RESEARCH ARTICLE

Implementing a Cervical Cancer Awareness Program in Low-income Settings in Western China: a Community-based Locally Affordable Intervention for Risk Reduction

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Abstract

Background: Some 60 years after introduction of the Papanicolaou smear worldwide, cervical cancer remains a burden in developing countries where >85% of world new cases and deaths occur, suggesting a failure to establish comprehensive cervical-cancer control programs. Effective interventions are available to control cervical cancer but are not all affordable in low-income settings. Disease awareness saves lives by risk-reduction as witnessed in reducing mortality of HIV/AIDS and smoking-related cancers. Subjects and Methods: We initiated a community-based awareness program on cervical cancer in two low-income Muslim Uyghur townships in Kashi (Kashgar) Prefecture, Xinjiang, China in 2008. The education involved more than 5,000 women from two rural townships and awareness was then evaluated in 2010 and 2011, respectively, using a questionnaire with 10 basic knowledge questions on cervical cancer. Demographic information was also collected and included in an EpiData database. A 10-point scoring system was used to score the awareness. Results: The effectiveness and feasibility of the program were evaluated among 4,475 women aged 19-70 years, of whom >92% lived on/below US$1.00/day. Women without prior education showed a poor average awareness rate of 6.4% (164/2,559). A onetime education intervention, however, sharply raised the awareness rate by 4-fold to 25.5% (493/1,916). Importantly, low income and illiteracy were two reliable factors affecting awareness before or after education intervention. Conclusions: Education intervention can significantly raise the awareness of cervical cancer in low-income women. Economic development and compulsory education are two important solutions in raising general disease awareness. We propose that implementing community-based awareness programs against cervical cancer is realistic, locally affordable and sustainable in low-income countries, which may save many lives over time and, importantly, will facilitate the integration of comprehensive programs when feasible. In this context, adopting this strategy may provide one good example of how to achieve "good health at low cost".

Keywords: Cervical cancer - awareness - risk-reduction - education intervention - low-income setting - Uyghur ethnicity

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Introduction

Cervical cancer is the fourth most common cancer worldwide in women with estimated 528,000 new cases and 266,000 new deaths in 2012, of which about 85% of cases and 87% of deaths occur in developing countries (International Agency for Research on Cancer, IARC, http://globocan.iarc.fr/Pages/fact_sheets_cancer.aspx). In sharp contrast, the incidence and mortality of cervical cancer have declined dramatically in developed countries

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(Jemal et al., 2008). In the United States, for example, the mortality has dropped by 70% over the last 60 years due to a successful comprehensive screening program that incorporates nationwide education campaign, effective screening methods including Papanicolaou (Pap) smear and human papillomavirus (HPV) testing, and advanced diagnostic and treatment technologies (Feldman, 2011). Despite widespread implementation of effective screening tools, the last 3 decades have witnessed 20% increase in cervical cancer cases mostly in developing countries and 23% of the total deaths are aged 15-49 years in developing countries (Forouzanfar et al., 2011). After 60 years of adopting Pap smear (Runowicz, 2007), this catastrophic inequality of cervical cancer distribution indicates a sad failure in terms of implementing affordable and sustainable cervical-cancer control programs in low-income or resource-constrained developing countries. With every one-day delay in introducing effective programs, about 600 more women per day will die from cervical cancer in developing countries (IARC, http://globocan.iarc.fr/factsheet.asp), pressing international advocacy organizations, professional communities and governments to act urgently and decisively on cancers including cervical cancer (Union for International Cancer Control, UICC, http://www.worldcancerday.org).

