Advancing OpenELIS Global Shelf-Readiness through Improved Quality Assurance

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

Overview

OpenELIS Global aims to improve its Shelf-Readiness through a transition from a manual software release testing model to a robust, comprehensive, and systematic automated testing process that will improve efficiency and reliability, reduce maintenance costs for the software, and facilitate re-use of OpenELIS Global code by community members. This investment will result in: adoption of the OpenHIE testing framework and tooling for automated testing of OpenELIS; collaboration with the OpenHIE Laboratory Information Systems Community of Practice (LIS CoP) to establish re-usable LIS interoperability test cases; and dissemination of LIS/LIMS software testing protocols, guidance, and learning resources which can be adapted by other global goods communities to improve software testing practices.

High-Level Budget Summary

	Work Package 1 Implement Automated Test Portfolio for OpenELIS Global	**Work Package 2 Build a Portfolio of Generalized LIS Test Cases**	**Work Package 3 Develop an OpenHIE Automated Testing Training Package**	**Total Cost (USD)**
Total Project Costs	$47,608.87	$32,168.18	$32,590.44	$112,367.00

Executive summary

OpenELIS Global is recognized as a leading open-source laboratory information system (LIS), which facilitates delivery of accurate and timely laboratory test results and data to healthcare providers, patients, and public health agencies. OpenELIS Global has been used for nearly a decade in Cote d'Ivoire, Haiti, and Vietnam, and as part of the Bahmni HMIS distribution. The government of Mauritius also recently adopted OpenELIS in its national reference laboratory to manage information related to SARS-CoV-2 diagnostics and pandemic response, and is scaling up to their national network of lab testing in the near future.

The OpenELIS Global team will employ the proposed investment from Digital Square to use the OpenHIE testing framework to develop and implement an automated testing framework for its software development cycle. Moving from manual to automated testing will improve efficiency, lower the cost of maintenance, and most importantly, increase implementer trust in the product. Adoption of a framework will increase the reliability and completeness of software testing. A more robust quality assurance process will help ensure that OpenELIS Global implementers can rely on the software from the moment they download it to the time they deploy it in laboratories.

The OpenELIS Global team plans to collaborate with the OpenHIE community to incorporate the OpenHIE test management platform and automated test tools into its quality assurance processes, using the OpenMRS quality assurance (QA) automated testing approach as our model. We will collaborate with the OpenHIE Laboratory Information Systems community (LIS CoP) to prioritize and develop LIS interoperability test cases around established LIS interoperability specifications published by the LIS CoP that can be reused by other LIS software in the OpenHIE architecture, specifically in the Instant OpenHIE project. In addition, I-TECH will leverage its expertise in creating high-quality training curricula to develop a learning session on automated testing for broader global goods consumption, including in the OpenHIE Academy, to aid in disseminating standardized test cases and promoting a shared foundation for quality assurance within the OpenHIE architecture.

Consortium team

The project team is part of the International Training and Education Center for Health (I-TECH) at the University of Washington (UW). I-TECH is a Center within the UW Department of Global Health (DGH) that leads health systems strengthening initiatives in more than 20 countries. In December 2018, I-TECH launched the Digital Initiatives Group at I-TECH (DIGI), a global health informatics center within I-TECH and the UW DGH, under the leadership of faculty members Nancy Puttkammer and Jan Flowers. The DIGI team brings together experienced I-TECH informatics experts and staff with a broad range of expertise in setting global health informatics standards and leading global goods communities and products at the domain level, as well as, applying those in real-world settings in LMIC in a sustainable, scalable, replicable manner. In addition to the core team members, our center collaborates and harnesses expertise from faculty, staff, and students from the UW's Schools and Departments including Health Sciences, Computer Science and Engineering, Bioengineering, Information Sciences, Business and others.

Related to this proposal, DIGI has been the steward of OpenELIS Global development and national implementations in Haiti and Cote d'Ivoire since 2009 and 2010 respectively, in more than 75 national public health reference labs as well as in large-volume clinical laboratories. In

addition, with funding from Digital Square Notice C, DIGI established integration between OpenELIS and OpenMRS using FHIR, and led and published the OpenHIE LIS-EMR architectural specification with the OpenHIE LIS Community of Practice. DIGI faculty and team members are leaders in the global goods communities at large, founding and actively leading the OpenHIE LIS Community of Practice; as well as, serving on the Board of Directors and in strategic leadership roles for both the OpenMRS and OpenELIS communities.

I-TECH also brings to the project the expertise in laboratory systems in LMIC, through our Laboratory Systems Strengthening (LSS) Team. Led by Dr. Lucy Perrone, a public health laboratory advisor specializing in infectious disease diagnosis, surveillance and response, and laboratory capacity building in LMICs, the team leverages partnerships within UW and with external collaborators globally on supporting laboratory capacity building. The team's mission is to improve laboratory operations for optimal patient care and treatment, disease surveillance and response, and biosecurity. The team has conducted training and mentoring in laboratory leadership and management, supported policy development for laboratories, and worked with reference and clinical laboratories on advancement toward accreditation. As part of reinforcing good laboratory practice, the team has also supported customization and implementation of LIS for improved information management within the laboratory. The LSS team is available to contribute expertise in the fit between LIS and laboratory workflows and systems to the proposed project.

Specific team members and their roles on the project are listed below, and the CVs of these team members are appended.

Jan Flowers, Faculty Co-Lead (Role: Principal Investigator): Ms. Flowers has led informatics organizations and teams for over 20 years, focused on technology policy and law, health information systems evaluation and maturity modeling, open source communities of practice building, health technology engineering and implementation, patient centered technologies and mHealth, and standards-based interoperability for improved care at the point of service, surveillance, and program monitoring. Ms. Flowers serves on the board of directors for both OpenMRS and OpenELIS Foundations, and the founder of the OpenHIE LIS Community of Practice, which develops and shares common standards and best practices amongst the open-source LIS community. She holds an MS in Health Law and Policy from the University of California San Francisco jointly with UC Hastings Law School, and a BS in Psychology from the University of Washington.

Carli Rogosin, MIA, Senior Digital Health Specialist (Role: Project Manager- Work packages 1-3; Work Package 3 Lead): Ms. Rogosin is a specialist in software design and testing processes, and in strategies for human capacity development in digital health. Her expertise includes curriculum development, training, and evaluation, primarily in laboratory and health systems development and strengthening. She is skilled in designing new software features based on user feedback and managing the software quality assurance process. She has also worked on stakeholder engagement and sustainability for health systems projects. She led the capacity building component of the Zimbabwe Data Improvement Project and guided the team towards deployment and implementation and managed a project funded by PATH/Digital Square to create out-of-the-box solutions for data exchange between OpenELIS and OpenMRS and between OpenELIS and OpenLMIS. She holds a Master of International Affairs degree from Columbia University and is fluent in French

Casey Iiams-Hauser, OpenELIS Product Owner (Role: Technical Lead): With more than 8 years of experience leading OpenELIS Global, Mr. Iiams-Hauser leads the OpenELIS Global

team in design, development and testing, as well as installation and deployment. He manages OpenELIS security upgrades, testing and release of OpenELIS. He holds his Master of International Affairs from Columbia University School of International and Public Affairs, and is proficient in French.

Christina White, Senior Digital Health Specialist (Role: Technical Lead): Ms. White is a software engineer with more than 10 years of experience in health information systems development, deployment, administration and support. She has experience translating clinical workflows into informatics systems requirements, integrating paper-based workflows into electronic systems, and health information systems standardization and interfacing. She also specializes in User interface/User interaction (UI/UX) design and development, and has collaborated on human computer interaction studies. Additionally, she has experience with health systems database architecting, MVC frameworks, development and execution of full scope testing protocols, registration modules, and lab information systems adaptation and implementation. Ms. White holds a Master's of Science in Cultural and Environmental Resource Management from Central Washington University and a Bachelor's of Science in Bioengineering from the University of Washington.

Greg Rossum, Senior Software Developer (Role: Developer). Mr. Rossum provides technical analysis and software development with OpenELIS, TrainSMART, and other open source software products as part of the DIGI team. He is the primary software engineer for OpenELIS, and led the effort to convert the OpenELIS Java framework from Struts I to Spring to enhance software security. He also contributed to the OpenELIS interoperability project funded by PATH/Digital Square to demonstrate interoperability between OpenELIS and OpenMRS using FHIR resources. He has worked on multiple health informatics projects in Haiti, Botswana, Namibia and Cote d'Ivoire. He holds a degree in Computer Science from the University of Calgary.

Lucy Perrone, Assistant Professor (Role: Laboratory Domain Expert): Dr. Lucy A. Perrone is a public health laboratory advisor specialized in infectious disease diagnosis, surveillance and response, and laboratory capacity building in resource-limited countries. Dr. Perrone has years of experience in these areas and has worked in multiple countries worldwide since 2009. Her areas of expertise include infectious disease diagnosis and surveillance, laboratory systems and capacity building, and improving human resources for health. Dr. Perrone is skilled in infectious disease epidemiology, evaluation of infectious disease surveillance programs, quality assurance of laboratory testing, developing international guidelines for the prevention and control of infectious diseases, as well as the training and mentoring of medical laboratory staff. Dr. Perrone is currently the Director of the Certificate Program in Laboratory Leadership and Management at the University of Washington.

