

REVIEW

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Prevalence of Cervical Cancer Screening in Asia: A Systematic Review and Meta-Analysis

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Abstract

Background: Cervical cancer is one of the most common causes of cancer-related mortality among female, especially in the low-and-middle income countries. This systematic review and meta-analysis aimed to identifying the prevalence and trend of cervical cancer screening among 21 member countries of the Asian National Cancer Centres Alliance (ANCCA)/ regions in Asia. **Methods:** We conducted a search on three databases including: PubMed, Web of Science and Scopus, using our search terms. Two independent reviewers screened titles and abstracts based on inclusion and exclusion criteria, and any conflicts were resolved through discussion. Full-text screening was also completed by two independent reviewers, and conflicts were resolved accordingly. Relevant information was extracted into an Excel sheet, and random-effects meta-analysis was performed to identify the pooled estimate of cervical cancer screening in Asia using Stata 17. The review has been registered in PROSPERO (registration ID: CRD42023401516). **Results:** We identified 54 studies from 19 ANCCA member countries/ regions in Asia reporting cervical cancer screening rates between 2012-2023. The pooled estimate of eight countries (Bangladesh, China, India, Iran, Japan, Korea, Nepal, and Thailand) that had more than three data points and were rated as satisfactory to very good in the quality assessment showed that cervical cancer screening rate was around 28% (95% CI: 0.25 - 0.32) in the last ten years. **Conclusion:** Most of countries/regions in Asia do not have sufficient data on cervical cancer screening due to lack of nationally representative surveys or national level cancer registries. Hence, it is crucial to encourage governments and private sector to strengthen their capacities and work in collaboration to enhance the cervical cancer screening rate in their respective countries.

Keywords: cervical cancer- screening- meta-analysis- Asia

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Introduction

Cancer is the second leading cause of death globally, accounting for nearly 10 million deaths, or one in six deaths, in 2020 [1, 2]. Cervical cancer (CC) is one of the most common causes of cancer-related mortality among female specially in the low-and-middle income countries (LMIC) [3-5]. Most of the deaths related to cervical cancer are preventable with early detection, screening, and vaccination against the Human Papilloma Virus (HPV) [6]. The World Health Organization (WHO) through its global strategy to eliminate cervical cancer aims at reducing the global cervical cancer burden by ensuring HPV vaccination to 90% of girls by their 15th birthday, HPV screening to 70% of women at their 35 and 45 years of age and treating 90% of women identified

with cervical cancer by 2030 [7]. However, more than six hundred thousand cases of cervical cancer were identified with about 341,831 deaths in the year 2020 alone globally with about 58% of the cases and mortality belonging to the Asian regions [8].

Asia is one of the most populated and affected continents in terms of the incidence and mortality related to the cancer [9]. The rapid scaling of cervical cancer screening (CCS) programs and HPV vaccination in this decade could avert 12.5-13.5 million cervical cancer cases within 40 years from now [10]. However, the diversity within and across countries is one of the major challenges for cancer screening and prevention in Asia [11, 12]. There are limited countries in Asia which have adapted the cervical cancer screening into their national policy and still, majority of the regions don't

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have national health policies even if it's one of the most common causes of mortality among their population [4, 13]. Lack of resources, trained professionals, and health facilities along with the low health literacy rate of the individuals are some of the major challenges faced by several Asian countries [14-18]. Most Asian countries focus on cervical cancer screening via outreach clinics however, often they miss the target population leading to low screening rates [19]. The centralization of health care facilities, poor supervision and monitoring from the government, economic recession, etc. are some added concerns in some Asian countries [20-23].

There are some disparities in health care accessibility and utilization among various cultural and ethnic groups both within and across counties in Asia [24]. Some national level statistics exist in certain regions like the Demographic and Health Surveys (DHS) or the annual reports containing information on CCS rates however in certain target age-groups [25, 26] otherwise, most of the Asian countries relies on national statistics provided by the International Agency for Research on Cancer (IARC) [27-29]. No studies have been conducted to accumulate the existing evidence on community based cervical cancer screening rates to identify if the CCS rate in a specific region is somewhere near the national statistics for that nation. In countries where the national level data is limited the individual studies conducted on several regions of the country might reflect the status of CCS within that country. The Asian National Cancer Centre Alliance (ANCCA) consists of 14 Asian countries with full membership and eight other associate members which are working together along with WHO, IARC and other organizations to prevent mortality and morbidity related to cancer in Asia [30]. Since the alliance includes most of the countries representing east, central and south Asia, this systematic review aims at identifying the prevalence and trend of cervical cancer screening among their member countries as it is crucial to identify the differences within and across these nations in cervical cancer screening so that necessary interventions can be implemented to reduce the existing burden of cervical cancer.