Ideally, a comprehensive cervical-cancer prevention and control program includes three essential components – community health education, screening services, and diagnostic and treatment services as recommended by several prominent organizations (Alliance for Cervical Cancer Prevention, ACCP, http://www.alliancecxca.org/english/publications.html#cciid; WHO, http://www.who.int/reproductivehealth/topics/cancers/en; American Cancer Society, ACS, http://www.cancer.org/Research/CancerFactsFigures/index). In reality, however, there are tremendous challenges in low- and middle-income countries including China, to implement such an ideal comprehensive national cancer program because of resource constraints. Effective interventions are available to control cervical cancer (UICC, http://www.worldcancerday.org; WHO, http://www.who.int/reproductivehealth/topics/cancers/en) but selecting and implementing appropriate intervention(s) is a strategic decision in resource-constrained settings. During the past 5 years, we have been performing organized screening for cervical cancer in a low-income Muslim Uyghur minority county in remote western China, about 4,407 km (2,739 miles) away from capital Beijing, which is of historically high burden of cervical cancer (Li et al., 1996; Tao et al., 2010). Our experiences indicate that it is simply unrealistic, now or in the foreseeable future, to implement a comprehensive cervical-cancer control program due to the nonexistence of funds, expertise in gynecology and pathology, and facility infrastructure in this setting. Yet, the best estimate is that there are countless such low-income communities worldwide, which are unable to afford implementing a cervical-cancer control program using even "the cheapest" Pap smear.

In resource-constrained settings, local affordability is a major factor that determines success and sustainability of an intervention strategy when external assistance is not available. Community health education, unfortunately, may be the only affordable component left in a comprehensive cancer control program. Educational intervention saves lives by risk-reduction (WHO, http://www.who.int/reproductivehealth/topics/cancers/en; Thun and Jemal, 2006; Dieffenbach and Fauci, 2011) and accordingly, is a useful tool in fighting cervical cancer when other tools are not locally affordable in resource-constrained settings. For these reasons and encouraged by the mission statement of World Cancer Day: "Stand Up and Do Something" (UICC, http://www.worldcancerday.org), we have chosen to initiate a community-based awareness education program to control cervical cancer in this resource-constrained county with high burden of cervical cancer. We have found that this awareness education program is locally affordable, locally manageable and effective in raising awareness of cervical cancer in low-income women.

China is particularly significant in terms of demands and benefits of a comprehensive national cervical-cancer control program due to China's near 20% of the world population that contributes 14.2% (75,434) of world new cases of, and 12% (33,914) of world new deaths from cervical cancer annually ((http://globocan.iarc.fr/fact_sheets_cancer.aspx). Yet, after 30 years of economic reform with much accumulated public wealth, China still has no established national cervical-cancer prevention and control program (Li et al., 2011). Ironically, China had numerous and sporadic organized cervical cancer screening programs covering rural low-income communities in many provinces before the early 1980s. These screening programs played an important role in the containment of cervical cancer. A retrospective analysis found a dramatic reduction in mortality of cervical cancer by 68% (from 10.3/100,000 in the early 1970s down to 3.3/100,000 in the early 1990s, age-adjusted) (Li et al., 1997). Unfortunately, these screening programs discontinued or were not active after China's market economy reform in the early 1980s due to lack of funding and interest in a profit-driven environment. As a result, the mortality of cervical cancer increased from 3.3/100,000 in the early 1990s to 4.3/100,000 in 2008 (http://globocan.iarc.fr/fact_sheets_cancer.aspx). It should be noted that the incidence of cervical cancer reported to the GLOBOCAN may be underestimated given the relatively high prevalence of HPV infections found in recent studies (Li et al., 2011).

There may be many drawbacks for unsustainable cervical cancer control programs in China but three major problems are apparent. First, these programs are grant-supported with a typical 3-year period and target one or few specific rural communities. The programs discontinue when funds run out, a phenomenon of "no funding, no screening". Second, these programs are research-oriented with major tasks in data collections, such as incidence and mortality, or field trials of screening methods, other than to implement a comprehensive control program to exist. When data are collected, screening programs are discontinued, a phenomenon of "shoot and run". Finally, due to the grant-supported and research-oriented nature, these programs are usually not well-conceived to integrate all three essential components (ACCP, http://

www. alliancecxca.org/english/publications.html#cciid; WHO, http://www.who.int/reproductivehealth/ topics/cancers/en; ACS, http://www.cancer.org/Research/CancerFactsFigures /index), of which health education and treatment intervention, two key components in a comprehensive program, are often poorly performed or neglected. Lessons from the past clearly indicates that it is time to establish a cervical cancer control program, simple or comprehensive, at national level to exist and last. On the other hand, continuous public campaigns will also have to coexist to make such a national program more effective.

