Driving Efficiency and Cost Assessment in Laboratory Waste Management

Launch of the Waste Cost Assessment Framework (WCAF) v2.0 Tool

Monte Martin, MPH; MLS, QLS (ASCP)
Lead, Laboratory Systems Strengthening Team
International Laboratory Branch
Division of Global HIV and TB
Global Health Center
Centers for Disease Control and Prevention

Anafi Mataka, BSc., MPH
Head of Division
African Society of Laboratory Medicine

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Louis Ekome, B.Pharm, MBA
Strategic Roche Healthcare Consulting Partner
Strategic Planning and Innovation Chapter
Roche Diagnostics, Africa Subregion.

Orji Bassey, MSc, FWAPCMLS, PhD.
Laboratory Systems and Service Delivery Specialist
U.S. Centers for Disease Control and Prevention
U.S. Embassy Abuja

Objectives

- A project under a strategic Public-Private Partnership
- Background on the challenges for operational laboratory waste management
- Evolution of the Waste Cost Assessment Framework (WCAF) from v1.0 to v2.0
- The new version of the WCAF Tool – v2.0
- The benefits & improvements based on user feedback
- Nigeria's experience and the way forward

CDC - Roche Public-Private Partnership (2022- 2026)

Lab Networks for Health

"The Division of Global HIV and Tuberculosis (DGHT), Center for Global Health (CGH), Centers for Disease Control and Prevention (CDC), Department of Health and Human Services of the United States of America, and Roche Diagnostics International Ltd (Roche) share a common goal of strengthening laboratory systems and diagnostic networks in countries severely affected by HIV and tuberculosis (TB). DGHT and Roche seek to share their respective strengths, experience, methodologies, and resources in order to pursue the next phase of a previously implemented Public Private Partnership (PPP) to strengthen targeted laboratory systems to improve HIV and TB prevention, detection, and treatment outcomes."

Participating organizations for the WCAF project

- **The CDC, International Laboratory Branch (ILB) and Roche Diagnostics (through Roche Healthcare Consulting)** provide resources and technical assistance for the project.

- The ILB and the **CDC country office in collaboration with Ministry of Health (MOH)** representatives in Eswatini, Ethiopia, Kenya, Lesotho, Malawi, Nigeria, Uganda, Zambia, and Zimbabwe will provide different levels of support to this project as needed.

- **African Society of Laboratory Medicine (ASLM)** provides a platform for sharing information, tools and resources that support clinical, policy, programmatic, technical and scientific aspects of the implementation of viral load waste management

Disclosure

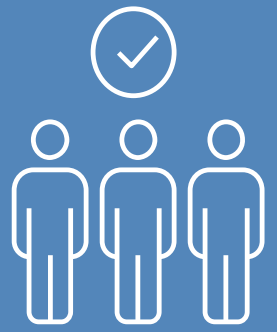
Governance & Neutrality

- Legal safeguards: Consulted respective legal teams to avoid any competitive advantage for Roche
- Project support occurred via Roche Healthcare Consultants , a unit within Roche for the purpose of supporting clients' needs in areas of complex problem solving- RHC is not incentivized based on revenue delivery from business products
- Project provides no direct benefit to Roche Diagnostics
- Manufacturer-agnostic
- CDC HQ and Roche do not request or have access to country-level data generated by the tool

Healthcare Waste Management Challenges

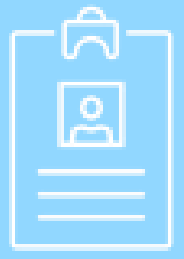
Increasing volumes of operational waste

By 2030, more than 30M HIV VL tests will be performed globally[1] plus TB & other ID testing



Improper & inadequate management of waste

Poses a significant threat to public health & the environment including GTC, other chemicals, plastics/consumable



Assistance required for standardization & budgeting

Need to quantify & sustainably address waste resulting from ID testing across laboratories

[1]Habiyambere V, Dongmo Nguimfack B, Vojnov L, Ford N, Stover J, Hasek L, et al. (2018) Forecasting the global demand for HIV monitoring and diagnostic tests: A 2016-2021 Analysis. PLoS ONE 13(9): e0201341. https://doi.org/10.1371/Journal.pone.0201341

Our goals from this collaboration

Support the quantification of waste from molecular diagnostics platforms for infectious disease testing.