Background or Problem Statement

OpenELIS Global is gaining traction as an open-source laboratory information system for use in LMIC. It currently operates in four countries, with the potential to expand to many more. Previous Digital Square investment has led to OpenELIS interoperability with the electronic medical record OpenMRS and the logistics and supply chain management system OpenLMIS. With the potential for more deployments at scale, OpenELIS Global seeks to improve the overall quality of its product through automated quality assurance processes in software testing.

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The proposed work would take place principally in Seattle, USA, at the headquarters of the OpenELIS Global team. It would involve collaboration, primarily in terms of input and feedback, from globally disparate communities with significant membership from LMIC, including the OpenHIE community.

This project would be the first initiative to automate testing for OpenELIS Global, and once this work is completed, the basic automated testing framework would be finished. Ongoing work to add to the test case library and make iterative improvements would take place out of scope.

Digital Health Technologies

OpenELIS Global Strong laboratory systems are critical for detecting outbreaks of infectious diseases, monitoring chronic diseases, and measuring pathogen resistance to antibiotics, among other clinical care and public health applications. Laboratory information systems (LIS) help ensure accurate, reliable, accessible, and traceable data. The OpenELIS Global software is an open enterprise-level laboratory information system built on open source web-based technologies that has been tailored for low-and-middle income country public health laboratories. The OpenELIS software serves as both an effective laboratory software solution and business process framework. It supports the effective functioning of public health laboratories for best laboratory practice and accreditation. OpenELIS is currently being used in two national scale implementations, in Haiti and Côte d'Ivoire, with more limited implementations in a handful of other countries and upcoming expansion to new locations.

OpenELIS Global runs on Ubuntu (16.04) LTS with PostgreSQL database. It has both HL7 and FHIR APIs for data exchange, and has standards-based interoperability built for exchange specifically with OpenMRS, OpenLMIS, and specific one-directional connectivity with a suite of laboratory test analyzers. More information regarding OpenELIS is available at http://openelisglobal.org/

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, founded and led by the DIGI faculty co-lead, and is still early in understanding its full potential. The test management platform will require additional exploration and use by global goods community members such as the OpenELIS team and the LIS Community of Practice in order to become a de facto standard for the global goods interoperability test management platform.

Use Cases and User Stories

Use Cases

Testing and release of OpenELIS Global codebase by the DIGI stewardship team:

The OpenELIS development team currently employs a team of testers to manually test OpenELIS release candidates. After implementing this project, the majority of testing will be automated using a standardized set of test cases. The OpenELIS leads will coordinate and execute testing for each release candidate. The testing manager would set up the automated testing framework and support processes. Then, the team would check for any additional

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features that require new test cases, adding to the system if necessary. Then the testing manager would run the automated tests. Individual story testing may still take place manually. Overall, the automated testing process will likely reduce cost and time to complete testing by a significant measure, with testing results of a higher level of accuracy and consistency, especially across releases.

Branching OpenELIS Global codebase for specific local needs:

OpenELIS Global is open-source and available to the public. A party who wishes to download and deploy OpenELIS Global, or fork the code, could participate in the Testing Framework training and/or access the training materials and then implement the OpenELIS Global testing framework and test cases as part of their implementation.

Implementing a LIS other than OpenELIS Global:

Developers of any other LIS could participate in the Testing Framework training and/or access the training materials. They could then adapt or directly implement the generalized test cases as part of an automated testing set-up for their LIS software.

Learning about OpenHIE and Testing Frameworks:

Anyone interested in testing frameworks or particularly in the OpenHIE Testing Framework could participate in or have access to the training and associated materials through various dissemination channels. This would further their learning and understanding of the topic.

User Stories

As an OpenELIS 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 OpenELIS software tester, I want to be able to systematically test the OpenELIS Global products, even if I am new to OpenELIS Global.

As an OpenELIS 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 work plans and deliverables, and affect future funding.

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

As an OpenELIS 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 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.

Objectives and Activities

Work package 1: Implement an Automated Test Portfolio for OpenELIS Global

The OpenELIS team will define an approach to identifying, prioritizing, and developing OpenELIS test cases and automated testing using the OpenHIE testing management platform, with the OpenMRS QA team's automated testing approach serving as the model. The team will collaborate with other members of the OpenELIS Global community to identify the high priority test cases and develop a strategy for addressing those prioritized. The team will engage the OpenHIE LIS CoP to ensure the test cases written in Gherkin can potentially be used by other LIS products in their testing strategies. Using a consultative process, the team will draft and finalize test cases and document test libraries. Each component of the development, adaptation, and testing process will be assigned a deadline and have accompanying documentation of the process and outcome. Evaluation of the test portfolio produced will consist of running OpenELIS Global through the testing and documenting the results as compared to manual testing of similar test cases. As part of these activities, the team will work with other OpenELIS Global community members to understand how to use and contribute to the OpenELIS Global test portfolio.

Deliverable/Schedule: Coherent package of test cases and documented test libraries. (9 months)

Objective 1.1: Develop documented OpenELIS test cases and automated testing using the OpenHIE test management platform

> **Activity 1.1.1:** Define the strategy for automated testing, and work with the OpenELIS Global community and LIS CoP to identify and prioritize test cases for automation.
>
> **Activity 1.1.2:** Create test cases and develop automated tests within the OpenHIE test platform.
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> **Activity 1.1.3**: Evaluate the testing portfolio.
>
> **Activity 1.1.4:** Document the OpenELIS Global test portfolio.

Objective 1.2 Build capacity in OpenELIS Global (OEG) community members for creating test cases.

> **Activity 1.2.1:** Conduct an orientation webinar for OEG community members to introduce the test case development process.
>
> **Activity 1.2.2:** Conduct 1-2 working sessions with OEG community members to review and practice applying the test case development process.

Work package 2: Build a Portfolio of Generalized LIS Test Cases

Collaborate with the LIS CoP to establish a portfolio of automated generalizable LIS/LIMS interoperability test cases for the OpenHIE framework, and use of LIS/LIMS products in the Instant OpenHIE product. The team will lead the collaboration of members in the LIS CoP to

create a LIS testing roadmap of prioritized test cases to be developed in the OpenHIE test management platform. The team will use the LIS CoP's standard requirements for an LIS/LMIS software in LMIC to frame what test cases are likely to exist in any LIS/LIMS solution as a starting point for those included in the roadmap. In addition, the team will hold community working sessions to build capacity in the LIS CoP community to build a set of those prioritized test cases in Gherkin, and in some cases, automate those tests using an automated test framework such as Selenium. The working sessions are anticipated to result in a small set of test cases ready for inclusion in the LIS/LIMS test portfolio within the OpenHIE test management platform. Lastly, the team will collaborate closely with the Instant OpenHIE project team to design and execute a strategy for testing a small set of LIS/LIMS interoperability test cases, using OpenELIS as the reference software.

Objective 2.1: Create a community road map within OpenHIE LIS CoP for interoperability test cases

> **Activity 2.1.1:** Define the purpose, objectives, and norms for the use and maintenance of the road map.

> **Activity 2.1.2:** Regularly, and as needed, update the road map.

Objective 2.2: Develop reusable test cases within the OpenHIE test management platform, and automate those tests for OpenELIS as the reference software, including documented shared practices and coding standards, testing tools and libraries.

> **Activity 2.2.1:** Convene monthly working sessions with LIS COP and other interested members; the outcome of the working sessions is draft versions of a set of test cases built within the test management platform and a limited set of automated tests.

> **Activity 2.2.2:** Regularly solicit feedback from the larger community, including LIS COP, OpenHIE community, OpenELIS community, on the draft test cases and automated tests.

> **Activity 2.2.3:** Test the test cases and automated tests using OpenELIS in the Instant OpenHIE project or other determined environment.

> **Activity 2.2.4:** Revise, finalize, and document the test cases and automated tests as part of the OpenHIE test management platform.

> **Activity 2.2.5:** Disseminate the testing portfolio through the OpenELIS, OpenHIE, and LIS CoP community wikis, blogs, conferences, and webinars, as appropriate.

Work package 3: Develop an OpenHIE Automated Testing Training Package

The OpenELIS Global team will develop a training session on OpenHIE automated testing. The team will work with subject matter experts to design and develop relevant, engaging content for skill building in rigorous QA processes, automated testing, and using the OpenHIE test framework. The session materials will be made available for dissemination via the OpenHIE

Academy, and other potential digital health and global goods web-based forums and training packages.

Objective 3.1: Develop "OpenHIE Automated Testing" training session and education/training materials.

> **Activity 3.1.1:** Conduct an informal assessment with the global goods community to identify the target audience and their learning needs for training.

> **Activity 3.1.2:** Identify key competencies and associated learning objectives related to skill building for QA processes and automated testing using the OpenHIE testing framework.

> **Activity 3.1.3:** Design session (develop session map and identify main training approaches).

> **Activity 3.1.4:** Develop session content in collaboration with subject matter experts (identify pre-existing content, develop training content and activities, invite review and feedback, design template for all materials).

> **Activity 3.1.5:** Package all session materials including participant, trainer, and implementer/host materials.

Objective 3.2: Identify potential avenues of dissemination of the training package.

> **Activity 3.2.1:** Develop outline for adapting the session to an online platform.

> **Activity 3.2.2:** Identify digital health and global goods-related avenues for dissemination and outreach, including the OpenHIE Academy.

