Title of Project. Stroke Prevention in Healthcare Delivery Environments (SPHERE)

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Structured Abstract

Purpose: To decrease the burden of stroke and its modifiable risk factors among older women in primary care practices by leveraging existing health information technology platforms.

Scope: To reach female patients aged 65 years and older who are seen in primary care in two outpatient clinics (one intervention, one control) in The Ohio State University Medical Center.

Methods: Develop an automated cardiovascular health tool that functions alongside the electronic health record (EHR) during the clinical encounter. Assess for changes in the cardiovascular health of participants using EHR data.

Results: We developed and deployed the automated cardiovascular health tool in our intervention clinic. We observed favorable changes in the cardiovascular health (body mass index, diabetes status) of patients in our intervention clinic, but not control clinic, at one-year.

Purpose: Our *central hypothesis* was that an individualized, automated cardiovascular health (CVH) assessment intervention would improve modifiable risk factors for stroke among older female patients in a primary care practice, as well as improve knowledge and awareness of modifiable risk factors for stroke among primary care providers, thus improving treatment. The *rationale* for the proposed research was that the American Heart Association's CVH metric is evidence-based, has substantial extant infrastructure, and can be readily interpreted by providers and patients in primary care settings.

Objective 1: To examine the effect of an individualized, automated CVH assessment intervention on modifiable risk factors for stroke. These risk factors are readily available in the electronic medical record (EMR).

Objective 2: To quantify the effect of an individualized, automated CVH assessment intervention on the ordering of laboratory tests for patients with missing values of cholesterol and glucose, and the pharmacologic treatment of modifiable risk factors for stroke among eligible patients identified via EMR.

Objective 3: To evaluate patient-facing tools that will communicate with existing EMR technologies, and determine if the use of patient-facing tools enhances the assessment of CVH.

Scope: Cardiovascular health (CVH) was introduced by the American Heart Association in 2010.[1] The metric classifies seven modifiable CVH behaviors and factors into categories of *ideal*, *intermediate*, and *poor* CVH. To date, CVH had not been assessed among older women in primary care settings, although the majority of these data are available in the electronic medical record (EMR).

Adverse health behaviors and health factors are consistently associated with increased cardiovascular disease and stroke risk.[1-3] The four CVH behaviors [smoking status, body mass index (BMI), physical activity (PA), and healthy diet] and three CVH factors (total cholesterol, blood pressure (BP), and fasting plasma glucose) are modifiable. The goal of achieving *ideal* CVH places an emphasis on primordial prevention, or the primary prevention of risk factors,[4] and thus the new CVH metric is useful for assessing the health of Americans of all ages.[5]

The burden of cardiovascular disease and stroke morbidity and mortality is high.[6] Increasing numbers of Americans have overweight/obesity, hypertension, diabetes, and hyperlipidemia.[5] The high cardiovascular disease and stroke burden is likely due to an increase in adverse CVH behaviors, such as unhealthy diet and physical inactivity. From a public health perspective, it is important to identify populations at-risk for cardiovascular disease and stroke.[4] A primary care intervention served to raise awareness of stroke risk among providers and patients, particularly in populations thought to be at low risk for stroke, such as older women.

Potential impact of the project on patients, providers, and the community. Overall, our results will add to the extant literature, which contains little information regarding CVH in community-based samples,[1-3] and no CVH data from older women in the primary care setting. The CVH assessment was designed by the American Heart Association to increase

awareness of and prevent cardiovascular disease risk factors, heart disease and stroke events, and for the secondary prevention of cardiovascular disease.[1] ***Our CVH assessment intervention was effective for improving CVH and treating cardiovascular disease risk factors. We demonstrated that an intervention with substantial extant infrastructure can lower stroke risk for older women in primary care settings.***

