



The impact of COVID-19 on essential health service provision for noncommunicable diseases in the South-East Asia region: A systematic review

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Summary

Background COVID-19 has had a profound impact on the health systems of the 11 countries of the WHO South East Asia Region. We conducted a systematic review of studies that used quantitative and comparative approaches to assess the impact of the pandemic on the service provision of four noncommunicable diseases (NCDs) (cancer, cardiovascular disease, chronic respiratory diseases, and diabetes) in the region.

Methods A systematic search was conducted in PubMed, Embase, MedRxiv, and WHO COVID-19 databases in December 2021. The quality of studies was evaluated using the Joanna Briggs Institute Critical Appraisal Checklist and the ROBINS-I risk of bias tool. A narrative synthesis was conducted following the 'synthesis without meta-analysis' reporting guidelines.

Findings Two review authors independently screened 5,397 records with 31 studies included, 26 which were cross-sectional studies. Most studies (n=24, 77%) were conducted in India and 19 (61%) were single-site studies. Compared to a pre-pandemic period, 10/17 cancer studies found a >40% reduction in outpatient services, 9/14 cardiovascular disease found a reduction of 30% or greater in inpatient admissions and 2 studies found diagnoses and interventions for respiratory diseases reduced up to 78.9% and 83.0%, respectively. No eligible studies on the impact of COVID-19 on diabetes services were found.

Interpretation COVID-19 has substantially disrupted the provision of essential health services for NCDs in the WHO South East Asia Region, particularly cancer and cardiovascular disease. This is likely to have serious and potentially long-term downstream impacts on health and mortality of those living with or at risk of NCDs in the region.

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Introduction

The COVID-19 pandemic has placed enormous strain on health systems globally, and there is increasing evidence from numerous settings that it has impacted adversely

on the provision of a wide range of essential health services.¹ Management of the COVID-19 pandemic is particularly challenging for the 11 countries in the WHO South East Asia (SEA) Region, which has the lowest level of health spending of all WHO Regions at less than 5% on average.^{2, 3} The SEA Region is home to over a quarter of the world's population and comprises eleven countries: Bangladesh, Bhutan, Democratic People's Republic of Korea, India, Indonesia, Maldives, Myanmar, Nepal, Sri Lanka, Thailand, and Timor-Leste. The pandemic toll in SEA Region has been severe – the region had

Abbreviations: SEA, South East Asia; NCD, Non-communicable disease; CVD, Cardiovascular disease; WHO, World Health Organization

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Research in context

Evidence before this study

The COVID-19 pandemic has placed enormous strain on health systems in the South East Asia region (SEAR), with the WHO PULSE survey estimating that up to 60% of essential services have been at least partially disrupted. Disruptions in access to noncommunicable disease (NCD) services may lead to delayed diagnosis and advanced disease, potentially setting back hard-fought gains in NCD control across the region. However, no comprehensive analysis of quantitative evidence documenting the displacement of NCD services from the SEAR has been undertaken to date.

Added value of this study

This study represents the first systematic review and evidence synthesis of published evidence to estimate the quantitative impact of the COVID-19 pandemic on essential service provision for NCDs in the SEAR. We document that the pandemic substantially disrupted the provision of health services for NCDs, and in particular - cancer and cardiovascular disease, across multiple SEA countries. All aspects of NCD care, including screening, diagnosis, treatment, palliative care, and follow-up management were reduced during the pandemic. We did not identify any relevant studies in Bhutan, North Korea, Maldives, Myanmar, Thailand, or Timor-Leste, nor for services related to the diagnoses, treatment or management of diabetes.

Implications of all the available evidence

Our findings demonstrate that essential services for a range of NCDs were substantially disrupted by the COVID-19 pandemic across the SEAR. The downstream effects of these disruptions are potentially dire and could result in delayed diagnoses, faster disease progression, and ultimately – higher rates of mortality. Further research is required to understand the impact of subsequent waves of COVID-19 infection on NCD service provision, effective strategies to recover and protect disrupted services, and how countries across the SEAR can utilise this evidence towards informing policy for building more resilient health systems for future pandemic preparedness.

experienced approximately one-fifth of global COVID-19 cases as of June 11, 2021.³

Besides its direct impact on health, COVID-19 has indirectly impacted health services due to lockdowns and other public health policies such as voluntary social distancing. In turn, these have led to decline in service utilization. The WHO PULSE survey on the continuity of essential health services during the COVID-19 pandemic has now published two rounds of information captured from 2020 and 2021.^{4,5} According to the WHO Pulse survey conducted in 2020, 77% of all

countries have experienced health service disruptions to some extent⁴. The services that were most frequently disrupted were routine immunization, noncommunicable disease (NCD) diagnosis and treatment, family planning and contraception, treatment for mental health disorders, antenatal care and cancer diagnosis and treatment. On average, close to 60% of essential services were at least partially disrupted in the SEA Region.⁴

Prior to the pandemic, all countries in the region had made improvement according to the WHO overall essential health service coverage index with the regional average increasing from 49% in 2010 to 63% in 2020.³ The largest progress was made in Indonesia, where the service coverage index increased by 18 percentage points.³ However, progress was largely uneven: the biggest gains were made in providing infectious diseases-related services, such as tuberculosis treatment and HIV antiretroviral therapy, while improvements related to noncommunicable diseases (NCDs) have been less rapid. In addition to being considered at higher risk for worse outcomes from COVID-19, people with NCDs may also experience disruptions or delays in access to health services due to mitigation measures such as national lockdowns.