Community Feedback

The consortium will coordinate with OpenHIE LIS COP and other OpenHIE subcommunities to schedule working sessions in order to identify and collaboratively develop reusable test cases and automated tests. This work will be led as an initiative within the LIS COP. The OpenELIS Global team will conduct continuous outreach to implementers and developers for feedback, such as posting on OpenHIE forums and other community forums. The OpenELIS team will also get community approval for contributing missing workflows to the OpenHIE testing framework.

Specific outreach activities will focus on cultivating ownership of the business-acceptance side of the testing process.

Schedule

The following is a high-level work plan.

Activity	Team Location Month/ Quarter	Quarter			
		[M] 1	[M] 2	[M] 3	[M] 4
Work planning and scheduling; background gathering (all work packages and objectives)	DIGI team	X M1			
Define the strategy for automated OEG testing (A.1.1.1)	DIGI team with LIS CoP	X M1-2			
Identify and prioritize OEG test cases for automation (A 1.1.1)	DIGI team with LIS CoP	X M1-3			
Develop OEG test cases and automated tests (A.1.1.2)	DIGI team with LIS CoP	X M3	X M4-5	X M7-8	
Evaluate the testing portfolio (A.1.1.3)	DIGI team with LIS CoP			M7-8	
Finalize OEG portfolio of tests (A 1.1.4)	DIGI team			X M8-9	
Conduct orientation webinar (A 1.2.1)	DIGI team			X M8	
Conduct working sessions (A 1.2.2)	DIGI team			X M8-9	
Convene first working session for Road Map definition (A 2.1.1)	DIGI team	X M1			
Review and update Road Map (A2.1.2)	DIGI team with LIS CoP	X M2-3	X M4-6	X M7-9	
LIS COP working sessions for test cases (A 2.2.1)	DIGI team with LIS CoP	X M1-3	X M4-6	X M7-9	
Feedback on draft test cases (A 2.2.2)	DIGI team with stakeholders		X M4-6	X 7-8	

Test the test cases (A 2.2.3)	DIGI team		X M6	X M7-8	
Finalize test cases portfolio (2.2.4)	DIGI team			X M8-9	
Disseminate final portfolio (A 2.2.5)	DIGI team			X M9	
Conduct informal assessment (A 3.1.1)	DIGI team		X M7		
Identify competencies and LOs (A 3.1.2)	DIGI team		X M7		
Public feedback on competencies and LOs	DIGI team with stakeholders		X M7		
Design session (A 3.1.3)	DIGI team		X M8		
Develop session content (A.3.1.4)	DIGI team		X M9	X M10-11	
Review of session content	DIGI team with stakeholders			X M11-12	
Package training materials (A3.1.5	DIGI team			X M12	
Develop adaptation outline (A.3.2.1)	DIGI team			X M12	
Identify dissemination outlets (A 3.2.2)	DIGI team		X M9	X M10-12	

Deliverables

Deliverable	Month/Quarter Due
Work Package 1, Objective 1, Activity 1 • A defined strategy for automated testing • Prioritized list of test cases for automation	**Q1**

Work Package 1, Objective 1, Activity 2 and 3 • Draft test cases • Notes from working sessions • Results of portfolio evaluation	**Q3**
Work Package 1, Objective 1, Activity 4 • Final OpenELIS Global testing portfolio	**Q3**
Work Package 1, Objective 2, Activity 1 • Recorded webinar • Copy or presentation materials • Attendance list	**Q3**
Work Package 1, Objective 2, Activity 2 • Notes from working sessions	**Q3**
Work Package 2, Objective 1, Activity 1 • Road Map for developing test cases and automated tests • Documented norms for managing Road Map	**Q1**
Work Package 2, Objective 2, Activity 1 • Documented notes from working sessions or links to posts	**Q2**
Work Package 2, Objective 2, Activity 1 • Draft test cases and automated tests	**Q2**
Work Package 2, Objective 2, Activity 2 • Documented feedback and revisions based on community feedback	**Q3**
Work Package 2, Objective 2, Activity 4 • Final portfolio of test cases and automated tests • Proof of dissemination through multiple channels	**Q3**

Work Package 3, Objective 1, Activity 1
• Informal assessment report including:
   o Dates, location, participants of assessment sessions/outreach
   o Assessment questions
   o Assessment results
	Q2

Work Package 3, Objective 1, Activity 2 • List of session competencies and learning objectives	**Q2**

Work Package 3, Objective 1, Activity 3 • Session map	**Q2**

Work Package 3, Objective 1, Activity 4
    • List of subject matter experts
    • Draft training content
	Q2

Work Package 3, Objective 1, Activity 5
    • Finalized training materials including participant materials, trainer materials, and implementer/host materials
    • Uploaded to previously identified channels (e.g. OpenHIE Academy website)
	Q3

Work Package 3, Objective 2, Activity 1 • Online adaptation outline	**Q3**
Work Package 3, Objective 2, Activity 2 • List of dissemination targets (locations, dates, contact people, reason for targeting)	**Q3**

Global Good Maturity Model Assessment

For OpenELIS Global (last updated 9 June 2020):

https://docs.google.com/spreadsheets/d/1iJ_neuWZKjWjj4Wm8KWnpVgtkwfyG8oR6rBb2PAoFik/edit#gid=0

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. PMCID: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, Boncy 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, Boncy 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**, Teggar 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

<u>**CURRICULUM VITAE**</u>

Carli Rogosin, MIA

SUMMARY STATEMENT
Master Trainer with 18 years of combined experience in HIV, reproductive health, gender, and digital health solutions

EXPERIENCE

International Training and Education Center for Health, University of Washington, Seattle, WA

Senior Digital Health Specialist   October 2019-present
- Lead digital health project strategy, design, development, and implementation to ensure fidelity to international standards and PEPFAR program guidelines in Zimbabwe
- Lead collaboration between partners to create use cases and design interoperability solutions for laboratory information software to improve data quality and clinical service provision
- Develop training strategies to support successful implementation of digital health initiatives including mobile data collection for HIV care and treatment, immunization, laboratory, and electronic medical records
- Participate in communities of practice and innovation to openly exchange information, disseminate lessons learned and best practices, and promote access to open-source software
- Provide oversight for budgets and contracts with funders and vendors

Senior Training and Capacity Building Specialist   April 2018- September 2019
- Lead development of national training plan and curriculum for Community Health Workers in South Africa
- Facilitate national Training-of-Trainers workshops to support rollout of the South Africa CHW training program
- Lead requirements gathering, design, and testing of the Policy Information Management (PIMS) System for the South African Ministry of Health
- Develop training strategy and materials to support implementation of the PIMS
- Design and conduct needs assessments and evaluations of training activities
- Collaborate with Ministries of Health, donor agencies, partner organizations, and community to implement national-scale healthcare worker training programs
- Supervise a team of curriculum developers, clinical content experts, and trainers
- Contribute to publications and to multi-level reporting on activities and budget expenditure

Technical Officer: Training Development   August 2012- July 2017
- Develop training curricula in health informatics, health system software development, and health information system administration for Cote d'Ivoire, Haiti, and Kenya
- Facilitate, follow-up, and evaluate participatory training in health informatics, including laboratory information systems, and electronic medical records
- Design, develop, and facilitate synchronous distance training sessions
- Design job aids and user manuals for healthcare workers for health information systems
- Conduct needs assessments and evaluations of training and job aid implementation

François-Xavier Bagnoud Center, UMDNJ School of Nursing, Newark, NJ
Program Manager- Botswana   April 2009- August 2012
Program Manager- Haiti, Assistant Program Manger- Tanzania   October 2006- March 2009
Curriculum development and training

- Led participatory training-of-trainers workshops for healthcare worker wellness, PMTCT, and family planning in Botswana, South Africa, Tanzania, and Zanzibar
- Facilitated, followed-up, and evaluated participatory training in family planning, database skills, program management, and training skills in Botswana, Tanzania, and US
- Developed training curricula in PMTCT, PITC, family planning, healthcare worker wellness
- Lead development of the Haiti national training manual for OVC care and support
- Designed job aids for healthcare workers for PMTCT and family planning
- Conducted needs assessments and evaluations of training and job aid implementation

Program management

- Coordinated technical advisory groups in Haiti, Zanzibar, and Botswana
- Supervised the Botswana In-Country Manager and Haiti Program Coordinator
- Managed budgets of up to $600,000 and submit quarterly reports to funding partner
- Collaborated with Ministries of Health, USAID, the CDC, EGPAF, and private foundations

Women's Edge Coalition, Washington D.C./Honduras
Gender Assessment Consultant   November 2005- June 2006
- Developed methodology for gender assessment of the consultation process and implementation of the Millennium Challenge Account compact in Honduras
- Carried out interviews, focus groups, and participatory appraisals in Honduras and synthesized data for final report for use by Women's Edge in lobbying the U.S. Congress

CARE International, Office of the UN Representative, New York, NY
Research and Policy Associate for HIV/AIDS Portfolio   September 2005- June 2006
- Conducted research and wrote briefing memos on HIV/AIDS debates, policies and programs
- Managed contact between CARE International and various NGOs and UN agencies regarding the 2006 UN Declaration of Commitment on HIV/AIDS Review conference
- Prepared advocacy materials for UNGASS 2006 Review reporting and participation and conducted advocacy meetings with UN Member States

International Institute of Rural Reconstruction, Awassa, Ethiopia
Program Intern   May 2005-August 2005
- Assisted in the planning and conduct of an evaluation of the family planning program
- Wrote concept papers on HIV/AIDS Capacity Building and Integrated Food Security Projects

