Cross-sectional survey of the impact of the COVID-19 pandemic on cancer screening programs in selected low- and middle-income countries: Study from the IARC COVID-19 impact study group

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Abstract
We conducted a study to document the impact of COVID-19 pandemic on cancer screening continuum in selected low- and middle-income countries (LMICs). LMICs having an operational cancer control plan committed to screen eligible individuals were selected. Managers/supervisors of cancer screening programs were invited to participate in an online survey and subsequent in-depth interview. Managers/supervisors from 18 programs in 17 countries participated. Lockdown was imposed in all countries except Brazil. Screening was suspended for at least 30 days in 13 countries, while diagnostic-services for screen-positives were suspended in 9 countries. All countries except Cameroon, Bangladesh, India, Honduras and China managed to continue with cancer treatment throughout the outbreak. The participants rated service availability compared to pre-COVID days on a scale of 0 (no activities) to 100 (same as before). A rating of ≤50 was given for screening services by 61.1%, diagnostic services by 44.4% and treatment services by 22.2% participants. At least 70% participants strongly agreed that increased noncompliance of screen-positive individuals and staff being overloaded or overwhelmed with backlogs would deeply impact screening programs in the next 6 months at least. Although many of the LMICs were

Abbreviations: COVID-19, The Coronavirus Disease; GDP, gross domestic product; HPV, human papillomavirus; HDI, human development index; IARC, International Agency for Research on Cancer; LMICs, low- and middle-income countries; MoH, Ministry of Health; PPE, personal protective equipment; REDCap, Research Electronic Data Capture; SARS-CoV-2, severe acute respiratory syndrome coronavirus 2; VIA, visual inspection with acetic acid; WHO, World Health Organization.

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deficient in following the “best practices” to minimize service disruptions, at least some of them made significant efforts to improve screening participation, treatment compliance and program organization. A well-coordinated effort is needed to reinitiate screening services in the LMICs, starting with a situational analysis. Innovative strategies adopted by the programs to keep services on-track should be mutually shared.

KEYWORDS
cancer screening, COVID-19, low- and middle-income countries

1 | INTRODUCTION

The Coronavirus Disease (COVID-19) pandemic caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection has claimed more than 1.4 million lives worldwide in less than a year. The lockdowns and movement restrictions, slowing down of non-emergency services and diversion of fiscal and manpower resources will deeply impact entire continuum of cancer care. The pandemic-induced health crisis will weaken health systems in most low- and middle-income countries (LMICs) that may shift priorities back to infectious disease control. This is likely to have a long-term impact on cancer prevention interventions, including cancer screening, which in turn will widen the existing disparities in oncology care. Economic consequence of the pandemic, with a 5.2% contraction in global gross domestic product (GDP) projected by the World Bank in 2020, is likely to derail resource-intensive public health programs like cancer screening in many limited resource countries. Some of the LMICs have substantially invested in recent times to improve organization, reach and quality of cancer screening programs. The call for action toward elimination of cervical cancer issued by the World Health Organization (WHO) in 2018 stimulated many LMICs in the pre-COVID times to revise their national cancer control policies and commit resources to improve cervical cancer screening. The COVID-19 induced health crisis is a potential threat to these LMIC initiatives.

Present study conducted by the International Agency for Research on Cancer (IARC/WHO) aims to document possible impact of the COVID-19 outbreak on cancer screening programs in selected LMICs and also highlight the best practices that some of these countries might have adopted or planned to mitigate the disruptive consequences of the pandemic on cancer screening service.

What’s new?

Reductions in non-emergency health services and diversion of resources during the coronavirus disease (COVID-19) pandemic have greatly affected all areas of health care, including cancer care. Here, the authors investigated the impact of the COVID-19 pandemic specifically on cancer screening in low- and middle-income countries. Nearly all countries investigated experienced suspensions in cancer screening lasting at least one month, owing to lockdown restrictions, changes in health priorities, and reduced patient visits. Upon reopening, cancer services generally operated at significantly reduced capacities, emphasizing a need for highly coordinated re-initiation efforts to ensure continuity of cancer care following lockdown.

2. The cancer control plan delineated a strategy to screen the population for at least one common cancer.

The source of abovementioned information was the seventh round of noncommunicable diseases country capacity survey, conducted by the WHO in 2019. The only country to be selected from Europe was Romania, which transitioned from upper-middle to a high income country in 2019.

We invited the cancer screening program focal point from Ministry of Health (MoH) of each of the 20 identified countries to participate in our study. Their contact details were obtained from WHO regional offices and/or our national collaborators. We requested the focal point to designate an alternative person; in case he/she was not able to participate. The alternative person could be from MoH or an organization external to the Ministry but closely associated with screening program implementation and/or supervision. We sent reminder letters to the focal points not responding within 2 weeks.