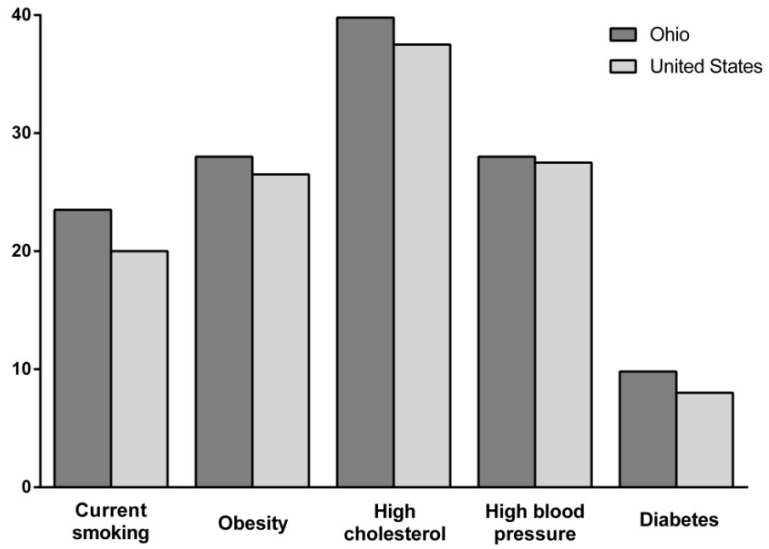
Howard and Goff recently predicted a doubling of incident strokes in the United States from 2010 to 2050, with higher rates among elderly and minorities.[7] This is a serious issue, since our source population comprises elderly women of different race/ethnicities with multiple risk factors for stroke.[8] In addition, management or prevention efforts aimed at stroke may be limited among older women in primary care settings if their CVH is not adequately assessed.[9] ***The study increased the awareness of stroke risk among older female patients in primary care practices and their primary care providers using an individualized, automated CVH assessment.***

CVH had not yet been used as a clinical tool for the improvement of cardiovascular disease risk factors or their pharmacologic treatment in the healthcare setting.[10] Its potential positive impact on a population of older female patients in the primary care setting is large, since it is estimated that only 3% of older women are in *ideal* CVH on all health behaviors and factors.[10] In addition to attaining the key objectives of this project, our findings will inform future investigations of the effect of reducing the risk of stroke among older female patients in primary care practices, and will help identify the most effective way to overcome physician-identified barriers to such an intervention.

Assessment of Need in Target Area. Heart disease and stroke are the 1st- and 4th-leading causes of death, respectively, among women in Ohio.[11] The *Ohio Plan to Prevent Heart Disease and Stroke* aimed to reduce the burden of heart disease and stroke primarily by promoting CVH behaviors such as controlling weight, being physically active, living tobacco-free and eating healthy.[11] The *Ohio Plan's* second goal was to reduce high BP, high cholesterol, and diabetes among Ohioans through early detection, treatment, and control of these CVH factors.[11] In the context of the goals set forth by the Ohio Department of Health,[11] the overarching aim of the proposed project is to decrease the burden of stroke and its modifiable risk factors among older women in primary care practices by leveraging existing health IT platforms.

Modifiable stroke risk factors that comprise CVH are: smoking status, BMI, PA, healthy diet (fruits and vegetables; fish; whole grains; limiting beverages with added sugar; and lower-sodium foods), total cholesterol, BP, and fasting plasma glucose. Data from the Ohio Behavior Risk Factor Surveillance System (BRFSS, 2009) indicate that many Ohioans are in *poor* CVH (Figure 1).[11] In addition, 74% of Franklin County, Ohio adult residents are screened for high cholesterol and 77% are treated for high BP.[11]

Figure 1. Prevalence of *Poor* CVH Behaviors and Factors in Ohio and the United States: Behavioral Risk Factor Surveillance System, 2009.



Complementary data point toward a large proportion of Ohio women who are in *poor* CVH according to the modifiable stroke risk factors shown above in Figure 1: 20% of women are current smokers, 29% are obese, 27% report no PA, 73% eat <5 servings/day of fruits and vegetables, 36% have high cholesterol, 26% have high BP, and nearly 7% are diabetic.[11] In these BRFSS data, few women indicated that they had been advised by a physician to: eat less high fat/high cholesterol foods (24%), eat more fruits and vegetables (33%), and increase PA (38%).[11]

These data indicate that there is much room for improvement in CVH among women in Ohio, and there remains a great opportunity for primary care physicians to communicate relevant healthcare advice and take action to reduce the risk of stroke among older women with evidence-based therapies.

