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Original Article

The quality of cervical smears from outreach screening services in remote areas in eastern Taiwan

Hui-Chuan Cheng [a, b, *], Yung-Hsiang Hsu [b, c]

[a] Department of Family Medicine, Buddhist Tzu Chi General Hospital, Hualien, Taiwan
[b] School of Medicine, Tzu Chi University, Hualien, Taiwan
[c] Department of Pathology, Buddhist Tzu Chi General Hospital, Hualien, Taiwan

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ABSTRACT

Objectives: Issues such as specimen adequacy and diagnostic yield have rarely been studied in rural regions. This study investigated specimen adequacy and the diagnostic yield of cervical smears from outreach screening services in remote regions in eastern Taiwan.

Materials and methods: There were 5670 smears from outreach screening services; 649 smears were taken in mobile screening van units or in temporary walk-in clinics. The quality, compromising factors, and positive rates of smears from mobile screening van units and temporary walk-in clinics were compared with those obtained in physician offices.

Results: The quality of smears from physician offices was better than the quality from mobile van screening units and temporary walk-in clinics; the satisfactory rates were 72%, 54%, and 53%, respectively ($\chi^2 = 109.9910$, $p < 0.0001$; df = 4). The most important limiting factor, absence of endocervical component (ECC), was reported in 56%, 57%, and 73% of suboptimal smears at physician offices, mobile van screening units, and temporary walk-in clinics, respectively ($\chi^2 = 25.2780$, $p < 0.001$; df = 2). Poor fixation compromised 18%, 18%, and 14% of smears taken at physician offices, mobile van screening units, and temporary walk-in clinics, respectively. For smears taken in physician offices, the odds ratio for positivity of suboptimal smears with ECC was nine times the odds ratio of suboptimal smears with no ECC.

Conclusion: The issue of quality of specimens from outreach services in rural areas needs to be emphasized to improve the sensitivity of the test. In future studies, the difficulties that health workers encounter when taking smears in outreach services and the underlying sociocultural and demographic barriers need to be elucidated.

1. Introduction

In 2012, cervical cancer was the ninth most common type of cancer in women in developed countries (age-adjusted mortality rate, 3.3 per 100,000 women) [1]. By contrast, it was the third most common type of cancer in developing countries (8.3 per 100,000 women). Since the introduction of cervical smear screening by George Papanicolaou, the incidence and mortality of cervical cancer have declined in many developed countries [2–4]. In Finland, where organized cervical screening was introduced in the 1960s, there was a decrease of 80% in the age-adjusted incidence and in the mortality of cervical cancer by the beginning of the 1990s [5]. Similar trends have been noted in developed countries with organized programs. In 2010 in Taiwan, cervical cancer had the sixth highest cancer mortality rate in females [6]. Mortality from cervical cancer in women aged > 30 years has decreased by 62.7%: the age-adjusted mortality rate was 22.0 per 100,000 women in 1997 and 8.2 per 100,000 women in 2011 [7]. This finding generally concurs with findings from developed countries that have organized screening programs in place.

Before the National Health Insurance (NHI) Program (Taipei, Taiwan) was established in 1995, cervical screening was performed opportunistically and haphazardly in Taiwan. A mass screening program was provided by the Taiwan Cancer Society from 1974 to

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* Corresponding author. Department of Family Medicine, Buddhist Tzu Chi General Hospital, 707, Section 3, Chung-Yang Road, Hualien, Taiwan. Tel.: +886 3 8561825x2280; fax: +886 3 8461865.
E-mail address: hccheng@tzuchi.com.tw (H.-C. Cheng).

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1984 with service delivered by > 700 gynecological clinics throughout the country. However, only 5.3% of eligible women were covered [8]. It was not until 1996 that a centrally organized cervical screening program was initiated. The screening program was funded by the NHI Program. It covers nearly 98% of the population. This cervical screening program was a health target program. It was listed as the top priority target of the 5-year National Cancer Prevention Project. Annual cervical screening is offered free to all women older than 30 years; in addition, human papilloma virus (HPV) self-testing is offered to people older than 36 years and in disabled women older than 30 years [7].