The screening program in India is administered by the individual states, and the state program focal point is responsible for implementation, data collection and monitoring. We directly approached the focal points of two states situated in different geographic locations (Assam in north-east and Tamil Nadu in South) of India.

The designated participant was invited to undertake an online questionnaire survey and participate in an in-depth interview
The survey questionnaire was filled out between 13 August and 22 September 2020 by 18 cancer screening program focal-points or supervisors from 17 countries. India had two participants, independently reporting for regional programs in the states of Assam and Tamil Nadu. Majority of the survey participants were from MoH, either acting as screening program(s) focal-point (9/18; 50%) or having a supervisory role (5/18; 27.8%) (Table 1). Rest of the participants (4/18; 22.2%) was from organizations external to the MoH (eg, voluntary organizations, academic institutions, independent coordinating agency). Participants from China and India reported status of regional programs, while others reported for national programs. Majority of the participants reported the status of breast (16/18; 88.9%) and/or cervical (16/18; 88.9%) cancer screening programs.

The first case of confirmed COVID-19 was detected in March 2020 in 11 (64.7%) countries, while the rest had the first case detected in January or February. Majority of the participants (16/18; 88.9%) reported to be using the WHO definition for confirmation of first COVID-19 case. The WHO Coronavirus Disease (COVID-19) Dashboard showed an upward trend in the weekly number of confirmed COVID-19 cases in Côte d'Ivoire, Rwanda, Honduras, India, Brazil and Zambia on the week of completion of interview (Table 1).

Nationwide lockdown was announced in 13 countries, while in Côte d'Ivoire, Zambia and the Islamic Republic of Iran lockdown was only regional (Table 2). Brazil was the only country not to have a lockdown till the date of interview. Administration of screening tests was suspended for at least 30 days in all countries except Côte d'Ivoire, Rwanda, Brazil and the Islamic Republic of Iran; while diagnostic services for screen-positive individuals was suspended in all except Côte d'Ivoire, Rwanda, Cameroon, Zambia, Brazil, Sri Lanka, the Islamic Republic of Iran and Malaysia (Table 2). Cancer treatment was suspended for at least 1 month in Cameroon, Bangladesh, India, Honduras and China. Zambia reported suspension of treatment of screen-detected cervical precancers. Except in Paraguay, China and Romania, the suspended services reopened with the withdrawal of lockdown. Availability of cancer screening (administration of screening tests), diagnosis and treatment services on the date of in-depth interview compared to pre-COVID days, rated by the program managers on a continuous scale of 0 (no activities) to 100 (activities normal and same as before), is shown in Table 2. A few participants changed the rating originally given at the survey during the interview. A rating of ≥50 was given for screening services availability by 11 out of 18 (61.1%) participants and for diagnostic services by 8 (44.4%) participants. The participants from Bangladesh, India (both regional programs) and Honduras (22.2%) suggested a rating of ≥50 for availability of treatment services. The reported impact of COVID-19 outbreak on availability of cancer screening, diagnostic and treatment services was generally more severe in countries with medium HDI compared to those with low or high HDI (Figure 1).