CVH has important implications for the prevention of stroke, yet had not been assessed among older women in primary care settings. The study was the first to: measure CVH in primary care practices; quantify the effect of an individualized, automated CVH assessment to improve the ordering of relevant laboratory tests and the pharmacologic treatment of modifiable risk factors; and identify patient-facing tools to enhance the CVH assessment in order to identify targets for reducing the burden of stroke among older women. We quantified the effect of an individualized, automated CVH assessment intervention on modifiable risk factors for stroke, and to inform healthcare systems by determining the influence of patient-provider communication via EMR workflow regarding ideal CVH.

Methods:

Study hypotheses. We estimated a CVH score among older women in the primary care setting and assessed for differences in the mean CVH score pre- and post-intervention (**Objective 1**). We expected that older women would have low CVH scores, and thus were high-risk for stroke and can benefit greatly from a prevention discussion with their

healthcare provider. We anticipated that the intervention would increase the proportion of laboratory tests ordered for women with missing EMR values for cholesterol and glucose at the current appointment (**Objective 2**). We further hypothesized that more eligible patients (those with hypertension, hyperlipidemia, and elevated glucose) would be treated with evidence-based pharmacologic therapies, post-intervention compared to pre-intervention, for the control of stroke risk factors (**Objective 2**).

An exploratory objective was to identify patient-facing tools that would communicate with existing electronic medical record (EMR) technologies in order to enhance the assessment of CVH (**Objective 3**). We recognize that a barrier to the present-day incorporation of such patient-facing tools in the assessment of CVH is the lack of an interface that allows for data to be communicated seamlessly between a patient-facing tool and the EMR. We designed an interface that was compatible with the needs of primary care providers with input from our collaborators. In addition, these findings advanced our understanding of how often and why physicians opt out of EMR-based prevention-focused interventions.

Study design. We used a non-randomized intervention design which will allow for a run-in period, comparison group data collection, a provider education period, and implementation of a best practice alert (BPA) to prompt provider-patient interactions regarding CVH.

Timeline. Key dates and implementation of events.

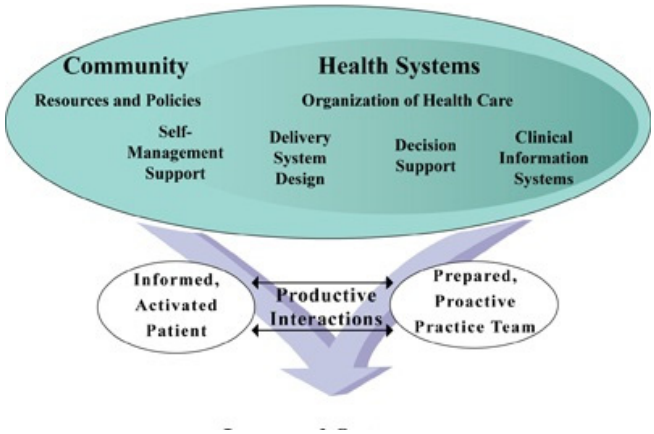
Key dates	**Study events**
01/01/13-04/30/13	Run-in period
05/01/13-07/31/13	Comparison data collection
08/01/13-08/31/13	Provider education
09/01/13-04/30/14	Intervention
05/01/14-07/31/14	Follow-up data collection
08/01/14-12/31/14	Sustained intervention and data analysis

Study population. Franklin County, Ohio is the home of The Ohio State University Medical Center (OSUMC). The county consists of 120,000 persons ≥65 years of age. Twenty-nine percent of the population is non-white (22% black, 4% Asian, 3% other) and 5% is Hispanic/Latino. Our target population for the proposed project was female patients aged 65 years and older who are seen at CarePoint East, a general internal medicine primary care clinic at the OSUMC. Clinical data from all women meeting the age criteria will be assessed in the current project, regardless of their history of cardiovascular disease or stroke. Over 400 female patients met our inclusion criteria.

