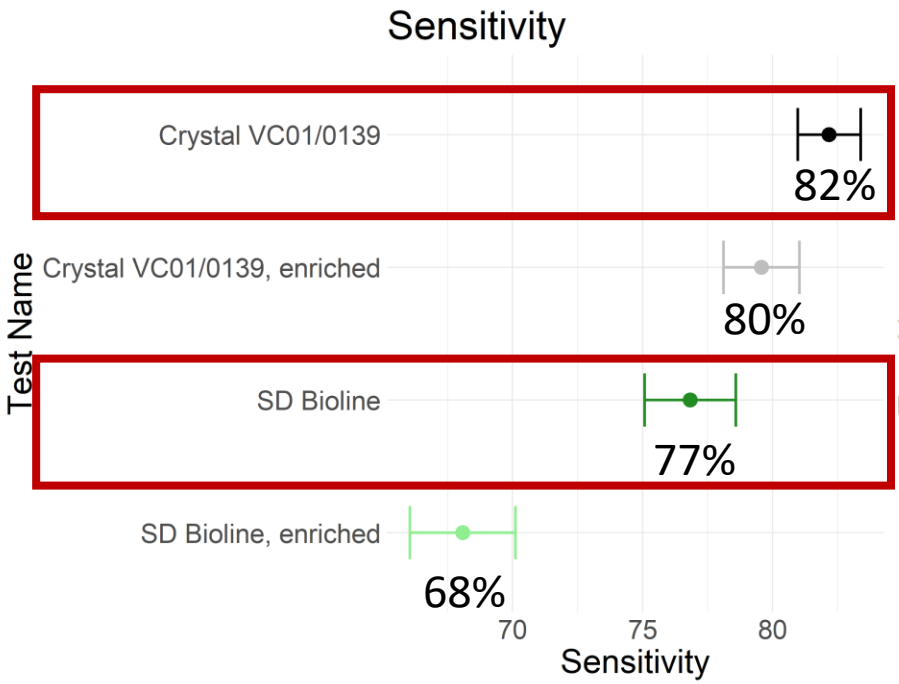
Whole study period	Sampling scheme: overall			Sampling scheme: only days with >3 cases		
Health Zones	CTC days with cases	Correct applied	Correct(%)	Days >3 cases	Correct applied	Correct(%)
Data until 14.12.2023						
Mukanga	5	3	60%	0	0	-
Mulongo	226	166	73%	24	7	29%
After Re-training (15.12.2023 until 29.04.2024)						
Mukanga	117	98	84%	15	2	13%
Mulongo	148	144	97%	1	0	0%

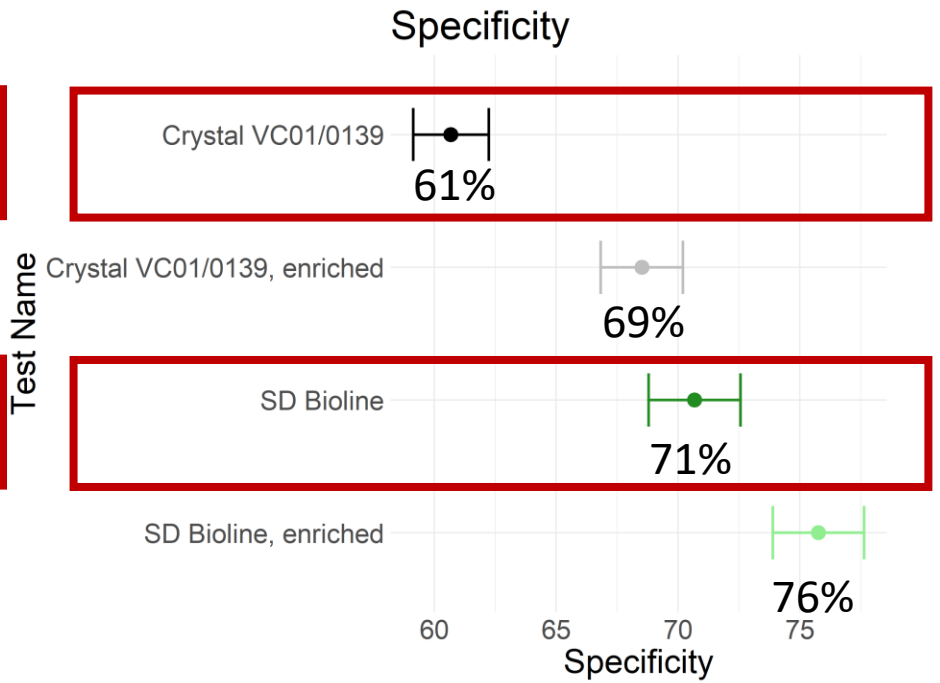
RDT performance

(Data collection in progress [data analysed up to the 29.04.2024]: Preliminary and Incomplete Results)