Create a next generation tool building on v1.0 to support infectious disease laboratories in budgeting for appropriate waste management as part of their internal and external budget requests

Building awareness and supporting data generation to help ensure waste generated within ID laboratories can be effectively and appropriately managed

WCAF v1.0 Recap

Purpose & Scope

- Developed to measure laboratory waste generation and accurately calculate associated management costs
- Scope focused on HIV Viral Load (VL) and Early Infant Diagnosis (EID) testing
- Included all major VL & EID platforms from multiple manufacturers (manufacturer-agnostic)

Key Features

- Excel-based tool for initial deployment
- Recognized all key variables in waste disposal from VL & EID instruments
- Allowed laboratories to forecast liquid and solid waste volumes accurately
- Simplified historical Country Operational Planning (COP) through standardized cost aggregation

Impact

- Provided baseline data for waste cost analysis
- Supported early cost-quantification strategies for internal and external budget requests
- Enabled labs to communicate true waste disposal costs to country-level program managers
- Designed as an easy-to-use tool for broad adoption across programs

WCAF v1.0 Tool Development and Dissemination

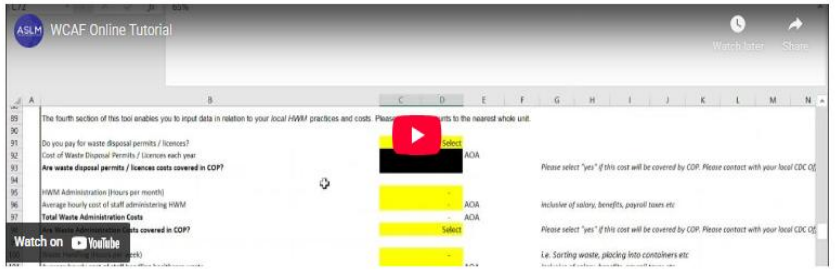
- **Phase 1 & 2** of development were in collaboration with country teams in Kenya, Nigeria and Zambia

- **Functional assessment** across Eswatini, Ethiopia, Kenya, Malawi, Nigeria, Uganda, Zambia, & Zimbabwe

- **Launched** February 8,2022 via African Society for Laboratory Medicine LabCoP webinar and tool/training video available within the ASLM Resource Center
    - Webpage views = 1,948*
    - WCAF v14.2 tool downloads = 346*
    - WCAF online tutorial views = 483

- **Questionnaire in December 2022**, captured feedback on accessibility, use, outcomes, recommendations and funding acquired as a result of using the WCAF tool in HIV VL/EID laboratories in 9 countries

- **Poster of outcomes** presented at the ASLM conference in Dec. 2023



https://aslm.org/resource/the-hiv-laboratory-waste-cost-assessment-framework-wcaf/ * For the period 2/8/2022- 2/5/2026

Countries' positive experiences with WCAF tool

7/9 countries would recommend its use to other organizations & have implemented **changes to their waste management systems***

3 countries secured funding for waste management totalling over US$500K**

Tool helped in **"building awareness"** and **"comprehensive estimates** of generated biohazardous waste"

"Yes, it is good tool to quantify waste"

"Pouring liquid waste down the drain was discouraged. …..instituted routine assessment visits to monitor waste management ….implementation of biosafety and biosecurity best practices."

*1 country stated "yes" with some modifications.
**As of Dec 2023

Key Lessons Learned

Modernize the tool architecture to transition from Excel-based to web-based for improved scalability and user experience

Improve clarity of data fields and guidance to ensure accurate and standardized data entry

Expand functionality to capture integrated testing and waste streams (e.g., non-HIV, POC platforms)