NCDs account for an estimated 8.5 million deaths annually in the WHO SEA Region.⁶ In India for instance, NCDs present a substantial burden to the health system, and it is estimated that 35% of all outpatient visits to hospitals in 2004 were for NCDs, and 40% of hospitalizations.⁷ The continued increase in NCDs and chronic care conditions necessitates available, accessible, and affordable NCD health services yet the impact of the COVID-19 pandemic on service provision threatens to slow down progress and even reverse the gains in controlling NCDs.

We review the published quantitative evidence on the impact of COVID-19, compared to pre-pandemic data, on the provision of essential prevention, detection, treatment, and management services for NCDs across the SEA Region. We focus on four NCDs selected on the basis that they have the highest burden of disease in adults in the region, accounting for over 80% of all premature NCD deaths: cardiovascular diseases and stroke, cancers, chronic respiratory diseases, and diabetes.⁶ This review also characterizes the various policy responses implemented across the region and their impact on health service provision during the COVID-19 pandemic.

Methods

Approach and design of review

A systematic review was conducted to identify quantitative evidence regarding the provision of essential health service for NCD services in each of the 11 countries

within the SEA Region. The review was reported according to PRISMA guidelines.

Search strategy

Between 1st and 15th of December 2021, we electronically searched the following databases: Ovid Medline, Embase and Global Health. The search included relevant medical subject heading terms, keywords, and word variant for NCDs, service disruption, COVID-19 and countries that belong to the SEA Region. The search was limited to English language sources published from 2020 to the time of the search. The complete search strategy is available in supplementary file 1. Additional nonstructured searches for grey literature were conducted in the WHO COVID-19 database and a pre-print database (e.g., <https://www.medrxiv.org/>).

Eligibility criteria

We limited eligibility to studies where one of the primary objectives was to determine the impact of the COVID-19 pandemic on the provision of health services for one or more of the NCD conditions of interest. Articles were included if the title and/or abstract indicated the report of results using quantitative and comparative approaches (i.e., 2020/21 estimates compared to 2019 and prior) that examine the impact of COVID-19 on the provision of any health service related to the prevention, diagnosis, treatment, or management for one of the four NCDs of interest in a SEA setting. Studies were excluded if they did not contain data from one of the listed countries, did not include a NCD of interest, were published outside the specified date range, contained only qualitative results, or did not include comparison groups.

Screening

Abstracts and potentially relevant full-texts were reviewed independently by two authors (TG and LD) with any conflicts resolved by consensus. Duplicates were removed from the initial search. Thereafter, full-texts of potentially relevant studies were reviewed to determine eligibility for inclusion. A full list of inclusion and exclusion criteria for the studies is provided in [Table 1](#). All articles identified in the searches were imported into the Covidence systematic review software (version 2, Veritas Health Innovation, Melbourne, VIC, Australia), and title and abstract screening, full-text review, data extraction, and quality assessment were all performed in Covidence.

Quality Appraisal

The methodological quality of the included studies was evaluated using validated tools for each study design. For cross-sectional before-after studies we used the six-

item Joanna Briggs Institute (JBI) Critical Appraisal Checklist for analytical cross-sectional studies. The JBI is an international, membership-based research and development organization within the Faculty of Health Sciences at the University of Adelaide. The instrument was developed by the JBI before being reviewed by an international methodological group. For cohort or case control studies we used the ROBINS-I [9] risk of bias tool, as recommended by the Cochrane Collaboration to assess non-randomized studies of interventions. Quality appraisal was undertaken by a single reviewer (TG) and any points of uncertainty were addressed through discussion and consensus with a second reviewer (LD).

Data extraction and analysis

Data were extracted in Covidence by two reviewers (TG, LD) using a standard template that was modified to include key parameters of interest. The following data were extracted: country; condition of interest; service of interest; study design; sampling period; % change in service delivery metrics from pre-COVID to peri-COVID. Essential health services were divided into the following categories of interest, in line with patient pathways of care: outpatient services (e.g., presentation rates), inpatient services (e.g., admission rates), diagnosis and case finding, pharmacological services, condition management and follow-up services. The following COVID-19 related information was also extracted from papers where possible: whether data collection coincided with a 'peak' of infection and/or lockdown; whether any service protection/mitigation measures were in place during the period of data collection; the reported efficacy of the mitigation measures; and reported consequences of forgone or displaced health services as a consequence of COVID-19.

