Applying a standardized, molecular entomology data labeling system in Ghana to effectively integrate into central DHIS2 database

RBM 18th Annual Meeting
Vector Control Working Group

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Feb. 2023

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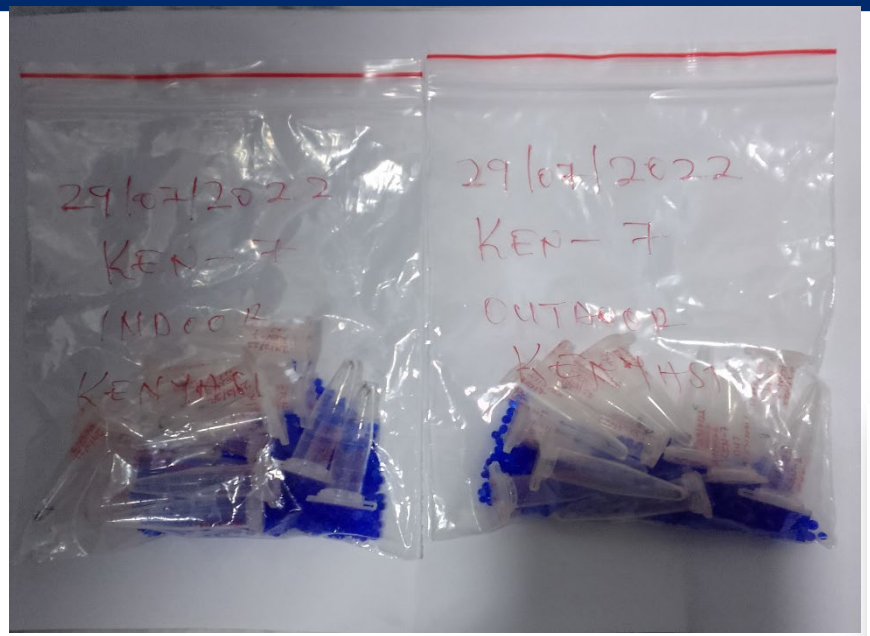
Introduction

- The PMI VectorLink project uses entomological data to inform and monitor vector control interventions.

- Molecular data, including species identification, detection of sporozoites and genetic marker of insecticide resistance, inform implementation of targeted vector control.

- Molecular data management is complex, often fragmented, and rarely integrated into existing entomology and vector control information systems.

Introduction: Previous System in Ghana



- Handwritten labelling on Eppendorf tubes and Ziplock bags.

- Mosquito data entered on paper forms.

- Paper forms later entered into excel for analysis

Sample shipment form for molecular analysis (samples from HLC)

Project: PMI VectorLink GHANA

No.	District	Community/Village	House no.	Collection method	In/Out	Hour of Collection	Collection date	Sample ID No.	Morpho ID
1	TML	Kulaa	KLV-17	HLC	In	1-2	17/03/2019	KuL-01	Ag.
2	TML	Kulaa	KLV-17	HLC.	In	4-5	17/03/2019	KuL-02	Ag
3	TML	Kulaa	KLV-17	HLC.	In	4-5	17/03/2019	KuL-03	Ag.
4	TML	Kulaa	KLV-17	HLC	In	3-4	17/03/2019	KuL-04	Ag.
5	TML	Kulaa	KLV-16	HLC	Out	10-11	✓	KuL-05	Ag
6	TML	Kulaa	KLV-16	HLC	Out	10-11	✓	KuL-06	Ag
7	TML	Kulaa	KLV-16	HLC	Out	10-11	✓	KuL-07	Ag.
8	TML	Kulaa	KLV-16	HLC	Out	12-1	✓	KuL-08	Ag
9	TML	Kulaa	KLV-16	HLC	Out	12-1	✓	KuL-09	Ag.
10	TML	Kulaa	KLV-16	HLC	Out	5-6	✓	KuL-10	Ag.
11	TML	Tugu	TGV-02	HLC	In	12-1	✓	TuG-01	Ag.
12	TML	Tugu	TGV-05	HLC	In	2-3	✓	TuG-02	Ag.
13	TML	Tugu	TGV-05	HLC	In	5-6	✓	TuG-03	Ag.
14	TML	Tugu	TGV-05	HLC	Out	10-11	✓	TuG-04	Ag.
15	TML	Tugu	TGV-05	HLC	Out	1-2	✓	TuG-05	Ag.
16	TML	Tugu	TGV-02	HLC	Out	3-4	✓	TuG-06	Ag.
17	TML	Tugu	TGV-02	HLC	Out	4-5	✓	TuG-07	Ag.

Objective

Implement a mosquito labeling system to enable direct links between the entomological collection and the molecular data sets within a central DHIS2 database, called VectorLink Collect, ultimately increasing sample tracking and data use.

Method

- Implemented a dual code system, allowing field technical teams to register mosquitoes in the field across 8 sentinel sites.

Printed scannable QR labels on pre-cut stickers in central office.

