Telemedical Cervical Cancer Screening to Bridge Medicaid Service Care Gap for Rural Women

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Abstract

Background: The Arkansas Medicaid program for low-income women provides cervical cancer screening, in the form of Pap smears, and treatment but no diagnostic means of bridging the two, such as a procedure called "colposcopy." Telemedicine offers a viable means to bridging this gap. Previously telecolposcopy has been used in small demonstration projects as a means to deliver colposcopy services to at-risk rural populations at a comparable quality to in-person colposcopy. **Subjects and Methods:** The University of Arkansas for Medical Sciences' Antenatal & Neonatal Guidelines, Education and Learning System Program and Center for Distance Health developed an innovative collaborative telemedicine pilot program with the Arkansas Department of Health that used both specialty physician oversight and nurse examiners. Underserved rural patients from the Department of Health were provided with colposcopy services via interactive telemedicine at four separate spoke sites. During each weekly 3-h clinic, an advanced practice nurse/nurse practitioner at each of the spoke sites performed the exams and collected biopsy specimens under the real-time, interactive supervision of an experienced faculty member at the hub site. **Results:** Between January 1, 2010 and June 21, 2011, the program scheduled 1,812 visits, involving 1,504 unduplicated patient referrals from 68 of Arkansas's 75 counties, and performed 1,298 telecolposcopic exams. **Conclusions:** This project provides complex specialty gynecological services using telemedicine technology to overcome geographic barriers to care while producing results comparable to traditional examinations. It is cost-effective and well received by patients and can be used as a model for improving access to care among vulnerable populations.

Key words: telemedicine, telehealth, technology

Introduction

Cervical cancer is one of the few cancers that is thought to be almost entirely preventable. Unlike many cancers, the abnormal dysplastic states from which cervical cancers develop are easily identified and treated with readily

available pathology services and outpatient surgical techniques. The adoption of widespread screening with Papanicolaou ("Pap") smears linked to colposcopic diagnosis of abnormal results has resulted in a substantial decrease in the incidence of cervical cancer and the associated mortality in the United States over the last 40 years. Cervical cancer rates in the United States have decreased by 70% since the introduction of the Pap smear.¹

Following an abnormal Pap smear result, diagnosing premalignant cervical disease and cancer is attained through a colposcopic exam, in which a healthcare provider uses a specially adapted microscope (a colposcope) to examine a woman's cervix after an abnormal Pap smear result. The image of the cervix is magnified up to 15 times normal to allow for a thorough evaluation and to enable the examiner to identify any abnormal areas of the cervix that require biopsy.

Like the rest of the country, Arkansas has also witnessed a reduction in rates of cervical cancer since the introduction of the Pap smear. However, compared with other states, Arkansas continues to be plagued by a high rate of new cervical cancers and cervical cancer deaths. Arkansas in 2008 had the fourth highest rate of death from cervical cancer in the United States and during 2002 ranked first.²

THE PROBLEM OF ACCESS

Although there is some evidence that clinical failures are responsible for a substantial minority of cases of cervical cancer in the United States, the predominant reasons for these persistent numbers are usually associated with inadequate access to appropriate screening or treatment.³ Inadequate access to overall medical care has been reported as being related to both poverty and health insurance,⁴ geographic isolation from care providers,⁵ and level of education and/or patient health knowledge.⁶ Studies have also consistently shown that rates of cervical cancer screening are lower in rural areas than urban areas,⁷ and rural women show greater morbidity and mortality due to the disease⁸ and tend to be diagnosed at a more advanced stage of cancer.⁹ It is speculated that this discrepancy in screening is at least partially due to rural women being on average poorer and less educated than their urban counterparts⁷: urban populations were 3.5 percentage points more likely to receive a high school diploma or equivalent than rural populations between 2005 and 2009. In 2009, 13.9% of those in urban areas lived below the poverty level, whereas 16.6% of rural populations lived below the poverty level.¹⁰

More specifically, women living in states from the Deep South have consistently higher incidence rates of cervical cancer (10.6 per 100,000 women) than do women in other parts of the country.¹¹ Some have demonstrated that as cervical cancer screening is accepted as a basic component of primary care for women, excess

cervical cancer mortality can therefore be seen as a marker for poor access to healthcare in general.¹²

Arkansas, like other poor Southern states, is burdened with high levels of poverty, especially in geographically isolated and medically underserved rural areas. Arkansas's most vulnerable residents also have relatively low levels of general education and healthcare knowledge among its most vulnerable residents.¹³ Poverty levels in Arkansas for 2010 were 18.8% for individuals and 14.1% for families, whereas the average for the country as a whole was 15.3% and 11.3%, respectively.¹³

Arkansas is primarily a rural state, with most counties designated as rural and 73 of 75 counties designated as either partially or fully medically underserved areas.¹⁴ Exacerbating the issue of access, rural counties in Arkansas demonstrate particularly high smoking rates,¹⁵ and smoking is believed to be the strongest determinant of cervical dysplasia after exposure to the human papillomavirus.