The in-depth interviews revealed a number of new strategies that the programs adopted to ensure continuity of services during the lockdown and beyond. These were primarily aimed at encouraging higher participation to screening, improving compliance to management of screen-positive individuals and ensuring access to cancer
| Country (region, when applicable) | HDI category (HDI value) | Cancer mortality rates* (/100,000) | Participant's role in cancer screening program | Screening programs that the participants reported on | Month of detection of first confirmed COVID-19 case | % change in weekly COVID-19 cases in the week of completing the interview | Date of completion of survey | Date of in-depth interview |
|----------------------------------|--------------------------|------------------------------------|-----------------------------------------------|--------------------------------------------------|-----------------------------------------------|-------------------------------------------------|-----------------------------|-----------------------------|
| Côte d'Ivoire                    | Low (0.474)              | 82.5                               | Program focal point                            | Breast, cervical                                 | March 2020                                    | +21.58%                                         | 01/09/2020                   | 06/11/2020                  |
| Cameroon                         | Low (0.518)              | 75.3                               | Program supervision, within MoH                | Breast, cervical, prostate                       | March 2020                                    | −6.64%                                          | 01/09/2020                   | 12/10/2020                  |
| Rwanda                           | Low (0.536)              | 104.8                              | Program supervision, outside MoH              | Breast, cervical                                 | March 2020                                    | +9.30%                                          | 20/09/2020                   | 05/11/2020                  |
| Bangladesh                       | Medium (0.579)           | 77.1                               | Program focal point                            | Breast, cervical                                 | March 2020                                    | −6.76%                                          | 13/08/2020                   | 08/10/2020                  |
| Zambia                           | Medium (0.579)           | 90.5                               | Program focal point                            | Breast, cervical                                 | March 2020                                    | +32.08%                                         | 02/09/2020                   | 14/10/2020                  |
| Bhutan                           | Medium (0.607)           | 76.6                               | Program focal point                            | Breast, cervical, gastric, oral                  | March 2020                                    | −20%                                            | 19/09/2020                   | 23/10/2020                  |
| India (Assam)                    | Medium (0.624)           | 61.4                               | Program focal point                            | Breast, cervical, oral                           | January 2020                                   | +12.16%                                         | 05/09/2020                   | 25/09/2020                  |
| India (Tamil Nadu)               | Program supervision, within MoH | Breast, cervical, oral             | February 2020                                   |                                                   |                                               |                                                 | 31/08/2020                   | 01/11/2020                  |
| Honduras                         | Medium (0.625)           | 81.8                               | Program supervision, within MoH                | Cervical                                         | March 2020                                    | +38.71%                                         | 24/08/2020                   | 22/09/2020                  |
| Morocco                          | Medium (0.647)           | 86.9                               | Program supervision, outside MoH              | Breast, cervical                                 | March 2020                                    | −27.55%                                         | 01/09/2020                   | 16/10/2020                  |
| Paraguay                         | Medium (0.693)           | 86.6                               | Program focal point                            | Breast, cervical, colorectal                     | March 2020                                    | −5.01%                                          | 24/08/2020                   | 14/09/2020                  |
| China (Tianjin)                  | High (0.738)             | 130.1                              | Program supervision, outside MoH              | Breast, lung, gastric, liver                     | January 2020                                   | −10.24%                                         | 07/09/2020                   | 18/09/2020                  |
| Thailand                         | High (0.74)              | 104.8                              | Program focal point                            | Breast, cervical, colorectal                     | March 2020                                    | −48.48%                                         | 22/09/2020                   | 15/10/2020                  |
| Brazil                           | High (0.754)             | 91.3                               | Program focal point                            | Breast, cervical                                 | March 2020                                    | +12.51%                                         | 18/09/2020                   | 22/10/2020                  |
| Sri Lanka                        | High (0.766)             | 51.0                               | Program supervision, within MoH                | Breast, cervical, oral                           | January 2020                                   | −4.82%                                          | 17/09/2020                   | 13/10/2020                  |
| Iran (Islamic Republic of)       | High (0.774)             | 74.5                               | Program focal point                            | Breast, cervical, colorectal                     | January 2020                                   | −4.01%                                          | 18/08/2020                   | 28/09/2020                  |
| Malaysia                         | High (0.789)             | 85.5                               | Program supervision, within MoH                | Colorectal                                       | January 2020                                   | −37.32%                                         | 17/09/2020                   | 22/09/2020                  |
| Romania                          | Very high (0.802)        | 123.3                              | Program supervision, outside MoH              | Breast, cervical                                 | February 2020                                   | −6.76%                                          | 16/08/2020                   | 29/09/2020                  |

*Age standardized for world population.

bThe participant reported primarily for colorectal cancer screening. During in-depth interview she informed that all cancer screening programs (breast, cervical, colorectal and oral) were equally affected in Malaysia (HDI, human development index; MoH, Ministry of Health).
| Country (region, when applicable) (HDI category) | If any lockdown was imposed, whether national or regional at first instance (period by month, year) | Status of administering screening tests | Status of diagnostic services for screen-positive individuals | Status of treatment services for cancer patients |
|-----------------------------------------------|-------------------------------------------------------------------------------------------------|----------------------------------------|-------------------------------------------------|---------------------------------------------|
|                                               |                                                                                                 | Whether suspended anytime\(^a\)        | Rating of current services compared to pre-COVID time\(^b\) | Whether suspended anytime\(^a\)        | Rating of current services compared to pre-COVID time\(^b\) | Whether suspended anytime\(^a\)        | Rating of current services compared to pre-COVID time\(^b\) |
| Côte d'Ivoire (low)                           | Yes, regional (June-August 2020)                                                                | No                                     | 65                                             | No                                     | 68                                             | No                                     | 65                                             |
| Rwanda (low)                                  | Yes, national (March-April 2020)                                                               | No                                     | 95                                             | No                                     | 95                                             | No                                     | 96                                             |
| Cameroon (low)                                | Yes, national (April-July 2020)                                                                | Yes                                    | 50                                             | No                                     | 75                                             | Yes                                    | 75                                             |
| Bangladesh (medium)                           | Yes, national (March-May 2020)                                                                | Yes                                    | 14                                             | Yes                                    | 23                                             | Yes                                    | 15                                             |
| Zambia (medium)                               | Yes, regional (March-May 2020)                                                                | Yes                                    | 62                                             | No                                     | 70                                             | No                                     | 80                                             |
| Bhutan (medium)                               | Yes, national (August-September 2020)                                                         | Yes                                    | 0                                              | Yes                                    | 50                                             | No                                     | 100                                            |
| India (Assam) (medium)                        | Yes, national (March-June 2020)                                                               | Yes                                    | 15                                             | Yes                                    | 20                                             | Yes                                    | 30                                             |
| India (Tamil Nadu) (medium)                   | Yes, national (March-June 2020)                                                               | Yes                                    | 50                                             | Yes                                    | 50                                             | Yes                                    | 50                                             |
| Honduras (medium)                             | Yes, national (March-August 2020), then regional                                              | Yes                                    | 20                                             | Yes                                    | 20                                             | Yes                                    | 20                                             |
| Morocco (medium)                              | Yes, national (March-June 2020)                                                               | Yes                                    | 30                                             | Yes                                    | 30                                             | No                                     | 70                                             |
| Paraguay (medium)                             | Yes, national (March-September 2020)                                                          | Yes                                    | 20                                             | Yes                                    | 20                                             | No                                     | 65                                             |
| China (Tianjin) (high)                        | Yes, national (January-April 2020)                                                            | Yes                                    | 85                                             | Yes                                    | 90                                             | Yes                                    | 95                                             |
| Thailand (high)                               | Yes, national (March-June 2020)                                                               | Yes                                    | 90                                             | Yes                                    | 90                                             | No                                     | 90                                             |
| Brazil (high)                                 | No                                                 | No                                     | 43                                             | No                                     | 68                                             | No                                     | 64                                             |
| Sri Lanka (high)                              | Yes, national (March-June 2020)                                                               | Yes                                    | 85                                             | No                                     | 100                                            | No                                     | 100                                            |
| Iran (Islamic Republic of)                     | Yes, regional (February-April 2020)                                                          | No                                     | 50                                             | No                                     | 64                                             | No                                     | 83                                             |
| Malaysia (high)                               | Yes, national (March-April 2020)                                                              | Yes                                    | 75                                             | No                                     | 75                                             | No                                     | 75                                             |