No qPCR results yet avaliable

Gold standard: culture





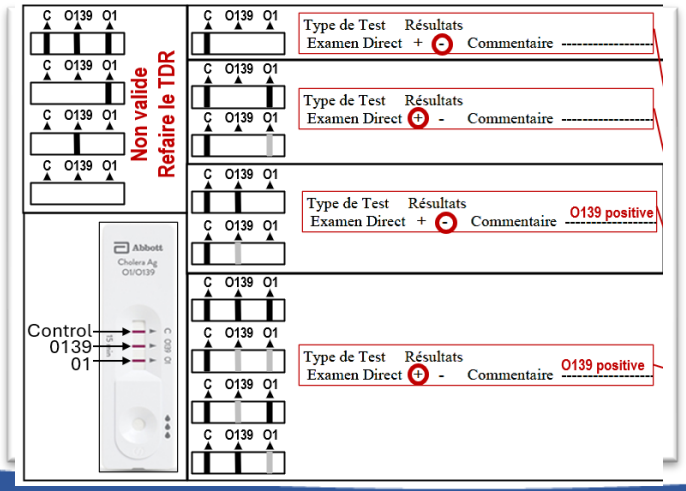
RDT application observations

	Average time	SOP step compliance
Stool collection	2:44 min	83% (4 steps)
RDT preparation	5:05 min	88% (10 steps)
Reading and recording	4:50 min	72% (8 steps)
Total	**12:39* min**	

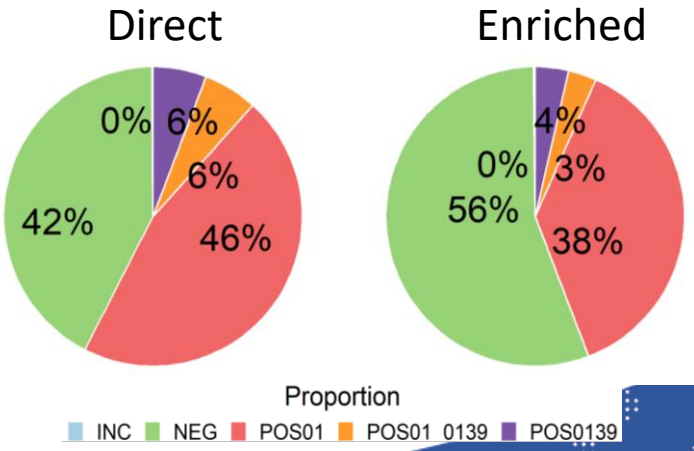
*Excluding 15-30 minutes until result reading

Main challenges

Result interpretation



Crystal VCO1/O139



Conclusion

- Over **10,000 suspected cases were included** in DRC (up to April 29, 2024), with the study planned for continuation until the end of June 2024.
- Comparing the performance to the RDTs (with and without enrichment) showed **highest sensitivity for the Crystal VC O1/O139**.
- Preliminary analysis, including only three sampling schemes (with further comparisons underway), has revealed a **convergence in incidence rates** between **exhaustive testing** and the examination of solely the **first three suspect cases** daily per structure.
- Applying a sampling scheme (e.g. RDT testing of first 3 patients/day/structure) might allow to conserve few RDTs in low-incidence settings, however, in **high-incidence settings** almost **two-third of the RDTs can be saved**.
- In a health zone with minimal study team implication, a **probable outbreak was correctly detected** using the **GTFCC probable outbreak threshold**.
- The **change in sampling scheme** after reaching the GTFCC threshold showed to be challenging. More training and supervision likely necessary.

Merci à tout le monde

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Sibylle Gerstl
Manal Shamseldin
Pierre Kasongo
Jonas Kamono
Begge Kayembe

PNECHOL

Dr Placide WELO OKITAYEMBA

DPS/BCZ/CTC

All MCZs

All CTC nurses

Labo

Dr Daniel Mukadi

DR Jaques Muzinga

Mode of data transmission

Notifiable diseases (aggregated weekly cholera cases)

National (Kinshasa)

Surveillance Department (DSE)

Province

Provincial Health Division (DPS)

Health Zone (ZS)

Health Zone Office (BCZ)

Health area (AS)

Health Center (CS)

Health area (AS)

CTC/CTU