United States Peace Corps, Lesotho
Education Volunteer- Teacher Trainer   November 2001- December 2003
- Trained 25 teachers in materials development classroom management, teaching techniques and HIV/AIDS, resulting in the improvement of pass rates by 25%
- Designed and taught basic sex education and life-skills curriculum for students
- Conducted needs assessments of three primary schools including teachers' skills, school strategic plans, materials development, and curriculum

Gender and Development Training Sector Coordinator   May 2002-December 2003
- Trained Peace Corps volunteers on Gender Analysis tools and issues
- Revised sector objectives for Peace Corps/Lesotho training in Gender and Development

International Rescue Committee, San Diego, CA
ESL Teaching Assistant   August 2001- November 2001
- Provided small-group English language instruction to resettled women refugees from Africa

EDUCATION

Columbia University School of International and Public Affairs, New York, NY
Master of International Affairs   2004-2006
Concentration: International Development, regional focus in Africa
Honors: Foreign Language and Area Studies Fellowship in Dutch, 2005-2006

Bryn Mawr College, Bryn Mawr, PA
Bachelor of Arts in French and Anthropology   1995-1999
Study Abroad: Université Aix-Marseille I, Aix-en-Provence, France   1997- 1998
Honors: Fulbright Scholar, France, 1999
          Department of Anthropology Scholarship for Fieldwork in Kenya, 1997

LANGUAGES

Fluent French, proficient Dutch, intermediate Spanish

OTHER

Guest lecture, "Mainstreaming Gender in Development", NYU Wagner School, Course:
Program Development and Management for International Organizations, October 2006, October 2007

CURRICULUM VITAE

Casey Iiams-Hauser, MIA

SUMMARY STATEMENT

In his current position Mr. Iiams-Hauser supports the design, development, capacity building and implementation of several information systems including electronic medical record systems (EMR), laboratory information systems (LIS), Mobile health, national data aggregation systems and asset tracking and maintenance systems with install bases in Cote d'Ivoire, Kenya, Mozambique, Vietnam and Haiti. He has worked with the Ivoirian Ministry of Health to create the national guidelines and requirements for laboratory information systems. Mr. Iiams-Hauser provides technical assistance to and helped to build capacity of ministry and partners to roll out LIS to over 100 sites in Cote d'Ivoire. He has conducted a system wide review of EMR use at facilities in Vietnam.

RELEVANT EXPERIENCE

Senior Digital Health Specialist, International Training & Education Center for Health (I-TECH), Department of Global Health, University of Washington, Seattle, WA, 2011-present

- Advised the implementation of an electronic medical records system (EMR) deployed at 316 medical facilities in four counties in Kenya.
- Responsible for coordinating the efforts of the operations, training, software development and systems design teams to create and deploy and EMR which will improve quality of care and decrease costs with a focus on HIV and TB prevention and treatment.
- Assists the Kenya country team in producing software specifications and standard operating procedures to assist in the implementation process.
- Worked with the development of a direct messaging system for maternal health in Kenya, and a system to facilitate HIV treatment decisions in Mozambique.

eHealth Implementation and Support Manager, the Earth Institute at Columbia University, New York, NY, 2009-2011

- Worked on mobile and electronic health interventions in the Millennium Villages Project (MVP) for The Earth Institute at Columbia University.
- Managed the design, development, implementation and support of eHealth tools with the help of a software development team (based in Nairobi), and a network of eHealth specialists in each of MVP's project sites.
- Managed, led training workshops, and provided mentorship for two regional and fourteen country level eHealth Specialists.
- He managed four applications in fourteen sites in ten countries. The applications are an EMR (OpenMRS), an ODK-based Verbal Autopsy application, SMS based health tool ChildCount+ and a pilot of a smartphone-based community health worker tool (Commcare). ChildCount+ had over two hundred thousand people registered with over 3 million observations and over four hundred thousand patients in OpenMRS with over seven million observations.
- He developed a mobile health module to assist with the prevention of mother to child transmission of HIV/AIDS program in partnership with UNAIDS in Kenya. He implemented this in Kenya, Ghana and Rwanda in partnership with UNAIDS country offices and MVP.

- Previously, as Columbia University seconded staff, he consulted for UNICEF Innovations Group and UNICEF Malawi on using mobile health tools to improve the continuum of care for those enrolled in PMTCT programs.

Client Products Coordinator, Labcorp/Dynacare, 2008

Program Manager, E-Quip Africa, 2005-2008

Information Technology Manager (volunteer), Damongo Regional Hospital, Ghana, 2006-2008

EDUCATION

- 2011- MIA, International Development, Columbia University, New York, NY
- 2006- BA, Intl Dev & African Studies, The Evergreen State College, Olympia, WA

<u>**CURRICULUM VITAE**</u>

<div align="center">**Christina White**</div>

<u>**SUMMARY STATEMENT**</u>

<u>**WORK EXPERIENCE**</u>

Feb 2018- present   University of Washington - ITECH   Seattle, Wa
Senior Technical Program Manager

- Serve as a project lead on assigned projects and coordinate with the software development team, external vendors or consultants, other stakeholders and client to meet project deliverables on time and within budget; provide oversight of the quality of work from external vendors or consultants.

- Design information management systems for health services delivery, human resources for health, health policy and other areas of the health sector.

- Conduct analysis and use of routine program or clinical data and share data visualization strategies, develop analytic capacity, and disseminate information products such as dashboards with clients or project stakeholders.

- Contribute to the analysis and dissemination of evaluation findings, including recommendations for system and program improvement and design and carry out systematic evaluation, using qualitative and quantitative methods, to answer these evaluative questions.

- Contribute to publications, including conference abstracts, evaluation reports, and journal publications for dissemination as needed.

July 2018- Jan 2019   University of Washington   Seattle, Wa
Independent Consultant

- Develop and organize user documentation for eSaude, a tailored OpenMRS implementation in Mozambique

- Develop electronic versions of paper forms in OpenMRS. Develop electronic reports to aid management and provision of care services to mental health patients in Mozambique

Sept 2018- present   Indian Health Services/Diabetes Center   Toppenish, Wa
Thesis Work

- Manage Chi'ish Wat'uy program. Facilitate and participate in timeline development and execution of grant deliverables (e.g. assessments and reports). Develop a stakeholder community around reducing sugary drink consumption. Manage collaboration with various local programs including WIC, Youth Multimedia Club, Community Health, Youth Services, and IHS Nutrition program

- Work with Indian Health Services (IHS) Healthy Heart Program and the Yakama Nation Diabetes Wellness Program on a Water first! grant funded by the Notah Begay III Foundation to perform a community health, water and sugary drink assessment. Utilize stakeholder input to develop a plan for drinking water first to combat diabetes and obesity in the community

Sept 2016- June 2018   Central Washington University   Ellensburg, Wa

Graduate Student/Teacher's Assistant

- Graduate coursework in Cultural and Environmental Resource Management, with a focus on community health and economics among socially disadvantaged populations. Thesis research related to developing socially and culturally relevant models to add the literature on issues related to health disparities in socially disadvantaged populations, particularly related to diabetes and obesity. Multivariate logistic regression analyses on the impact of socio-economic variables on water and sugary drink consumption.

Nov 2012- Oct 2015   Genelex Corporation   Seattle, Wa

Senior Software Engineer

- Developed on a pharmacogenetics application which served as a clinical decision support tool to identify potentially harmful drug-drug and drug-gene interactions in patients.
- Managed the design, development, implementation, and administration of a web-based application (built on LAMP)
- Developed UI and web APIs and collaborated between developer groups to achieve standardized, integrated messaging between systems
- Developed a drug mapping program to map standardized drug identifiers (rxCUIs) with internal drug coding infrastructure to allow for wider integration and use of our clinical decision support tools. Integrated this tool with Allscripts EMR to participate in their integration contest and won 3rd place, awarding our company ~$100,000 and a secured integration spot with Allscripts.
- Introduced new tools to the company to help with streamlining requirements development (Balsamiq) and standardize and expand the scope and automation of testing (PHPUnit, Selenium, Browserstack)

Sept. 2007 – 2011   University of Washington, CIRG   Seattle, WA

Technical Program Manager and Senior Software Engineer

- Developed, implemented and maintained EMR and other health informatics systems available for a variety of projects in global clinical and public health informatics, all of which involved secure web applications and data integration, the largest of which including a networked system of 40+ servers implementing a medical record/point of care system in Haiti, and a national reporting system for aggregating health data in Mozambique.
- Technically managed developers. Developed on systems using PHP, MySQL, Java Struts, PostgreSQL, Perl, ExtJS, HTML5, Apache, IIS, Microsoft SQL Server, on Linux and Windows platforms. Interface design using CSS3 and JavaScript libraries.
- Managed, designed, developed, tested, validated, and documented changes to database, interfaces, and systems upstream and downstream of all systems (including Laboratory Information Management Systems (LIMS) and electronic medical record (EMR) systems) for CIRG/I-TECH associated information systems projects in Mozambique, Haiti, Cote d'Ivoire and other countries.