(Continues)
These new strategies and practices adopted by the countries are listed in Table 3. A few noteworthy among these are improving community outreach through mobile clinics or expansion of screening facilities to primary care (Rwanda, Bangladesh, Zambia), introducing hotlines or mobile apps for cancer patients to seek hospital appointment and advice (Cameroon, Bhutan, India, Malaysia), delivering screening test results online (India, China), teleconsultation for the screen-positive individuals (India, Malaysia), using community health workers to distribute kits for fecal immunochemical test for colorectal cancer screening during home visits (Malaysia), proactively recalling screen-positive individuals and ensuring their free transportation (Rwanda, Zambia) and engaging youth volunteers as navigators to reach oncology centers (India). Cancer drugs were transported from oncology institutions to primary care in Tamil Nadu, India. Brazil considered the postcrisis situation as an opportunity to minimize opportunistic screening and improving organization of services. “Putting cancer screening back on the agenda with primary-care being at the center” would be a priority for Zambia.

| Country (region, when applicable) (HDI category) | If any lockdown was imposed, whether national or regional at first instance (period by month, year) | Status of administering screening tests | Status of diagnostic services for screen-positive individuals | Status of treatment services for cancer patients |
|--------------------------------------------------|--------------------------------------------------------------------------------------------------|----------------------------------------|--------------------------------------------------------|-----------------------------------------------|
| Romania (very high)                               | Yes, national (April-May 2020)                                                                  | Yes                                    | Yes                                                    | No                                            |

Abbreviation: HDI, Human development index.

aNo service provided for at least 1 month (could be during or beyond lockdown period).

bRated on a sliding scale ranging between 0 (No activities) and 100 (same as pre-COVID time) on the date of survey and updated on the date of in-depth interview, if felt necessary.

![Figure 1](wileyonlinelibrary.com)

**FIGURE 1** Rating of screening, diagnostic and cancer treatment services as on the date of in-depth interview compared to pre-COVID time by the participants from the countries (grouped by HDI category and in ascending order, from left to right, of HDI value) on a sliding scale ranging between 0 (no activities) and 100 (same as pre-COVID time). Total suspension of the service for at least 1 month during the outbreak (generally in lockdown) was represented in diagonal dashed lines [Color figure can be viewed at wileyonlinelibrary.com]
Table 3: New strategies adopted by the countries to ensure continuity of screening, diagnostic and treatment services during the lockdown and beyond and/or to improve overall program organization