Primary prevention of cervical cancer using HPV vaccines would be the best approach to alleviate the burden of the deadly cancer in low-income countries. This approach, however, faces a dilemma in developing countries due largely to the unprecedented high price of HPV vaccines ($360 for 3 doses in the United States) (Agosti and Goldie, 2007), prohibiting widespread application in the developing world. Yet, HPV vaccines are not available at any price in China (Zhang et al., 2013) despite the country's high burden of HPV-related diseases (IARC, http://globocan.iarc.fr/fact_sheets_cancer.aspx). To cope with this dilemma, we have recently proposed a 'semi-mandatory HPV vaccination strategy' in which governments subsidize HPV vaccination initially in low-income settings for high-risk individuals willing to pay an affordable cost (Zhang et al., 2013). This strategy may also be meaningful to high-income countries given current financial austerity worldwide. It has been estimated that, with every 5-year delay of no action (such as no HPV vaccination), more than 1.5 million more women worldwide will die from cervical cancer (Agosti and Goldie, 2007). In China alone, no action for every 5 years will cost at least 170,000 more women's lives from cervical cancer (IARC, http://globocan.iarc.fr/fact_sheets_cancer.aspx). Therefore, developing countries, especially China, need urgent actions to avoid further tragedies from this deadly cancer.

In the recent 3-year healthcare reform launched in 2009, China has pumped CN¥850 billion (US$125 billion) to act as the first phase toward achieving comprehensive universal health coverage by 2020 (Yip et al., 2012). This provides an excellent opportunity for medical communities to argue for a sustainable national program for cervical-cancer control as the reform prioritizes primary healthcare systems (Yip et al., 2012), which covers low-income settings where the incidence and mortality of cervical cancer are historically high in China. Before a national program for cervical cancer is established and HPV vaccines become available, however, should public health workers in low-income communities do something now? Disease awareness saves lives through risk-reduction. A well-demonstrated example of benefits obtained from disease awareness is the significantly decreased death rates of lung cancer resulting from the dramatic reduction of tobacco smoking due to anti-smoking campaigns, raising awareness by public education and other tobacco control measures implemented since the 1950s. The reduction in tobacco smoking accounts for about 40% of the decrease in overall male cancer death rates and have prevented at least 146,000 lung cancer deaths in men during 1991 to 2003 (Thun and Jemal, 2006). With continued public awareness programs and anti-smoking campaigns worldwide (WHO, http://www.who.int/tobacco/en), progress in tobacco control programs will sustain progress against cancer and save lives (Thun and Jemal, 2006; Jemal et al., 2008).

Another proven example that disease awareness saves lives is the containment of HIV/AIDS epidemics after a 30-year worldwide campaign (Dieffenbach and Fauci, 2011). The prevalence of new HIV infections has dropped 19% in the past decade and AIDS-related deaths have dropped 19% during 2004-2009, thanks to a worldwide comprehensive program in which education intervention has played a vital role (WHO, http://www.who.int/hiv/pub/ progress_report2011/en/index.html). Education raises awareness that prompts client-initiated "voluntary counseling and testing (VCT)" for HIV/AIDS patients, which in turn saves many lives due to early detection of HIV infection (WHO, http://www.who.int/hiv/pub/ progress_report2011/en/index.html). Evidence that is more direct comes from the awareness education intervention aimed at risk-reduction that increases condom use and lowers the incidence of HIV infection (Bhave et al., 1995). After 30 years of fighting HIV/AIDS pandemic, raising disease awareness has proven to be an effective intervention in preventing HIV/AIDS by modifying behaviors among people at-risk (Dieffenbach and Fauci, 2011).