Materials and Methods

Data sources and inclusion criteria

All relevant literatures were searched from PubMed, Scopus and Web of Science using the search strategy shown in Supplementary File 1. The articles were reviewed to identify the cervical cancer screening rates in various Asian countries or regions which were a part of ANCCA. We limited our search to adult cancers however, this review includes the studies conducted on cervical cancer only and the other part of this review has already been published elsewhere [31], any cross-sectional studies, case-control studies, quasi-experimental studies, or cohort studies including information on the cervical cancer screening rate were included. Animal studies, review articles, systematic reviews, case reports, meta-analysis were excluded from this review. Studies conducted among Asians residing outside of Asia or their home country were excluded from this study. We included the screening

rates of healthy populations or populations without any intervention (controls/ pre-intervention groups) and excluded high risk populations such as studies conducted among sex workers, HIV positive patients, etc. Any studies not reporting any two of the following: the underlying sample size, the number of screened population and the screening rate were also excluded. We also excluded studies published or conducted before 2012 as we wanted to collect latest information on cancer screening. We additionally performed hand searching using the key search terms on Google Scholar and PubMed and searched through the reference lists of relevant papers for additional studies.

Study population

Studies conducted among the citizens of the ANCCA countries or Asian regions (Bangladesh, Bhutan, Brunei, Cambodia, China, India, Indonesia, Iran, Japan, Korea, Laos, Malaysia, Myanmar, Nepal, Pakistan, Philippines, Singapore, Sri Lanka, Taiwan, Thailand, and Vietnam) of any age-group with the aim to identify cervical cancer screening rates were included in this review.

Study selection and review

The PRISMA flow chart showing the process of including/excluding papers has been published elsewhere [31]. Articles identified in the three databases were imported into EndNote and duplicates removed. Then articles were imported to Rayyan for the screening process. Screening of the research title and abstract were reviewed by two authors independently (AKB and ZW). Any conflicts between the two were resolved by the third author (RP). The included articles from the title and abstract screening were subject to the full text screening, performed by one author (AKB) however, 10% of the full text screening were performed by two independent authors (AKB and ZW). The reference list of included articles from the full text screening were used for further searching. The final inclusions were a set of articles obtained from hand searching, inclusions from Rayyan and through reference searching. Data extraction was carried out independently by four authors (AKB, RP, ZW, and MM) in an excel sheet. The review was registered in PROSPERO (registration ID: CRD42023401516).

Data quality

We used Newcastle – Ottawa Quality Assessment Scale for case-control and cross-sectional studies to identify the quality of the included articles. For quasi- experimental studies, the JBI critical appraisal checklist was used. For cross-sectional and case-control studies various characteristics of the study selection, comparability and outcome/ exposure were assessed. A single study could obtain a maximum of one point for each category of selection and outcome/ exposure and two points for comparability. Studies obtaining 9-10 points were identified as very good studies, 7-8 points were termed as good studies, 5-6 points were coined as satisfactory studies and those obtaining 0-4 points were considered as unsatisfactory studies [32]. The unsatisfactory studies were removed from the meta-analysis to improve the

quality of the analysis. Similarly, the quasi-experimental studies were rated in a four-point Likert scale on nine different aspects of the study like the casual pathway of the study, comparability of the groups, presence of control group, etc. Based on the Likert scale the study was deemed to be included or excluded from further analysis [33].

Data synthesis and analysis

The cervical cancer screening rate was defined as the number of people screened for cervical cancer by total sample size of the study and the frequency of screening was often obtained using a question like “have you ever participated in the cervical cancer screening” or “have you ever had cervical cancer screening” in the cross-sectional studies. We combined estimates from more than one paper to examine the pooled screening rate by country using the sub-group meta-analysis of proportion when studies examined the rate of cervical cancer screening in the same country or state. We used the study with highest sample size when the year of screening was similar in a country. We used the random-effect model to provide a more conservative estimate of effect. All analyses were conducted in Stata 17.

Role of funding source

The funder of the study had no role in study design, data collection, data analysis, data interpretation, or writing of the report.

Results

The study identified 54 articles on cervical cancer screening rate in various ANCCA member countries/regions in Asia (Bangladesh, Bhutan, Cambodia, China, India, Indonesia, Iran, Japan, Korea, Laos, Malaysia, Nepal, Pakistan, Philippines, Singapore, Sri Lanka, Taiwan, Thailand, and Vietnam) from 2012-2023.

We didn't find any relevant studies on cervical cancer screening from Brunei and Myanmar. Most of the studies were conducted in India (N = 8) followed by China (N = 6) and Iran (N = 6). Evidence was limited from many countries/ regions like Bhutan, Cambodia, Indonesia, Laos, Malaysia, Sri Lanka, Taiwan, and Vietnam (N < 3). Pap smear was the most used cervical cancer screening method among all countries. Most of the identified studies were cross-sectional studies (N = 50). We identified that none among the 21 countries had a regular screening interval for cervical cancer and majority of screening were conducted before 2020 (Table 1).

Table 2 shows the results of the quality assessment of the cross-sectional and case-control studies (N = 51) and based on the given findings 13 studies were identified as unsatisfactory hence, were excluded from further analysis. All studies excluded were cross-sectional studies which didn't report the information on comparability across various sub-groups of the population and didn't control for any possible confounders. Many studies also scored lower for the study selection due to lack of information on sample size calculation and collecting data based on subjective information provided by the respondents (Table 2). The quality assessment of three quasi-experimental studies

showed satisfactory results, hence were included in final analysis in this review Supplementary File 2.

