



2.1 Technical Application

OpenMRS Quality Assurance for Interoperability

Final Technical Application
Submitted July 24, 2020

Contact Information: Jan Flowers, MS, jflow2@uw.edu; Jennifer Antilla, MPH, jantilla@uw.edu;

This application is valid for 90 days from the date of submission.

Two-Sentence Overview

OpenMRS aims to advance our shelf-readiness by producing high-quality interoperable software and increasing trust in our system through rigorous, comprehensive, systematic quality assurance. By bringing together experienced community members and collaborating with other global goods communities, this investment will be used to 1) extend OpenMRS automated test portfolio, 2) address QA for OpenMRS interoperability testing, and 3) strengthen the adoption of the improved QA for community-wide utilization and conduct dissemination of a QA model to the broader global goods community.

High-Level Budget Summary

	Work Package 1 Assuring a quality, shelf-ready and standalone OpenMRS Reference Application.	Work Package 2 Develop shelf-ready interoperability test cases to support priority EMR interoperability workflows.	Total Cost (USD)
Total Project Costs	\$49,256.95	\$49,256.95	\$90,254.75**

**** UW NOTE ABOUT IDC:** The "Total Cost" column in the below table is not equal to the sum of work package 1 and work package 2, due to an adjustment that is made to the indirect costs (IDC) charged by the University of Washington Biobehavioral Nursing and Health Informatics (UW BNHI) Department when subcontracts are over \$25,000. If only one of the work packages is awarded, the IDC is applied to the full work package due to the subcontract being <\$25,000. If both are funded, then the IDC is applied to the full package, where UW BNHI only charges IDC on the first \$25,000 of a subcontract.

Executive Summary

Founded in 2004, OpenMRS is a high quality, open source, integrated electronic medical records platform (EMR) aimed at resource-constrained settings where structured patient record keeping systems can

support improved care delivery and help achieve health equity. As OpenMRS continues its growth in over 5,500 health facilities in 60 countries to date, it increasingly is recognized as a de-facto EMR standard, supported by the OpenMRS community.

At OpenMRS, we contend that a critical factor of shelf-readiness is a user being able to trust the product. This trust is earned through rigorous, comprehensive, and systematic quality assurance testing and protocols; thus, quality assurance is an integral part of building shelf-ready, standalone, and interoperable OpenMRS technical products. With funding from Digital Square Notice C, the OpenMRS Quality Assurance (QA) Team was established to improve community quality assurance processes and tools. As a first step, our QA Team identified an initial set of priority test cases to automate with the OpenHIE testing framework. As a result, OpenMRS is the first global good trialing the adoption of the OpenHIE testing framework into a community QA process and tooling for OpenMRS products.

With additional funding, the OpenMRS QA team can a) expand the set of automated tests for full product release and system interoperability testing, b) participate in the generalizability of the OpenMRS test portfolio for standard EMR/EHR testing in the Instant OpenHIE ecosystem, and c) transition the QA process from emerging to established, community-owned and community-wide standard. Our consortium will achieve these objectives by fostering collaborative work between the OpenMRS QA Team and the larger OpenMRS community, including the FHIR Module Squad and OpenMRS implementers, OpenHIE subcommunities such as the LIS CoP and Client Registry CoP, and Instant OpenHIE representatives. The QA Team's current scope of work and relationships with these stakeholders serves as a foundation for future collaboration. The QA team recently explored an approach for integrating this process and tooling into the FHIR Squad project to support their work on EMR-LIS and EMR-SHR use cases. The OpenMRS QA team is well positioned to serve as an advocate and leader for how other global goods can adapt the model and tooling to their community and products, resulting in Shelf-Readiness improvements to the global goods domain as a whole.

Consortium Team

In 2019, UW CIRG and OpenMRS partnered to lead OpenMRS QA Team work as well as the OpenMRS FHIR Squad project. Our consortium team reflects our commitment to supporting the OpenMRS QA Team and FHIR Squad by continuing this partnership.

UW CIRG (University of Washington Clinical Informatics Research Group) is one of the premier global health informatics organizations, specifically working to advance digital health global goods and the communities supporting them. CIRG has contributed substantially to multiple digital health communities, and led numerous large-scale informatics grants and programs around the world in partnership with global health funders and Ministries of Health. CIRG faculty member Jan Flowers serves as Chair of the Board of Directors of OpenMRS, a member of the Board of Directors for OpenELIS, and is the co-founder and project co-lead of the OpenHIE Laboratory Information Systems Community of Practice. In addition, CIRG staff member Jennifer Antilla has served as the Director of Community for OpenMRS for nearly 2 years, successfully supporting the development of a new governance model that included the decentralization of decision making into small committees focused on specific aspects of the product, strategy, or operations of the community. Ms. Flowers and Ms. Antilla have over a decade of experience working on OpenMRS and other global goods and HIS architectures in real-world LMIC implementations. They have each led multiple national-level OpenMRS architecture, implementation, and interoperability projects, including in Kenya (KenyaEMR), Haiti (iSantePlus), Mozambique (eSaude), and Vietnam (eClinica). Ms. Flowers has been the lead interoperability architect for Haiti, Kenya, Cote d'Ivoire,

Mozambique, and Vietnam health programs. Ms. Flowers and Ms. Antilla are the founders of the OpenMRS Quality Assurance team and is an ongoing required operational group and process within the community.