Why WCAF v2.0

Broaden Scope

Improve Usability

Leverage Global Insights

Enable Accurate Forecasting

What’s New in v2.0

Updated cost calculation methodology

Enhanced reporting and visualization tools

Expanded scope for diverse waste streams

Web based tool

WCAF v2.0 Development and Functional Assessment

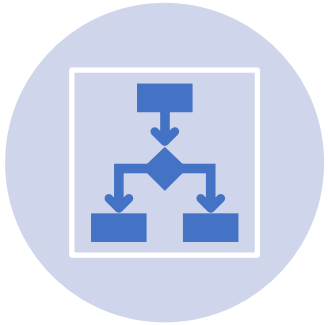
- **Fieldwork Approach**
  - Direct observation through continuous monitoring at participating laboratories
  - Labs selected by CDC in-country offices and Ministries of Health, in consultation with Roche Healthcare Consulting (RHC)
- **Observation Process**
  - Conducted jointly by Roche team and laboratory staff (assigned by Lab Director)
  - All instrument interactions handled by lab personnel to ensure safety
  - Observations focused only on waste generated during test result production
  - Data recorded using the Direct Observation Checklist template
- **Methodology for data assessment**
  - Executive interviews conducted by RHC for strategic insights
  - Weighing scales used for accurate waste measurement as needed
- **Data sources needed to program the tool**
  - Labs across Ethiopia, Kenya, Nigeria, Zambia
  - Waste generated by molecular platforms including Abbott, Cepheid, Hologic, Molbio and Roche
  - Assays including HIV VL, EID, TB, Hepatitis B & C, HPV and COVID-19
  - Gathered based on normal or average runs over the course of a week in each lab
- **Functional Assessment**
  - 66 respondents from Labs across 7 countries- Ethiopia, Kenya, Lesotho, Nigeria, Uganda, Zambia, Zimbabwe, were provided the beta version of the online tool to enter data and provide feedback via a questionnaire

Platform	Assay	Total Samples Processed
Panther	HIV-EID	443
cobas 4800	HIV-EID	292
cobas 6800	HIV-EID	837
m2000	HIV-EID	48
Alinity m	HIV-VL	5,988
cobas 8800	HIV-VL	372
Panther	HIV-VL	8,781
cobas 4800	HIV-VL	6,629
cobas 5800	HIV-VL	10,273
cobas 6800	HIV-VL	8,277
m2000	HIV-VL	3,906
GeneXpert	HPV	63
Panther	HPV	267
cobas 6800	HPV	188
GeneXpert	MTB	318
TrueNat	MTB	58
Total number of samples		46,740