| Purpose                          | Description of new strategy                                                                 | Countries where introduced during the lockdowna | Countries where introduced after the lockdowna |
|----------------------------------|--------------------------------------------------------------------------------------------|-----------------------------------------------|-----------------------------------------------|
| To improve screening coverage    | Improve community outreach through mobile clinics; expand screening services to the rural primary health centers and anti-retroviral therapy (ART) clinics | Rwanda*                                       | Bangladesh**, Zambia**                        |
|                                 | Use campaigns to screen a large number of individuals in a day maintaining social distancing | Bangladesh**                                 |                                                |
|                                 | Online appointment system for cancer screening                                             | China***, Sri Lanka***                        |                                                |
|                                 | Using community health workers to distribute kits for colorectal cancer screening and educate the community | Malaysia                                      |                                                |
| To ensure high compliance to further management of screen-positive individuals | Minimize the number of clinic visits (ie, switch to “screen and treat” approach from existing “screen colposcopy and treat” approach for cervical cancer screening) | Rwanda*                                       | Bangladesh**                                 |
|                                 | Use magnifying device (compact colposcopes) to improve decision making for treatment       | Bangladesh**                                 |                                                |
|                                 | Online delivery of test results, or set up a hotline to manage screen-positive cases        | India**, China***                            |                                                |
|                                 | Tele-consultation for the screen-positive individuals                                      | Malaysia***                                   | India**                                       |
|                                 | Transport services or reimbursement for the screen-positive individuals                    | Rwanda*, Malaysia***                          | India**                                       |
|                                 | Call the screen-positives or send short text messages on mobile phones                    | Rwanda*, Paraguay**                          | Zambai**                                     |
|                                 | Testing of already collected samples during lockdown to reduce backlogs                    | Honduras**                                   |                                                |
| To improve/ensure access to cancer treatment | Dedicated hotlines or mobile apps for cancer patients to seek hospital appointment and advice | Cameroon*, Bhutan**, Malaysia***              | India**                                       |
|                                 | Free transport for cancer patients                                                         | Bhutan**, Malaysia**                          | India**                                       |
|                                 | Keeping oncology center(s) open                                                            | Bhutan**, Paraguay**                          | India**                                       |
|                                 | Creating teams of youth volunteers to assist and guide patients to reach oncology centers  | India**                                       |                                                |
|                                 | Ensuring the supply of oncology drugs through special procurement channels                 | Bhutan**, Sri Lanka***                        | India**                                       |
|                                 | Centralized call center at the major oncology centers and a patient database management system to manage mainly cancer patients access appointments, follow-up noncompliant patients | Bangladesh**                                 | India**                                       |
| To improve overall program organization | Take the opportunity to minimize opportunistic screening and move toward introducing population-based screening | Brazil***                                    |                                                |
|                                 | Postpone certain components of scaling up and focus on improved organization of existing cancer screening | Zambia**, Bhutan**                           |                                                |
|                                 | Centralize management of the COVID-19 outbreak in order to free primary services to provide routine care | Iran (Islamic Republic of)**                 |                                                |

*Low Human development index (HDI) country (*), medium HDI country (**), high or very high HDI country (**).*

Staff associated with cancer screening, diagnostic or treatment services were reassigned to COVID-19 related duties in 14 out of 18 (77.8%) programs. The MoH issued official notifications to the health providers in 10 (55.6%) programs on whether screening activities should be continued or not. Specific communications to inform the general public about stoppage or reinitiation of screening services were issued by 11 (61.1%) programs.

All the programs reported following standard safety protocols at the workplace. Staff involved in cancer screening were trained on measures to mitigate the risk of transmission of SARS-CoV-2 in 83.3% (15/18) of the programs. Only two programs reported to have trained their staff on how to continue with screening related services with adequate protection for both clients and providers.

Staff delivering cancer screening and related services were provided with personal protective equipment (PPE) in all the programs, although nine (50.0%) reported the supply to be irregular. Provision for hand sanitizers and masks for the screening participants was made by almost all programs, although supply was irregular in one third of them.

We listed the factors that could potentially impact cancer screening programs in the near future and asked the study participants to rate their agreement on a continuous scale of 0 to 100 (Table 4).
The COVID-19 pandemic, described by some as ‘the worst public health crisis in our generation,’ has strained health systems to the extreme. Experts had already predicted a negative impact of the pandemic on cancer screening, and our study reported similar concerns expressed by program managers. Almost all the countries included in our study reported suspension of cancer screening for at least a month due to restrictions associated with lockdown, shifting of health priorities to manage SARS-CoV-2 infections and reluctance among the public to visit health facilities. Screening, diagnostic and treatment services restarted at much reduced capacities after withdrawal of lockdown in most of the programs, as has been reported by countries outside our study.

A program from east Asia reported a 35% to 60% reduction in the monthly number of women participating in mammography screening during March to May 2020, the peak time of the outbreak, compared to the observed numbers in the past 3 years. Average number of screening mammograms in the Australian breast cancer screening programs drastically reduced to just over 1000 in the month of April 2020 compared to the expected average of over 70 000. A 62% to 96% decrease in lung, cervical, colorectal and breast cancer screening rates has been recently reported over seven states in the United States of America (USA). Even the average number of cancer surgeries being performed in a week in the USA reduced up to 88% during the peak period of the outbreak. Slowing down of cancer screening and deferring diagnostic and treatment services will lead to a surge in the number of cancer deaths, both in high and limited resourced countries.