OpenMRS, Inc. OpenMRS is an open source EMR and community that functions as a consortium, with many organizations working in LMICs supporting the work of individual OpenMRS contributors. As such, the community seeks to engage and motivate both volunteers and supporting organizations to actively contribute to all aspects of the software development and implementation process. OpenMRS is the home for the OpenMRS Quality Assurance team, with the expectation that this emerging team, led by the UW currently, will transition to a core operational component of the OpenMRS community long-term and will be funded under the OpenMRS core operational budget after that transition in the next few years once the QA process and adoption has been fully established. The OpenMRS Quality Assurance team has led the first global good community pilot of the OpenHIE test management platform. In addition, the QA Team has established a need for and disseminated lessons learned in how to manage the required culture change in a global good community to build and incorporate comprehensive proactive quality assurance program as part of a core aspect in software development. This ultimately leads to increased trust and value in the products.

Background or Problem Statement

OpenMRS is utilized globally as the de facto EMR for LMIC, implemented in more than 5,500 facilities across 64 countries, serving ~12.5 million patients. Although OpenMRS is a mature software, QA processes have been largely left to developers to manage; resulting in limited and non-systematic testing that didn't involve the acceptance by implementers, which leaves low levels of trust in the safe and effective use of the product. With the establishment of the QA Team from Notice C, there has been a community-wide initiative to move from reactive QA to proactive QA by including both developer and implementer participation in the software release lifecycle, and through the initial steps to adopt the OpenHIE testing framework and tooling. Although well-received by the community, this more robust and systematic QA is in its infancy in establishing a community-wide comprehensive testing portfolio, and implementer product acceptance. The QA team has begun to explore how this process and use of the OpenHIE tooling can be disseminated to the broader global goods community and utilized by the OpenHIE subcommunities to address interoperability test standards with OpenMRS and EMRs in general.

Digital Health Technologies

OpenMRS The OpenMRS platform is a generic platform for developing electronic medical record (EMR) system implementations. It is designed to collect and manage patient-centric longitudinal medical data. The platform consists of a database, an abstraction layer between code and the database (i.e., Hibernate, a tool to map between Java objects and a database), a Java-based service layer, and a web services (a bespoke REST interface and a standard FHIR interface). The data model is heavily influenced by the HL7 reference information model and uses a central concept dictionary to define the data it contains. As a result, the system is very flexible – not focused on a specific vertical use case – and can be adapted for any patient-centric health solution. The platform is also designed to be modular, making it extremely extensible by allowing customizations to be added or removed to meet local needs.

Multiple APIs are available, supporting interoperability. Proven interoperability already exists between multiple systems, and, in fact, OpenMRS has been proven to support case based reporting using the OpenHIE architecture. We also use OCL for terminology support, and actively support this work. We have been working closely with OpenHIE, building and evaluating the ability of OpenMRS to share data

through the defined OpenHIE architectural stack. More information is available at <https://wiki.openmrs.org/display/docs/Technical+Overview>.

OpenHIE Test Management Platform OpenHIE utilizes the Cucumber Studio test platform for open source projects to be able to build the business test case and trigger automated test scripts for conducting comprehensive and systematic software testing. The test platform has solely been utilized by OpenMRS QA team thus far, and is early in understanding its full potential. The test management platform will require additional exploration and use by global goods community members to become a de facto standard for the global goods interoperability test management platform.

Use Cases and User Stories

As an OpenMRS user, I want to be able to use the system without bugs so that I am not interrupted or having to find workarounds to do my work.

As an OpenMRS implementer, I want to know that the products I am installing are rigorously tested and bug-free so that I do not experience system issues during installation or implementation that can slow or delay my workplans and deliverables, and affect future funding.

As an OpenMRS software tester, I want to be able to systematically test the OpenMRS products, even if I'm new to OpenMRS.

As a stakeholder in the public health system, I want to feel confident that I can make critical and timely decisions based on the data within the systems that are implemented.

As an OpenMRS software developer, I want to be able to have my code quickly systematically tested once it is integrated into the development branch so that I know if there are issues I need to fix before I can consider that work completed.

