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mHealth to train community health nurses in Visual Inspection with Acetic Acid for cervical cancer screening in Ghana

Ramin Asgary, MD, MPH[1], **Philip Baba Adongo, PhD**[2], **Adanna Nwameme, MD, MPH**[2], **Helen V. S. Cole, MPH**[1,3], **Ernest Maya, MD**[6], **Mengling Liu, PhD**[4], **Karen Yeates, MD, MPH**[5], **Richard Adanu, MBChB, MPH**[6], and **Olugbenga Ogedegbe, MD, MPH**[1]

[1] Departments of Medicine and Population Health, NYU School of Medicine, New York, NY, USA

[2] Department of Social and Behavioral Sciences, University of Ghana School of Public Health, Legon, Ghana

[3] Doctorate Program in Public Health, CUNY Graduate Center and CUNY School of Public Health, New York, NY

[4] Division of Biostatistics, Department of Population Health, NYU School of Medicine, New York, NY, USA

[5] Department of Medicine, Queen's University, Kingston, Ontario, Canada

[6] Population, Family and Reproductive Health Department, University of Ghana School of Public Health, Accra, Ghana

Abstract

Objectives—There is a shortage of trained healthcare personnel for cervical cancer screening in low/middle income countries. We evaluated the feasibility and limited efficacy of a smartphone-based training of community health nurses in Visual Inspection of the cervix under Acetic Acid (VIA).

Methods—During April-July of 2015 in urban Ghana, we designed and developed a study to determine the feasibility and efficacy of an mHealth supported training of community health nurses (CHNs) (n=15) to perform VIA and to use smartphone images to obtain expert feedback on their diagnoses within 24 hours and improve VIA skills retention. CHNs completed a 2-week on-site introductory training in VIA performance and interpretation followed by an ongoing 3-month text messaging supported VIA training by an expert VIA reviewer.

Results—CHNs screened 169 women at their respective community health centers while receiving real-time feedback from the reviewer. The total agreement rate between all VIA diagnoses made by all CHNs and the expert reviewer was 95%. The average rate of agreement between each CHN and the expert reviewer was 89.6% (Standard Deviation (SD)=12.8). The

Corresponding Author: Ramin Asgary, Departments of Medicine and Population Health, New York University School of Medicine, 227 East 30th Street, Rm 639, New York, NY 10016, USA, Tel: (646) 501-2835, Fax (212) 861-0642, ramin.asgary@caa.columbia.edu.

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agreement rates for positive and negative cases were 61.5% and 98.0%, respectively. Cohen's kappa statistic was 0.67 (95% CI; 0.45-0.88). Around 7.7% of women tested VIA positive and received Cryotherapy or further services.

Conclusions—Our findings demonstrate the feasibility and efficacy of mHealth-supported VIA training of CHNs and has the potential to improve cervical cancer screening coverage in Ghana.

Keywords

mHealth; cervical cancer; sub-Saharan Africa; screening; community health nurses

Introduction

Annually, almost a half million women develop cervical cancer and 274,000 die from the disease worldwide, with approximately 80% of cervical cancer deaths occurring in low and middle income countries (LMICs) [1]. The higher rates of cervical cancer and mortality in Sub-Saharan African (SSA) countries are mainly attributed to poor access to screening and treatment of precancerous lesions [2]. In Ghana, cervical cancer is the leading cause of cancer-related death among women aged 15-44 [3].

Visual Inspection of the cervix under Acetic Acid (VIA) is an effective alternative to Pap test, which is unavailable in most SSA countries [4]. In 2005, Ghana's first national policy on cervical cancer prevention recommended VIA screening coupled with Cryotherapy for women aged 25-45 [5]. Currently, VIA and Cryotherapy is only available in a few specialized hospitals in Ghana and the National Screening Program has not been widely accessible due to lack of integration of screening into the primary healthcare system and a shortage of healthcare workforce [6]. Lack of comprehensive training of non-physician health workers in VIA is a major reason why many VIA programs have not been sustainable in SSA [7, 8].