- Performed site assessments, user interaction studies, and developed detailed workflow documentation related to implementing medical records systems in resource limited settings.
- Analyzed information related to system impact on clinic workflows and assessed suitability of requirements to incorporate needs at all levels (from the data entry clerk, to the clinician, all the way to the CDC and ministry of health officials). Coordinated and managed testing, implementation, end-user and IT support training, and developed documentation pertinent to implementing health information systems in resource limited settings, particularly Haiti, Cote d'Ivoire, and Mozambique
- Developed in-the-field, technical expertise with the following: clinical laboratory instrumentation, clinical systems, clinical operations, and data flow throughout the laboratory and Medical Centers.
- Drafted RFP responses, wrote conference papers and presentations, helped develop grant budgets and assisted writing grant applications and grant reports.
- Coordinated communication, requirements gathering, strategic planning, and development between multiple country officials, hospitals, organizations, laboratories, divisions, departments, staff and vendors.

May 2007 – Sept 2007   University of Washington, CIRG   Seattle, WA
Web Developer
- Responsible for developing (50%), installing (25%), and maintaining (25%) health information systems (HIS) for chronic disease management and research
- Implementation using PHP, Microsoft SQL Server 2000,2003 & 2005, MySQL, JavaScript, Ajax, based in Windows, Windows server 2003 and Linux OS

Sept. 2005 – Jan 2007   University of Washington, Dr. Yongmin Kim   Seattle, WA
Bioengineering Researcher / Clinical Informatics
- Designed, developed and implemented a web-based survey interface for template-based documentation and decision support for nurses treating patients with Congestive Heart Failure (CHF)
- Worked jointly with the University of Washington Department of Bioengineering and Cardiology Department
- Collected and interpreted quality assurance survey results, server usage statistics, and documented workflow processes

June 2005 – Aug. 2005   University of Washington   Seattle, WA
NIH trainee, Clinical Research Experience for Engineers (CREE) Intern
- Worked jointly with the University of Washington Department of Bioengineering and Cardiology Department designing, developing and implementing an electronic personal health record and referral system for cardiac patients using C#, and the .NET Framework
- Collected and interpreted quality assurance, non-user survey results, and server usage statistics
- Attended and participated in weekly classes regarding research presentation, and weekly journal clubs.
- Funded to attend the annual IEEE-EMBC conference in Shanghai, China.

June – Aug. 2004   Children's Hospital/Harvard U/ HHMI, Dr. Len Zon   Boston, MA
Howard Hughes Medical Institute (HHMI) – EXROP Research Intern
- Performed chemical screen on zebrafish embryos to identify a stem –cell proliferative enhancer. Utilized in-situ hybridization, PCR, and Benzidine staining techniques.
- Shadowed oncologist/hematologist to obtain knowledge of job and skills requirements, and time demands.

EDUCATION

Sept. 2016- present   Central Washington University   Ellensburg, WA
Master's in Science Coursework in Cultural and Environmental Resource Management
- Cumulative GPA: 3.99
- Focus on economic modeling of social and cultural determinants of food security, community health assessment and water/sugary drink consumption

Mar. 2003- Dec. 2006   University of Washington   Seattle, WA
BS in Computational Bioengineering, Minor in Mathematics
- Cumulative GPA: 3.63
- Senior thesis work on E-medicine and health informatics

Graduate non-matriculated Coursework in infectious disease epidemiology

SCHOLARSHIPS AND AWARDS RECEIVED

- Louisiana Governor's Office of Indian Affairs Scholarship, *Sept 2018*
- Braedon-Dodd Scholarship, *March 2018*
- CWU Graduate Assistantship, *September 2016 and 2017*
- Bioengineering Departmental Scholarship, *January 2006*
- NACME Minority Scholarship, *January 2005 and 2006*
- CREE Internship, *June 2005*
- Kimberley-Clark Scholarship, *January 2004*
- CH2M Hill Scholarship *January 2004*
- HHMI - EXROP Summer Research Internship, *June 2004*
- CSEM Success Scholarship, *September 2004*
- UW GenOM Project Funding, *2003 and 2004*
- ALVA Honor Student Scholarship, *June 2003 and 2004*
- UW Alumnae Scholarship *September 2003*
- Dean's List, *Fall 2002- Fall 2004, Spring and Fall 2005, Summer and Fall 2006*

PRESENTATIONS

- "NACNA Traditional Ecological Knowledge (TEK) Food Gathering Program" Symposium On University Research and Creative Expression, Ellensburg, WA. *May 2017*
- "Chemical screening in zebrafish". HHMI EXROP Meeting. Bethesda, MD. *May 2005*.
- "UW GenOM (genomics opportunities for minorities) research experience discussion". Presented to Dan Ling, the IBM vice president, and Dean of the college of engineering. University of Washington, Seattle, WA. *March 2005*

- "E-medicine and the D2H2 paradigm". CREE summer undergraduate poster session. University of Washington, Seattle, WA. *September 2005*

PUBLICATIONS

- "Conduit to Tribal and Environmental Justice? Unpacking Washington v. United States", accepted for publication in Berkeley Law *Ecology Law Current (45) 2018* Berkeley, CA
- "Three years experience with Implementation of a Networked Electronic Medical Record in Haiti", *accepted for publication at AMIA 2009* San Francisco, CA
- "Development and Implementation of a loosely coupled, multi-site, networked and replicated electronic medical record in Haiti", *accepted for publication at NSDR 2009,* Big Sky Montana
- "An innovative tool for Supporting the Quality of Care and Program Reporting: The Haiti HIV Electronic Medical Record Project", *accepted for publication at the 2009 PEPFAR Implementer's Conference,* Windhoek, Namibia
- "Improving Healthcare Quality through Distributed Diagnosis and Home Healthcare (D2H2)", *accepted for publication at the 2006 D_2H_2 Conference,* Washington, D.C.

SKILLS

- Extensive work in global health informatics in Haiti, Mozambique, and Cote d'Ivoire.
- Technical program management (7 years)
- Expertise in clinical information systems and various clinic workflows
- Experience in stochastic modeling of biological systems (cell systems dynamics and pharmaceutics)
- Coursework and research in genetics
- Technical and development expertise with the following: clinical laboratory instrumentation, clinical systems, clinical operations, and data flow throughout the laboratory and medical centers.
- Excellent skills in working with a wide variety of clients and stakeholders, as well as managing and working with small to medium size groups of developers
- Served for 3 years on the board of directors for Medicine Creek, applying for and obtaining 501(c)(3) status for the organization as well as volunteering over 200 hours developing grants, fundraising, developing a website, logo and Facebook page for the organization.
- Extensive knowledge of UI design and development tools
- Experience in architecting, building and maintaining IT systems in resource limited settings
- Software development using PHP, Java, HTML/5, C#; CSS3, JavaScript and libraries;
- Excellent skills in working with a wide variety of clients and stakeholders, as well as managing and working with small to medium size groups of developers
- Graduate coursework and experience in grant writing and management
- Spanish (7 years)
- Haitian Creole (7 years)
- Portuguese (3 years)
- French (5 years)

Gregory Nelson Rossum

SUMMARY STATEMENT
Excellent verbal and written communication skills, leadership and technical background, senior engineer/ project manager with key assets:

- Experienced, Full Stack Engineer, 20+ years with clients,
- Extensive telecom and EDI experience,
- Current technical skill set, Spring, FHIR
- Android, LAMP, .NET, Oracle, SQL, PLSQL and data-warehouse,

EDUCATION
1985 B.Sc., Computer Science, University of Calgary

SOFTWARE
OS: ALL UNIX, AIX, HP/UX, Solaris, Linux, .NET
Languages: C/C++, C#, SQL, Perl, Java, LAMP
DBMS: Oracle (OCI, AQ, PL/SQL), SQL Server, Sybase, MySQL, PostgreSQL
CASE: Rose, Clear Case, PVCS, Perforce, Source Safe, GIT, SVN
Web Services, Android, API's, FHIR, Spring MVC

EXPERIENCE

University of Washington., Seattle, WA   **November 2013 to**
Lead Software Engineer   **Current**
Co-lead the design and build of the FHIR API to OpenELIS-Global-2. Our design utilizes the HAPI JPA server to store FHIR service requests to create lab orders and diagnostic reports that are available for external EMR system that made the request.
Co-lead the design and re-write of OpenELIS(OE) to OpenELIS-Global-2. This project modernized OE from the original 2008 design using Struts to Spring MVC. All component software were upgraded and I worked under a colleague to upgrade the software to US Government security standards.
Complete major client enhancements. Interview and mentor new developers. Create and support software engineering processes. Design/build/implement new code control and deployment process. Provide technical expertise and analysis regarding future product development. Major initiatives include BIRT reporting, design/build/implement Funding Mechanism Tracking, and design/build/implement the FP Dashboard for the Clinton Health Access Initiative for the Nigerian ministry of health. Develop connected mobile (android) survey app for Clinical Mentorship. Design/build/implement cloud-based financial data mart. Design/build/implement VMMC mobile app featuring data sync for resource limited environment.

Communications Test Design Inc., Vancouver, BC   **February 2013 to**
Software Engineer   **November 2013**
Design/build/implement web services interface to Telus SAP. Redesign/build/implement customer premises equipment return system. Design/build/implement equipment status update process. Design/build/implement Canada Post web service interface.

Exan Group Ltd., Vancouver, BC   **May 2011 to**
Technical Support Analyst   **September 2012**
Provide tier II support to Axium dental school/practice management software in universities and HMO's throughout North America. Resolve software and data issues with university IT staff in an Oracle, PL/SQL and C++ environment. I specialized in dental/medical EDI during the HIPAA 4010 to 5010 transition in a multiple clearing house/multiple payer environment. I authored an ETL layer to facilitate data conversion between legacy systems and the Axium database. Provide custom analysis, development and implementation on complex production systems.