HPV infection is a sexually transmitted infection (STI) with high-risk HPV types being the major cause to cervical cancer (Zur Hausen, 2000). Therefore, raising awareness of HPV infection among women can help avoid/reduce high-risk sexual behaviors (Shepherd et al., 2000; Zhang et al., 2011), increase self-protection in sexual activities (Stanton et al., 1998), and promote client-initiated cancer screening (Stone et al., 2002). It is anticipated that health education, integrated with prevention, early detection and appropriate treatment will save millions of women's lives from cervical cancer in resource-constrained settings in China, Middle and Far East regions and sub-Saharan Africa among many other countries in the long-term (IARC, http://globocan.iarc.fr/fact_sheets_cancer.aspx).

Materials and Methods

Ethics Statement

The Institutional Ethics Review Board (IERB) at the First Affiliated Hospital of Shihezi University School of Medicine approved the study (IERB No. SHZ2008LL01). Standard university hospital guidelines including informed consent, voluntary participation, confidentiality, and anonymity were followed. All participants gave written informed consent before the survey began.

Settings and Participants

As a pilot education program, we chose two rural township communities, Hexia'awati and Jiangbazi townships, about 16 km apart, in Jiashi (Payzawat in Uyghur language) County where approximately 98% of the population are minority Muslim Uyghurs. Most of rural Uyghur residents still live in traditional lifestyle with little changes after 3 decades of China's economic

Table 1. Prior Health Education Significantly Increases Awareness of Cervical Cancer among Women in a Resource-poor Setting

Knowledge Questions	No prior health education (Hexia'awati, n = 2559)				Prior health education (Jiangbazi, n = 1916)				*P*
	Yes		No		Yes		No		
	n	%	n	%	n	%	n	%	
1. Do you know that cervical cancer is one of the major cancers worldwide harming women's health and life?	266	10.4	2293	89.6	498	26.0	1418	74.0	<0.0001
2. Do you know that cervical cancer is often difficult to detect early without screening, and is difficult to treat when diagnosed late, which results in a high death rate?	196	7.6	2363	92.4	557	29.1	1359	70.9	<0.0001
3. Do you know that a virus infection, called HPV infection, is a major risk factor of cervical cancer?	27	1.1	2532	98.9	120	6.3	1796	93.7	<0.0001
4. Do you know that early sexual life (<20-year old) is a risk factor of cervical cancer?	174	6.8	2358	93.2	307	16.0	1609	84.0	0.022
5. Do you know that having multiple sexual partners is a risk factor of cervical cancer?	171	6.7	2387	93.3	611	31.9	1305	68.1	<0.0001
6. Do you know that multiple pregnancies (>3) are a risk factor of cervical cancer?	239	9.3	2320	90.7	602	31.4	1314	68.6	<0.0001
7. Do you know that smoking is a risk factor of cervical cancer?	247	9.7	2312	90.3	532	27.8	1384	72.2	<0.0001
8. Do you know that family member(s) having cancer may increase your probability of getting cervical cancer?	66	2.6	2493	97.4	512	26.7	1404	73.3	<0.0001
9. Do you know that actively avoiding the above risk factors can prevent cervical cancer?	112	4.4	2447	95.6	583	30.4	1333	69.6	<0.0001
10. Do you know that taking periodic screening and treating precancerous disease can prevent cervical cancer?	141	5.5	2418	94.5	610	31.8	1306	68.2	<0.0001
Average awareness	164	6.4	2392	93.6	493	25.5	1443	74.5	

Statistical analyses: Crosstabs χ^2 test was used in analyses and differences were considered significant if $P<0.05$

reform. Jiashi County is one of the poorest counties in China located in Kashi (or Kashgar) Prefecture, Xinjiang Uyghur Autonomous Region in remote western China, about 4,407 km (2,739 miles) away from the capital Beijing. Historically, Jiashi County had high prevalence of cervical cancer, being 459/100,000 in 1991 (Li et al., 1996) and increased to 622/100,000 in 2007 (Tao et al., 2010).