	031222-BAN1-OPK
	031222-BAN4-OPK
	031222-BANH1R2-IPK

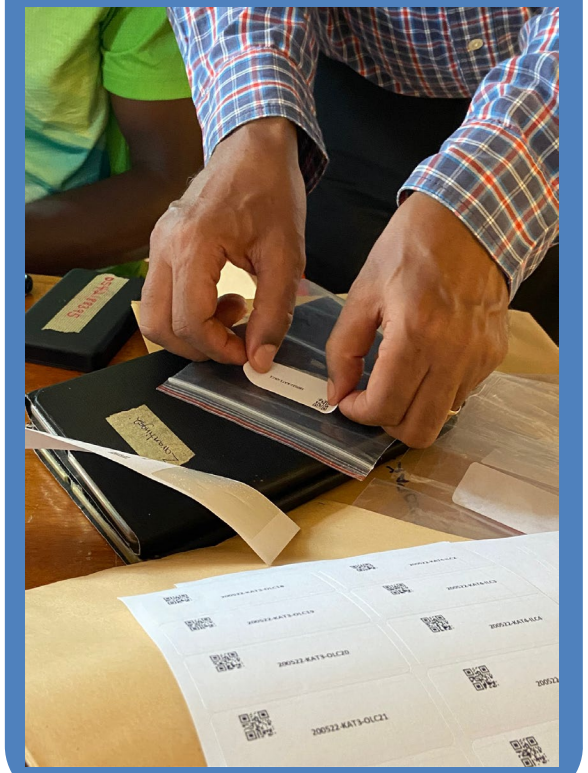
Trained three technician leads to label collection bags and register mosquito samples in Excel.

Distributed handheld scanners and 2,080 pre-cut printed labels to field teams before deployment.

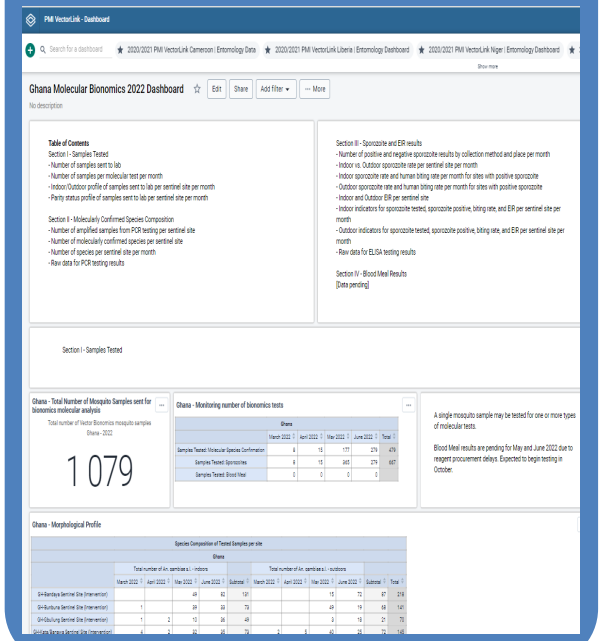
Method

Conducted field mosquito collections, with data capture mobile devices (tablets).

Affixed scannable collection labels to mosquito bags.

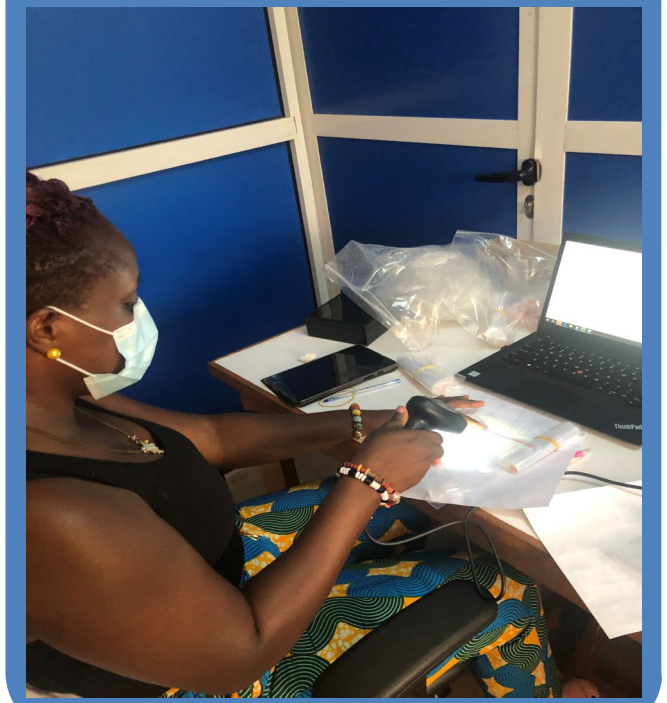


Used vector bionomics data available in DHIS2 to calculate needed sample sizes for laboratory analysis.