Benefits & Impact

Operational Efficiency

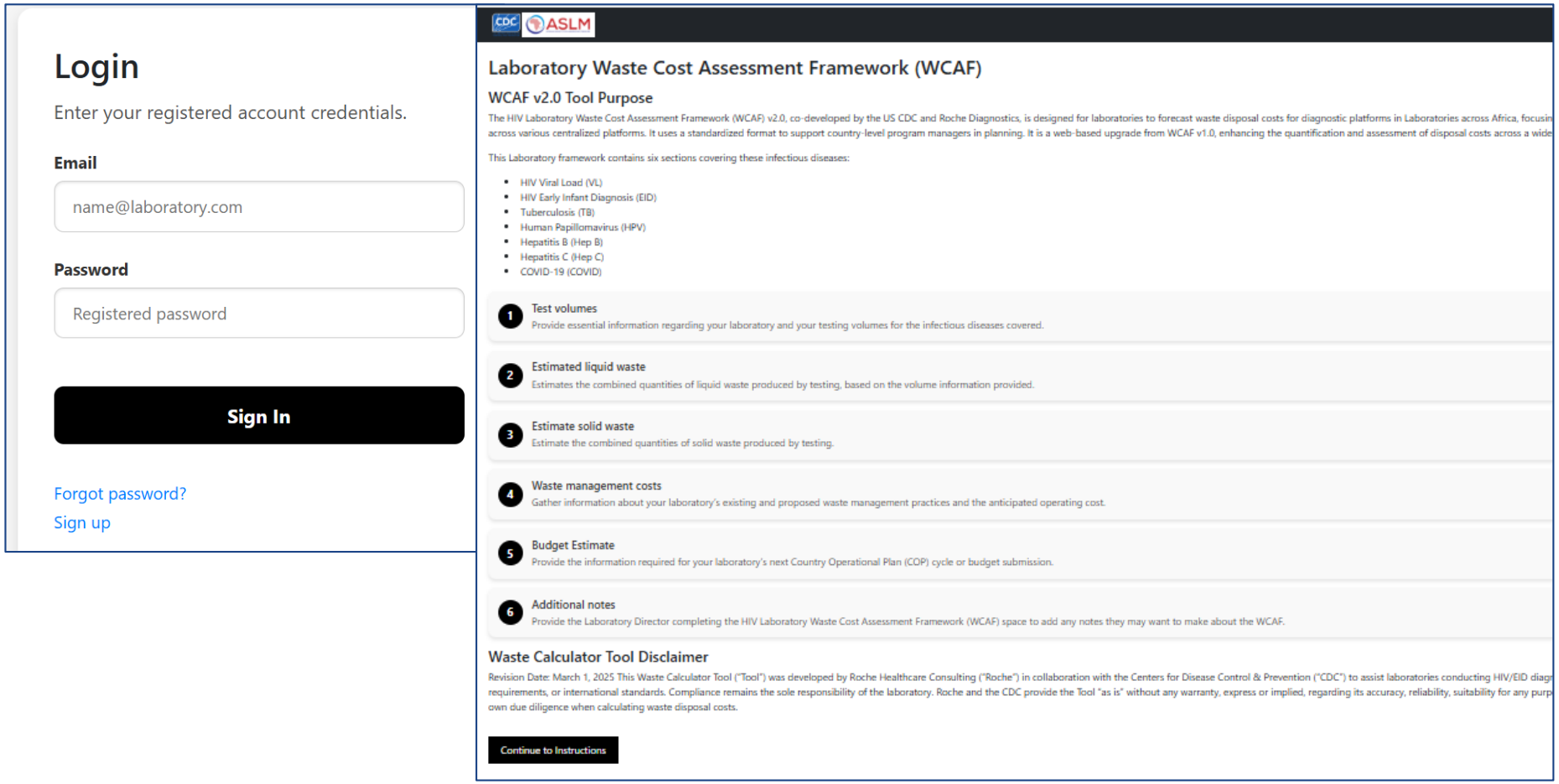
Compliance



Strategic Decision-Making

Real-world Impact

WCAF v2.0: Key Attributes

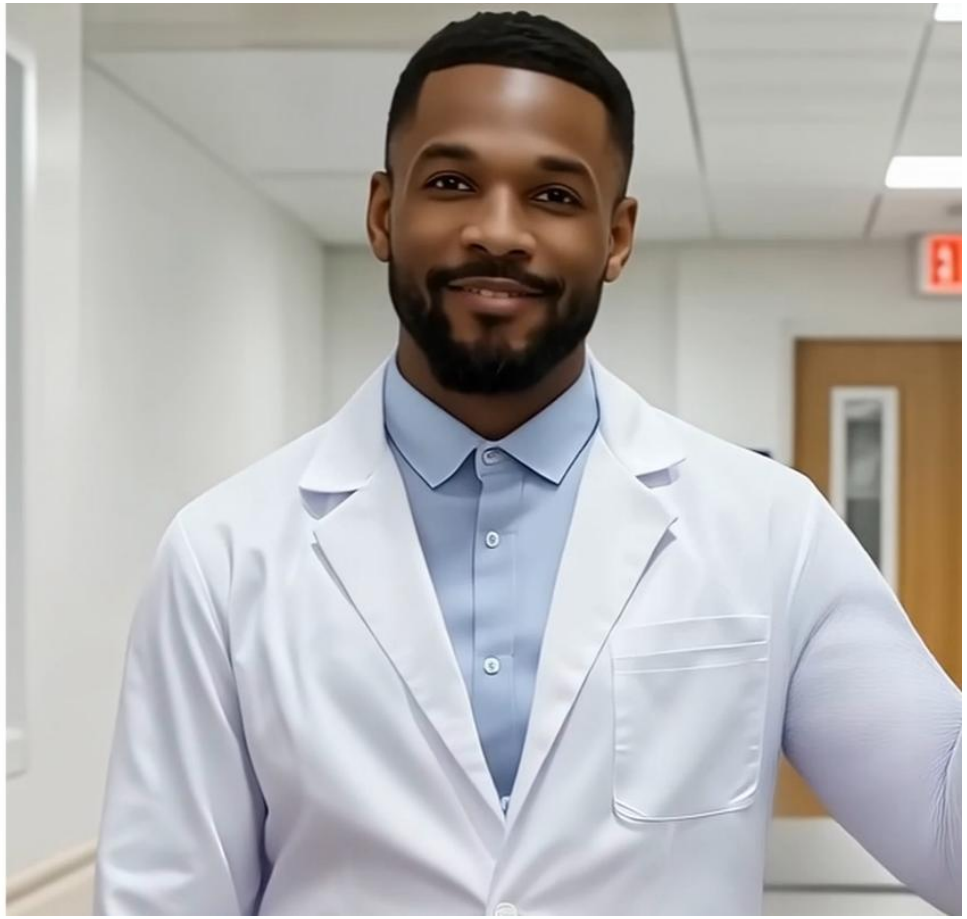


HIGHLIGHTS

- Web- based tool. Web address will be provided to laboratories for the functional assessment.
- Comprehensive instructions for use
- The tool is intentionally designed to rely on readily available or easily accessible lab data, with automated calculations for ease of use
- The tool is intended to be completed by the laboratory manager or director, with support from their operational team as needed.

Demonstration

Waste Cost Assessment Framework (WCAF) v2.0 Tool Demo



[WCFA v2.0 Tutorial | How to Use ASLM's Waste Cost Assessment Framework (Web-Based Tool)]

Nigeria Experience and Lessons Learned from WCAF version 1.0

Successes

- Informed us that we can track waste types:
  - Solid infectious and non-infectious
  - Liquid waste containing guanidine thiocyanate (GTC)
- Gave the Nigeria team an insight on how to estimate the costs associated with waste processing, handling and disposal (waste management)
  - Provided further insights on different waste mitigation strategies suitable for Nigerian context including the procurement of a high temperature incinerator equipped with a pollution control system.
  - Implementing the wcaf v1.0 attracted about $200,000 COP funding
- The practice of flushing GTC liquid waste was successfully discouraged across all supported PCR laboratories

Insights for Improvement

- Focused only on one Disease entity – HIV.
- Testing equipment were also focused on HIV VL and EID testing
- Difficulty in estimating cost using the WCAF tool v1.0 as currency conversion grossly overestimates cost when displayed in local currencies