Table 3 shows the cervical cancer screening rate from 2012 to 2023 in 18 ANCCA member countries however, it was evident from the table that there was no reporting of cervical cancer screening rate every year for all the countries or regions included in this review. We also included the population-based cervical cancer screening rate for countries where some latest government reports like Demographic and Health Survey (DHS) reports, population census reports, etc. was available and only eight ANCCA member countries had national level data reporting the cervical cancer screening rates during our study period. The most recent study exploring the rate of cervical cancer screening in 2015 in Bangladesh showed a rate of 8% [95% CI = (6.0 – 10.0)] which was somewhat consistent with the national statistics of the country in 2019 with a screening rate of about 9% [28]. There was not a single satisfactory study on cervical cancer screening rate from Bhutan, Brunei, and Myanmar. A study from Cambodia reported the rate of screening of 7% in 2016 however, the demographic and health survey (DHS) 2021-2022 reported the cervical cancer screening rate of the country as 15% [25]. In contrary China and Iran showed progressive improvement in the screening rate along the years with about 57.2% SR in 2019 in Iran [95% CI = (50.0-65.0)] and nearly 64% in 2020 in China [95% CI = (61.0-67.0)]. The studies conducted in India showed huge variation in the screening rate with none being close to but higher than the 2019-2021 DHS report of the cervical cancer screening rate i.e. 1% among women in reproductive age group [34]. Nearly 40% of the population were screened in Japan in 2013 however, another study conducted after two years showed a sharp decline to about 5%. Though there was a slight improvement in the subsequent years the screening rates were twice as low as that of the national statistics of 2017 (~16%) [29]. Most of the studies conducted in Korea shows a screening rate of about 20-22% which is almost half than the one reported in the national statistics of 2016 at 47% [27]. Studies conducted in Nepal and the Philippines shows nearly 2-3 times higher screening rates than that of their respective national statistics [26, 35]. There was a dearth of studies from Laos, Malaysia, Sri Lanka, Taiwan, and Vietnam. Singapore and Thailand have huge fluctuations in the screening rates reported in different years (Table 3).

The pooled estimate of eight countries (Bangladesh, China, India, Iran, Japan, Korea, Nepal, and Thailand) with more than three data points and those identified as satisfactory to very good studies in the quality assessment showed that cervical cancer screening rate is 28% (95% CI: 0.25 - 0.32) in the last ten years. Studies from China and India alone contributed to more than 35% weight of the estimate. Thailand showed the highest estimate of cervical cancer screening at 0.60 (95% CI: 0.33 -0.87) followed by Iran [0.38, 95% CI = (0.29-0.47)] in last decade. There is huge variation in screening rate among these countries even those within the same regions. India from South-Asia showed 28% (95% CI: 0.15 - 0.42) cervical cancer screening rate however, other countries from the same region: Bangladesh and Nepal, showed

Table 1. Description of Studies Included in the Systematic Review (N = 54)