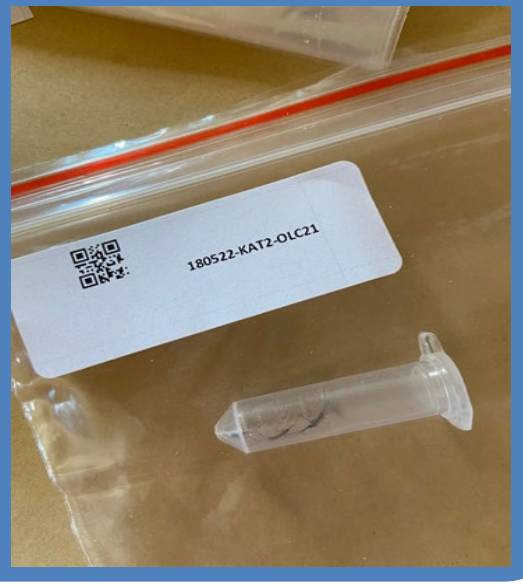


Method

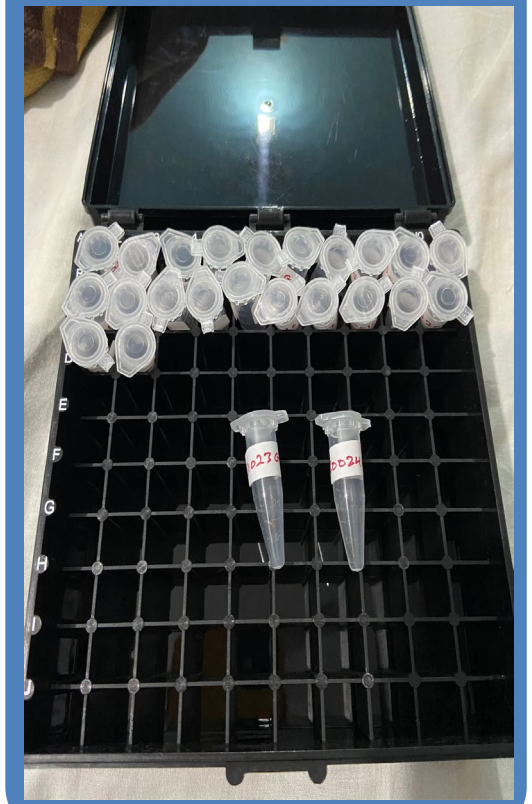
Scanned QR labels to register selected samples in the structured Excel.



Labeled selected samples with unique identifier and included duplicate label in collection bag for archiving.



Sent to laboratory for lab analysis.



Results

- **Dual code system adapted** for field-based registration and multiple points of entry for laboratory data.
- Efficiently printed and distributed 2,080 collection labels per month, allowing for faster mosquito sample processing and timely available results on DHIS2 dashboard.
- Pre-printed collection labels replaced manual writing on bags, **eliminating an estimated 5 errors per month**.
- Auto-population from scanning replaced duplicated manual data entry in the laboratory, **eliminating approximately 46 errors per month** in Excel and on tubes.

Results

Dashboard developed on VectorLink Collect to immediately report on commonly used molecular entomology indicators, **eliminating routine external data analysis.**

Ghana - Total Number of Mosquito Samples sent for bionomics molecular analysis

Total number of Vector Bionomics mosquito samples
Ghana - 2022

2 605

Ghana - Monitoring number of bionomics molecular tests

Ghana							
	March 2022	April 2022	May 2022	June 2022	July 2022	August 2022	Total
Samples Tested: Molecular Species Confirmation	8	15	177	279	456	778	1 713
Samples Tested: Sporozoites	8	15	365	601	620	846	2 455
Samples Tested: Blood Meal	0	0	0	0	0	0	undefined
Total number of Vector Bionomics mosquito samples	8	15	431	625	638	888	2 605

Ghana - Morphological Profile

Species Composition of Selected Samples per site														
Ghana														
	Total number of An. gambiae s.l. - indoors							Total number of An. gambiae s.l. - outdoors						
	March 2022	April 2022	May 2022	June 2022	July 2022	August 2022	Subtotal	March 2022	April 2022	May 2022	June 2022	July 2022	August 2022	Subtotal	Total

Discussion/Conclusions

- The pilot improved mosquito sample labeling standards and enabled bulk upload of molecular data into the global DHIS2-based system.
- VectorLink Ghana has expanded this QR Coding approach to samples for insecticide resistance testing.
- PMI VectorLink project plans to expand the system to other PMI focus countries to improve integrated data analysis.
- The system is cost effective and uses accessible software, such as MS excel, open-source DHIS2, and a WHO-developed application, called Bulk Load.

Acknowledgements

PMI VectorLink Global Support team	PMI VectorLink Ghana	U.S. President's Malaria Initiative
Marianne Parrish	Edem Obum	Melissa Yoshimizu
Allison Hendershot	Louisa Antwi-Agyei	Jennifer Armistead
Yemane Yihdego	Osei Akuoko	
Matthew Boddie	Lena Kolyada	
Matthew Kirby		
Kathryn Stillman		

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