1 REVIEW ARTICLE

Q1 # Cervical cancer screening programs and guidelines in low- and middle-income countries

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A B S T R A C T

Background: Screening reduces cervical cancer incidence and mortality. Objective: To describe cervical cancer epidemiology and screening guidelines in six low- and middle-income countries (LMICs) participating in the Study on global AGEing and adult health (SAGE). Search strategy: Incidence, mortality, and screening-rate data were obtained for six LMICs and three higher-income comparator countries (Australia, USA, and UK). SCOPUS and PubMed were used to identify literature published after 2000 in English, using several screening-linked terms. Selection Criteria: Literature describing the use of cervical cancer screening guidelines in China, Ghana, India, Mexico, Russia, and South Africa were included. Data collection and analysis: Incidence, mortality trends, and screening rates were graphed and screening recommendations were summarized. Main Results: Higher rates of cervical cancer incidence, mortality, and 5-year prevalence were found in LMICs compared with the comparator countries. LMICs with absent or newly implemented screening guidelines had the lowest rates of crude and effective cervical cancer screening, with high cancer incidence and mortality. Countries with established guidelines had higher screening rates and lower disease burden. Cost, inadequate knowledge, geographical location, and cultural views were common barriers to effective screening coverage. Conclusion: Work must continue to improve the implementation of affordable, relevant, and achievable methods to improve screening coverage in LMICs.

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1. Introduction

Reliable screening methods decrease cervical cancer incidence and mortality. Several methods exist for cervical cancer screening, the most common being the cervical smear test, a cytology-based method where a small sample of cervical tissue is obtained during a pelvic examination for analysis. The goal of cervical smear testing is to identify lesions that have potential to become cancerous, allowing preventative treatment. Human papillomavirus (HPV) testing is also a primary or concurrent testing method to reduce the risk of cervical cancer [1]. HPV, specifically types 16 and 18, has been identified as being responsible for 70% of cervical cancers [2].

Most higher-income nations have guidelines for screening women who are at risk of developing cervical cancer. These guidelines define not only the target population for screening, but also screening methods, intervals, and appropriate interventions depending on test results [3,4]. Some studies have estimated that the incidence of cervical cancer has decreased by approximately 80% in high-income settings as a result of screening programs and actions following abnormal test results [5].

Whereas this is good news for higher-income countries, globally, lower and middle-income countries (LMICs) bear the greatest cervical cancer burden. The International Agency for Research on Cancer has estimated that there were 528 000 new cases of cervical cancer and 266 000 deaths from cervical cancer in 2012 [6]. Approximately 85% of cases of cervical cancer and 87% of deaths related to it occurred in lower-income regions of the world [6]. This striking disparity in incidence and mortality rates is due in part to poorly or underdeveloped screening initiatives, and decreased access to treatment [7].

Whereas screening tests are standard healthcare practices in most higher-income countries, screening is much less common in many LMICs owing to high costs, limited health infrastructure, and policy priorities [8]. Screening guidelines are not available in most LMICs [5,7]. Simply applying guidelines used in high-income settings to LMICs would not be appropriate because healthcare systems in LMICs usually lack the resources to implement the screening strategies employed in higher-income settings. Several papers and reports have described how countries can best utilize the resources available to them to screen, diagnose, and treat women with precancerous lesions and cervical cancer [5,7,8]. However, it is unclear to what extent screening programs in LMICs are effective. Understanding cancer epidemiology and screening

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in these settings provides an opportunity to evaluate screening programs and identify ways to optimize effectiveness.

The aim of the present study was to describe cervical cancer epidemiology in the six countries participating in WHO's Study on global AGEing and adult health (WHO SAGE) [9]. SAGE is a longitudinal health and well-being study of aging populations in six countries representing diverse geographical regions, levels of development, and stages of demographic transition. The present study also described current screening guidelines and existing barriers that prevent women from seeking cervical cancer screening in these settings. The findings were compared with data from higher-income countries.

2. Materials and methods

The six LMICs participating in WHO's SAGE include China, Ghana, India, Mexico, the Russian Federation, and South Africa. In the present study, cervical cancer epidemiological data from these countries, including screening, incidence, and mortality rates, were compared with those in three higher-income settings that have national screening guidelines: Australia, the UK, and the USA.