Sprint Communications Company, Kansas City, KS   **January 2002 to**
Principal Network Systems Engineer   **August 2003**
Network engineer with the Next Generation Networks group of Technology and Advanced Systems Design.
Team member on the Integrated Campus Network project. Developed and drove approval of the Systems Requirement Document for the Soft Wireless Access Tandem (SWAT) program. Team member that evaluated the vendor responses to the SWAT RFP. Conceived and developed traffic analysis utilities and program that examined PCS market condition and suitability of SWAT. Developed business case to justify next generation implementations. Member of the One-Sprint core design team for NGVN (Next Generation Voice Network) a collaboration of Sprint Global Markets Group and Sprint PCS. Environment and tools included Sun Solaris, NT, Java and the PCS Stage Gate process.

Sprint Communications Company, Kansas City, KS   **January 2001 to**
Consultant   **October 2001**
Software developer on the ANTS project. Automated National Translations will provision Mobile Codes and Local Calling Areas in Sprint PCS's Lucent and Nortel switches. Worked to create service view database abstracting switches, routes, codes, provisioning scenarios, transactions and service requests.
Performed CORBA enabled multi-threaded server and domain object design and development. Environment and tools included HP/UX, C++, CORBA(ORBacus), Oracle, Oracle OCI, Rose

Sprint Communications Company, Kansas City, KS   **December 1999 to**
Consultant   **January 2001**
Team Lead / Software developer on the SM2 project. Service Manager Manager (not a typo) provided subscriber and network provisioning to the packet switching function of Sprint's ION product. Technical-Team Lead managing five developers. Hire and fire responsibilities, mentoring, major release delivery, managed developer support and work assignments. Performed as software developer on server and framework teams. Implemented CORBA Name Service and CORBA Notification Service. Developed IDL and developed/debugged and deployed multi-threaded CORBA enabled servers.
Environment and tools included HP/UX, C++, CORBA(Visibroker), ClearCase, Persistence Power-Teir, Oracle.

Sprint Communications Company, Kansas City, KS   **April 1999 to**
Consultant   **December 1999**

Software developer in the LAP (Local Administrative Processes) group on the JCS2000 switch project. Primarily responsible for switch provisioning. Mediation device software that extracted data from the Call Processor Control System (CPCS) database and controlled the validation, transportation and initiation of Call Processor (CP) data fills. Environment and tools included Sun Solaris, Digital Unix, C++, STL, Perl, Expect, Rational ClearCase, Oracle RDBMS, Oracle Call Interface, Oracle Advanced Queuing and PL/SQL.

USN Communications Inc., Chicago, IL   **December 1997 to**
Consultant   **January 1999**
Full cycle data warehouse DSS implementation, technical lead for data transformation of Ameritech, Nynex and Bell Atlantic USOC/usage data, internal provisioning system and billing vender data feeds. Participated in model development, segmentation planning, index planning, query development, performance tuning and load planning. Provided developer mentoring and management as well as user training and support.

Metapath Software Corp., Seattle, WA   **April 1997 to**
Consultant   **November 1997**
Wrote the Software Functional Specification for the CEER data warehouse project. Participated in the design and development of the CEER data warehouse project to capture cellular telephone call detail record's (CDR's). The CDR's were extracted from an Oracle database, then ASN.1 encoded and transported to the warehouse platform and decoded. The data was then uploaded into the Red Brick data warehouse supporting queries from the sales and marketing department. Specific tasks included: data modeling, extraction, transformation and transportation of data from a real-time OLTP environment CEOS, developing methods and utilities that support the data warehouse refresh cycles, and knowledge transfer.
Environment: Sequent/Dynix, Sun/Solaris, HP-UX operating systems, Oracle RDBMS, Redbrick Data Warehouse, Brio Query, OSS/ASN.1 compiler and libraries, C/C++, SQL, Ksh scripts and languages.

Northern Telecom Ltd., Richmond, BC   **March 1996 to**
Consultant   **February 1997**
Experienced using design patterns to develop reusable object oriented communications software. Reactor, acceptor and connector patterns were used to build a network element agent. The agent connects and maintains communication between network elements and network management modules. The agent then reacts to alarms, messages and commands, translating between TL-1 and XDR.
Environment: Network elements from Northern Telecom, Fujitsu, Aloutel and Tellabs, C/C++, Adaptive Communications Environment (ACE), RogueWave and HP-UX.

MPR Teltech Ltd., Burnaby, BC   **August 1994 to**
Consultant   **March 1996**
Performed as a Member of the Technical Staff in the Intelligent Network Group at MPR from October 1994 to March 1996. Became familiar with the Bellcore AIN (Release 0.1, 0.2, 1.0) and ITU (CCITT) CS-1 definitions of IN. Work on the MPR INEmulator provided a background in Service Switching Functions, Service Control Functions, Service Logic Programs, Service Resource Functions and Service Independent Building Blocks(SIBS). Participated in porting

projects involving Stratus/FTX, HP-UX, Dec/OSF1, Intel/SCO Unix, and Sun/Solaris. Access to data was by embedded, dynamic SQL. Added the Call Waiting Service and Conference Call Service to the INEmulator using a conference card in a Redcom MSP and advanced function in the AIN Basic Call Model. Participated in the Stratus Computer SINAP/SIB Integration project and became familiar with the Stratus environment for fault tolerant processing (SINAP). Wrote and performed performance testing for the project using an SS7 traffic generator.

Designed and developed distribution hub for radio advertisement system. Production studios create "spot", send to hub over ISDN line and hub distributes digitized audio to radio outlets across the continent. Used sockets and shared memory for inter-process communication.

Databyte Consulting Inc., Vancouver, BC   **May 1994 to**
Lead Programmer/Analyst   **August 1994**
Supervised five programmers and provided analysis and programming in a SCO Unix, Unify and Accell environment.

HeathVISION Corporation, Vancouver, BC   **February 1994 to**
Programmer/Analyst   **May 1994**
Worked on the Resource Vision Out Patient Scheduling Project. Responsible for analysis, GUI design and technical specifications. The development environment was DEC/Sybase servers and Windows clients.

Western Software Solutions, Vancouver, BC   **1989 to 1993**
Project Manager
Rule-based cost of maintenance forecasting on Catapiller products, components and sub-assemblies.   Programmer/Analyst UNIX, networks, databases and Windows PC's with various third and forth generation languages to develop commercial client-server systems. Consulting Programmer/Analyst to the Manalta Coal Mine Automation Project. Custom development, data conversion and implementation of inventory, purchasing, maintenance, payroll and accounting systems.

Computerized Lodging Systems, Alameda, CA   **1988 to 1989**
Account Manager
Responsible for the development of a territory including the four western provinces of Canada and five north western states. Designed a central reservations and multi-property management network for the Vancouver-based Coast Hotel chain.

NCR Canada Ltd., Calgary AB   **1985 to 1988**
Account Manager
Responsible for UNIX workstations, PC's and advanced retail systems in major accounts across western Canada. Designed an inventory system for the Bonanza restaurant chain using communicating POS terminals and PC's.

Lucy A. Perrone, MSPH, PhD

SUMMARY STATEMENT

Dr. Perrone is a public health laboratory advisor specializing in infectious disease diagnosis and surveillance, laboratory systems and capacity building, and improving human resources for health in resource-limited countries. As a trained virologist, Dr. Perrone previously worked for the CDC Influenza Division and WHO Collaborating Center for Influenza Surveillance in Atlanta and supported all member states and referring laboratories in the diagnosis and reporting of seasonal and avian influenza viruses. In her role with CDC she was seconded to WHO WPRO during the 2009 HI1N1 outbreak response and supported 37 countries in WPRO on influenza diagnostics. Since joining I-TECH in 2011, Dr. Perrone has come to lead the laboratory system strengthening program for I-TECH's USG funded GHSA and PEPFAR oriented projects. Dr. Perrone leads a multidisciplinary team working in multiple countries to strengthen laboratory and point of care based diagnostics and she has worked in over 25 countries in her 20 year long career in infectious diseases. She is highly skilled in infectious disease epidemiology, evaluation of infectious disease surveillance programs, quality assurance of laboratory testing, developing international guidelines for the prevention and control of infectious diseases, as well as the training and mentoring of health laboratory staff.