As an OpenMRS implementer, I'd like to make sure that features or changes that I requested work the way that I expected them and need them to work before I install the product at the site.

Objectives and Activities

Our consortium proposes two work packages. Work package 1 will expand the current portfolio of test cases managed in the OpenHIE test management platform, Cucumber Studio. Work package 2 will expand collaboration to include the FHIR Module Squad and OpenMRS implementers, OpenHIE subcommunities such as the LIS CoP and Client Registry CoP, and Instant OpenHIE representatives. Expanding this work will allow us to progress towards our goal of providing a quality, shelf-ready product and result in a significant gain in Shelf-Readiness for the OpenMRS products.

Work Package 1: Assuring a quality, shelf-ready and standalone OpenMRS Reference Application.

In work package 1, the team will focus on expanding the current portfolio of automated test cases for the OpenMRS reference application. The team will utilize several different methods to grow and strengthen the culture and the skillset within the OpenMRS community to develop automated test cases. The team will conduct OpenMRS University working sessions to work with community members on how to build out

the business test case in Gherkin, to develop the automated test script for each test case, and to work with the Cucumber Studio test platform to manage the software testing cycle. The team will recruit and engage community members to develop the prioritized test cases on the existing QA test portfolio roadmap, and integrate those into the OpenMRS testing. Finally, the team will conduct additional webinars, and working sessions with the broader global goods community through OpenHIE, to disseminate knowledge and lessons learned in utilizing the OpenHIE test management platform.

Objective 1.1: Automate priority Reference Application test cases using OpenHIE test framework.

Activity 1.1.1: Develop Reference Application test cases in Cucumber Studio-Selenium integration through OpenMRS University sessions and sprints

Activity 1.1.2: Integrate set of shelf-ready OpenMRS automated test cases into the OpenMRS Release Cycle

Activity 1.1.3: Document automated testing on OpenMRS Wiki

Objective 1.2 Disseminate lessons learned and knowledge to support the improvement of global goods quality

Activity 1.2.1: Identify specific global goods communities or stewards/implementers that are ready to use the OpenHIE test management platform and conduct specific 1:1 outreach to engage them, share lessons and knowledge

Activity 1.2.2: Conduct webinars and working sessions for showcasing and sharing knowledge of automated testing using the OpenHIE platform by the OpenMRS community and global goods domain

Work Package 2: Develop shelf-ready interoperability test cases to support priority EMR interoperability workflows.

In work package 2, the team will focus on identifying a core set of interoperability test cases for OpenMRS to exchange data with other systems in the OpenHIE architecture. By addressing interoperability test cases, OpenMRS will be able to integrate with the Instant OpenHIE project, as well as, leverage its experience with the OpenHIE testing framework and process to serve as an advocate and leader for adapting this model and tooling for other global good communities and products, resulting in Shelf-Readiness improvements to the global goods domain as a whole. The team will engage several OpenHIE subcommunities that already have developed a standards-based exchange specification and at minimum, a working prototype with OpenMRS - including the Lab Information Systems subcommunity, and the Client Registry subcommunity - and the Instant OpenHIE project team to collaborate in designing a test strategy using the test management platform. The team will then identify criteria for selecting prioritized interoperability test cases, and develop a roadmap for addressing those. The team will work with the OpenMRS FHIR squad to develop test cases as an initial set.

Objective 2.1: Automate interoperability test cases for the OpenMRS FHIR module and Instant OpenHIE.

Activity 2.1.1: Identify and prioritize interoperability test cases in the OpenMRS QA roadmap with input from OpenMRS community squads, developers, and implementers; OpenHIE CoPs; and from Instant OpenHIE project members

Activity 2.1.2: Develop automated interoperability test cases in Cucumber Studio-Selenium (OpenHIE test framework)

Activity 2.1.3: Conduct OpenMRS automated interoperability testing with Instant OpenHIE project

Activity 2.1.4: Document recommendations for how to generalize OpenMRS interoperability test cases to other EMRs, and use within the Instant OpenHIE project.

Community Feedback

This consortium expects to collaborate closely with the OpenMRS and OpenHIE communities of practice, and will actively engage other global good partners that are interested in developing robust test management portfolios utilizing the OpenHIE test management platform. The team will continue to lead the OpenMRS community QA team, engaging additional members for that team and contributors to the QA portfolio. The team will work directly with the Director of Product, the Technical Advisory Committee (TAC), and the individual community project squads to identify and develop priority test cases. In work package 2, the team will also specifically work with the OpenHIE subcommunities and the Instant OpenHIE project team to identify priority interoperability test cases and to conduct testing within the OpenHIE architecture.

Schedule

The following is a high-level work plan.