Theoretical basis for the intervention. The primary audiences targeted for this intervention were: older women in primary care practices, represented in the Chronic Care Model (Figure 2) as the informed, activated patient; and their primary care providers, represented in Figure 2 as the prepared, proactive practice team. We believe the targeted patients, as well as future patients of the targeted health care providers, will directly benefit from this intervention in terms of improved CVH, and the prevention and treatment of

modifiable risk factors. We also expect the individualized, automated CVH assessment intervention delivered via EMR to benefit the targeted health care providers by ameliorating barriers to patient-provider communication of stroke risk.

Figure 2. The Chronic Care Model.



Provider education. Primary care providers are tasked with assisting patients with their acute health issues as well as chronic health conditions. Although guidelines exist for the appropriate pharmacotherapy treatments for stroke risk factors,[12] to date, there is no individualized, automated way to assess stroke risk in the primary care setting. ***The primary care providers at OSUMC are in a strategic position to offer pharmacotherapy for risk factors of cardiovascular disease and stroke.***

Dr. Foraker (PI) developed provider education materials that were specific to CVH. Provider education was conducted in 30-minute sessions. An overview of non-modifiable risk factors such as age and race/ethnicity was provided, with an emphasis on the established modifiable risk factors of hypertension, cigarette smoke exposure, diabetes, dyslipidemia, obesity, poor diet, and physical inactivity.[12]

Dr. Foraker used case-based examples that include EMR notifications and the use of an external website for facilitating productive interactions between the provider and patient (Figure 3). The primary care physicians and residents were given an opportunity to briefly role-play the interpretation of a simulated CVH assessment from the external website (CVH tool).

Implementation methods. We developed a best practice alert (BPA) in Epic, our EMR, which prompted physicians to discuss a patient's clinical CVH score with patients that meet the eligibility criteria. This BPA was triggered on women age 65 years of age or older who were attending the outpatient primary care clinic at our CarePoint East General Internal Medicine clinic. When the BPA was triggered, the CVH score was automatically computed using data in the EMR routinely collected as part of usual patient care and displayed the resulting score to the treating physician. Within the BPA, there was a link to take the physician to a website outside of the EMR (CVH tool) that we developed to facilitate the educational discussion between the physician and patient regarding the patient's CVH score.

Our CVH tool generated visualizations of the CVH score and how each of the input variables would change the patient's CVH score. The visualization is shown in Figure 3. In the figure below, the left column is designed to represent the current CVH of a hypothetical patient given the data pulled from the EMR.

Figure 3. CVH tool.

Comparison data. Comparison data were collected from the CarePoint East clinic for three consecutive months as shown in the timeline above, along with data from our control clinic. Of note, the follow-up data were collected one year later during the same three

consecutive months to minimize the influence of seasonality on the CVH data and secondary outcomes of interest (see timeline). Comparison data of interest will include that available from the EMR: smoking status, BMI (height and weight) total cholesterol, BP (systolic and diastolic), blood glucose; orders for laboratory tests for assessing cholesterol and glucose; and treatment for hyperlipidemia, hypertension, or diabetes.

Results: At baseline, the average age of eligible patients seen in the intervention clinic was 74 years, while the average age was 73 in the control clinic (**Table 1**). Larger differences were seen at baseline by race between the intervention (35% black) and control (19% black) clinics (**Table 1**). The demographic data in the intervention clinic did not change appreciably between the baseline and follow-up periods, and the baseline data of women seen during the baseline and follow-up periods in the intervention clinic (patient subset) had a similar distribution of demographic factors compared to all eligible patients at baseline (**Table 1**). Meanwhile, there was a slight change between the demographics of the eligible patient population between baseline and follow-up in the control clinic, as more eligible patients were seen during the follow-up period compared to the baseline period. Specifically, eligible patients seen during the follow-up period at the control clinic were slightly younger and comprised a lesser proportion of those of black race compared to baseline (**Table 1**). Similar to the intervention clinic, eligible patients seen in both the baseline and follow-up periods in the control clinic had a similar distribution of demographic factors compared to all eligible patients seen at baseline.