Survey participants were married village women (n=4,475, aged 19-70 years with a medium age of 37 years) enrolled in a screening program for cervical cancer from two rural township communities. Participants from Hexia'awati Township were surveyed as controls (awareness baseline) who had never received awareness education on cervical cancer (n=2,559). While Jiangbazi Township was a test township (awareness promotion) where women (n=1,916) had received a onetime awareness education on cervical cancer in 2008.

Cancer Awareness Education

The education material was an informative pamphlet in plain Uyghur language containing basic knowledge, risk factors, and preventive methods of cervical cancer. The awareness education was individual-approaching, defined as direct delivery of pamphlets to individual village women at screening site or to their homes ensuring a maximal effect of the education. The delivery was executed by "village doctors" who were lay community health workers, historically called "barefoot doctors" in China. Community health workers are playing increasingly important roles in low-income countries (Singh and Sachs, 2013). For illiterate women, local health workers explained the content in the pamphlet. To maximize the effect of awareness education, the content in the pamphlet was also broadcasted through a wired township-to-village loudspeaker system established in all villages. These education activities lasted for one week in Jiangbazi Township in September 2008 and the survey was performed in November 2010.

Questionnaire Survey

Demographic information was collected from participants who were surveyed for their awareness of cervical cancer by trained local bilingual Uyghur health workers (speaking both Uyghur and Chinese Han languages) using a questionnaire with 10 knowledge questions including basics about cervical cancer, risk factors and available preventive measures (Table 1). The understandability of the questionnaire was pre-tested by surveying 20 female villagers who were visiting township hospitals. We established a simple scoring system giving one point score to one question with a Yes answer and a total of 10 points was scored if Yes answers to all 10 knowledge questions. A databank was created to include demographic information and survey results using EpiData software (EpiData Association, Odense, Denmark, http://www.epidata.dk/).

Statistical Analysis

Statistical analyses were performed using a statistical software package (Statistical Program for Social Sciences or SPSS, version 17.0, 2008). Descriptive data were analyzed using Chi-square (χ^2) and non-parametric test (K independent sample test) was used in multivariate comparisons. Differences with *P* values of <0.05 were considered statistically significant.

Results and Discussion

Education Raises Cancer Awareness in Low-income Rural Women

In a comprehensive cancer prevention and control

Table 2. Education and Income Affect Average Awareness Scores on Cervical Cancer Among Women Without Prior Awareness Education (Hexia'awati Township)

Characteristics	n	%	Average/ total score	*P*
Education received				
No school	745	29.2	0.53/10	0.0016
Elementary school	1,278	50.1	0.61/10	
Middle or higher school	527	20.7	0.85/10	
Total*	2,550	100.0		
Per capita income per day US$				
≤0.50#	1,754	69.4	0.47/10	<0.0001
0.51-1.00	606	24.0	0.96/10	
>1.00	166	6.6	1.03/10	
Total*	2,526	100.0		
Age (years)				
<30	506	19.9	0.59/10	0.069
30-39	1,092	42.9	0.73/10	
40-49	703	27.6	0.64/10	
≥50	244	9.6	0.36/10	
Total*	2,545	100.0		

In each characteristic category, average score was obtained using total scores from individual answers divided by the number of total individuals in that category. *Varying totals were the result of relevant information missing in some questionnaires. #US$0.50 per day (US$181 per year) was the Chinese rural poverty line in 2010 and before (US$1=CN¥6.623 by 31 December 2010)

Table 3. Education and Income Affect Average Awareness Scores on Cervical Cancer among Women with Prior Awareness Education (Jiangbazi Township)

Characteristics	n	%	Average/ total score	*P*
Education received				
No school	266	13.8	1.17/10	<0.0001
Elementary school	1,084	56.1	2.18/10	
Middle or higher school	583	30.1	3.12/10	
Total*	1,933	100.0		
Per capita income per day US$				
≤0.50#	1,328	69.3	1.98/10	<0.0001
0.51-1.00	440	23.0	3.95/10	
>1.00	147	7.7	3.80/10	
Total*	1,915	100.0		
Ages (years)				
<30	251	13.2	2.77/10	0.211
30-39	788	41.4	2.55/10	
40-49	626	32.9	2.64/10	
≥50	237	12.5	2.18/10	
Total*	1,902	100.0		