Key:

- OpenMRS QA Team (QA), University of Washington (UW), OpenMRS Community (OMRS), Global Goods (GG), OpenHIE Community (OHIE), Instant OpenHIE Project (IHIE)
- Responsible (R), Accountable (A), Support (S), Consult (C), Inform (I)

Activity	Team Location Month/ Quarter	Q1	Q2	Q3
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<i>Activity 1.1.1: Develop reference Application test cases in Cucumber Studio-Selenium integration through OpenMRS University sessions and sprints</i>	QA (R) UW (A) OMRS (S,C) GG, OHIE (I)	X	X	X
<i>Activity 1.1.2: Integrate a set of shelf-ready OpenMRS automated test cases into the OpenMRS Release Cycle</i>	QA (R) UW (A) OMRS (S,C) GG, OHIE (I)		X	X
<i>Activity 1.1.3: Document automated testing on OpenMRS Wiki</i>	QA (R) UW (A) OMRS (S,C,I)		X	X
<i>Activity 1.2.1: Identify specific global goods communities or stewards/implementers that are ready to use the OpenHIE test management platform and conduct specific 1:1 outreach to engage them, share lessons and knowledge</i>	QA (R) UW (A) OMRS (S), GG, OHIE (C, I)	X	X	X
<i>Activity 1.2.2: Conduct webinars and working sessions for showcasing and sharing knowledge of automated testing using the OpenHIE platform by the OpenMRS community and global goods domain</i>	QA (R) UW (A) OMRS (S), GG, OHIE (C, I)	X	X	X
<i>Activity 2.1.1: Identify and prioritize interoperability test cases in the OpenMRS QA roadmap with input from OpenMRS community squads, developers, and implementers; OpenHIE CoPs; and from Instant OpenHIE project members</i>	QA (R) UW (A) OMRS, OHIE, IHIE (S,C) OHIE, GG (I)	X		
<i>Activity 2.2.2: Develop automated interoperability test cases in Cucumber Studio-Selenium (OpenHIE test framework)</i>	QA (R) UW (A) OMRS, OHIE, IHIE (S,C) OHIE, GG (I)		X	X
<i>Activity 2.2.3: Conduct OpenMRS automated interoperability testing with Instant OpenHIE project</i>	QA (R) UW (A) OMRS, OHIE, IHIE (S,C) OHIE, GG (I)			X
<i>Activity 2.2.4: Document recommendations for how to generalize OpenMRS interoperability test cases to other EMRs, and use within the Instant OpenHIE project.</i>	QA (R) UW (A) OMRS, OHIE, IHIE (S,C) OHIE, GG (I)			X

Deliverables

Deliverable	Month/Quarter Due
Work Package 1	
Activity 1.1.1 Link to OpenMRS Reference Application test portfolio	M9
Activity 1.1.2 Reference Application Release Cycle QA Process Document	M9
Activity 1.1.3 Link to OpenMRS Wiki QA Test Development Documentation	M9
Activity 1.2.1 and 1.2.2 Link to Webinar and Working Session Minutes and Recordings	M3, M6, M9
Work Package 2	
Activity 2.1.1 Link to OpenMRS Roadmap with Interoperability Test Cases	M3
Activity 2.1.2 Link to OpenMRS Interoperability test portfolio	M9
Activity 2.1.3 Link to Test Results Documentation	M9
Activity 2.1.4 EMR Interoperability Testing Recommendations Report	M9

Global Good Maturity Model Assessment

OpenMRS Maturity Model Assessment

https://docs.google.com/spreadsheets/d/11VUCKxI0k00NcFboT_HiJGnLhi5KcwXs1Y587CAkyZ0/edit#gid=249752520

CURRICULUM VITAE

Jan Flowers, MS
Proposed Role: Principal Investigator

SUMMARY STATEMENT

Ms. Flowers is a Clinical Faculty member within the Department of Biobehavioral Nursing & Health Informatics at the University of Washington, the Director of Global Health Informatics in the Clinical Informatics Research Group (CIRG) at University of Washington, and the faculty Co-Lead of the Digital Initiatives Group at I-TECH (DIGI). Ms. Flowers area of focus is on innovative strategies and technologies for healthcare systems strengthening in resource constrained settings through appropriate electronic collection and use of quality health data for evidence-based decision making. Her work involves leadership in health informatics standards organizations and digital health communities of practice, digital health policy and compliance, health information systems engineering and implementation, digital health evaluation and maturity modeling, patient centered technologies and mHealth, and standards-based interoperability for improved care at the point of service, surveillance, and program monitoring. Ms. Flowers has led and supported country-wide digital health projects in Cameroon, Cote d'Ivoire, Haiti, Kenya, Mozambique, Namibia, Nigeria, Uganda, and Vietnam and provided support to U.S. based resource-constrained agencies, such as the Indian Health Services (IHS) in their agency-wide HIT modernization project. Ms. Flowers will join the Senior Management Team for the project and provide leadership and strategic visioning to achieving the objectives of the program related to interoperability of systems, including the overlap of those with related to program evaluation and capacity building.