Cervical cancer disproportionately affects the poorest, most rural residents of Arkansas, which in turn places a significant financial burden on the state's public healthcare system. The cost of this disease to Arkansas Medicaid is substantial. During calendar year 2010, Arkansas Medicaid was billed over \$7.4 million and paid over \$2 million for claims of all cervical cancer diagnoses, involving some 689 unduplicated patients at an average cost of \$2,977 per patient. By comparison, Arkansas Medicaid spent only \$578 per recipient to treat carcinoma *in situ*, an early form of cancer that has not yet invaded surrounding tissue (Arkansas Medicaid data, 2012).

THE GAP IN CARE

Starting in the late 1990s, the Arkansas Department of Health (DOH) responded to budgetary pressure and excluded colposcopy from the covered services for women receiving care through the Medicaid Family Planning Waiver Program. Colposcopy is a key part of the process for diagnosing and sometimes treating cervical cancer. The DOH did, however, continue to provide Pap smear screening, the initial test that indicates the need for a colposcopy. As a result, local health departments could inform women about their abnormal Pap smears but could not offer a viable option for follow-up. The only available viable source for the required colposcopic exams is the state's academic medical center (University of Arkansas for Medical Sciences [UAMS]), which is beyond the geographic reach of many underserved rural Arkansans.

Ironically, for women who are somehow able to access colposcopic evaluation and with a biopsy showing moderate dysplasia or worse, Medicaid coverage for treatment is available. In other words, the Medicaid program for low-income women in Arkansas provides cervical cancer screening and treatment but no diagnostic means of bridging the two. During 2010 DOH collected approximately 35,000 Pap smears, among which approximately 4% were abnormal enough to warrant colposcopic evaluation (communication from the Arkansas DOH).

TELECOLPOSCOPY IMPROVES ACCESS TO CARE

It is not surprising that research has demonstrated that removing both geographic and financial barriers to care improves both access

to care and outcomes.^{16,17} Among various solutions proposed to help with this problem, telemedicine has been shown to be a viable technique for improving geographic access to care and has demonstrated both improved access to multiple medical specialties and a willing acceptance by patients.¹⁸ More specifically, colposcopy via telemedicine (telecolposcopy) has been used as a means to deliver cervical cancer screening and diagnosis to at-risk groups. Ferris et al.^{19,20} and others²¹ have consistently demonstrated that both real-time and store-and-forward technology can be used to provide colposcopy services that are comparable to traditional in-person colposcopy. In addition, telemedicine has shown itself to be well received and accepted by patients.²² However, published studies have demonstrated MD-only models in which both the hub site and spoke sites are staffed by physicians. To our knowledge no program has used a combination of physician and non-physician examiners to increase efficiency and reduce costs.

Subjects and Methods

The researchers were interested in two goals: (1) to provide needed care to an at-risk population and (2) to test the validity of providing care by pairing local examiners with only limited experience in colposcopy with distant expert oversight provided by telemedicine, and therefore provide a model that could be duplicated in other medically underserved areas. To help bridge the gap in cervical cancer screening in rural Arkansas and to also assess the effectiveness of telemedicine to provide this care, the UAMS and the Center for Distance Health developed a program using nurse practitioners in the field with expert obstetrics-gynecology supervision provided via interactive video.

The telecolposcopy program serves four Arkansas sites at County Health Units, aimed at servicing every region of the state: Hempstead County serving the southwest, Johnson County serving the northwest, Cross County serving northeast and southeast regions, and Desha County serving the southeast. The hub site, the UAMS, is located in Little Rock, which is centrally located. Patients whose Pap smears are abnormal are referred from their specific County Health Unit to receive telecolposcopy services.