Table 1. Demographic characteristics of all eligible patients seen at baseline and follow-up.

	Intervention clinic			Control clinic		
	Baseline (all eligible patients)	Follow-up (all eligible patients)	Baseline (patient subset*)	Baseline (all eligible patients)	Follow-up (all eligible patients)	Baseline (patient subset*)
N	160	168	109	62	96	42
Age (sd)	74.2 (6.7)	74.5 (7.0)	75.0 (6.8)	72.8 (7.5)	71.6 (6.7)	72.4 (7.4)
Race						
White	93 (59%)	96 (57%)	64 (59%)	45 (73%)	76 (79%)	30 (71%)
Black	56 (35%)	62 (37%)	38 (35%)	12 (19%)	14 (15%)	9 (21%)
Other	9 (6%)	9 (5%)	6 (6%)	5 (8%)	6 (6%)	3 (7%)

*Subset comprises patients seen in both baseline and follow-up periods.

At baseline, a greater proportion of eligible patients in the intervention clinic were in ideal CVH compared to those in the control clinic for current smoking and total cholesterol (**Figure 4**). However, eligible patients in the intervention clinic were more likely to be in poor CVH for body mass index and blood pressure, and to be treated for diabetes, compared to the control clinic (**Figure 4**). Among all eligible patients in the intervention clinic, improvements were seen from baseline to follow-up for body mass index and diabetes status. Average overall CVH score increased by 0.024 (95% CI: -0.24 to 0.29) in the intervention clinic (p=0.86), indicating that improvements in BMI and diabetes were somewhat offset by losses on other factors. Conversely, CVH components either held

constant or worsened among eligible patients seen in the control clinic (**Figure 4**). In the control clinic, the estimated change in total CVH score was 0.018 (95% CI: -0.40 to 0.44).

When we restricted the analyses to eligible patients who were seen in the baseline and follow-up periods, we observed similar patterns in the data. Specifically, the CVH of women in the intervention clinic improved on the metrics of body mass index and diabetes, and the CVH of women in the control clinic either held constant or worsened slightly (**Figure 4**).

Summary. We implemented and utilized the automated SPHERE tool as part of a feasibility study in a primary care clinic. The SPHERE tool, by design, brings lifestyle factors into the workflow of patient care. As a result, the EMR becomes less of a passive data capture system as is typically the case. In this relatively small sample of patients, we noted improvements in CVH, which has important clinical implications for the prevention of chronic disease.[27]

Shared decision-making is the hallmark of patient-centered care. Our EMR systems should help improve shared decision-making around primordial, primary, and secondary prevention of chronic disease. A Cochrane review of interventions for improving the adoption of shared decision making suggested that healthcare provider training and patient-mediated interventions be considered when developing interventions at the point-of-care.[28]

Providers need easy-to-use tools at the point-of-care to help patients improve CVH, as less than 3% of Americans described in population-based studies are in ideal CVH according to AHA's metric.[1, 2, 4, 29, 30] We demonstrated that the EMR could deliver such a tool using an existing AHA framework designed to improve CVH.[9] We hypothesize that the success of the tool may be due to its ease of use and the use of the tool at the point-of-care to improve patient-provider communication around CVH.

Our intervention clinic is located in a lower socioeconomic neighborhood with a more racially diverse patient population as compared to the control clinic.[25] Our results add to a paucity of literature that demonstrates improvements in CVH using EMR-based tools. Another study is underway to measure improvements in physical activity, hyperglycemia, and diet by using an EMR-based tool to aid in shared decision-making between providers and pre-diabetic patients.[31] Unlike existing research, our study was done in a primary care setting and targeted all patients meeting age and clinic criteria, regardless of presence of comorbid conditions. Our tool aims to facilitate patient-provider communication of behaviors and factors affecting CVH.