RELEVANT EXPERIENCE

Faculty Co-Lead, Digital Initiatives Group at I-TECH (DIGI), University of Washington (UW), Seattle, WA, 2018-present

Co-lead [DIGI technical resource team](#) within I-TECH, which provides leadership to global domain-setting organizations and digital health communities of practice (including digital health global goods), technical assistance on strategic eHealth planning, digital health evaluation, developing and deploying digital health tools, building health workforce capacity in digital health, and data use and analytics using routine data systems.

Director of Global Health Informatics in Clinical Informatics Research Group (CIRG), Biobehavioral Nursing & Health Informatics, School of Nursing, University of Washington (UW), Seattle WA, 2015-present

Develop and direct the global health and underserved populations informatics portfolio focused on software engineering for resource-constrained environments, in both the U.S. and abroad. Projects include establishing and leading international digital health software engineering communities of practice, eHealth architectures, and software engineering and standards-based interoperability for improved care delivery at the point of service, surveillance, and program monitoring.

Clinical Faculty in Clinical Informatics & Patient Centered Technologies (CIPCT), Biobehavioral Nursing & Health Informatics (BNHI), University of Washington (UW), Seattle, WA, 2014-present

Teach NMETH 526 "Patient-Centered Interactive Health Communication Technologies", a Masters-level and Biohealthinformatics (BHI) Post-doctoral course for approximately 25-30 students per year. Mentor CIPCT and BHI students on PhD dissertations, Masters theses, and practicum projects.

Sr. Informatics Program Manager, International Training and Education Center for Health (I-TECH), Department of Global Health, University of Washington (UW), Seattle WA, 2012-2015

Manage the global health informatics programs and team across Cote d'Ivoire, Haiti, Kenya, Mozambique, Namibia, and Vietnam. Responsible for setting the direction for eHealth architecture strategy, developing and advising on eHealth policies and governance, and managing health information systems development and capacity building.

Clinical Lecturer in Doctoral in Nursing Practice (DNP), Biobehavioral Nursing & Health Informatics (BNHI), University of Washington (UW), Seattle, WA, 2011-2013

Teach "Introduction to Health Informatics", a PhD course for approximately 70 students per year. Mentor CIPCT and BHI students on PhD dissertations, Masters theses, and practicum projects.

Sr. Informatics Program Manager in Clinical Informatics Research Group (CIRG), Biobehavioral Nursing & Health Informatics, School of Nursing, University of Washington (UW), Seattle WA, 2009-2012

Manage the global health informatics programs for digital health informatics projects supporting LMIC programs in collaboration with I-TECH. Responsible for setting the direction for eHealth architecture strategy, developing and advising on eHealth policies and governance, and managing health information systems development and capacity building.

Technical Program Manager, Electronic Medical Records and Patient Centered Technologies, UW Medicine Information Technology Services, Seattle WA, 2006-2009

Program Manager for the UW Medicine MINDscape EMR and Epic and Cerner integration; Manage and execute the UW Medicine Patient Centered technologies portfolio; including, the UW Medicine patient portal, patient mHealth tools for chronic disease management, and *games for health* applications for patient knowledge improvement for disease management.

EDUCATION

- MS, Health Policy and Law (HPL), University of California, San Francisco, 2017
- Certificate, Implementation Science, University of Washington, Seattle, WA, 2017
- BS, Psychology with Honors, Bioethics & Medical History minor, University of Washington, Seattle, WA, 2013

PROFESSIONAL AFFILIATIONS

2019-present	Founder, Project Co-Lead	OpenHIE LIS Community
2017-present	Board of Directors, Chair	OpenMRS, Inc.
2017-Present	Governance Committee	Bahmni Collaborative
2016-Present	Board of Directors	OpenELIS Foundation
2013-Present	Strategic Leadership	OpenMRS Community