Country of study	Authors	Publication year	Study design	Year of screening	Sample size	Age	Type of screening	Screening interval
Bangladesh	Ferdous, J. et al (20)	2014	cross-sectional study	2013	200	>30	NA	ever screened
Bangladesh	Pengpid, S. and Peltzer, K. (45)	2014	cross-sectional study	2014	256	18-26	pap smear	ever screened
Bangladesh	Islam, R. M. et al (46)	2015	cross-sectional study	2015	773	30-59	NA	ever screened
Bhutan	Dhendup, T. and Tshering, P. (47)	2014	cross-sectional study	2012	557	All	pap smear	at least once
Cambodia	Vorn, R. et al (48)	2020	cross-sectional study	2013	1039	NA	pap smear	ever screened
Cambodia	Touch, S. and Oh, J. K. (49)	2018	cross-sectional study	2016	440	20-69	pap smear	ever screened
China	Bao, H. et al (50)	2018	cross-sectional study	2013	91816	>=21	NA	ever screened
China	Pengpid, S. and Peltzer, K. (45)	2014	cross-sectional study	2014	636	18-26	pap smear	ever screened
China	Zhang, M. et al (51)	2020	cross-sectional study	2015	75287	20-64 years	NA	3 years
China	Li, H. et al (52)	2023	cross-sectional study	2017	1446	35-64	NA	ever screened
China	Zhang, M. et al (23)	2022	cross-sectional study	2018	72095	20-64	NA	NA
China	Lin, W. et al (53)	2022	cross-sectional study	2020	3651	20-65	NA	in past three years, over three years
India	Rahman, H. and Kar, S. (54)	2015	cross-sectional study	2012	253	All	pap smear	ever screened
India	Budukh, A. et al (55)	2021	cross-sectional study	2013	945	All	HPV testing	NA
India	Jeyapaul, S. et al (56)	2021	cross-sectional study	2014	18490	25-60	VIA	NA
India	Zhu, C. K. et al (57)	2022	cross-sectional study	2015	699686	15-49	NA	ever screened
India	Nararyana, G. et al (58)	2017	cross-sectional study	2017	403	>=18	NA	past 3 years, > 3 years
India	Reichheld, A. et al (59)	2020	cross-sectional study	2019	1033	20-65	VIA	ever screened
India	Sharma, A. et al (60)	2021	cross-sectional study	2021	397	<=40	NA	NA
India	Menakuru, S. R. and Kalla, S. (61)	2022	cross-sectional study	2022	4121	>=21	VIA	NA
Indonesia	Anwar, S. L. et al (62)	2018	cross-sectional study	2014	1058	40-60	pap smear	NA
Indonesia	Sumarmi, S. et al (63)	2021	cross-sectional study	2016	682	>=30	pap smear	regular, irregular
Iran	Aminisani, N. et al (64)	2016	cross-sectional study	2014	560	>=40	pap smear	ever screened
Iran	Almadipour, H. and Sheikhrizade, S. (65)	2016	cross-sectional study	2015	236	>=20	pap smear, pelvic examination	NA
Iran	Amin, R. et al (66)	2020	cross-sectional study	2016	15260	>=18	NA	ever screened
Iran	Eghbal, S. B. et al (67)	2020	quasi experimental study	2017	80	20-65	pap smear	NA
Iran	Jeihooni, A. K. et al (68)	2021	quasi experimental study	2018	150	All	pap smear	ever screened
Iran	Chalav et al (69)	2021	cross-sectional study	2019	400	18-49	pap smear	ever screened
Japan	Kaso, M. et al (70)	2019	cross-sectional study	2013	49217	20-39	NA	last 2 years
Japan	Mizota, Y. and Yamamoto, S. (71)	2021	quasi experimental study	2015	64690	>=20	NA	ever screened
Japan	Mizota, Y. and Yamamoto, S. (71)	2021	quasi experimental study	2016	45927	>=20	NA	ever screened
Japan	Mizota, Y. and Yamamoto, S. (71)	2021	quasi experimental study	2017	66968	>=20	NA	ever screened
Japan	Mizota, Y. and Yamamoto, S. (71)	2021	quasi experimental study	2018	52455	>=20	NA	ever screened