RELEVANT EXPERIENCE

Adjunct Assistant Professor, Department of Laboratory Medicine, School of Medicine, University of Washington, Seattle, WA, USA, 2018- present

Associate Faculty, Faculty of Medicine, Department of Pathology and Laboratory Medicine, University of British Columbia, Vancouver BC, Canada, 2017-present

Assistant Professor, Department of Global Health, Schools of Public Health and Medicine, University of Washington, Seattle, WA, USA, 2015- present

Acting Assistant Professor, Department of Global Health, School of Public Health, University of Washington, Seattle, WA, USA, 2014 - 2015

Laboratory Systems Strengthening Specialist, International Training and Education Center for Health (I-TECH), Department of Global Health, School of Public Health, University of Washington, Seattle, WA, USA, 2011- 2014

Senior Scientist, Vaccines, TRIA Biosciences, Seattle, WA, USA, 2010- 2011

Global Laboratory Systems Strengthening Specialist, Influenza Division, National Center for Immunization and Respiratory Diseases, Centers for Disease Control and Prevention (CDC), Atlanta, GA, USA, 2009- 2010

Technical Officer, Communicable Disease Surveillance and Response Unit, Western Pacific Regional Office, World Health Organization (WHO), Manila, Philippines. 2009

Scientist, Influenza Division, National Center for Immunization and Respiratory Diseases, Centers for Disease Control and Prevention, Atlanta, GA, USA, 2006- 2009

EDUCATION
- Fellowship in Infectious Diseases and Public Health Microbiology, American Society for Microbiology/ Centers for Disease Control and Prevention, National Center for Infectious Disease, Atlanta, GA, 2006–2008
- PhD, Infectious Disease Pathology, University of Texas Medical Branch, Galveston, TX, 2006
- MSPH, Tropical Medicine, Tulane University School of Public Health and Tropical Medicine, New Orleans, LA, 2000
- BS, Biology, Fordham University, New York City, NY, 1999

PROFESSIONAL AFFILIATIONS
- Member, African Society for Laboratory Medicine, 2015-present
- Member, Association of Public Health Laboratories, 2006-present
- Member, American Society for Tropical Medicine and Hygiene, 2001-present
- Member, International Society for Infectious Diseases, 2001-present
- Advisor, Global Emergency Care Collaborative, 2010-present

RELEVANT PUBLICATIONS AND PRESENTATIONS

Refereed Research Articles
1. **Perrone, LA,** Voeurng, V, Sek,S, Song, S, Vong, N, Tous, C, Flandin, JF, Confer, D, Costa, A, Martin, R . Improving laboratory testing quality and capacity in Cambodia using a mentored laboratory quality stepwise implementation (LQSI) approach. Bull World Health Org. 2016;94:743–751.
2. **Perrone, LA,** Confer, D, Scott, E, Livingston, L, Bradburn, C, McGee, A, Furtwangler, T, Downer, A, Mokdad, AH, Flandin, JF, Shotorbani, S, Asghar, H, Esmat Tolbah, H, Ahmed, HJ, Alwan, A, Martin, R. Implementation of a Mentored Professional Development Program in Laboratory Leadership and Management in 10 Countries in the Middle East and North Africa. Eastern Mediterranean Health Journal. 2016;22 (11): 832-839.
3. Clegg CH, Roque R, **Perrone LA**, Rininger JA, Bowen R, Reed SG. GLA-AF, an emulsion-free vaccine adjuvant for pandemic influenza. PLoS One. 2014 Feb 14;9(2):e88979.
4. **Perrone, LA,** Belser, J.A., Wadford, D.A., Katz, JM, Tumpey, TM. Inducible nitric oxide contributes to viral pathogenesis following highly pathogenic influenza virus infection in mice. J Infect Dis. 2013 Mar 15.
5. Clegg, C, Roque, R, Van Hoeven, N, **Perrone, LA,** Baldwin, SL, Rininger, JA, Bowen, R, Reed, SG. Adjuvant Solution for Pandemic Influenza Vaccine Production. Proc Natl Acad Sci U S A. 2012 Oct 23;109(43):17585-90.
6. **Perrone, LA,** Szretter, K.J, Mizgerd, J, Katz, JM, Tumpey, TM. Mice lacking both the TNF and IL-1 receptors exhibit reduced lung inflammation and enhanced survival following H5N1 infection. J Infect Dis. 2010 Oct 15;202(8):1161-70.
7. **Perrone, LA**, Veguilla, V, Lu, X, Ross, T, Katz, JM, Tumpey, TM, Pushko, P. Intra-nasal vaccination with 1918 virus like particles protects mice and ferrets from lethal H5N1 influenza virus challenge. J. Virol. 2009 June:83 (11): 5726-34.

8. Goodman, AG, Fornek, JL, Medigeshi, GR, **Perrone, LA**, Pengi, X, Dyeri, MD, Proll, SC, Knoblaugh, SE, Carter, VC, Korth, MJ, nelson, JA, Tumpey, TM, Katze, MG. P58(IPK): a novel "CIHD" member of the host innate defense response against pathogenic virus infection. PLoS Pathog. 2009 May;5(5):e1000438.
9. **Perrone, LA**, Plowden, J, García-Sastre, A, Katz, JM, Tumpey, TM. Infection with highly pathogenic avian H5N1 and the pandemic 1918 influenza viruses results in early and excessive infiltration of macrophages and neutrophils in the lungs. PLoS Pathog. 2008 Aug 1;4 (8):e1000115.
10. Maines TR, Szretter KJ, **Perrone LA**, Belser JA, Bright RA, Zeng H, Tumpey TM, Katz JM. Pathogenesis of emerging avian influenza viruses in mammals and the host innate immune response. Immunol Rev. 2008 Oct;225: 68-84.
11. Yu, X, Tsibane, T, McGraw, PA, House, FS, Keefer, CJ, Tumpey, TM, Pappas, C, **Perrone, LA**, Martinez, O, Stevens, J, Wilson, IA, Aguilar, PV, Altschuler, EL, Basler, CF, Crowe, JE. Neutralizing antibodies derived from the B cells of 1918 influenza pandemic survivors. Nature. 2008 Sep 25;455 (7212):532-6.
12. Pappas, C, Basler, CF, Aguilar, PV, Solórzano, A, Zeng, H, **Perrone, LA**, Palese, P, Katz, JM, García-Sastre, A, Tumpey, TM. Single gene reassortants identify a critical role for PB1, HA and NA in the high virulence of the 1918 pandemic influenza virus. Proc Natl Acad Sci U S A. 2008 Feb 26;105 (8):3064-9.
13. Conenello, GM, Zamarin, D, **Perrone, LA,** Tumpey, TM, Palese, P. A single amino acid change in the PB1-F2 protein from H5N1 and 1918 Influenza A viruses contributes to increased pathogenicity. PLoS Pathog. 2007 Oct 5;3 (10):1414-21.
14. **Perrone, LA** and Tumpey, TM. Reconstruction of the 1918 Pandemic Influenza Virus: How Revealing the Molecular Secrets of the Virus Responsible for the Worst Pandemic in Recorded History Can Guide Our Response to Future Influenza Pandemics. Infect Disord Drug Targets. 2007 Dec;7 (4):294-303.
15. **Perrone, LA,** Narayanan, K, Worthy, M, Peters, CJ. The S segment of Punta Toro virus (Bunyaviridae, Phlebovirus) is a Major Determinant of Virulence in the Syrian Hamster and Encodes for a Type 1 Interferon Antagonist. J Virol. 2007 Jan;81 (2):884-92.
16. Yueh, A, Leung, J, Bhattacharrya, S, **Perrone, LA,** de los Santos, K, Goff, SP. Interaction of Moloney murine leukemia virus capsid with Ubc9 and PIASy mediates SUMO-1 addition required early in infection. J Virol. 2006 Jan;80 (1):342-52.
17. Tseng, CTK, Tseng, J, **Perrone, LA**, Worthy, M, Popov, V, Peters, CJ. Apical Entry and Release of Acute Respiratory Syndrome-Associated Coronavirus (SARS-CoV) in Polarized Calu-3 Lung Epithelial Cells. J Virol. 2005 Aug; 79 (15):9470-9.
18. Tseng, CTK, **Perrone, LA**, Zhu, H, Makino, S, Peters, CJ. SARS and the Innate Immune Responses: Modulation of Effector Cell Function without Productive Infection. J Immunol. 2005 Jun 15; 174 (12):7977-85.

Submitted Manuscripts

1. Implementation of a Professional Development Program in Laboratory Leadership and Quality Management in Zambia from 2016 - 2018. Gopolang, F., Kruuner,A., Kasvosve, I., Gomo,R., Motlhabane,T., Chohan, B., Zulu-Mwamba, F., Nsama, D., Shibemba, A., Kaoma, D., Nonde, L., Campbell, N., Noble, M.A., Downer, A., Soge, O., Sadate-Ngatchou, P., Ndongmo, C., Nsofwa, D., Steinau, M., **Perrone, L.A.** Submitted to the African Journal of Laboratory Medicine on March 13, 2020.

2. Strengthening quality management and capacity of clinical laboratories in Cambodia; 2017-19. Ong SK, Donovan G, Ndefru N, Song S, Sek S, Leang C, **Perrone LA**. Submitted to the Journal of Global Health Science and Practice on March 20, 2019
3. Strengthening the clinical laboratory workforce in Cambodia; a case study of a mixed-method in-service training program to improve laboratory quality management system oversight. Ong,SK, Donovan, G, Ndefru, N, Song, S, Leang, C, Sek, S, Noble, M, **Perrone, LA.** Submitted to the BMC Human Resoources for Health Journal on March 20, 2019

Book Chapter
1. Robert Martin, **Lucy A. Perrone** and Michael Noble. Point of Care Diagnostics for Travelers Health, Travel and Tropical Medicine Manual. 5th edition, Saunders/Elsevier 2015. Editors: Elaine Jong, Christopher Sanford and Paul Pottinger.

HONORS
- Charles C. Shepherd Award Nomination for Achievement in Public Health Science for the manuscripts: *Perrone, LA et al, PLoS Pathog. 2008 Aug 1;4 (8):e1000115., 2008, and Pappas, C, et al. Proc Natl Acad Sci U S A. 2008 Feb 26;105 (8):3064-9.* 2008
- McLaughlin Graduate Fellowship in Infection and Immunity, University of Texas Medical Branch, 2004-2006
- Robert L. Harrison award for Molecular/ Cell Biology Research, Department of Pathology, University of Texas Medical Branch, 2005
- Sigma Delta Epsilon Society, Graduate Women in Science, Eli Lilly Travel Award, 2003
- Sigma Xi Scientific Research Society, Inducted 1999

<u>CURRICULUM VITAE</u>

Michelle Virgin, MA

SUMMARY STATEMENT

Ms. Virgin is an experienced grant manager with 10 years' international program management and leadership experience in a wide array of challenging assignments in Afghanistan, Turkey/N. Syria, Haiti, the Philippines, Rwanda, Cameroon and Argentina, as well as education and work experience in Canada and the United States.