Task-shifting of primary care duties to non-physician health workers such as nurses is a viable strategy to address the inadequate cervical cancer screening in SSA because they can perform VIA safely. In India, Shastri and colleagues demonstrated that periodic VIA screening conducted every 24 months by trained primary health workers resulted in a 31% reduction in cervical cancer mortality over a 12-year follow-up period.[9] Ghana adopted a Community-based Health Planning and Services (CHPS) initiative in 1999 to increase the delivery of basic primary care to all citizens by employing community health nurses (CHNs), each with 2 years of nursing training, who are assigned to specific districts, [9] which presents an opportunity to train them in VIA and improve screening at the district level.

However a major problem with standard short-term VIA training has been loss of skills retention over time [7, 8]. The addition of cervicography improves visualization of the cervix with an opportunity for health professionals to review the cervical images with experts to ensure long-term accuracy of the screening program. [7, 10] The advent of smartphones with digital cameras presents the opportunity to utilize smartphone's

capabilities to enhance training of health professionals, facilitate storage of patient's screening records, transfer images for expert opinion, and re-train via text messaging. We conducted a study in sub-districts in Ga East Municipal in Accra, Ghana, to evaluate the feasibility and limited efficacy of a smartphone/text messaging supported training of CHNs in performing cervical cancer screening using VIA.

Methods

Setting and participants

We enrolled CHNs (n=15, 2 years of nurse training) from two community health centers (CHCs) in Ga East district in Accra, Ghana in a pilot study during April-July 2015. The overall catchment area included 4 CHCs with total of 30 CHNs. CHNs were recruited from two CHCs (Dome and Taifa) in collaboration with and as per suggestion of officials from the CHPS. All working CHNs from these two CHCs were included in the study. They attended a standard on-site two-week introductory training at a local hospital conducted by nurse practitioners with extensive experience in VIA/Cervicogram, Crytherapy and VIA training. This training was modeled after the JHIPEGO course, used globally [11], which is an in-person, onsite 2-week course that follows a detailed training manual in a classroom setting with audio-visual course materials. The course was led by the expert trainers (including the expert reviewer, an experienced nurse at Korle Bu Teaching Hospital) and consisted of didactic and clinically mentored instruction in VIA and using mannequins to teach the mechanics of a speculum exam, followed by 20-30 actual clinical and practical cases, and training on the use of a smartphone camera (digital photography) to gather appropriate cervical images including the mechanics and subtleties of photography of the cervix. Initially, trainees observed an experienced provider take digital photographs of the cervix, after which they were observed taking pictures under the mentorship of the experienced provider until high-quality images were obtained without guidance. Training in the use of SMS using WhatsApp (2015, Mountain View, California, U.S.) was provided. CHNs were also trained in cancer health education, post VIA management decisions, and reviewed around 150 VIA images. After the initial training, the expert reviewer conducted two days of field training in each of the two participating community health clinic sites (where the CHNs are based and would perform the VIAs). Subsequently, CHNs were enrolled in a three-month offsite mHealth training phase in which they offered VIA screening to eligible women (age 25-45, residing in the area of capture for the study, no history of cervical cancer, and not having up-to-date for cervical cancer screening) in their respective sub-district community health centers, captured cervical images using smartphones, recorded their diagnosis and plan of care, sent images and their diagnosis and plan of care real-time electronically (via SMS) to the expert reviewer, and received feedback on their diagnosis and management plan within 24 hours. CHNs were instructed to ask additional clarifying questions and communicate directly with the reviewer when needed. All pelvic exams and VIA screenings took place in the community health centers. Women who screened positive by CHNs and the expert reviewer were provided Cryotherapy and/or gynecology consultation free of charge. Bi-weekly Cryotherapy clinic was provided at the community health centers by an expert gynecologist. For positive cases needing biopsy or further care, the gynecologist was available to provide consultation and standard of care services

including a repeat screening using Pap smear, colposcopy, cervical diathermy, cervical conization or hysterectomy at the collaborating medical centers. CHNs and patients received informed consent for the study. Data including diagnoses and images were captured using a smartphone application, de-identified, coded, and shared with the reviewer.