Sample size for case-control studies indicates only the sample of healthy controls and those from quasi-experimental studies indicates the sample size of pre-test or before intervention group only, N, total number of studies; NA, Not Available; VIA, Visual Inspection with Acetic acid

Table 1. Continued

Country of study	Authors	Publication year	Study design	Year of screening	Sample size	Age	Type of screening	Screening interval
Korea	Sub, M. et al (72)	2013	cross-sectional study	2012	2395	>=30	pap smear	lifetime screening rate
Korea	Lee, K. et al (73)	2022	cross-sectional study	2018	2759	20-74	NA	last 1 year
Korea	Lee, K. et al (73)	2022	cross-sectional study	2019	2756	20-74	NA	last 1 year
Korea	Lee, K. et al (73)	2022	cross-sectional study	2020	2743	20-74	NA	last 1 year
Laos	Pengpid, S. and Peltzer, K. (45)	2014	cross-sectional study	2014	528	18-26	pap smear	ever screened
Malaysia	Gan, D. E. and Dahlui, M. (74)	2013	cross-sectional study	2013	959	20-64	pap smear	every year, once every 2 years, once every 3 years
Malaysia	Chin, S. S. et al (75)	2022	cross-sectional study	2019	452	18-65	pap smear	last three years
Nepal	Ramabhat, S. et al (76)	2014	cross-sectional study	2013	607	35-59	pap smear	ever screened
Nepal	Acharya Pandey, R. and Karnacharya, E. (77)	2017	cross-sectional study	2014	180	30-60	pap smear	NA
Nepal	Ranjit A et al (78)	2016	cross-sectional study	2016	829	21-65	pap smear	NA
Nepal	Maharjan, M. et al (79)	2020	cross-sectional study	2017	510	20-65	NA	ever screened
Nepal	Shrestha, A. D. et al (80)	2022	cross-sectional study	2019	729	30-60	NA	ever screened
Pakistan	Pengpid, S. and Peltzer, K. (45)	2014	cross-sectional study	2014	457	18-26	pap smear	ever screened
Pakistan	Javeed, A. et al (81)	2019	cross-sectional study	2018	594	All	pap smear	ever screened
Pakistan	Riaz, L. et al (82)	2020	cross-sectional study	2019	388	17-65	pap smear	NA
Pakistan	Hirani, S. et al (83)	2021	cross-sectional study	2021	384	15-50	pap smear	ever screened
Philippines	Pengpid, S. and Peltzer, K. (45)	2014	cross-sectional study	2014	385	18-26	pap smear	ever screened
Philippines	Imoto, A. et al (84)	2020	cross-sectional study	2017	338	20-50	NA	ever screened
Philippines	Imoto, A. et al (85)	2020	cross-sectional study	2020	250	20-50	NA	ever screened
Singapore	Tay, K. et al (86)	2015	cross-sectional study	2013	612	>=25	NA	in past 3 years
Singapore	Pengpid, S. and Peltzer, K. (45)	2014	cross-sectional study	2014	414	18-26	pap smear	ever screened
Singapore	Chan, T. K. et al (87)	2021	cross-sectional study	2015	3584	>=40	pap smear	every 2 years, every 3 years
Sri Lanka	Shivanthan, M. C. et al (88)	2014	cross-sectional study	2014	53	25-65	pap smear	ever screened
Sri Lanka	Arumapperuma et al (89)	2016	cross-sectional study	2016	425	All	NA	ever screened
Taiwan	Chen, S. L. et al (90)	2014	cross-sectional study	2012	500	All	pap smear	ever screened
Thailand	Wongwacharakul, L. et al (91)	2014	case-control study	2012	547	30-60	NA	ever screened
Thailand	Budkaew, J. and Chumworathayi, B. (92)	2014	cross-sectional study	2013	195	30-60	pap smear	within last 5 years
Thailand	Srisuwan, S. et al (93)	2015	cross-sectional study	2014	128	All	NA	ever screened
Thailand	Gotschlich, A. et al (94)	2019	cross-sectional study	2017	267	NA	pap smear	NA
Thailand	Inahphrak, S. et al (95)	2021	cross-sectional study	2018	650	>=30	pap smear	NA
Vietnam	Lee, H. Y. et al (96)	2021	cross-sectional study	2017	192	21-39	pap smear	ever screened