During each weekly 3-h clinic, an advanced practice nurse (APN)/nurse practitioner at each of the four spoke sites, who has been trained in the mechanics of colposcopy, performs the exams and collects biopsy specimens under the real-time interactive supervision of an experienced UAMS Obstetrics-Gynecology Faculty member at the hub site in Little Rock.

The program is available to any woman receiving screening Pap smears through her local County Health Unit. The program is voluntary, and each patient is also given the option of being referred to either a local provider or to the main UAMS campus in Little Rock.

TRAINING THE APN

APNs, who either worked for the local Health Unit or who lived in the area, were identified and recruited into the project if they had experience in routine women's health but did not have any experience with colposcopy. Each of the recruited APNs then completed a

short (1-day) didactic training in the indications for and application of colposcopy in addition to the mechanics of using both colposcopic and telemedicine equipment. This training was then followed by a two-stage clinical practicum during which the APN performed traditional colposcopic exams and collected biopsy specimens under the direct supervision of an experienced colposcopist. Finally, each APN spent several days in the field performing telecolposcopy exams under the supervision of both an experienced colposcopist who was present at the distant site as well as the supervising Obstetrics-Gynecology Faculty member who monitored the exams via telemedicine from the central hub site in Little Rock.

TRAINING SCHEDULE

Stage 1: didactic:

- Part 1: 2-h session including introduction to cervical dysplasia and cancer, the role of human papillomavirus, natural history, screening, diagnosis, and treatment.
- Part 2: 2-h session including review of normal and abnormal cervical images and introduction to colposcopic equipment, examination, and collection of cervical, vaginal, and vulvar biopsies.
- Part 3: 2 h in the telemedicine classroom, with an introduction to using telemedicine equipment in a clinical setting.

Stage 2: clinical practicum (observation):

- 8 h in a traditional colposcopy clinic, observing an experienced clinician performing colposcopic exams.

Stage 3: clinical practicum:

- 8 h in a traditional colposcopy clinic performing exams with collection of biopsy specimens under the direct supervision of an experienced clinician.

Stage 4: telecolposcopy clinical practicum:

- 8–16 h in telemedicine at the spoke site performing telecolposcopy exams under the direct/local supervision by an experienced clinician in addition to the supervision of hub-site faculty.

Results

Between January 1, 2010 and June 21, 2011, the program scheduled 1,812 visits involving 1,504 unduplicated patient referrals from 68 of the 75 counties in Arkansas (Fig. 1) and performed 1,298 colposcopic exams. The average age of these patients was 26.2 years (standard deviation 6.1) with a median age of 25 years and a range of 14–58 years. Among the 1,118 sets of biopsy specimens collected, 333 (29.8%) showed precancerous lesions or cancer and were all referred for treatment paid for by Arkansas Medicaid (Table 1). The number of patients seen during this period reflected a show rate of approximately 70%. Precancerous lesions are designated high-grade squamous intraepithelial lesions (HSILs) and are rated on a scale of

Fig. 1. Map of catchment area for each spoke site.

severity, with CIN2 being moderate dysplasia, CIN3 being severe dysplasia, and CIS being a form of severe dysplasia that is the last step before invasive cancer. Cancerous lesions are designated as squamous cell carcinoma or adenocarcinoma.

A marker of this program's success and an indication of the need for colposcopy services in Arkansas is that this project now produces the majority of referrals for cervical dysplasia and cancer to the Arkansas Medicaid Program for the entire state. For example, during the 6-month period between March 1 and August 31, 2011, women seen by the Antenatal & Neonatal Guidelines, Education and Learning System START Program made up 86% of referrals from all providers in the state to Medicaid for the treatment of high-grade dysplasia or cervical cancer.

Complications with the telecolposcopic method were rare during the study period. Two patients required referral to UAMS due to the presence of very large endocervical polyps that required removal with the patient under anesthesia. Another 2 patients were referred to UAMS because of anxiety states requiring intravenous sedation for the examination. There were no other complications, and no patients refused the examination because of concerns about the telemedicine component of the project.

Table 1. Breakdown of Biopsy Results

DIAGNOSIS	NUMBER
Benign	403
Mild dysplasia	382
Moderate dysplasia	154
Severe dysplasia	173
Carcinoma <i>in situ</i>	5
Squamous cell carcinoma	1

Data are from the University of Arkansas for Medical Sciences START Program, 2012.