NB, *Varying totals were the result of relevant information missing in some questionnaires. See Table 2 for additional footnotes

program, health education is a primary prevention of cervical cancer (WHO, http://www.who.int/reproductivehealth/topics/cancers/en) and, therefore, is a strategic option in low-income settings when other options are not affordable for now or in the near future. During our cervical-cancer screening practice, we have realized the serious limitations to establish a comprehensive program in resource-constrained settings and therefore, initiated a community-based awareness education program as the first action to immediately control or reduce risk factors of cervical cancer in low-income rural communities in collaboration with local health departments and community hospitals.

As shown in Table 1, women without prior education (Hexia'awati) had very poor knowledge of cervical cancer with an average awareness rate of 6.4% (164/2,559). In this baseline population, the best aware knowledge was Question 1 (basic knowledge), to which 10.4% (266/2,559) of the women were aware. The least aware knowledge was Question 3 (HPV infection as a major risk factor for cervical cancer), to which just 1.1% (27/2,559) of the women heard of. With a onetime prior education, however, women from Jiangbazi Township showed remarkably higher awareness across all 10 questions than those without prior education from Hexia'awati Township (Table 1). Women with prior education showed a 4-fold higher average awareness rate (25.5%, 493/1,916) than those without prior education (6.4%, 164/2,559). Awareness of HPV infection is important (Question 3, Table 1) and women with a prior education raised the awareness of HPV infection by 5.7-fold (6.3% versus 1.1%) as compared with women without prior education. These observations were the first in a resource-constrained setting indicating that a onetime education could significantly raise the awareness. However, it should be noted that the average awareness rate was still very low (25.5%) after receiving a onetime education (Table 1), suggesting that continued education is necessary to further improve the awareness of cervical cancer.

Limiting Factors in Awareness-raising—Challenges in Low-income Settings

Low income and illiteracy were serious in these two townships. Among 4,475 women surveyed, more than 92% of them lived on or below US$1.00 per day (Table 2 and Table 3), a sharp contrast to the national average of 15.9% of people living on <$1.00 per day in 2005 (WHO, http://apps.who.int/ghodata/?theme=country). On the other hand, illiteracy (no school) rate reached 22.6% among these women (1,011/4,475, Table 2 and Table 3), a rate dramatically higher than the national average of 4.1% in 2010 (China National Bureau of Statistics, http://www.stats.gov.cn/tjgb/rkpcgb). Furthermore, when demographic factors were analyzed against average awareness scores, it was consistent that low income and illiteracy were two reliable factors associated with low average awareness scores in these two populations no matter with or without prior education (Table 2 and Table 3). In both townships, age did not appear to affect average awareness scores (Table 2 and Table 3). These findings were the first in a resource-poor setting, which has important implications in the effectiveness of a health education that better-educated and wealthier women can understand and absorb more information from the education and may better benefit them in participating prevention, screening and early treatment of cervical

Table 4. Approximate Local Costs Per Item/Test Per Person for Cervical Cancer Control and Prevention*

Cost items#	Education pamphlet	Condom	VIA (visual inspection)	Pap test	Liquid-based cytology	HPV test (HC2)	HPV vaccine¶
CN¥/item	0.65	3	10	30	200	300	2000
US$/item	0.10	0.45	1.50	4.50	30	45	302
Per 1,000	$100	$450	$1,500	$4,500	$30,000	$45,000	$302,000
Per 1 million	$0.1M	$0.45M	$1.5M	$4.5M	$30M	$45M	$302M

NB, *Cost of a test/item per person if made locally or performed in local tertiary healthcare facilities, and of liquid-based cytology and HPV testing was based on healthcare facilities in larger cities or university hospitals. ¶Estimated cost for a 3-dose HPV vaccination based on discounted price of GARDASIL® in Hong Kong market as HPV vaccine is not available in mainland China (Zhang et al. 2013). #Population coverage costs per 1,000 persons or per 1 million persons (M=US$ million). Currency exchange rate was US$1=CN¥6.623 as of December 31, 2010 (Bank of China)

cancer. On the other hand, low income and high illiteracy in resource-constrained settings pose additional challenges to developing countries in terms of promoting cancer awareness programs.