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a screening rate of 13% from 2012 - 2022. Similarly, Korea and China from East-Asia had a screening rate of 35% (95% CI: 0.18-0.52) & 29% (95% CI: 0.25 - 0.34) respectively which was more than double than that of Japan [0.13, 95% CI = (0.07 – 0.19)] (Figure 1). Publication bias based on the observation of the funnel plot was minimal (Figure 2).

Discussion

This systematic review and meta-analysis identified

the proportion of cervical cancer screening across Asian regions or countries who are the members of ANCCA from 2012 to 2023. It was interesting to note that the rate of screening is below 30% within this decade in Asia. The study identified huge disparities across and within countries regarding the cervical cancer screening.

The national cervical screening program of WHO reported the screening rate of maximum of 70% in Brunei and the WHO STEPS survey report from Bhutan reported 54.4% screening rate in 2019 [36, 37]. However, we didn't find any relevant studies exploring the cervical

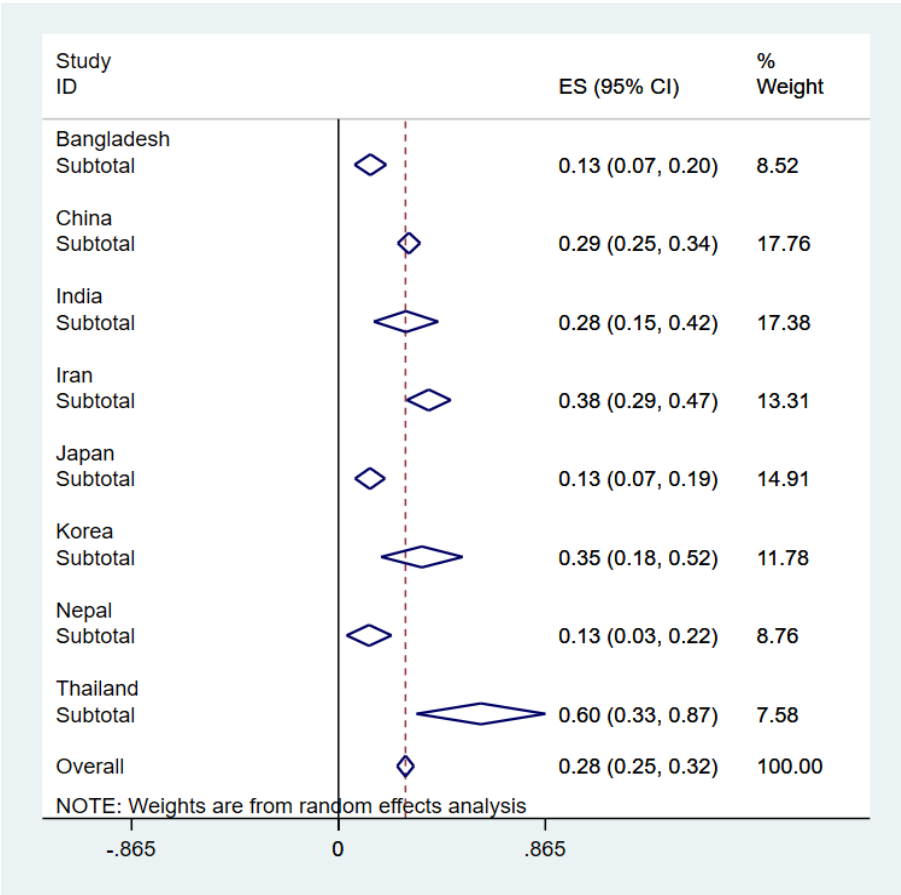


Figure 1 Meta-Analysis of the Rate of Cervical Cancer Screening in Asia

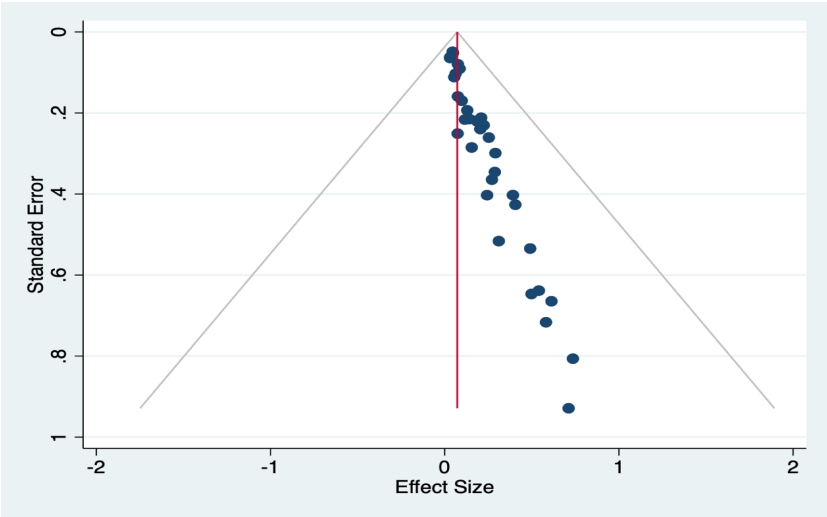


Figure 2. Funnel plot

Table 2. Cervical Cancer Screening Rate among ANCCA Member Countries from 2012-2023

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	National CSR (year)
Bangladesh	-	0.22	0.12	0.08	-	-	-	-	-	-	-	0.09 (2019) (28)
Cambodia	-	0.16-0.29	0.08-0.16	0.06-0.10	0.07	-	-	-	-	-	-	0.15 (2021-2022) (25)
China	-	0.23	0.047	0.26	-	0.32	0.3	-	0.64	-	-	-
		0.22-0.23	0.03-0.06	0.25-0.26		0.29-0.35	0.29-0.30		0.61-0.67			
India	0.17	0.59	-	0.21	-	0.13	-	0.07	-	0.08	0.51	0.01 (2019-2021) (33)
	0.12-0.22	0.54-0.64		0.21-0.21		0.10-0.17		0.05-0.09		0.06-0.11	0.49-0.54	
Indonesia	-	-	0.24	-	0.14	-	-	-	-	-	-	-
			0.21-0.27		0.11-0.17							
Iran	-	-	0.32	-	0.42	0.16	0.41	0.57	-	-	-	-
			0.27-0.36		0.41-0.43	0.07-0.25	0.31-0.52	0.50-0.65				
Japan	-	0.4	-	0.05	0.05	0.08	0.09	-	-	-	-	0.16 (2017) (29)
		0.39-0.40		0.05-0.05	0.05-0.05	0.08-0.08	0.09-0.09					
Korea	0.77	-	-	-	-	-	0.2	0.22	0.2	-	-	0.47 (2016) (27)
	0.74-0.81						0.19-0.22	0.20-0.24	0.19-0.22			
Laos	-	-	0.04	-	-	-	-	-	-	-	-	-
			0.02-0.06									
Malaysia	-	0.18	-	-	-	-	-	0.49	-	-	-	-
		0.16-0.21						0.42-0.55				
Nepal	-	0.16	-	-	0.05	0.18	-	-	-	-	-	0.06 (2022) (26)
		0.13-0.19			0.03-0.06	0.14-0.22						
Pakistan	-	-	0.02	-	-	-	0.06	-	-	-	-	-
			0.01-0.04				0.04-0.08					
Philippines	-	-	0.04	-	-	0.14	-	-	-	-	-	0.09 (2022) (34)
			0.02-0.06			0.10-0.18						
Singapore	-	-	0.06	0.77	-	-	-	-	-	-	-	0.41 (2021) (40)
			0.04-0.08	0.74-0.80								
Sri Lanka	-	-	0.64	-	-	-	-	-	-	-	-	-
			0.43-0.86									
Taiwan	0.66	-	-	-	-	-	-	-	-	-	-	-
	0.59-0.73											
Thailand	0.65	0.32	NA	-	-	0.82	-	-	-	-	-	-
	0.58-0.72	0.24-0.40				0.71-0.93						
Vietnam	-	-	-	-	-	-	-	-	-	-	-	-
						0.161						

CSR, Cervical cancer Screening Rate; -, information Not Available

Table 3. Quality Assessment of the Cross-Sectional and Case-Control Studies (N = 51)