EMPLOYMENT

University of Washington Department of Global Health

Senior Program Manager, **I-TECH, Seattle, WA**   **January 2020-Present**
- Collaborate with Haiti-based stakeholders, including CDC and Ministry of Health, to design, conduct, and achieve global health deliverables, with focus on health information systems and HIV care and treatment
- Lead award administration for the Digital Initiatives Group at I-TECH

*Program Manager***, Int'l AIDS Research & Training Program, Seattle, WA   May 2019-January 2020**
- Managed daily operations of five training and research grants with focus on low- and middle-income countries.
- Oversaw pre- and post-award administration for National Institutes of Health/Fogarty International Center and Health Services and Resources Administration awards, exceeding $1.5 million annually.
- Supervised program team of four staff.
- Prepared grant applications and marshaled through University of Washington and NIH systems; successful competitive win of $1.5M.

Catholic Relief Services

Interim Education Coordinator, **Afghanistan**   **September 2018 – November 2018**
Proposal Coordinator, **Philippines**   **May 2018 – June 2018**
Emergency Food Security Program Manager, **Turkey/N. Syria**   **January 2017 – April 2018**
- Managed $84M Food for Peace (FFP) grant targeting 25,000 households in over 140 villages of Northern Syria with life-sustaining monthly food support in the form of in-kind food commodities and food vouchers, preparing and adjusting annual, monthly, and weekly implementation plans based on security and operating constraints.
- Remotely managed team of over 60 staff in complex operating environment, ensuring high quality supervision.
- Worked closely with operations, supply chain, compliance, and finance teams for timely procurement, cross-border delivery, and payment for food commodities and vouchers.
- Ensured compliant reporting, prepared proposals, budgets, budget narratives, cost modifications, and pipelines for FFP and joint FFP-Office of U.S. Foreign Disaster Assistance (OFDA) award.

Head of Office, **Bamiyan & Daykundi Provinces, Afghanistan**   **October 2015 – October 2016**
- Responsible for all 100+ programming and operations staff in two provinces to deliver community-based education and agricultural livelihoods portfolio of >$2.5M to over 100 remote communities. Oversaw all aspects of programming, operations, finance, and HR for primary office, four sub-offices, and five smaller satellite offices located more than 12 hours' drive from one another.
- Proactively managed staff security across broad geographic territory, updating Country Representative on incidents and trends, consulting with senior staff and external stakeholders, proposing adjustments to SOPs and security posture as needed. Oversaw government and

community relations, promoting acceptance through high quality program design and implementation, transparent systems, careful recruitment, and strong staff management.

- Managed expansion of operations to support program growth, including expansion to over 20 new communities: established one new sub-office and guesthouse and four satellite offices, oversaw recruitment and onboarding of new staff; managed changes in base location for 10 employees.
- Led provincial participation in Afghanistan CP Strategy Development Process.

Education Program Manager, **Bamiyan & Daykundi Provinces, Afghanistan** **May 2014 – September 2015**

- Led cross-functional team of 28 programming and support staff across three offices to implement high quality community-based education programming for over 1400 students (> 50% of whom were girls), establishing community-based schools in 40 new communities, for a total of 56 communities and 70 classes.
- Managed budget for Government Affairs Canada (formerly DFATD)-funded Community Based Education Enrichment Program (>$5M over five years across five provinces); Caritas Australia CBE in Western Afghanistan (>$300,000)
- Facilitated office set-up in remote province of Daykundi, ensuring facilities and systems in place to allow for smooth program implementation.
- Built staff capacity through mentoring, regular inter-office exchanges, trainings, and adherence to CRS performance management standards.
- Promoted linkages between between monitoring, evaluation, accountability, and learning (MEAL) initiatives and programming, conducting regular data reflection sessions and follow-up to encourage adaptive management.
- Initiated and led all recruitment for education programming in Bamiyan and Daykundi.
- Ensured productive coordination with government and partners, including New York University for CRS' participation in a randomized controlled trial (see www.alseproject.com).
- Participated in CRS proposal design training (12/2014) and leadership training (6/2015).

International Development Fellow, **Les Cayes, Haiti** **September 2013 – May 2014**

- Conducting work in French, oversaw microenterprise and savings & internal lending components in support of agricultural value chains programming, including staffing, partner collaboration, and revision of work plans.
- Supported start-up activities for Inter-American Development Bank-funded $5M cacao value chain project: launch event for 100+ participants; operations manual development; organization of meetings with partners; development of project steering committee; coordination of sub-recipient assessment; drafting of sub-recipient terms of reference.
- Assisted in assessments and proposal development for WASH, disaster risk reduction, and agricultural programming, including for OFDA and World Bank opportunities,.
- Participated in prepositioning workshop (10/2013) and finance training for non-finance staff (02/2014).

University Neighborhood Housing Program

Program Assistant, **Bronx, NY** **January 2013 – April 2013**

- Provided financial advising in Spanish and English to low income residents of the Bronx, including completion of tax returns and referrals to other financial services.
- Managed recruitment, training, and support for 40+ volunteers.

United States Agency for International Development

Democracy and Governance Unit Intern, **Kigali, Rwanda** **June 2012 – August 2012**

- Conducted monitoring visits to USAID-funded projects and provided feedback to project coordinators.

- Collaborated with Mission team leaders to revise Mission's gender assessment, identifying actionable items.
- Developed curriculum for young women's entrepreneurship training.

Refine+Focus

Project Coordinator, **Boston, MA (from Buenos Aires, Argentina)   December 2010 – September 2011**

- Developed outreach and marketing strategies with clients (including NGOs), leading clients through visioning, goal-setting, and project development.
- Set, developed and budgeted deliverables, integrating measurable outcomes.
- Performed timely research relevant to client needs.

United States Peace Corps

Small Enterprise Development Volunteer, **Ngaoundéré, Cameroon   June 2008 – August 2010**

- Identified, trained, and provided technical support to 10 groups of women (200+ individuals) in *Village Savings & Loans Associations* program, which offers independent financial services and social insurance.
- Initiated and taught business classes and financial literacy classes for adults and youth at microfinance bank, government Center for the Promotion of Women, local high school, and seminars held by Cameroonian and international organizations.
- Provided technical support to a microfinance bank with over 1000 clients and net worth of US $500,000, turning a profit for the first time at the end of 2008; concentrated assistance on analysis of loan applications. Served as liaison between local associations and the bank, explaining concepts of savings and credit to clients and assisting with loan applications.
- Linked honey producers of Adamawa Region with the United States Embassy's Trade Section to start procedure for honey exportation under African Growth and Opportunities Act (AGOA).
- Completed two Peace Corps Partnership Projects; conducted needs assessment and consultation with beneficiaries regarding their contribution, obtained funding for completion of a school, as well as funding for start-up capital for young women's entrepreneurial projects.
- Designed and conducted training for 15 new Peace Corps Small Enterprise Development volunteers.

International Centre for the Prevention of Crime

Analyst, **Montreal, Canada   September 2007 – May 2008**

- With a multi-lingual team representing seven countries and three continents, produced first ever biennial report on international trends in crime prevention and community safety published in three languages.
- Researched and drafted chapter for biennial report on international, national and local policies and practices to prevent violence against women.
- Co-coordinated compendium of inspiring practices in crime prevention.
- Researched and drafted chapter for compendium on practices addressing prevention of youth gang formation and recidivism.
- Wrote commissioned paper on violence against women in Central America for Observatorio Centroamericano sobre Violencia (Central American Observatory on Violence), translated to Spanish.

Connections Group, LLC

Analyst, **Seattle, WA   June 2006 – August 2006**

Center for Peace & Human Security, Sciences Po

Intern, Paris, France   March 2006 – June 2006

EDUCATION

MA, International Political Economy & Development   February 2013
Fordham University, Bronx, NY
- Awardee, Public Service Assistantship

- Recipient, Matteo Ricci Award for Academic Excellence (highest academic honor awarded)
- Campion Institute Research Fellow, Emerging Markets, South Africa 2012
- Campion Institute Research Fellow, Monitoring & Evaluation, Philippines 2012
- Coursework including: Project Assessment, Project Accounting, Project Design, Project Proposal Writing; Applied Econometrics; Agricultural & Development; Community Economic Development; Financial Analysis

BA, Joint Honours Political Science and International Development Studies   **May 2007**
McGill University, Montreal, Canada
- *Certificate,* Université Paris-Sorbonne, Paris, France   *Spring 2006*
- *Exchange,* University of Hong *Kong*, Hong Kong, PRC   *Fall 2005*

Rotary International Youth Exchange   **2001-2002**
Lycée Mme de Staël, Montluçon, France

OTHER SKILLS & TRAININGS
Proficient in French and Spanish
Humentum USAID Rules & Regulations: Grants & Cooperative Agreements training   **2017**
eCornell Project Leadership Certificate   **2014**
Project Management for Development Professionals (PMD Pro) Level 1 Certification   **2014**