PATIENT-DELAYED CARE

To establish a baseline level to which our patient population was at risk for delaying or abandoning needed colposcopic care, a pre-project survey was conducted to establish the percentage of DOH patients with abnormal Pap smears who had received a colposcopic exam during a 6-month period prior to the beginning of our project. This survey showed that only 20–30% of these women had been scheduled for a colposcopic exam within 6 months of their Pap smear. By contrast, during the 18-month period between January 1, 2010 and June 30, 2011 we estimate that this program scheduled approximately 74% of the DOH patients requiring colposcopy and performed exams on 63% (communication from the Arkansas DOH).

To further analyze this issue, each of the women seen through our telecolposcopy program was given a short survey that elicited information regarding her ability to seek appropriate care if the program was not available. Each patient was asked to answer the following questions:

- If this local telecolposcopy service was unavailable, *would* you have sought care elsewhere? (Response options provided: yes, no.)
- If this local telecolposcopy service was unavailable, *when* would you have sought care? (Response options provided: up to 1 month, up to 3 months, up to 6 months, up to 1 year, over 1 year, none—did not intend to seek care.)
- Did the local availability of this service encourage you to seek more immediate diagnosis? (Response options provided: yes, no.)

Sixty-one percent of our patients reported that without this program they would have waited for at least 12 months or not sought care at all. This group made up 60% of the women with HSIL biopsies.

Seventy-four percent of patients reported that they would have waited for at least 6 months or not seek care at all. This group made up over 75% of the women with HSIL biopsies.

In addition, factors significantly associated with reporting delayed care for 12 months or more included smoking, increased anxiety

scores, age at first sexual experience, and race (white), all of which are predictors of cervical dysplasia and cancer (*Table 2*).

HIGH-RISK POPULATIONS

An analysis of the patients seen through this program demonstrates that in addition to sharing problems with access, they also have a tendency for behaviors known to increase the risk for cervical dysplasia and cancer.

SMOKING

Overall, approximately 43% of patients seen were smokers with an average of 13 cigarettes per day for 10 years. Among white patients, who made up 58% of all patients, the smoking rate increased to 60%.

SEXUAL HISTORY

On average, our patients' age at first intercourse was 16.10 years old, with total number of lifetime partners of 8.5.

REFERRAL CYTOLOGY

In addition, a comparison of referral Pap smear results with biopsy results also supports the notion that this population has an increased risk for high-grade lesions requiring identification. When compared with studies of similar low-income populations being seen at colposcopy clinics, our study group participants were significantly more likely to produce a HSIL biopsy regardless of referral Pap smear results as follows: 20.6% of Pap smears labeled atypical squamous cells of undetermined significance produced an HSIL biopsy, along with 28.8% of those labeled low-grade squamous intraepithelial lesion, 60.6% of those labeled atypical squamous cells, cannot rule out a high-grade lesion, and 77.3% of those labeled HSIL Pap smears (*Table 3*).

COMPARISON WITH TRADITIONAL COLPOSCOPY

Published studies largely report both sensitivity for finding high-grade lesions (i.e., finding HSIL on biopsy compared with that ultimately found on excisional biopsy) and the sensitivity/positive

Table 2. Comparison of the Deferral of Care Groups

VARIABLE	DEFER CARE <12 MONTHS	DEFER CARE 12 MONTHS OR MORE	STATISTICAL SIGNIFICANCE
Smoking	39.3%	50.7%	Yes
Race			
White	56.0%	66.4%	Yes
African American	24.0%	18.5%	Yes
Hispanic	12.5%	10.9%	No
Pre-anxiety	18.5	22.5	Yes
HSIL BX	31.4%	29.6%	No
First intercourse (years)	16.2	15.7	Yes

HSIL BX, high-grade squamous intraepithelial lesion biopsy.

Table 3. Comparison of Presenting Pap Smear Versus High-Grade Squamous Intraepithelial Lesion Biopsy

	ANGELS' START	MASSAD AND COLLINS ²³	GAGE ET AL. ²⁴
ASCUS	20.6	13	12.5
LSIL	28.8	21.8	14.5
ASC-H	60.6	NA	47
HSIL	77.3	52.7	74
All Pap smears	30.82	24	NA

ANGELS, Antenatal & Neonatal Guidelines, Education and Learning System; ASC-H, atypical squamous cells, cannot rule out a high-grade lesion; ASCUS, atypical squamous cells of undetermined significance; HSIL, high-grade squamous intraepithelial lesion; LSIL, low-grade squamous intraepithelial lesion; NA, not available.