Outreach screening services are commonly used worldwide to reach rural residents to improve access to cancer preventive services and increase screening uptake [7]. To reduce health service disparities in rural regions, the Health Promotion Administration in Taiwan has been sponsoring and promoting outreach services in remote regions to provide cervical smears for marginalized and underserved women. In routine medical practice, Pap smears are conventionally taken by physicians in hospitals or private clinics. To breach sex and sociocultural barriers in rural areas, it is a common practice to recruit female aboriginal health center nurses to take Pap smears. To further boost uptake, outreach teams working in alliance with aboriginal health services and bilingual health workers send out postcards to notify residents in villages about the dates, times, and locations of outreach services that smears will be taken. They also organize group bookings of screening services in local activity centers during special gatherings of local villagers or in local elderly unions. Mobile van screening units and temporary walk-in clinics have been utilized in rural areas for outreach purposes [7]. These temporary walk-in clinics are established in local activity centers sports centers, or local school gymnasiums and school auditoriums. Temporary walk-in clinics use ordinary tables instead of bulky gynecologic examination tables and use simple curtains for privacy. On mass screening days, the screening unit staff traveled to the designated area in the rural communities in the early morning to reach women before they went to work. These outreach screening services rotate throughout different villages annually to facilitate cervical sampling in remote regions. This project targeted women older than 30 years, although all women who were sexually active were welcome to register for the service. When abnormalities are detected, patients are tracked by public health nurses and are referred to the appropriate regional treatment centers.

To the best of our knowledge, however, issues such as specimen adequacy and diagnostic yield have rarely been investigated in remote regions. In this study, we evaluated the specimen adequacy and diagnostic yield of smears that were taken in outreach screening programs in rural eastern Taiwan, and explored the most likely causes that compromise specimen quality.

2. Materials and methods

The data used for analysis was based on the screening results reported by a pathology laboratory at a university-affiliated hospital in eastern Taiwan between January 2006 and March 2011. This laboratory handles approximately one-third of all smear readings in eastern Taiwan. The catchment area of the source laboratory included the area stretching along the Hua-Tung Rift Valley, which is approximately 8044 square kilometers, and covers approximately 22.5% of the surface area of Taiwan [9–11]. It is sparsely populated with inhabitants accounting for only 2.38% of the total population of Taiwan [10–12]. The geography features mountains, hills, and the valley where aboriginals account for approximately 31% of the inhabitants [9,12–14]. Outreach screening services took 5670 smears; of these, 649 smears were from mobile screening van units or from temporary walk-in clinics.

The specimen adequacy was rated as “satisfactory”, “suboptimal”, or “unsatisfactory”, based on the consensus reached by the National Health Research Institutes (Taipei, Taiwan) and Taiwan Cooperative Oncology Group (Taipei, Taiwan). Reporting was based on a modification of the Bethesda System [15,16]. For each suboptimal smear, the cytopathologist was allowed to list two factors that compromised the smear quality such as poor fixation, too few cells, thick or bloody consistency, lack of endocervical component (ECC), inflammation, foreign bodies, and lysis. The variables we collected included specimen adequacy, descriptive diagnosis, the clinic, the type of professional taking the smear, and limiting factors that compromised specimen quality. Eighteen different interpretation results are listed in the descriptive diagnosis in the cancer registry [17]. In this study, no smears were diagnosed as “adenocarcinoma *in situ*” or “other malignant neoplasms.” For data visualization purposes, the remaining 16 cytopathology descriptive diagnosis results were grouped into four major categories: (1) “negative”; (2) “atypical”; (3) “atypical favoring dysplasia”; and (4) “dysplasia or malignancy” (Table 1). The quality, compromising factors, and positive rates of smears from remote outreach services were compared with smears from physician offices using the Chi-square test. A p value < 0.01 was regarded as significant. Data analysis was performed using the statistical package STATA version 11 software (StataCorp, College Station, TX, USA).

3. Results

Table 1 shows the cytological interpretation and specimen quality of the smears in this study. The positive rate of smears in remote regions was 2.98%, which included all categories, except the “negative” category (Table 1; $n = 169$). The satisfactory rate of the smears overall was 70%, and the suboptimal rate was 26%. The positive rates of the satisfactory smears and suboptimal smears were 3.31% and 2.55% respectively.

Table 2 shows the distribution of the sampling sites and the specimen adequacy. Eleven percent of smears were from mobile van screening units or temporary walk-in clinics. The quality of smears from physician offices was better than the quality from mobile van screening units and temporary walk-in clinics. The satisfactory rates were 72% (physician offices), 54% (mobile van screening units), and 53% (temporary walk-in clinics) ($\chi^2 = 109.9910$, $p < 0.001$; df = 4).

Table 3 lists the major limiting factors for suboptimal smears. The most important limiting factor was absence of ECC. Suboptimal smears from 56% of physician offices, 57% of mobile van screening units, and 73% of temporary walk-in clinics lacked ECC ($\chi^2 = 25.2780$, $p < 0.001$; df = 2). Furthermore, the suboptimal smears were compromised by poor fixation in physician offices (18% of smears), mobile van screening units (18% of smears), and temporary walk-in clinics (14% of smears), although the difference was not significant ($p = 0.324$).