Country: Authors name	Type of study	Quality Assessment			Total points
		Selection	Comparability	Outcome/ Exposure	
Bangladesh: Ferdous, J. et al (20)	Cross-sectional study	**	**	***	7
Bangladesh & others*: Pengpid, S. and Peltzer, K. (45)	Cross-sectional study	**	**	***	7
Bangladesh: Islam, R. M. et al (46)	Cross-sectional study	***	**	***	8
Bhutan: Dhendup, T. and Tshering, P. (47)	Cross-sectional study	*		**	3
Cambodia: Vorn, R. et al (48)	Cross-sectional study	*		**	3
Cambodia: Touch, S. and Oh, J. K. (49)	Cross-sectional study	*	**	***	6
China: Bao, H. et al (50)	Cross-sectional study	***	**	***	8
China: Zhang, M. et al (51)	Cross-sectional study	***	**	***	8
China: Li, H. et al (52)	Cross-sectional study	***	**	***	8
China: Zhang, M. et al (23)	Cross-sectional study	**		***	5
China: Lin, W. et al (53)	Cross-sectional study	**	**	***	7
India: Rahman, H. and Kar, S. (54)	Cross-sectional study	*	**	***	6
India: Budukh, A. et al (55)	Cross-sectional study	**	**	***	7
India: Jeyapaul, S. et al (56)	Cross-sectional study	*		**	3
India: Zhu, C. K. et al (57)	Cross-sectional study	***	**	***	8
India: Narayana, G. et al (58)	Cross-sectional study	***		***	6
India: Reichheld, A. et al (59)	Cross-sectional study	***	**	***	8
India: Sharma, A. et al (60)	Cross-sectional study	***	**	***	8
India: Menakuru, S. R. and Kalla, S. (61)	Cross-sectional study	**		***	5
Indonesia: Anwar, S. L. et al (62)	Cross-sectional study	***	**	***	8
Indonesia: Sumarmi, S. et al (63)	Cross-sectional study	***	**	***	8
Iran: Aminisani, N. et al (64)	Cross-sectional study	*	**	***	6
Iran: Ahmadipour, H. and Sheikhezade, S. (65)	Cross-sectional study	*		***	4
Iran: Amin, R. et al (66)	Cross-sectional study	***	**	***	8
Iran: Ghalav et al (69)	Cross-sectional study	**	**	***	7
Japan: Kaso, M. et al (70)	Cross-sectional study	***	**	***	8
Korea: Suh, M. et al (72)	Cross-sectional study	***		***	6
Korea: Lee, K. et al (73)	Cross-sectional study	***	**	***	8
Malaysia: Gan, D. E. and Dahlui, M. (74)	Cross-sectional study	**	**	***	7
Malaysia: Chin, S. S. et al (75)	Cross-sectional study	***	**	***	8
Nepal: Ranabhat, S. et al (76)	Cross-sectional study	*	**	***	6
Nepal: Acharya Pandey, R. and Karmacharya, E. (77)	Cross-sectional study	*		***	4
Nepal: Ranjit, A et al (78)	Cross-sectional study	***	**	***	8
Nepal: Maharjan, M. et al (79)	Cross-sectional study	***	**	***	8
Nepal: Shrestha, A. D. et al (80)	Cross-sectional study	*		***	4
Pakistan: Javaeed, A. et al (81)	Cross-sectional study	**		***	5
Pakistan: Riaz, L. et al (82)	Cross-sectional study	*		***	4
Pakistan: Hirani, S. et al (83)	Cross-sectional study	*		***	4
Philippines: Imoto, A. et al (84)	Cross-sectional study	*	**	***	6
Philippines: Imoto, A. et al (85)	Cross-sectional study			***	3
Singapore: Tay, K. et al (86)	Cross-sectional study			***	3
Singapore: Chan, T. K. et al (87)	Cross-sectional study	***	**	***	8
Sri Lanka: Shivanthan, M. C. et al (88)	Cross-sectional study	**	**	***	7
Sri Lanka: Arumapperuma et al (89)	Cross-sectional study	*		***	4
Taiwan: Chen, S. L. et al (90)	Cross-sectional study		**	***	5
Thailand: Wongwacharanukul, L. et al (91)	Cross-sectional study		**	***	5
Thailand: Budkaew, J. and Chumworathayi, B. (92)	Case-control study	***	**	*	6
Thailand: Srisuwan, S. et al (93)	Cross-sectional study			***	3
Thailand: Gottschlich, A. et al (94)	Cross-sectional study	*	**	***	6
Thailand: Intahphuak, S. et al (95)	Cross-sectional study	*		***	4
Vietnam: Lee, H. Y. et al (96)	Cross-sectional study		**	***	5

*, China; Laos, Pakistan, Philippines, Singapore

cancer screening rate in these countries in the community or population level. Even though the National Cervical Cancer Screening and Prevention Program has been implemented in Myanmar since 2019 [38] there were no studies conducted regarding CCS to explore the implementation status of the program. Hence, scaling up of national and government projects for cervical cancer screening is necessary in these countries. The evidence regarding community and population-based CCS rate was limited in almost all countries included. Some countries like Bangladesh has started the HPV vaccination program recently in 2023 as their national strategy to prevent cervical cancer [39] and hence, there might be an increase in the screening rate in the future. But, for most other developing countries like Laos, Malaysia, Pakistan, Sri Lanka, Taiwan, and Vietnam the evidence were limited on cervical cancer screening.