predictive value of the impression compared with the biopsy results.²³ A review of several published studies of traditional colposcopy shows our program to be comparable in terms of positive predictive value and sensitivity regarding colposcopic impression and ultimate biopsy report. The positive predictive value and sensitivity of colposcopic impression in general are notoriously poor; however, the sensitivity of colposcopy for discovering HSIL lesions is quite good as examiners tend to biopsy any abnormal lesion seen regardless of their impression. The sensitivity of the colposcopic exam is known to improve with the number of biopsy specimens collected, and this is likely reflected in the large percentage of HSIL biopsies found through this program (Table 4).²⁴

PATIENT SATISFACTION

Telemedicine in general and telecolposcopy specifically has demonstrated good patient acceptance.¹⁹ Patient satisfaction of the telecolposcopy program has been positive throughout the life of the program. A 5-item Likert-type satisfaction scale was administered to all patients to monitor acceptance and showed that over 90% of patients reported that they agree (score of 4) or strongly agree (score of 5) with the statement "I was satisfied with this exam today." Even though all women who received abnormal Pap smear results during the study period were offered the option of traveling to have the colposcopy performed on-site or having a telecolposcopy at her local clinic, almost all the participants chose telecolposcopy.

COST-EFFECTIVENESS

By maximizing the relative utility and expertise of the MD and nurse providers, this program was able to deliver this service to a large number of women over a short period of time in a very cost-effective model. By combining the hourly rates for all practitioners and assistants involved, this telecolposcopy program produced significant cost savings when compared with the traditional physician examiner model. Our model of using one physician with four nurse practitioner examiners and four assistants produced an hourly cost of \$321.00, or a cost of \$40 per exam. This compares with a traditional model incorporating four MD examiners with four assistants pro-

ducing an hourly cost of \$416.00 or a cost per exam of \$52 (assuming hourly costs of MD = \$85.00, APN = \$40.00, and assistant = \$19.00 or assuming annual salaries of MD = \$177,000, APN = \$83,000, and assistant = \$40,000).

Additionally, the cost-effectiveness of the telecolposcopy can be determined by calculating the quality-adjusted life years (QALYs), which is a ratio used to estimate the cost of adding a year of ideal health to a person's life from a certain intervention or treatment. A value of \$50,000 is used by some as a threshold, and cost-effective interventions should come in under \$50,000 per QALY.²⁵ Cervical cancer screening does very well, as it is aimed at young women, a population who lose approximately 26 years of life if they die from cervical cancer.²⁶ The estimated dollars-per-QALY for a conventional Pap test every 3 years up to the age of 75 years was \$11,830 per QALY saved in year 2000 dollars.²⁷ This cost analysis does not include costs of technology, telecommunications, or overhead.

Although rates of progression from CIN 2 and CIN 3 to invasive cervical cancer are difficult to project, it is likely that between 1.5% and 20% of CIN 2 lesions, between 14% and 50% of CIN 3 lesions, and 100% of CIS lesions will develop into cancer.^{28,29} By extrapolating these progression risks to our patients seen between January 1, 2010 and June 30, 2011, we would expect to have prevented between 32 and 123 cases of invasive cervical cancer.

Discussion

This innovative project, combining both physician and non-physician examiners, was able to provide complex specialty gynecological services using telemedicine technology that overcame geographic barriers to care while producing results comparable to traditional examinations. The project has also demonstrated an extremely cost-effective approach that was well received by patients and can be used as a model for improving access to care among vulnerable populations.

FUTURE DIRECTION

Telecolposcopy could become a model for underserved regions of developed nations as well as undeveloped and emerging nations, such as Haiti or Tanzania. Future studies may include trials using nonlicensed health workers in the field to carry out the exam with expert oversight via telemedicine technology.

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Disclosure Statement

No competing financial interests exist.

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Table 4. Comparing Telecolposcopy Sensitivity with Traditional Colposcopy Sensitivity

TEST	ANGELS TELECOLPOSCOPY	NATIONAL STANDARD- TRADITIONAL COLPOSCOPY
PPV HSIL	63%	39%
PPV any lesion	66%	80%
Sensitivity HSIL	42%	49–60%
Sensitivity any lesion	97%	89%

ANGELS, Antenatal & Neonatal Guidelines, Education and Learning System; HSIL, high-grade squamous intraepithelial lesion; PPV, positive predictive value.

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