Our study demonstrated feasibility and tested a novel EMR-based tool in a real-world setting. A unique strength of the study was the use of an intervention clinic that was located in an underserved area of our community. In addition, the SPHERE tool is platform-independent and scalable to other patient populations and healthcare settings. The best healthcare providers cannot improve CVH without input and effort from the patient. A shared-accountability metric, recently recommended by the ACC/AHA-led Task Force on Performance Measures,[32] serves to acknowledge patient effort. In order to make lasting improvements in CVH, both patient and provider need to be engaged in the process and maintain patient-centricity during the encounter. Automated tools such as SPHERE help both patient and provider work toward improved CVH in manageable steps.

This is the first study to develop and implement an EHR-based CVH visualization tool. Our study demonstrates that it is feasible to implement patient-centered EHR-based tools at the point-of-care in the primary care setting. Despite recommendations and calls for

research, little empirical evidence exists to understand patient-provider communication with the increase in use of EMRs. Our work answers the call for next-generation EHR design to facilitate patient-provider communication.[13] The SPHERE study is a unique multidisciplinary collaboration aimed at addressing the feasibility of using a system embedded in the EMR to improve patient-centered care. Future work is needed to assess how to best harness the potential of such tools in order to have the greatest impact on the CVH of a patient population.

Figure 3. Changes in CVH from baseline to follow-up in the (A) intervention and (B) control clinics: all eligible patients.

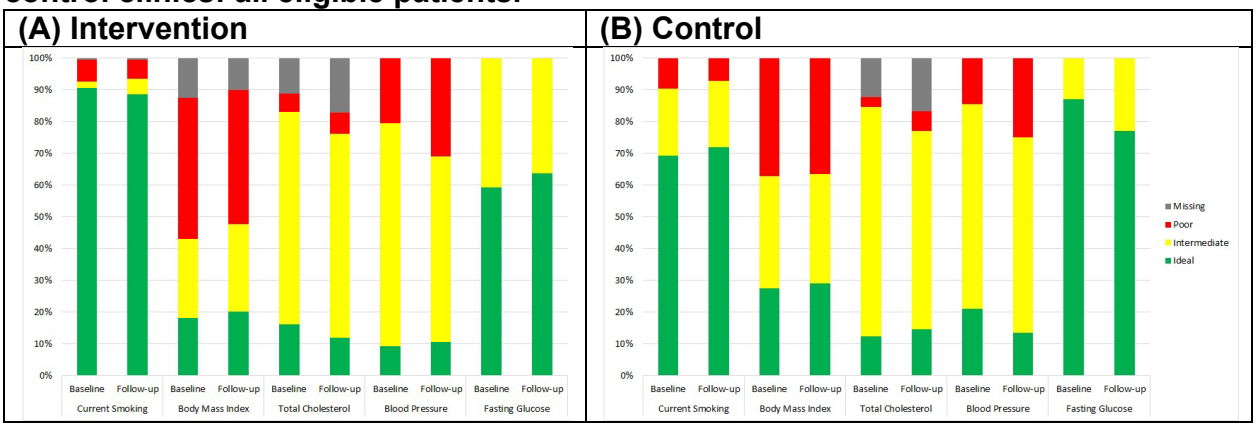
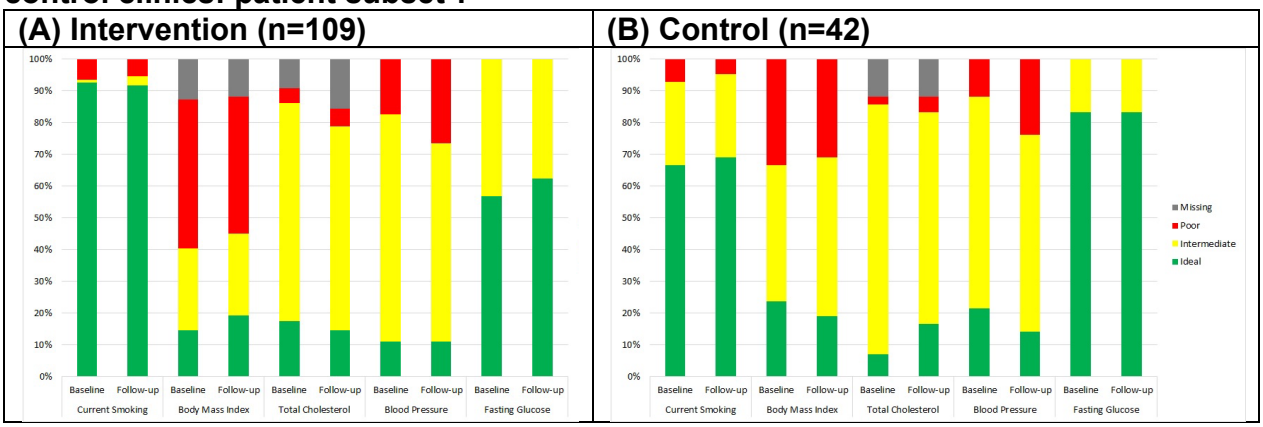