- Difficulty in estimating energy consumption for relevant equipment.
- Laboratory staff unable to secure management cooperation in sharing administrative costs on waste management at various healthcare facilities.
- WCAF v1.0 Was not readily implemented across all supported PCR laboratories due to limited knowledge and associated grey areas surrounding completion of the tool
- Overall, tool is not completely user-friendly
- The WCAF v1.0 functional assessment was unable to successfully determine the volume of water required to completely flush the liquid contents of the GTC down the drain.

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Nigeria Experience and Lessons Learned from WCAF version 2.0

Successes

- The WCAF v2.0 covers multiple disease entities and their associated testing plat forms
- Completion instruction is clearer and well-simplified
- It is web-based and can be completed at convenience
- A scientific protocol was developed to establish a national network for hazardous waste management in Nigeria, based on the WCAF.
- Currency conversion better when compared with previous version as it mimics real life costing experiences
- The WCAF v2.0 was employed during COP funding allocation and budgeting
- Overall, the WCAF tool v2.0 is user-friendly

Insights for Improvement

- The laboratory managers are unable to see what was inputted in this web-based WCAF v2.0 format and cannot readily monitor implementation using the WCAF tool v2.0
- Buy-in from the host government has been slow and difficult due to government program prioritization
- Inclusion of other funding option: host government funding sources (national, state or local government), USG/global fund/other donor agencies or private organizations etc.