Outcomes and statistical analysis—Diagnostic criteria in VIA and digital cervicography constituted of a normal test (negative) or abnormal test (positive) based on the detection of any distinct acetowhite area. The categories of diagnostic interpretation was defined as follows: 1) VIA/cervicography negative meaning no atypical changes in the transformation zone; 2) VIA positive, lesion will need cryotherapy; 3) Suspicious for cancer needing biopsy for histology confirmation. The cervical screening diagnosis was categorized as either “normal” or “abnormal”. The primary outcome was the agreement or disagreement of the diagnoses made with VIA plus Cervicography by the CHNs with those made by the expert reviewer. The overall and average percentages of agreement on VIA diagnoses made on the patients over the 3-month period by all and each CHN and the reviewer were calculated. Cohen's kappa statistic was used to measure the reproducibility of screening test diagnoses made by CHNs compared to those made by the reviewer, which is considered none to slight, fair, moderate, substantial, and almost perfect for ≤0.20, 0.21–0.40, 0.41–0.60, 0.60–0.80, and 0.80–1.00, respectively. Statistical significance was defined as $P < 0.05$. We tested socio-demographic and clinical variables of patients and CHNs for association with positive screening outcomes. We used SPSS (IBM, 2015, V 23, Armonk, New York, U.S.) for analysis. Continuous feedback sessions were held with CHNs, nurse supervisors, and support staff at CHCs to anticipate and address logistical and system challenges.

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Results

All CHNs had 2 year nursing training and the same level of experience and received equal salaries from the government. All CHNs completed the study and there was no drop-out. During the pilot phase, in which CHNs received immediate feedback from the expert reviewer, 169 women were screened. Table 1 presents socio-demographics regarding CHNs and patients. CHNs rated 12 (7.1%) of the cases positive, and one case was suspicious of cancer. The expert reviewer rated 13 (7.7%) positive and confirmed the one case suspicious of cancer. The reviewer was unable to determine the results for 9 (5.3%) of the cases due to unclear images of which only 1 was rated as positive by the CHN (see Table 2). These 9 patients were offered a repeat test. The total agreement rate between all VIA diagnoses made by all CHNs and the expert reviewer for the remaining 160 patient images (total agreement rate at the image/patient level) was 95.0% (152/160). The agreement rates for positive and negative cases were 61.5% and 98.0%, respectively. The average rate of agreement between each CHN and the expert reviewer was 89.6% (SD=12.8). Kappa statistic was measured as 0.67 (95% CI; 0.45-0.88).

Screening positive (by expert determination) was negatively associated with patient age ($p<0.05$) and was not significantly associated with marital status, age at first intercourse, number of lifetime sexual partners, or number of children. All screened positive cases received cryotherapy administered by a study gynecologist at one of the community health centers participating in the study and received follow-up as needed. The screened positive for suspicion of cancer case was referred to the study gynecologist for biopsy.

Originally, patient recruitment for screening was lower than expected due to unfamiliarity and perceptions regarding cancer screening, fear of results, and competing priorities. After the first month, all CHNs received additional training on patient education regarding cancer screening. Images for 9 patients, taken by 6 CHNs, were unclear, which were rectified through direct communication with the expert reviewer. Only a couple of CHNs needed an additional one-on-one training session in taking quality images during the early phase of the study. Screened patients did not report unresolved barriers to accessing VIA screening or follow up care. Preliminary feedback through formal sessions with CHNs, nurse supervisors, and other staff revealed smooth processes without disruption in the flow or usual activities of the health centers or CHNs' daily tasks. VIA screening was well-received by the CHNs and patients and by and large using smartphones, text messaging images, and receiving real-time feedback went smoothly.

Discussion

We documented a simple agreement rate with the expert reviewer of up to 89.6% and a substantial kappa statistic of 0.67 for VIA diagnoses made by each CHN over three-months of mHealth supported training, during which CHNs received immediate expert feedback on their diagnoses and plan of care. The relatively low agreement rate for positive cases was largely due to the small number of positive VIA cases in this sample. On the other hand a very high agreement rate for negative cases would help decrease the number of referrals for treatment and/or further evaluation, which would decrease unnecessary burden within the Ghana health system. Singh and colleagues in 2012 demonstrated an expert/trainee agreement rate of 85.5% among community health workers in the period immediately following a standard VIA training, which declined over 6 months to around 55%.[12]