2.1. Existing data on cervical cancer and screening rates

Data on incidence, mortality and screening rates were obtained directly from existing data sources [10,11]; the International Agency for Research on Cancer maintains databases describing the occurrence of numerous cancers worldwide [11] and the GLOBOCAN database provides estimates on the incidence, mortality, and prevalence of certain cancers for many countries, including cervical cancer data for the six SAGE countries, and Australia, the UK, and the USA [10]. Estimates for Australia, the UK, and the USA, which have national screening guidelines, were included in the present study as comparators.

Cervical-cancer incidence and mortality trends between 1980 and 2010 were obtained from the Cancer Incidence in Five Continents registry data; these were supplemented by additional registry data searches [12]. The trends observed were reported as cumulative probability data.

In 2002/04, WHO obtained health data from 70 countries through the World Health Survey [13]. The results from these national surveys were used to determine cervical-screening rates for the six SAGE countries, Australia, and the UK [14]. No data were collected from the USA in the World Health Survey.

2.2. Review of guidelines and recommendations

A review of published literature was performed using SCOPUS and PubMed; this was combined with a review of gray literature (such as government, WHO, public health, and medical organization reports). The search terms used are presented in Box 1. Bibliographies from retrieved studies were also reviewed for relevant literature sources. All retrieved sources were reviewed to obtain information about cervical cancer screening guidelines and current efforts to reduce the cervical

Box 1
Literature review search strategy.

Keywords in literature search:
- pap test OR pap smear OR papanicoulaou
AND
- cervical cancer OR cervical cancer screening
AND
- China OR Ghana OR India OR Mexico OR Russia OR South Africa

cancer burden. Articles published in English between January 1, 2000 and February 19, 2016 were included. The search strategy and results were independently reviewed by all authors.

3. Results

3.1. Cervical cancer epidemiology in SAGE countries

The age-standardized incidence (Fig. 1a), mortality (Fig. 1b), and five-year prevalence (Fig. 1c) of cervical cancer in 2012 in the six SAGE countries and the three higher-income comparator countries are detailed in Fig. 1 [10,11].

Cervical cancer incidence, mortality, and 5-year prevalence rates were higher in the LMICs included in the present study (Fig. 1). Whereas these rates were clearly higher in a majority of the LIMCs compared with the higher-income countries, China demonstrated similar rates to the UK, USA, and Australia. Variation was also observed among the LMICs; the highest incidence and mortality rates were recorded in India, Ghana, and South Africa, whereas low mortality rates and relatively high 5-year prevalence rates were recorded in Mexico and Russia.

The current incidence and mortality rates were considerably higher in LMICs in comparison with higher-income countries; however, decreasing trends were observed in these rates across all countries (Fig. 2). Owing to population growth, the raw global average annual incidence rate has increased by 0.6% and the mortality rate has increased by 0.5% [12]. However, average cumulative probability incidence and mortality rates have both decreased by 1.6% per year since 1980 [12].

3.2. Screening rates

Large differences were observed in the percentage of women who have received a pelvic exam at least once in their lifetime between the countries included (Fig. 3a). In terms of this crude indicator of cervical cancer screening, rates in Mexico and Russia (close to or above 90%) are comparable to, or even higher than, those recorded in Australia and the UK. Approximately 70% and 80% of women reported having undergone crude screening in China and Mexico, respectively. In Ghana and India, only 20%–30% of the female population had received a pelvic examination at some point in their life.

Data from the World Health Survey were used to generate estimates of effective screening coverage, the percentage of women aged 25–64 years who had received a pelvic exam and cervical smear in the 3 years preceding being interviewed [14]. As evidenced by the various guidelines identified (Table 1), screening every 3 years was one of the most commonly recommended testing intervals. The two LMICs without standardized screening guidelines (Ghana and India) had extremely low rates of effective screening coverage (4% and 5.3%, respectively); South Africa and China both demonstrated effective screening rates of approximately 23%, while Russia (77%) and Mexico (66%) had rates closer to those recorded in the UK and Australia (Fig. 3b). The sources of the incidence and mortality data are detailed in Table 2.

3.3. Existing recommendations and current efforts

Currently, no organized cervical screening programs exists in any province or region in India [20], and there is no national cervical screening program in Ghana [19]. Cervical smear tests are not covered by Ghana's National Health Insurance Plan and testing kits must be purchased privately by the patient at a cost of approximately US$16 [19]. Furthermore, cervical smear tests in Ghana are used for the diagnosis of cervical cancer and are normally performed in cases of anomalous vaginal bleeding rather than as part of routine gynecologic examinations [19]. Ghana could also consider what priority cervical cancer takes in comparison with other competing problems, including endemic and emergent infectious disease [25]. Both Ghana and India have