The positive rates of smears from physician offices, mobile van screening units, and temporary walk-in clinics were 3.26%, 4.05%, and 1.51%, respectively (Table 4). The odds ratio of positivity for suboptimal smears containing ECC from physician offices was 9.06 times that of suboptimal smears containing no ECC ($p < 0.001$). The odds ratio of positivity for suboptimal smears containing ECC from temporary walk-in clinics was 2.74 times that of suboptimal smears containing no ECC ($p = 0.29$).

4. Discussion

Four characteristics of failed cervical screening programs have been identified: (1) failure to reach at-risk women, (2) inadequate

Table 1
Descriptive diagnosis and specimen adequacy among smears taken in remote eastern Taiwan.

Descriptive diagnosis	No. (%)	Specimen adequacy		
		Suboptimal, *n* (%)	Satisfactory, *n* (%)	Unsatisfactory, *n* (%)
Negative ($n = 5281$)				
Within normal limits	3599 (63)	984 (17)	2615 (46)	0
Reactive changes	1649 (29)	462 (8)	1187 (21)	0
Atrophy with inflammation	33 (1)	4 (0)	29 (1)	0
Atypical ($n = 103$)				
Atypical squamous cells	56 (1)	14 (0)	42 (1)	0
Atypical glandular cells	8 (0)	1 (0)	7 (0)	0
Mild dysplasia with KC	15 (0)	3 (0)	12 (0)	0
Mild dysplasia without KC	24 (0)	6 (0)	18 (0)	0
Atypical favor dysplasia ($n = 25$)				
AGC, favor neoplasia	3 (0)	0 (0)	3 (0)	0
ASC, cannot exclude HSIL	14 (0)	3 (0)	11 (0)	0
Dysplasia, cannot exclude HSIL	8 (0)	0 (0)	8 (0)	0
Dysplasia or malignancy ($n = 41$)				
Moderate dysplasia	8 (0)	2 (0)	6 (0)	0
Severe dysplasia	17 (0)	4 (0)	13 (0)	0
Carcinoma *in situ*	2 (0)	0 (0)	2 (0)	0
Squamous cell carcinoma	12 (0)	4 (0)	8 (0)	0
Adenocarcinoma	2 (0)	1 (0)	1 (0)	0
Others ($n = 220$)	220 (4)	0 (0)	0 (0)	220 (4)
Total	5670 (100)	1488 (26)	3962 (70)	220 (4)

The data are presented as *n* or *n* (%).
AGC = atypical glandular cells; ASC = atypical squamous cells; HSIL = high-grade squamous intraepithelial lesion; KC = koilocytosis.

follow-up of abnormal smears, (3) a long screening interval (i.e., > 5 years), and (4) false-negative smear results [18]. Since the 1970s in Latin America, there have been efforts to organize cervical cytology screening programs nationally and regionally. However, there have been no notable changes in the cervical cancer incidence and mortality [19]. The health system infrastructure, human power, and effective case tracking are lacking, which could be attributed to program failure.

In Taiwan, the nearly universal coverage by the NHI system has greatly facilitated the buildup of the cancer registry and case tracking system, and women do not have to pay for screening services. The currently used cervical screening report system was adopted and revised from the Bethesda System [20,21]. In the Bethesda System, the evaluation of specimen adequacy provides feedback to clinicians on the sampling technique and gives a rough indication of how reliable the sample may be in detecting an abnormality. The percentage of suboptimal smears has been decreasing. One survey of American pathologist interlaboratory comparison programs in cervicovaginal cytology reported a satisfactory rate of 90% and a suboptimal rate of 9%.

In 2001, the suboptimal category for specimen adequacy was eliminated from the Bethesda System. In Taiwan, the suboptimal category has remained in use. In this study, the satisfactory rate of smears taken in remote regions was 70%, which was lower than the rate of the university lab as a whole (79%) and the estimated national average (74%) [7]. In this study, mobile van screening units and temporary walk-in clinics collected 11% of the smears. The quality of smears from physician offices was better than the quality from mobile van screening units and temporary walk-in clinics. The quality of smears from walk-in clinic seemed to be the worst among the three locations, and nearly three-fourths of the smears lacked ECC, which could severely compromise sensitivity (Table 4).

Studies show that specimen quality influences smear interpretation and consequently the accuracy of diagnosis [22,23]. This study and other studies showed that the positive rate decreases if there is no ECC [24–26]. There has been little effort in researching the quality of smears from outreach services and remote regions. Thus, it is of utmost importance to improve specimen quality, to target especially remote health workers who are responsible for collecting smears, and to increase coverage in remote regions. The importance of correct technique cannot be overstated because the efficacy of the program could be eroded and compromised by suboptimal quality smears. According to this study, 37% of Pap smears in rural villages are collected by public health nurses, and 86% of smears taken in mobile screening vans and rural walk-in clinics are collected by nurses. Public health nurses who collect smears, especially nurses who work in remote regions, need further support such as training in sampling techniques [27]. The

Table 2
Smear quality at the different sampling sites.