RELEVANT PUBLICATIONS AND PRESENTATIONS

1. Cullen T., **Flowers J.** (co-first author), Sequist T., Hays H., Biondich P., Laing M. (2019). Envisioning health equity for American Indian/Alaska Natives: a unique HIT opportunity. Journal of the American Medical Informatics Association: JAMIA. <https://doi.org/10.1093/jamia/ocz052>. PMID:PMC6696492.
2. **Flowers J.** (2018). Different Labs Need Different Systems: An Exploration of Open Source Laboratory Information Systems Use in Global Health and the Community of Practice that Brings Them Together. Presented at the Global Digital Health Forum, Washington D.C.
3. **Flowers J.** (2018). Ensuring an open source digital health solution has a healthy community: An OpenMRS case study on good governance, fiscal sponsorships, and partnerships. Presentation at the Global Digital Health Forum, Washington D.C.
4. **Flowers J.** (2017). Building an Informatics Community and Non-Profit Foundation for Health Systems Strengthening Sustainability. Panel at the Global Digital Health Forum, Washington D.C.
5. Brandt P., Lober B., **Flowers J.** (2017). Enabling Collaboration for Building High Quality, Sustainable and Scalable National Health Information Systems in Resource-Limited Settings. Poster at AMIA Conference, Washington D.C.
6. **Flowers J.** (2017). OpenMRS EMR in Point of Care: Real World Case Studies of Approaches and Challenges in Kenya, Mozambique, and Haiti. Presented at the Global Digital Health Forum, Washington D.C.
7. **Flowers, J.**, Odawo, P., Wanyee, S., Baseman, J., & Lober, W. (2011). Using successful HIV program tools in the strengthening of national health care: Expansion of Haiti's HIV Electronic Medical Record into primary care. Presented at the Consortium of Universities for Global Health, Montreal, CA.

8. **Flowers, J.**, Odawo, P., Wanyee, S., Baseman, J., & Lober, W. (2011). Global OpenELIS: Progress on an Open-source Laboratory Information System in Haiti and Cote d'Ivoire. In AMIA Annu Symp Proc. Presented at the American Medical Informatics Association Annual Scientific Symposium, Washington DC.
9. Lober WB, **Flowers JL**. Consumer empowerment in health care amid the internet and social media. *Semin Oncol Nurs*. 2011 Aug;27(3):169-82. doi: 10.1016/j.soncn.2011.04.002. PubMed PMID: 21783008.
10. Baseman, J., Emmanuel, E., Charles, K. J., Bijou, S., Antilla, J., **Flowers, J.**, & Lober, W. (2011). Supporting Clinical and Public Health Decision Making Through An EMR System In Haiti. Presented at the CDC Public Health Informatics Conference, Atlanta GA.
11. **Flowers JL**, Odawo P, Wanyee S, Baseman J, Lober WB (2011). Improving patient management in low resource settings through standards based interoperability: Demographic surveillance and electronic medical records. Poster at CDC Public Health Informatics Conference, Atlanta, GA.
12. Lober, W., **Flowers, J.**, & Baseman, J. (2011). EMR-Lab Interoperability for Low Resource Settings: a Design Pattern for Facility-Level Architecture. Presented at the CDC Public Health Informatics Conference, Atlanta GA.
13. **Flowers, J.**, Odawo, P., Wanyee, S., Baseman, J., & Lober, W. (2011c). Improving Patient Management In Low Resource Settings Through Standards Based Interoperability: Demographic Surveillance and Electronic Medical Records. Presented at the CDC Public Health Informatics Conference, Atlanta GA.
14. Nelson JW, Frederic R, Philippe R, Pierre-Lys D, Nagel M, Antilla J, Schwartz P, **Flowers JL**, Bijou S, Bony J (2011, August) Collaboration with Haitian Laboratories to Develop and Implement OpenELIS for Integrated Management of Laboratory Network Data, Poster at Consortium of Universities for Global Health.
15. Sutton P, Bony J, Wesley J, Adje C, Sogo J, Schwartz PF, **Flowers JL**, Nixon L, Hill P, Antilla J, Puttkamer N, Lober WB (2010, August). OpenELIS: Open-source laboratory information system for clinical and reference laboratories: Implementations in Haiti and Cote d'Ivoire. Poster at Consortium of Universities for Global Health, Seattle, WA.
16. Sutton P, Labbe-Coq R, Joseph P, Valles, JS, Lamothe R, Edouard F, White C, Wagner S, Sibley J, Webster E, **Flowers JL**, Teggat M, Puttkamer N, Lober WB (2010, August). The iSanté electronic medical record system; responding to the needs of post-earthquake Haiti. Poster at Consortium of Universities for Global Health, Seattle, WA.
17. Lyles CR, Harris LT, Le T, **Flowers J**, Tufano J, Britt D, Hoath J, Hirsch IB, Goldberg HI, Ralston JD. Qualitative evaluation of a mobile phone and web-based collaborative care intervention for patients with type 2 diabetes. *Diabetes Technol Ther*. 2011 May;13(5):563-9. Epub 2011 Mar 15. PubMed PMID: 21406018.