Lessons learned

Establishing this protocol within the well-structured and supervised community nurse program, which is linked to the national health program was essential. Through long-term existing working relationship, members of our team were well known by the CHNs and their supervisors prior to implementing the study. Nevertheless, we have experienced several logistic challenges. Securing necessary supplies to establish adequate pelvic exam rooms at participating community health clinics and transferring grant funds to acquire identical smartphones for each of the CHNs took much more time and we faced some additional administrative hurdles than we had originally expected. Assuring that available smartphone cameras could produce reliable images was essential and we had piloted a number of existing available models to assess the quality of the camera, an essential feature for this study. We had originally planned to provide Cryotherapy to all positive cases within 2 weeks

of their screening which proved to be difficult largely due to both administrative issues and availability of basic supplies at the community health centers. All these challenges were eventually addressed by negotiating with different stakeholders and provision of necessary basic supplies at community health centers.

We experienced additional delays initiating screening, after the on-site training was complete, first due to a long holiday season, which deterred women from seeking screening due to competing priorities, and then due to a lag of awareness raising in the communities served by the CHNs. Fear of potential cancer diagnoses was a barrier for seeking screening among patients which we overcame by offering additional training sessions for the CHNs focused on skills in communicating the importance of screening and addressing negative perceptions and fear among patients. This led to a sharp increase in the number of women who sought screening. We also experienced some low image qualities for a small number of VIAs performed by CHNs. In these cases, the CHNs were provided additional one-on-one training on how to take better images during the screening process. Having overcome these logistic and other barriers, we are well prepared to continue this work and to expand the scope of future research.

Limitations

Our study is not without limitations. First, this study is a limited efficacy study with feasibility components, thus by design we were not set to determine whether the intervention is effective at increasing retention of VIA skills over time among CHNs. Further, we did not include a comparison group in this small scale study, thus a rigorous comparison with other similar mHealth or eHealth interventions or a control group was not possible. Although our study was implemented in collaboration with Ghana's Health Services and within an existing CHNs program, which is part of the national health care system in Ghana, we are unable to determine the long term sustainability of such an intervention at this time as additional resources for training and provision of equipment needs to be addressed outside of this research context. Finally, as this study was implemented in an urban community in Ghana, and included only 15 nurses from two community health centers, we are unable to determine whether its results would be generalizable to other settings including rural contexts or outside of Ghana.

This study is currently ongoing and in its second phase, which will be devoted to independent screening by the CHNs, without immediate feedback, after which we will re-assess expert/nurse agreement to determine whether VIA skills were retained beyond 9 months. The second phase of our pilot study will also include systematic qualitative interviews with CHNs, patients, and other stakeholders to further evaluate provider-, patient-, and system-level barriers. The next step will be to conduct a randomized control trial to examine the efficacy of the mHealth supported VIA training compared to 2- week VIA training in multiple sites in Ghana.

Conclusions

Our findings indicate that there is substantial potential for increasing VIA screening coverage in urban Ghana by training CHNs, and that the use of smartphone imaging can

support VIA training efforts. If satisfaction and skills retention over time among CHNs is further established, scaling up this initiative has the long term potential to reduce cervical cancer morbidity and mortality among women in Ghana and other LMICs, a population which has largely been neglected from population-based cancer screening efforts due to limited healthcare providers, laboratory capability, and appropriate funding. Expanding mHealth supported VIA screening to community-based health centers conducted by CHNs, who already provide preventive care and health education particularly in the area of maternal and infant health, may ultimately reduce cervical cancer incidence and mortality in LMIC.

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List of Abbreviations

VIA	Visual Inspection of the cervix under Acetic Acid
CHN	Community Health Nurse
SSA	Sub-Saharan Africa
LMIC	Low or Middle Income Country
SD	Standard Deviation