Our study focused on LMICs spread across different continents and belonging to different categories of HDI. Primary reason for selecting these countries was that they were committed to improve quality and reach of cancer screening services before the outbreak struck. Ministry of Public Health of Cameroon initiated a pilot cervical cancer screening program in 2018 using low-cost HPV detection test in West Cameroon and was in the process of scaling up to other regions. Morocco adopted a strategic cancer control plan in 2010 and implemented breast cancer screening with clinical breast examination across all regions of the country. The program achieved more than 60% annual coverage of the target population within 5 years of initiation. Bangladesh has heavily invested in developing infrastructure, human resources and information system over the last 15 years to improve the quality of cervical cancer screening based on visual inspection with acetic acid (VIA) test. The Zambian cervical cancer prevention program strategically leveraged existing antiretroviral therapy and reproductive health infrastructure to scale up VIA “screen and treat” services gradually up to national level. Emerging economies like Brazil, China and India with very heterogenous health care within the country have scaled up breast and cervical cancer screening in recent times with some efforts to improve program organization (strong political commitments, increased funding, more effective

### Table 4

| Degree of agreement (range)* | Number (% of participants in the range of agreement for different factors) |
|-----------------------------|--------------------------------------------------------------------------|
| Individuals will be reluctant to participate | Noncompliance of screen-positive individuals will increase | Number of staff available for screening related activities will be reduced | Providers will not prioritize screening | Service providers will be overloaded | Diagnostic and treatment services will be overwhelmed with backlogs | Planned expansion of program will be withheld due to competing priorities | Screening program will have less financial resources |
| 75 to 100 | 6 (33.3%) | 4 (22.2%) | 3 (16.7%) | 3 (16.7%) | 6 (33.3%) | 3 (16.7%) | 5 (27.8%) | 5 (27.8%) |
| 50 to <75 | 5 (27.8%) | 9 (50.0%) | 6 (33.3%) | 7 (38.9%) | 9 (50.0%) | 10 (55.6%) | 6 (33.3%) | 6 (33.3%) |
| 25 to <50 | 3 (16.7%) | 1 (5.6%) | 4 (22.2%) | 3 (16.7%) | 0 | 4 (22.2%) | 4 (22.2%) | 1 (5.6%) |
| <25 | 4 (22.2%) | 4 (22.2%) | 4 (22.2%) | 5 (27.8%) | 3 (16.7%) | 1 (5.6%) | 3 (16.7%) | 6 (33.3%) |

*The study participants rated their agreement on a sliding scale ranging between 0 (do not agree at all) and 100 (completely agree).
health information system, etc.\textsuperscript{22-24} Thailand switched to HPV test from existing cytology-based screening in 2020, after successful implementation of a pilot to demonstrate feasibility and cost-effectiveness.\textsuperscript{25} Islamic Republic of Iran has also introduced HPV screening with a home-grown real-time PCR-based test in selected regions.\textsuperscript{26} Honduras and Bhutan implemented and evaluated HPV screening in selected areas and Bhutan was planning to scale up nationally.\textsuperscript{27,28} Colorectal cancer screening program is being implemented as pilots in Morocco and Islamic Republic of Iran and is in the process of being scaled up in Thailand. These LMIC programs are likely to be much less resilient and less prepared to overcome such a major public health crisis, compared to the programs ongoing in the high-income countries. The program focal points participating in our study have expressed very valid concerns about several factors that would disrupt screening services further in the short term, at least.

The study participants were concerned that the uncertainties arising from the waxing and waning of the outbreak would have a lasting effect on reinitiation and normalization of cancer screening services. In general, patients with cancer symptoms face significant delays in accessing diagnostic and treatment services in the LMICs, resulting in late stage at presentation and significantly compromised post-treatment survival.\textsuperscript{29,30} The pandemic induced backlogs and slowing down of diagnostic and treatment services will further aggravate the situation with greater impact on the socioeconomically disadvantaged populations. The screening testing, diagnostic and treatment services in the medium HDI countries were worst affected, as per our study. The reported number of daily deaths from COVID-19 in countries belonging to low HDI category (Côte d’Ivoire, Rwanda and Cameroon) was extremely low (0-3 per day) at the time of implementation of our study, which possibly explains why these countries reported better situation compared to the medium HDI countries.\textsuperscript{1}

Several factors may explain the wide variation in performance of the cancer screening services observed during the COVID-19 pandemic among the participating countries. Besides the variable severity of the disease in terms of number of cases and deaths, these factors included effective governance committed to maintain focus on cancer control services in the midst of the pandemic, timely and efficient planning to ensure continuity of all or some of the screening services and stakeholders’ engagement. Innovative strategies adopted to bypass COVID-19 related barriers, either material such as the lack of transportation or psychological such as the fears of the population, also paid dividends. All these factors together might explain why countries like Rwanda, Zambia, Bhutan and Sri Lanka were performing better than others appertaining to the same HDI group. The managerial factors/decisions listed above, which sometimes might have been taken under financial constraints, reflect organization of the cancer screening services and the commitment of the policymakers, program leaders and service providers.