Awareness Education Program—an Affordable Approach without External Assistance

Cost is a major issue in developing countries as so many health priorities are competing for limited finance and resources (Agosti and Goldie, 2007). In a financial environment of austerity worldwide today and in the near future, a comprehensive cancer control program (ACCP, http://www.alliance-cxca.org/english/publications.html#cciid) is simply too "luxurious" to implement in most, if not all, developing countries without heavy international investments and much involved technology assistance. For example, in Xinjiang Uyghur Autonomous Region of western China, covering one million women using the cheapest Pap testing will cost $4.5 million (CN¥29.8 million) while sophisticated HPV DNA testing will need a budget of $45 million (CN¥298 million) (Table 4), both of which are not thinkable now or in the near future in China and other developing countries. A cost-effective measure does not mean that it is affordable. For example, HPV vaccination is cost-effective in the long-term, but it is the most expensive measure costing $302 million (CN¥2 billion) to cover one million women (Table 4), apparently not affordable by any developing country (Agosti and Goldie, 2007) without alternative strategies in national health policy.

These overwhelming challenges have brought us to a reality that sophisticated options are excellent but simply not affordable in resource-constrained settings, and awareness education is the only option locally affordable yet effective strategy in controlling cervical cancer by risk-reduction (WHO, http://www.who.int/reproductivehealth/topics/cancers/en; ACS, http://www.cancer.org/Research/CancerFactsFigures/index). For example, local printing of an education pamphlet costs only $0.10 each and delivery of these materials by "village doctors" is free of charge as part of their duty, which brings the budget down to $100,000 (CN¥662,300) to cover one million women (Table 4). The 2010 census data showed that Xinjiang Uyghur Autonomous Region has a population of about 21.8 million (National Bureau of Statistics of China, http://www.stats.gov.cn/tjgb/rkpcgb) with over 4 million women aged 30-59 years who are at higher risk for cervical cancer. Covering these 4 million women in Xinjiang using the awareness education program will only need $400,000 (CN¥2.5 million), which is the average budget of a program project for cervical-cancer screening in China that is affordable by most China's provincial health departments.

Implementing Community-based Cancer Awareness Programs Is a Real World Reality

Local affordability determines the success and sustainability of a cancer program and selecting appropriate intervention(s) is an urgent strategic decision to control the burden of cervical cancer in these resource-constrained settings. Having encouraged by the effectiveness of the education in raising the awareness, we have chosen to collaborate with local county and prefecture health departments to initiate a pilot community-based cervical cancer awareness program in the county. In China, township community is a basic government administration entity with primary healthcare facilities including women's healthcare. Our experiences suggest that an individual-approaching education strategy, in addition to public campaign strategy, is necessary for village women due to their fieldwork and poor access to public media like TV, radio and newspapers. The individual-approaching education is a strategy that requires door-to-door delivery of education materials and face-to-face explanation of questions by "village doctors". Our education program will cover more than 20,000 women aged 20-59 years because of early marriages around 20 years in this Muslim Uyghur population. This coverage will only cost US$2,000 (CN¥13,000) annually, which is affordable by the program budget. The program provides education materials and necessary training of "village doctors" in basic knowledge, risk factors and preventive methods of cervical cancer, including information of HPV vaccination although HPV vaccines have not been approved in mainland China (Li et al., 2011). The county health department is responsible for delivering education materials and arranging wired township-to-village broadcasting of the material content. We have framed a workable agenda for the awareness program: (1) At county level, establish the first week in every February as Cervical Cancer Awareness Week to coincide with the World Cancer Day in every February (UICC, http://www.worldcancerday.org). (2) During the week, deliver education information via county-run TV and radio, by which provides a wider coverage to the public. Awareness information will be delivered via a wired township-to-village broadcasting system to covered