Studies from India, Nepal, Singapore, and Cambodia showed huge within country-level variation in cervical cancer screening rate which were not even close to their corresponding national statistics. For example: the rate obtained from various parts of India was 7-59 times than cervical cancer screening rate reported in their National Family Health Survey (NFHS-5) 2019-21 [34]. Similarly, the 2010 National Guideline for Cervical Cancer Screening and Prevention of Nepal aimed to screen at least 50% of the women aged 30-60 years however, by 2022 only about 6% women were screened but only one study included in this review showed somewhat similar rate of screening [40, 26]. Likewise, two studies identified from Singapore had a difference of about 71% in their reported cervical cancer screening rate which was also quite different than their national statistics [41]. The Cambodia Demographic and Health Survey in the year 2021-22 reported a cervical cancer screening rate of about 15% which was more than double than that observed in our included study [25]. Hence, there is a huge uncertainty on the generalizability of the findings obtained from the individual studies conducted in these countries.

Furthermore, there are some existing disparities in accessibility and utilization of cervical cancer screening services within and across various regions in Asia. A global study identified the coverage of cervical cancer screening based on Sustainable Development Goal (SDG) regions of Asia to be lowest in Western Asia (4.1%) followed by Central and Southern Asia (10.2%) and highest in Eastern and South-Eastern Asia (44.4%) in 2019 among women aged 30-49 years [42]. The results of this review were also coherent with this finding as countries in east and south-east Asia like China, Korea, and Thailand had higher cervical cancer screening rate than the others. However, Japan showed some exception, the cervical cancer screening participation rate in the most recent years were lower but the study conducted in 2013 had almost similar rate as reported in the Comprehensive Survey of Living Conditions 2019 (43%) [43]. Meanwhile, there were fewer studies which identified the cervical cancer screening rate after 2019. This could be because of covid-19, as most of these countries were affected by the pandemic and the restrictions applied in many countries to constrain the coronavirus pandemic might have affected

the available health care services including the cancer screening services [44]. The health care systems were not resilient enough to tackle the effects of pandemic [45]. Hence, along with the existing challenges, an additional challenge to revert the rate of cervical cancer screening to the rate before the pandemic in the following years is to be considered for all these countries. It is important to promote research in the community and national level and develop a cancer screening database in many ANCCA member countries. This could help to identify challenges and strengthen the existing policies on cervical cancer screening to reduce the incidence and mortality related to cervical cancer in the future.

The strengths of this study are, we were able to review 54 articles reporting the cervical cancer screening rate from 2012 – 2023 in various ANCCA member countries or regions in Asia and compare them with their national statistics. We were able to show the descriptive background of the studies and obtained a pooled estimate from eight countries. However, due to the unavailability of enough data points very few studies were included in the meta-analysis. Similarly, due to the lower sample size, lesser comparability and high within country variation we were not able to conclude the trend of the cervical cancer screening even though there were enough data points available for some of the countries to perform trend analysis. Lastly, the generalizability of study findings should consider the difference in between observed screening rate and national level statistics of corresponding countries and the possible recall bias imposed by the nature of the maximum number of cross-sectional studies included on this review. However, despite of this limitation we were able to discuss the situation of cervical cancer screening in the national and community level in various Asian countries or region in the last decade.

In conclusions, cervical cancer is one of the major causes of cancer-related mortality among women in many Asian countries. However, there is lack of evidence on actual rate of cervical cancer screening in those countries and often the screening rate is based on opportunistic screening. Most ANCCA countries do not have sufficient studies conducted on cervical cancer screening and additionally, many countries lack nationally representative surveys or national level cancer registries. The community level studies show high variation in the screening rate due to the selection bias and poor methodology even though conducted in a same country. The coronavirus pandemic also had some adverse effect in the health service delivery including screening services in most of the countries in last few years. It is crucial to encourage governments and private sector to strengthen capacity and work in collaboration to enhance cervical cancer screening rate in their respective countries.

Author Contribution Statement

Conceptualisation AKB; Data curation AKB, ZW, RP, MM; Formal analysis: AKB; Funding acquisition SKA; Investigation AKB; Methodology AKB, ZW, RP, MM; Project administration AKB, ZW, RP, MM, TM, SKA;

Resources AKB; Software AKB SKA; Supervision TM, SKA; Validation AKB; Visualisation AKB; Writing-original draft AKB; Writing- review and editing AKB, ZW, SKA. All authors have read and approved the final manuscript.

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If it was approved by any scientific Body/ if it is part of an approved student thesis

The study was not approved by any scientific body or is not a part of an approved student thesis.

Availability of data

The data utilized in this scoping review are readily available on online databases.

Registration

The scoping review has been registered in PROSPERO with the registration ID: CRD42023401516.

Competing interests

None to declare. The authors have no potential financial, personal, or other conflicts of interests.

Ethical approval

This study utilized information from preexisting literatures hence, ethical approval was not obtained.

Abbreviations

ANCCA: Asian National Cancer Centres Alliance, CC: Cervical Cancer, CCS: Cervical Cancer Screening, CI: Confidence Interval, DHS: Demographic and Health Survey, HPV: Human Papilloma Virus, IARC: International Agency for Research on Cancer, LMIC: Low-middle-income countries, NCD: Non-Communicable Disease, RCT: Randomized Controlled Trial, WHO: World Health Organization

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