Sampling sites	Specimen adequacy (%)			Total
	Satisfactory *	Suboptimal	Unsatisfactory	
Physician office	3617 (72)	1228 (24)	176 (4)	5021
Mobile van screening unit	46 (54)	28 (33)	11 (13)	85
Temporary walk-in clinic	299 (53)	232 (41)	33 (6)	564

The data are presented as *n* or *n* (%).
* The percentage in parentheses in this column has been analyzed using the Chi-square test; $\chi^2 = 109.9910$; $p < 0.001$.

Table 3
The limiting factors of suboptimal smears at the different sampling sites.

	Physician office	Mobile van screening unit	Temporary walk-in clinics
Total	1228 (100)	28 (100)	232 (100)
Limiting factors			
No ECC *	682 (56)	16 (57)	170 (73)
Poor fixation	225 (18)	5 (18)	33 (14)
Few cells	179 (15)	6 (21)	16 (7)
Thick or bloody	132 (11)	3 (11)	21 (9)
Inflammation	82 (7)	0	16 (7)
Foreign body	10 (1)	0	0
Lysis	5 (0)	0	2 (1)

The data are presented as *n* or *n* (%).
* The percentage in parentheses in this row has been analyzed using the Chi-square test; $\chi^2 = 25.2780$; $p < 0.001$.
ECC = endocervical component.

Table 4
The positive rate of smears at the different sampling sites.

	All smears			With ECC			Without ECC			OR	*p*
	Total	Pos.	%	Total	Pos.	%	Total	Pos.	%		
Physician office	4845	158	3.3	546	29	5.3	68	4	0.6	9.06	< 0.001
Mobile van screening unit	74	3	4.1	12	1	8.3	16	0	—	—	0.429
Temporary walk-in clinic	531	8	1.5	62	2	3.2	170	2	1.2	2.74	0.29

ECC = endocervical component; OR = odds ratio.

difficulties encountered in taking smears in outreach screening services also need further investigation.

High coverage is an important prerequisite of a successful organized screening program. The definition of coverage varies: some reports base the definition on the percentage of target women who have had Pap tests in their lifetime, whereas other reports base their definition on women who have had Pap smears in the past 3 years or 5 years [5,7,28–30]. The reliability of estimates of coverage relies heavily on a good registry system because estimates based on interviews or questionnaires are subject to human recall. The screening interval is 5 years in Finland, which launched the earliest organized screening program in Europe; 87% of women aged 25–69 years have had at least one test during the past 5 years [29]. One study reports that 60–80% of women in Germany (depending on age group) and 57% of women in France have had at least one test during the past 3 years [5]. In the United States, Pap test coverage largely depends on whether the client has insurance, and therefore low-income women are likely to be underscreened [31]. In Taiwan, the coverage among women older than 30 years who have had at least one smear during the past 3 years has risen steadily from 35.0% in 1997 to 55.5% in 2012 [7]. In 2012, coverage among women 30–69 years old in eastern Taiwan reached 65.9%. Despite efforts to improve the outreach screening program in rural eastern Taiwan, this study estimated that only 34.10% of participants in remote and rural regions had received a Pap test in the past 5 years.

The issue of targeting rural and remote areas has received attention worldwide. Outreach services are commonly used to reach target populations by combining different strategies to boost uptake such as media campaigns; group bookings; networking with indigenous health workers and health services; increasing grant funding; and using interpreter services, reminder letters, and mobile screening vans [32,33]. A study conducted in the Mae Sot District in northern Thailand, reports that using mobile units could improve coverage to up to 70.1% of the population. The Mae Sot District is a relatively closed and self-sufficient society (i.e., people live and work in their farming communities), which may explain why the coverage was lower in eastern rural Taiwan. The demographic changes in rural eastern Taiwan may be more drastic in this region (e.g., people tend to move away for part-time jobs in the forestry or highland farms).

One concern is that the chance of detecting high-grade lesions is much higher in rural regions than the national average [28]. The positive rate in remote regions in this study was 2.98%, which is higher than the national average of 1.27% [7]. Women in rural or remote regions should be especially targeted as high-risk groups as far as their screening behaviors are concerned. The underlying causes that hinder receiving preventive services should be further investigated. The World Health Organization (Geneva, Switzerland) has proposed using a highly sensitive test (e.g., combining cytology and HPV test) for high-risk women at least once or twice in their lifetime with an emphasis on high coverage (i.e., > 80%) of the targeted population, which seems to be a feasible and practical solution [19].

5. Conclusion

The issue of specimen quality from outreach services needs to be emphasized to improve the sensitivity of the test. The difficulties that health workers encounter during smear taking in outreach services need further investigation. Screening uptake needs further improvement and the underlying sociocultural or demographic barriers should be elucidated in future studies.

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