References

1. Sankaranarayanan R, Ferlay J. Worldwide burden of gynaecological cancer: the size of the problem. Best Pract Res Clin Obstet Gynaecol. 2006; 20(2):207–225. [PubMed: 16359925]
2. Forman D, de Martel C, Lacey CJ, Soerjomataram I, Lortet-Tieulent J, Bruni L, et al. Global burden of human papillomavirus and related diseases. Vaccine. 2012; 30(Suppl 5):F12–23. [PubMed: 23199955]
3. Ghana Demographic and Health Survey 2008. Ghana Statistical Service (GSS), Ghana Health Service (GHS) and ICF Macro; Accra, Ghana: 2009.
4. Miller AB, Sankaranarayanan R, Bosch FX, Sepulveda C. Can screening for cervical cancer be improved, especially in developing countries? Int J Cancer. 2003; 107(3):337–340. [PubMed: 14506730]
5. Blumenthal PD, Gaffikin L, Deganus S, Lewis R, Emerson M, Adadevoh S, Ghana Cervicare G. Cervical cancer prevention: safety, acceptability, and feasibility of a single-visit approach in Accra, Ghana. Am J Obstet Gynecol. 2007; 196(4):407, e401–408. discussion 407 e408-409. [PubMed: 17403438]
6. Hill AG, Darko R, Seffah J, Adanu RM, Anarfi JK, Duda RB. Health of urban Ghanaian women as identified by the Women's Health Study of Accra. Int J Gynaecol Obstet. 2007; 99(2):150–156. [PubMed: 17628563]
7. Bomfim-Hyppolito S, Franco ES, Franco RG, de Albuquerque CM, Nunes GC. Cervicography as an adjunctive test to visual inspection with acetic acid in cervical cancer detection screening. Int J Gynaecol Obstet. 2006; 92(1):58–63. [PubMed: 16269147]

8. Mwanahamuntu MH, Sahasrabuddhe VV, Kapambwe S, Pfaendler KS, Chibwesha C, Mkumba G, et al. Advancing cervical cancer prevention initiatives in resource-constrained settings: insights from the Cervical Cancer Prevention Program in Zambia. PLoS Med. 2011; 8(5):e1001032. [PubMed: 21610859]

9. Shastri SS, Mittra I, Mishra GA, Gupta S, Dikshit R, Singh S, Badwe RA. Effect of VIA Screening by Primary Health Workers: Randomized Controlled Study in Mumbai, India. Journal of the National Cancer Institute. 2014; 106(3)

10. Cronje HS, Cooreman BF, Beyer E, Bam RH, Middlecote BD, Divall PD. Screening for cervical neoplasia in a developing country utilizing cytology, cervicography and the acetic acid test. Int J Gynaecol Obstet. 2001; 72(2):151–157. [PubMed: 11166748]

11. Gaffikin L, Blumenthal PD, Emerson M, Limpaphayom K. Royal Thai College of Gynaecologists JCCCPG: Safety, acceptability, and feasibility of a single-visit approach to cervical-cancer prevention in rural Thailand: a demonstration project. Lancet. 2003; 361(9360):814–820. [PubMed: 12642047]

12. Singh V, Parashari A, Sehgal A. Man power training for early cervical cancer detection. Acta Obstetricia et Gynecologica Scandinavica. 2012; 911124-1127

Table 1

Characteristics of patients and CHNs during mHealth support VIA training, Ghana, 2015

Characteristics	Mean (SD)
CHN (N=15)	
Age	28.2 (2.9)
Female	100%
Patients (N=169)	
Average age	33.8 (7.0)
Marital Status (%)	
Married/Partnered	69.2%
Never married	27.8%
Divorced/Separated	3.0%
Average age at first sexual intercourse	20.1 (4.1)
Average lifetime sexual partners	3.1 (2.0)
Number of living children	2.1 (1.6)

Table 2

Results of VIA screening by CHNs during mHealth-supported VIA training, Ghana, 2015

Screening Results	N	%
CHN Determination (n=169)		
Negative	156	92.3%
Positive	12	7.1%
Suspicious for cancer	1	0.6%
Expert Determination (n=169)		
Negative	146	86.4%
Positive	13	7.7%
Suspicious for cancer	1	0.6%
Unclear image/Unable to determine	9	5.3%
Cohen's Kappa Statistic (n=160)	0.67	(95% CI: 0.45-0.88)
Total Agreement Rate (n=160)[a]	152	95.0%
Average Agreement Rate per CHN	15	89.6% (SD=12.8)

[a]Patients with unclear images were excluded (n=9)