INVITED PRESENTATIONS

- 2020: Real World Interoperability for the Greater Good, Integrating the Healthcare Enterprise North America Connectathon Conference, Cleveland
- 2019: Building Capacity for HIS in Global Health, World Health Organization, Geneva
- 2019: Lessons in Implementing Medical Records Systems, World Health Organization, Geneva
- 2018: HIS Community Governance – OpenMRS Case Study, Digital Square Annual Meeting
- 2018: Global Goods Guidebook – OpenMRS, World Health Organization, South Africa
- 2018: Global Goods Guidebook – OpenELIS, World Health Organization, South Africa
- 2017: The Future of Global Health Informatics – Pursuit of Health Equity and Improved Outcomes, Association of Professional Futurists
- 2017: Policy Recommendations for Health IT for Continuity of Care during Regional Crisis, UCSF
- 2017: Policy and Roadmap for a National Data Sharing Architecture, Vietnam VAAC/MoH
- 2017: Facility-level Architectures and Data Exchange Planning, UCSF Global Health
- 2016: Open Source Community and Leadership, OpenMRS Implementers Meeting, Uganda
- 2016: Data Management Policies for Health Systems in RCS Clinics, WHAA
- 2016: Electronic Medical Records for Free and Charitable Clinics, WHAA

- 2016: National Policy for Laboratory Information Systems, Ministry of Health, Hanoi Vietnam
- 2015: Community Governance and Policy for Health Systems, OpenMRS Summit, Singapore
- 2014: eHealth Architecture and National Policy, UW HIHIM Certificate Program
- 2014: eHealth Architecture and National Policy, UCSF Global Health Conference
- 2013: Laboratory Informatics, MOH Zambia
- 2011: Haiti National Architecture, WHO eHealth Architecture and Interoperability, Vietnam
- 2011: Interoperability in Resource Constrained Settings, Change Initiative

CURRICULUM VITAE

Jennifer Antilla, MPH
Proposed Role: Community Director

SUMMARY STATEMENT

Jennifer Antilla is a Senior Computer Specialist within the Clinical Informatics Research Group (CIRG) in the Department of Biobehavioral Nursing & Health Informatics at the University of Washington. Ms. Antilla serves as an informatics community of practice building specialist within CIRG projects. She serves in the position as the OpenMRS Community Director, and provides community operations oversight and coordination with the community development projects for the OpenMRS Quality Assurance Team. Ms. Antilla has over 14 years in global health experience as a senior program manager and health information system advisor, providing technical assistance on community of practice building and leadership, health information systems, supply chain management, and workforce development programs. She applies participatory approaches to gain consensus among stakeholders; develops practical, cost-effective, yet innovative strategies for results-oriented health information system programs in resource-limited countries; is process-oriented team player; and has worked with many global goods products and communities, including, OpenMRS, BLIS, OpenELIS, DHIS2, and TrainSMART. Ms Antilla is conversant in French and Bambara. Ms. Antilla will provide coordination strategy and activities with the larger OpenMRS community and the OpenMRS QA Team. She will support the QA Lead in identifying opportunities for QA involvement and coordinating efforts for QA in OpenMRS Squad projects, OpenMRS software development grants/awards, and OpenMRS implementation support.

PROFESSIONAL EXPERIENCE

Community Capacity Development

- Provided guidance and direction aimed at increasing engagement by implementers and service providers in OpenMRS community activities (i.e: producing community modules, defining technical roadmaps, defining technical conventions).
- Launched and managed the International Association of Public Health Logisticians (IAPHL), recruiting and engaging members to participate in an online community of practice that currently has over 5400 members in 143 countries.
- Designed and developed eLearning modules on system classification, eHealth architecture, interoperability, data quality, data management, and data use, leading to increased capacity among national health information system leadership.
- Managed the design, development, and implementation of the KenyaEMR Training Program, used to train over 40 EMR System facilitators, 340 EMR mentors, 620 health managers, and over 1000 EMR system users.
- Collaborated with local subject matter experts and applied adult learning theory to create, pilot and revise curricula for over five in-service training courses on topics related to leadership in informatics, supply chain management, information systems and data use, IT support, and software development.
- Created and applied a tool to tailor informatics competencies and define human resource needs in support of electronic health information systems implementation in three countries (Kenya, Cote d'Ivoire, Malawi).

Information System Development, Implementation, and Evaluation

- Adapted Agile-based approaches to strengthen processes for open-source information system development and implementation across I-TECH countries
- Assisted the Ivorian ministry of health to review and document laboratory information system (LIS) requirements and specifications, enabling the selection of an LIS best suited to local data needs.
- Developed information system software requirements, specifications, and testing materials, leading to stable system updates and reductions in on-site technical support.
- Led and trained technical teams to conduct site visits to define laboratory data needs and gather requirements for strengthening laboratory information system reporting and use.