villages. (3) Deliver education materials (pamphlets) to 20,000 married women (20-59 years) through "village doctors" ("barefoot doctors") who played a critical role in community healthcare and disease prevention in the 1970s and 1980s in China (Nkonki et al., 2011). (4) Deliver education materials to primary healthcare providers who in turn can promote awareness education in their daily clinic. (5) Achieve the sustainability of the awareness program through a gradual transition to local health departments. Future funds to sustain the ongoing awareness program will be negotiated with provincial and local health departments. We will also negotiate funds or seek new grants to evaluate the outcomes of the community-based awareness program against cervical cancer by screening about 4,000 women (2,000 in each township) using economic visual inspection with acetic acid (VIA) and Pap smear methods we have used in these communities (Table 4).

In conclusion, health education is a proven strategy in disease prevention and control, which forms a critical component of a comprehensive program (ACCP, http://www.alliancecxca.org/english/ publications.html#cciid; WHO, http://www.who.int/reproductivehealth/topics/cancers/en; ACS, http://www.cancer.org/Research/CancerFactsFigures/index). Here we show that the health education significantly raises awareness of cervical cancer and its risk factors in typical low-income rural settings. In low-income developing countries, do something is certainly better off than do waiting when international assistance from organizations, such as World Health Organization (WHO), Alliance for Cervical Cancer Prevention (ACCP), and Global Alliance for Vaccines and Immunization (GAVI), is not available for years due to a triaged strategy toward worldwide coverage. In this context, we argue and propose that, although promoting awareness education alone cannot achieve what a comprehensive program can in controlling cervical cancer (Feldman, 2011), community-based awareness program is the do something that many, if not all, low-income settings in developing countries can afford to initiate immediately and sustain in the long-run. More importantly, because awareness education is an essential component in a comprehensive program (ACCP, http://www.alliancecxca.org/english/publications.html#cciid; WHO, http://www.who.int/reproductivehealth/topics/cancers/en), initiating a cervical-cancer awareness program today is a necessary step and will certainly facilitate the integration of a comprehensive cervical-cancer control program tomorrow when the reality arrives. Our experiences in establishing a community-based cervical-cancer awareness program in resource-constrained settings may be useful to many rural settings in China's 2,859 counties and, similarly, to numerous resource-constrained communities in other developing countries worldwide.

We appreciate the wisdom in the WHO's testimony that "a well-conceived and well-managed national cancer control program lowers cancer incidence [and mortality] and improves the life of cancer patients, no matter what resource constraints a country faces" (WHO, http://www.who.int/cancer/nccp/en). This again advocates an achievable approach, i.e. step-by-step, to first implement affordable measure(s), and gradually add sophisticated measure(s) in the program possibly over a long time. In China, the recent healthcare reform with a huge investment (Yip et al., 2012) may well allow China to "Stand Up and Do Something" (UICC, http://www.worldcancerday.org) now to alleviate the country's significant contribution to the world burden of cervical cancer (IARC, http://globocan.iarc.fr/factsheet.asp), particularly in low-income rural and mountain communities.

We would also like to suggest to the WHO to formulate expert education materials for cervical cancer in various languages for use worldwide. The WHO's involvement in this regard would expedite the initiation of national cancer education programs in developing countries. To promote primary prevention of cervical cancer in low-income countries, the recently proposed semi-mandatory HPV vaccination strategy may prove to be realistic and cost-effective (Zhang et al., 2013). In terms of cancer prevention and control in low-income countries as a whole, do something affordable now, such as cancer awareness education, rather than do waiting for an ideal comprehensive solution in years, may provide a realistic step on the roadmap to achieve "good health at low cost" (Balabanova et al., 2011).

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