ASLM Engagement

Materials Hosting – ASLM will serve as the central hub for WCAF resources and training materials

Monitoring & Evaluation – Tracking adoption and performance metrics to measure impact and identify gaps

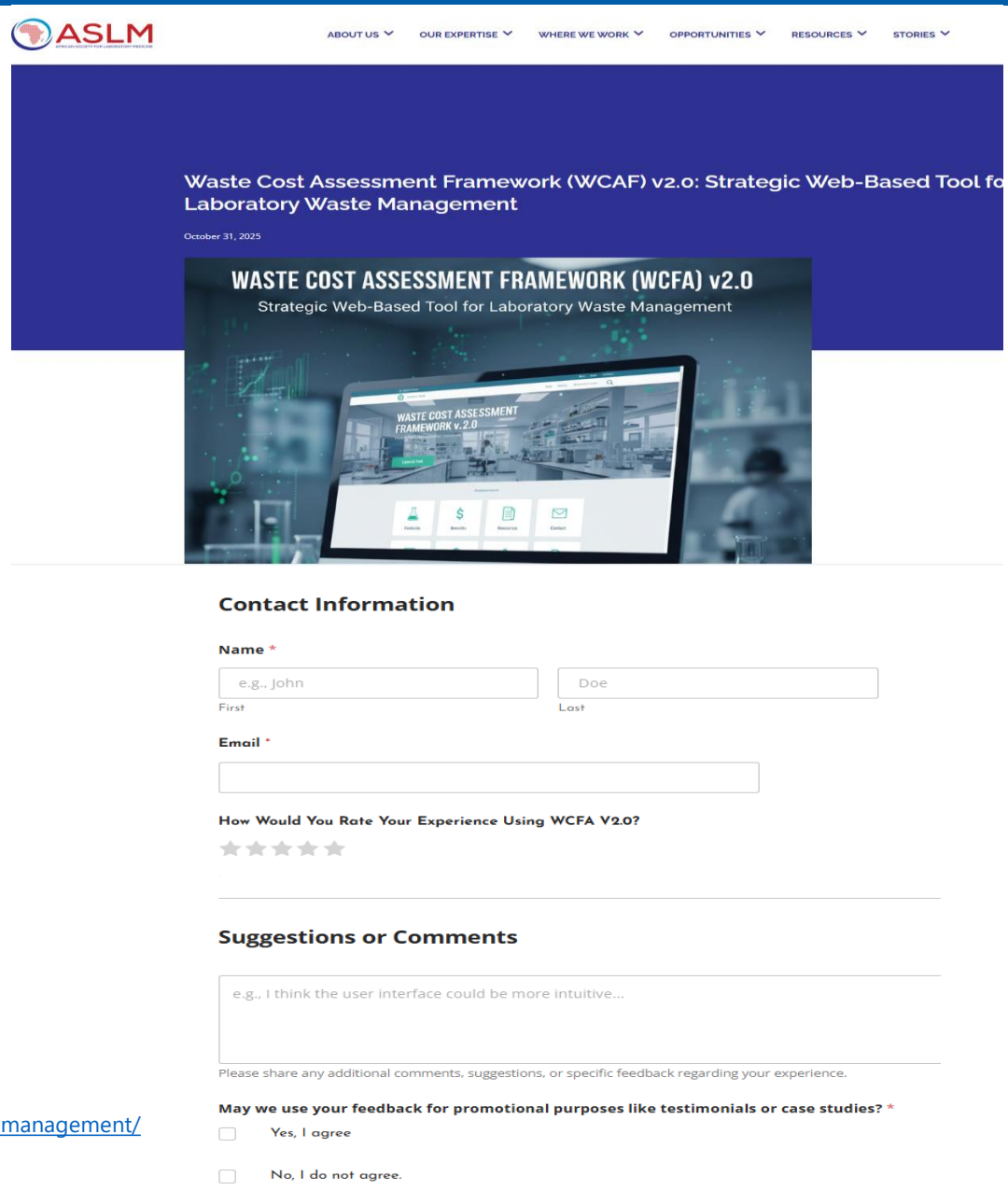
A structured feedback mechanism will allow users to report issues and propose tool improvements

Insights from users will feed into future tool improvements, ensuring sustainability and relevance

Next Steps

- Feedback process
  - Comment box on ASLM website
  - Feeback form in the WCAF v2.0 tool (after login)
  - For any questions around the use of the waste management tool contact Monte D. Martin (gqe5@cdc.gov) and David Bressler (dpb8@cdc.gov)

- Action items for participants
  - Use the tool for evidence and funding decisions
  - Collaborate with peers
  - Disseminate information learned from this session



https://aslm.org/resource/waste-cost-assessment-framework-wcfa-v2-0-strategic-web-based-tool-for-laboratory-waste-management/

Acknowledgements

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Questions