- Evaluated the development and pilot implementation of an electronic medical record system in Guyana.

Strategic Planning and Management

- Collaborated with Ministries of Health to plan, organize, and facilitate collaborative meetings with CDC, UNAIDS, PAHO, UNFPA, and other ministry agencies to craft strategic plans for national eHealth information systems (Guyana, Cameroon) and commodity security (Haiti, Liberia).
- Streamlined system development, implementation, capacity building, and transition technical activities into a strategic vision for improving information system implementation and data use
- Applied quality improvement methods to strengthen Kenya's EMR user training program, leading to a 300% increase in the number of on-site mentors and MOH facilitators as well as a 50% reduction in training costs.
- Led virtual teams in Kenya and Cote d'Ivoire to coordinate development and implementation plans for open-source information system software, resulting in successful information system deployment in 65 laboratories in Cote d'Ivoire and 340 health care facilities in Kenya.
- Built consensus among donors, ministry of health units, and international partners to adopt sustainable strategies to transition key laboratory information system technical and programmatic activities to the Ivoirian Ministry of Health
- Developed three successful grant proposals worth \$3.84 million aimed at strengthening laboratory and information system implementation, data systems, and/or data use globally.
- Managed a five year CDC cooperative agreement with an annual workplan and budget of \$2.74 million
- Collaborated with technical and programmatic teams to develop monitoring and evaluation plans for information system development and implementation activities in Kenya and Cote d'Ivoire.
- Prepared monthly progress updates, quarterly and annual reports for project leadership and donors on progress towards technical and programmatic deliverables.

EMPLOYMENT HISTORY

UNIVERSITY OF WASHINGTON

Department of Biobehavioral Nursing and Health Informatics (BNHI) – Seattle, WA
OpenMRS Director of Community 2018 - present

International Training and Education Center for Health (I-TECH) – Seattle, WA

Department of Global Health

Senior HIS Implementation Specialist 2015 - 2018

Senior Program Manager (Cote d'Ivoire) 2015 – 2017

Technical Officer: Informatics Capacity Building, 2010 – 2015

JOHN SNOW, INC - Arlington, VA

JSI Logistics Services, DELIVER Project, and the USAID | DELIVER PROJECT

Organizational Strengthening Technical Advisor, 2007 – 2009

Performance Improvement Course Planner, 2005 – 2007

Program Coordinator, 2004 – 2005

UNIVERSITY OF NORTH CAROLINA - Chapel Hill, NC

HIV Antiretroviral Adherence Program Model Evaluation

Research Assistant

2002-2003

CEDPA - Washington, DC

Technical Advisors in AIDS and Child Survival (TAACS) Project

Program Associate, 2000-2002

PEACE CORPS - Mali, West Africa

Health Education Specialist, 1997-1999

EDUCATIONAL BACKGROUND

MPH, University of North Carolina, School of Public Health, 2004

Chapel Hill, NC

Health Behavior/Health Education

B.A., Whitman College, 1996

Walla Walla, WA

Sociology with minors in French and Education

PUBLICATIONS

- **Antilla J**, Wall L, Atelu C, Muthee V, Liku N, Puttkammer N. *Building Human Capacity for Optimal Use of an Electronic Medical Record System in Kenya: Results of a Pilot Evaluation of Two eLearning Modules*. Accepted for Poster Presentation at 2016 Consortium of Universities for Global Health Conference, San Francisco, CA, USA, April 2016
- Atelu C, **Antilla J**, Muthee V, Puttkammer N. *Evolution of the KenyaEMR training program: Towards efficiency and quality in scale-up*. Oral Presentation at 2014 Kenya National AIDS Control Program M&E Best Practices Conference, Nairobi, Kenya, September 2014 (with award for best oral abstract for the Human Resources for Health track).
- **Antilla, J**, Nzyoka R, Waldman K, Wanyee S, Morrison M, Odawo P. *One Size Does Not Fit All: Tailoring Health Informatics Competencies and Training Programs Based on Local Context*. Poster Presentation at 2011 Consortium of Universities for Global Health Conference, Montreal, Quebec, Canada, November 2011.
- **Antilla, J**, Durgavich J, Gonzalez H. *Analyse de la situation de la sécurité des produits de santé de la reproduction en Haïti*. Arlington, VA: John Snow, Inc. / Services de Logistique, UNFPA et le Ministère de la Santé Publique et de la Population, Direction de la Santé Familiale et Direction de la Pharmacie et du Médicament. June 2007.
- Kagone, M, Dowling P, **Antilla J**, and Cooper R. *Liberia: A Contraceptive Security Assessment*. Arlington, Va.: DELIVER, for the U.S. Agency for International Development. 2007.