Our study has a few weaknesses. At least some of the self-reported outcomes in our study may have been affected by response bias, which is a tendency for participants to respond what was expected of them. Selection of countries has not followed a rigorous systematic selection process and the outcomes may not be considered as generalizable in the LMICs. We have been selective intentionally, as conducting a study like ours would not have been meaningful in the LMICs that do not have any screening program or have a low-quality program without any central coordination. Selection of LMICs with significant political and programmatic commitment to provide effective services and collecting information from the program focal persons or the supervisors themselves are the strengths of our study. The pandemic-induced disruptions are likely to hurt the screening programs in these countries the most and the impact is worth evaluating.

Restarting cancer screening activities as the crisis situation somewhat settles down will require a well-coordinated effort to reach out to the community more proactively, alleviate concerns of the apparently healthy individuals to return to routine health care and reorganize clinical services to minimize backlogs in services, especially cancer treatment. There is an urgent need for every screening program to perform a thorough situational analysis to quantify impact of the pandemic from health systems perspectives, focusing on governance, finance, workforce, infrastructure and services, information system and quality assurance process relevant to screening continuum. Policy interventions are necessary to mitigate further disruptions in nonemergency services through building public trust. The perception of the common public of their personal risk of severe illness from COVID-19 vs the risk of not seeking health-care advice if they have symptoms suggestive of cancer needs to be changed. “The patients with suspected cancer should realize that the benefit of their getting an early cancer diagnosis and initiating treatment without delay far outweigh the threats posed by COVID-19”—a quote from one of the program focal points in our study. Supporting health-care workers to tide over the increased work pressure and protecting them from getting infected will be key to improve health system capacity. Additional funding is necessary to build a resilient primary health system to improve people’s access to much needed preventive health care. Reallocating at least an additional 1% of GDP of...
public spending for primary care is within reach in all countries and should be seriously considered.\(^{31}\)

**CONFLICT OF INTEREST**
The authors declared no potential conflicts of interest.

**DISCLAIMER**
Where authors are identified as personnel of the International Agency for Research on Cancer/World Health Organization, the authors alone are responsible for the views expressed in this article and they do not necessarily represent the decisions, policy, or views of the International Agency for Research on Cancer/World Health Organization.

**DATA AVAILABILITY STATEMENT**
The data that support the findings of this study are available on request from the corresponding author.

**ETHICS STATEMENT**
Ethical approval for our study was obtained from the IARC Ethics Committee. In the email invitation sent to participants, an information sheet was attached describing the study objectives and methodology. The participant had to sign an informed consent electronically, before being able to initiate the survey. Also, at the beginning of the Zoom or WhatsApp calls, verbal consent from the participant was obtained before recording the interview. Only fully anonymized data were received, stored and handled at IARC in a central secure server. Data will be archived at IARC to allow retrieval for any scientific or regulatory external audits.