Figure 4. Changes in CVH from baseline to follow-up in the (A) intervention and (B) control clinics: patient subset*.



*Subset comprises only those patients seen in both the baseline and follow-up periods.

Strengths and limitations of the approach. Although the concept of overall ideal CVH is not new,[1] utilizing a CVH score in clinical practice had not yet been demonstrated in the literature. This project added substantially to the extant literature on CVH and its relevance to the prevention of stroke among older women in primary care practices. The project maximized the utility of clinical information systems by pulling relevant data from the EHR on the CVH of older women in the community. This project, by design, is scalable to other primary care clinics and healthcare settings. Specifically, it is estimated that 30-40% of healthcare providers in the United States use the same EHR software (*Epic*©) in which we

implemented the intervention. The SPHERE tool could also be modified for other preventative health domains (i.e. arthritis, mental health, cancer, diabetes, and pain management). Additionally, the patient-facing tools for improving patient-provider communications can be easily adopted in various healthcare settings with diverse patient populations.

We acknowledge that while provider education sessions included an overview of CV disease risk factors and BPA use, we did not provide training to physicians on how to activate patients to improve lifestyle or medication adherence, which may limit the impact of our study. It should also be noted that our study was not designed to measure the cost-effectiveness of the SPHERE tool. However, we acknowledge the importance of delivering evidence-based medicine in a cost-effective manner. We plan to consider cost-effectiveness as a future direction for our ongoing investigation of this EHR-based tool.

We assessed for the prescription of medications in three general classes: BP-lowering, cholesterol-lowering, and blood sugar-lowering or diabetic medications. We acknowledge that a limitation of this approach is that these classes of medications have other applications or off-label uses for which we may not account in this analysis.[21] For example, a BP-lowering beta-blocker may be in use for migraine prevention, heart failure treatment, or post-traumatic stress disorder. We will attempt to investigate, among those taking more common types of medication (i.e., propranolol hydrochloride), if the dose is appropriate for the management of hypertension, or if it is below the therapeutic threshold to have an effect on BP. We also plan to assess for co-morbid conditions. Regardless of our non-specific definition of hypertensive medication use, we will be able to observe the real-world usage of these medications in the primary care setting.

Clinical and public health significance: Given the immense burden of stroke and CV disease, the SPHERE tool has the potential to make a large impact on patients' health. Stroke is the third leading cause of death in the United States, trailing only heart disease and cancer.[22] The population in focus, women over the age of 65, was of particular importance given that more women suffer death from stroke than men, and have a higher lifetime incidence. Beyond mortality, stroke is the leading cause of long term disability in the US, and led to $34.3 billion in direct and indirect costs in 2008.[22] Meanwhile, coronary heart disease and stroke are the first and fourth-leading causes of death among women in Ohio.[23] The Ohio Plan to Prevent Heart Disease and Stroke aimed to reduce the burden of coronary heart disease and stroke primarily by promoting CVH behaviors such as controlling weight, being physically active, living tobacco free and eating healthy.[23] The Ohio Plan's second goal was to reduce high blood pressure, high cholesterol, and diabetes among Ohioans through early detection, treatment, and control of these CVH factors.[23]

On account of these issues, studying tools to improve patient care with a focus on stroke prevention and CVH is critical. With the SPHERE tool, we improved patient care, enhanced patient-provider communication, and optimized the utility of the EHR.[6] The tool offered assistance to providers in identifying, assessing, and managing CV risk factors. Perhaps more importantly, it allows the patient care team to engage the patient regarding their CVH. This provides an opportunity not only for education and goal-setting, but to improve patient satisfaction as well. Finally, this tool may enhance the usefulness of the EHR for physicians, serving to harvest information, identify gaps in data, and store input from the physical exam, lab results, and patient correspondence.[6] The SPHERE tool can

improve health outcomes through health information technology designed to empower clinicians to discuss CVH with their patients and augment primary prevention efforts.