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**REFERENCES**

1. World Health Organization. WHO Coronavirus disease (COVID-19) dashboard. https://covid19.who.int/. Accessed November 21, 2020.
2. Bouanani N, Bendari M, Naim A, et al. Managing cancer center during the SARS-COV2-19 pandemic: Moroccan experience. Asian Pac J Cancer Care. 2020;5(51):219-223.
3. Webb Hooper M, Nápoles AM, Pérez-Stable EJ. COVID-19 and racial/ethnic disparities. JAMA. 2020;323(24):2466-2467.
4. The World Bank. The global economic outlook during the COVID-19 pandemic: a changed world. https://www.worldbank.org/en/news/feature/2020/06/08/the-global-economic-outlook-during-the-covid-19-pandemic-a-changed-world. Accessed November 21, 2020.
5. Beddoe AM. Elimination of cervical cancer: challenges for developing countries. Eancancermedscience. 2019;13:975.
6. World Health Organization. Noncommunicable diseases and their risk factors. Assessing national capacity for the prevention and control of NCDs (who.int). Accessed November 12, 2020.
7. The World Bank. The World Bank in Romania. Romania’s priorities include investments in infrastructure, health care, education, job creation, and small and medium enterprise development. The country’s economic growth has been one of the highest in the EU since: 2010. https://www.worldbank.org/en/country/romania/overview. Accessed November 21, 2020.
8. Harris PA, Taylor R, Minor BL, et al. REDCap consortium: building an international community of software platform partners. J Biomed Inform. 2019;95:103208.
9. Ferlay J, Ervik M, Lam F, et al. Global Cancer Observatory: Cancer Today. Lyon, France: International Agency for Research on Cancer; 2018. https://gco.iarc.fr/today. Accessed November 12, 2020.
10. United Nations Development Programme. Human Development Reports. Human Development Data (1990-2018). http://hdr.undp.org/en/data. Accessed November 12, 2020
11. Cash R, Patel V. Has COVID-19 subverted global health? Lancet. 2020;395(10238):1687-1688.
12. Peng SM, Yang KC, Chan WP, et al. Impact of the COVID-19 pandemic on a population-based breast cancer screening program. Cancer. 2020;126(24):5202-5205.
13. Australian Institute of Health and Welfare. BreastScreen Australia monitoring report: 2020. BreastScreen Australia monitoring report 2020. Table of contents - Australian Institute of Health and Welfare (aihw.gov.au). Accessed November 11, 2020.
14. Corley DA, Sedki M, Ritzwoller DP, et al. Cancer screening during the coronavirus Disease-2019 pandemic: a perspective from the National Cancer Institute’s PROSPR consortium. Gastroenterology. 2020; 50016-5085(20):35317-35318.
15. Fox B. Non-emergency procedure volumes in the wake of COVID-19. EHRN. Non-Emergency Procedure Volumes in the Wake of COVID-19 (ehrn.org). Accessed November 12, 2020.
16. Maringe C, Spicer J, Morris M, et al. The impact of the COVID-19 pandemic on cancer deaths due to delays in diagnosis in England, UK: a national, population-based, modelling study. Lancet Oncol. 2020;21(8):1023-1034.
17. Grohar D, Vassilakos P, Benkortbi K, Tincho E, Kenfack B, Petignat P. Scaling up community-based cervical cancer screening in Cameroon employing a single visit approach. Int J Gynecol Cancer. 2020;30(9):1455-1457.
18. Selmouni F, Zidouh A, Belakhel L, et al. Tackling cancer burden in low-income and middle-income countries: Morocco as an exemplar. Lancet Oncol. 2018;19(2):e93-e101.
19. Basu P, Selmouni F, Belakhel L, et al. Breast cancer screening program in Morocco: status of implementation, organization and performance. Int J Cancer. 2018;143(12):3273-3280.
20. Bhatla N, Nessa A, Oswal K, Vashist S, Sebastian P, Basu P. Program organization rather than choice of test determines success of cervical cancer screening: case studies from Bangladesh and India. Int J Gynaecol Obstet. 2021;152:40-47. https://doi.org/10.1002/igo.12486.
21. Holme F, Kapambwe S, Nessa A, Basu P, Murillo R, Jeronimo J. Scaling up proven innovative cervical cancer screening strategies: challenges and opportunities in implementation at the population level in low- and lower-middle-income countries. Int J Gynaecol Obstet. 2017; 138(Suppl 1):63-68.
22. Costa RFA, Longatto-Filho A, de Lima Vazquez F, Pinheiro C, Zeferino LC, Fregnani JHTG. Trend analysis of the quality indicators for the Brazilian cervical cancer screening programme by region and state from 2006 to 2013. BMC Cancer. 2018;18(1):126.
23. Aoki ES, Yin R, Li K, et al. National screening programs for cervical cancer in Asian countries. J Gynecol Oncol. 2020;31(3):e55.
24. Chen P, Li F, Harmer P. Healthy China 2030: moving from blueprint to action with a new focus on public health. Lancet Public Health. 2019;4(9):e447.
25. Termurunguanglert W, Khemapech N, Tantitamit T, Havanond P. Cost effectiveness analysis of HPV primary screening and dual stain cytology triage compared with cervical cytology. J Gynecol Oncol. 2019;30(2):e17.
26. Motlagh A, Saniee S, Maleki A, Moshiri F. HPV screening. In Cervical Cancer Screening in Iran: Developing a New Method. FC 21-10. https://secure.key4events.com/key4register/AbstractList.aspx?e=612&preview=1&aig=-1&ai=15938. Accessed November 12, 2020.
27. Baussano I, Tshering S, Choden T, et al. Cervical cancer screening in rural Bhutan with the careHPV test on self-collected samples: an
ongoing cross-sectional, population-based study (REACH-Bhutan). *BMJ Open*. 2017;7(7):e016309.

28. Thomson KA, Sandoval M, Bain C, et al. Recall efforts successfully increase follow-up for cervical cancer screening among women with human papillomavirus in Honduras. *Glob Health Sci Pract*. 2020;8(2):290-299.

29. Ramirez AJ, Westcombe AM, Burgess CC, Sutton S, Littlejohns P, Richards MA. Factors predicting delayed presentation of symptomatic breast cancer: a systematic review. *Lancet*. 1999;353(9159):1127-1131.

30. Richards MA, Westcombe AM, Love SB, Littlejohns P, Ramirez AJ. Influence of delay on survival in patients with breast cancer: a systematic review. *Lancet*. 1999;353(9159):1119-1126.

31. World Health Organization. *Primary Health Care on the Road to Universal Health Coverage: 2019 Global Monitoring Report*. Geneva: WHO; 2019.

**SUPPORTING INFORMATION**

Additional supporting information may be found online in the Supporting Information section at the end of this article.

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