List of Publications and Products:

Roth C, Foraker RE, Lopetegui MA, Kelley MM, Kite BJ, Jackson RD, Schreiner A, Shoben AB, Payne PR. Interactive Health Calculator and Visualization Module: Improving Patient-Provider Communication. *Academy Health 2014 Stakeholder Symposium*. June 8, 2014. San Diego, CA.

Foraker RE, Lai AM, Shoben AB, Jackson RB, Payne P. SPHERE: Facilitating and Enhancing Patient-Clinician Communication. . *Academy Health 2014 Stakeholder Symposium*. June 8, 2014. San Diego, CA.

Lopetegui M, Foraker RE, Harper J, Ervin D, Payne P. Real-time Data-driven Tools for Clinicians: A Module for Extending Functionalities within the EHR. Concurrent Panel Session C | Methods to Achieve Personalization Beyond the Genome. *4th Annual EDM Stakeholder Symposium: Evidence, Data, and Methods to Build Learning Health Systems of the Future*. June 7, 2014. San Diego, CA

Roth C, Foraker RE, Lopetegui M, Kelley M, Payne P. Facilitating EHR-based Communication and Understanding in a Learning Healthcare System. *4th Annual EDM Stakeholder Symposium: Evidence, Data, and Methods to Build Learning Health Systems of the Future*. June 7, 2014. San Diego, CA.

Roth C, Foraker RE, Payne PR. Bringing Public Health into the Primary Care Clinic through an EHR-based Application: Lessons Learned for Public Health and Informatics. *2014 Public Health Informatics Conference*. Atlanta, GA. May 1, 2014.

Foraker RE, Lai AL, Payne P, Lopetegui M, Shoben AB, Tindle H, Kelley M, Schreiner A, Jackson RD. Assessment of Life's Simple 7 in the primary care setting: the Stroke Prevention in Healthcare Delivery EnviRonmEnts (SPHERE) study. *Contemporary Clinical Trials*. 2014 Apr 8 l38(2):182-189.

Foraker RE, Shoben AB, Lopetegui MA, Lai AM, Payne PR, Kelley M, Roth C, Tindle H, Kelley M, Schreiner A, Jackson RD. Assessment of Cardiovascular Health among Older Women in Primary Care. *American Heart Association Epidemiology and Prevention/Nutrition, Physical Activity and Metabolism 2014 Scientific Sessions.* San Francisco, CA. March 19, 2014.

Lopetegui MA, Lara BA, Roth C. Interactive Health Calculator Visualization Module: Facilitating and Enhancing Patient-Physician Communication. *2013 American Medical Informatics Association Student Competition.*

Roth C, Payne PR, Weier RC, Shoben AB, Fletcher EN, Lai AM, Kelley MM, Foraker RE. The geographic distribution of cardiovascular health in the Stroke Prevention in Healthcare Delivery EnviRonmEnts (SPHERE) study. *Under review.*

Foraker RE, Lai AL, Payne P, Lopetegui M, Shoben AB, Tindle H, Kelley M, Schreiner A, Jackson RD. EHR-based Visualization Tool: Adoption Rates, Satisfaction, and Patient Outcomes. *Under review.*

Foraker RE, Lai AL, Payne P, Lopetegui M, Shoben AB, Tindle H, Kelley M, Schreiner A, Jackson RD. Electronic Health Record-Based Assessment of Cardiovascular Health: The Stroke Prevention in Healthcare Delivery Environments (SPHERE) Study. *In Preparation.*