Evidence synthesis

Given the heterogeneity in setting, population, condition, and service area, a meta-analysis was not undertaken. A narrative synthesis was conducted following the 'synthesis without meta-analysis (SWIM)' in systematic review reporting guidelines to explore, describe, and interpret key findings related to the impact of COVID-19 on the provision of essential health services for NCDs during 2020 and 2021 in the SEA Region.

Role of the funding source

This study was funded by the World Health Organisation Sri Lanka (WHO-SL) Country Office. The funder of the study had no role in study design, data collection, data analysis, data interpretation, or writing of the report. The WHO-SL office and the WHO South East Asia Regional Office (WHO-SEARO) have reviewed and approved this manuscript for publication.

	Inclusion Criteria	Exclusion Criteria
Date range	Published at any time in 2020 onwards	Published prior to 2020
Population	Adult, adolescent, and child populations in the WHO SEA Region*	Countries outside of the WHO SEA Region
Study design	Comparative study designs that quantify the impact of the COVID-19 pandemic and associated public health response measures on health service provision	Qualitative studies, non-longitudinal studies, studies without comparison groups, commentaries, opinions, letters and clinical guidelines data
Conditions of interest	All types of cancers, cardiovascular diseases and stroke, chronic respiratory diseases, chronic kidney disease and diabetes	Infectious diseases, acute infections or episodes, other conditions not otherwise classified as non-communicable diseases
Other	Published in English language	Published in language other than English

Table 1: Review protocol inclusion and exclusion criteria.

* Bangladesh, Bhutan, Democratic People's Republic of Korea, India, Indonesia, Maldives, Myanmar, Nepal, Sri Lanka, Thailand and Timor-Leste.

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Ethical approval

Ethical approval was not required for this review as all information collected was available in the public domain.

Results

An initial 8,601 papers were identified through a database search and 9 through the grey literature. 5,397 records remained after duplicates were removed. 74 were relevant for full-text review and 31 met the inclusion criteria for systematic review (Figure 1).⁸⁻³⁷ Forty-three studies were excluded. Primary reasons for exclusion included the study setting outside SEA (n=21), conference abstract or poster presentation (n=9) inappropriate study design (i.e., not comparative; n=6) and reporting on outcomes outside of the scope of this review (n=6).

Table 2 shows the characteristics of the 31 included studies. Five countries in the region were represented: India (24 studies; 77.4%), Bangladesh (2), Sri Lanka (2), Indonesia (1) and Nepal (1). There were no relevant papers identified for Bhutan, North Korea, Maldives, Myanmar, Thailand, or Timor-Leste.

Fifteen studies (48.4%) reported on disruptions to cancer related health services^{9,14,16,18,23,25-29,32,34}, 12 (38.7%) on cardiovascular diseases^{10-13,17,19,24,30,31,36-38}, one (3.2%) on respiratory services³⁵ and diabetes services.²² Additionally, one study reported on disruptions to both cancer and cardiovascular services²¹ and one on disruptions to diagnostic procedures for cancer,

cardiovascular and respiratory diseases.²⁰ There was one report using a national registry, 11 multi-site studies and the remaining 19 were single-site studies.

Nearly all studies were cross-sectional in nature (n=30), though different study design labels were applied including ‘ambi-directional’ cohort study,²⁹ prospective mixed-quantitative methods study³³ and emulated natural interrupted time series.³⁷ One study was a retrospective matched cohort study where clusters of geographic districts were exposed to a different form of follow-up provision.³¹ Eighteen studies compared a period of time during the COVID-19 pandemic, often during lockdown, with the corresponding period in the prior year (i.e., 2019) while nine studies obtained a comparison group from a period immediately preceding the pandemic or lockdown. Sample sizes varied from 50 to 41,832 (Table 2).

Among analytical cross-sectional studies, 21 were considered moderate quality^{8-14,17-20,23,25,27-29,32,33,36-38} and 9 low quality.^{15,16,21,22,24,26,30,34,35} The majority of studies outlined clear time periods for comparison, the study setting, outcomes for measurement and their data source. Comparatively, sample size was not reported in 12 studies, and studies commonly did not explain their statistical analysis methods nor provide confidence intervals. Only one study – the retrospective matched cohort study – controlled for confounding and was found to have a moderate risk of bias.³¹ None of the included studies were scored a high methodological quality. Results of the quality assessment are contained in supplementary file 2.

Impact of COVID-19 on patient pathways for cancer care

Of the 17 studies that assessed disruptions to cancer related health services, 13 were conducted in India (Table 3). The majority (n=11) assessed services provision in tertiary oncology departments (for all types of cancer) while others focused specifically on cervical

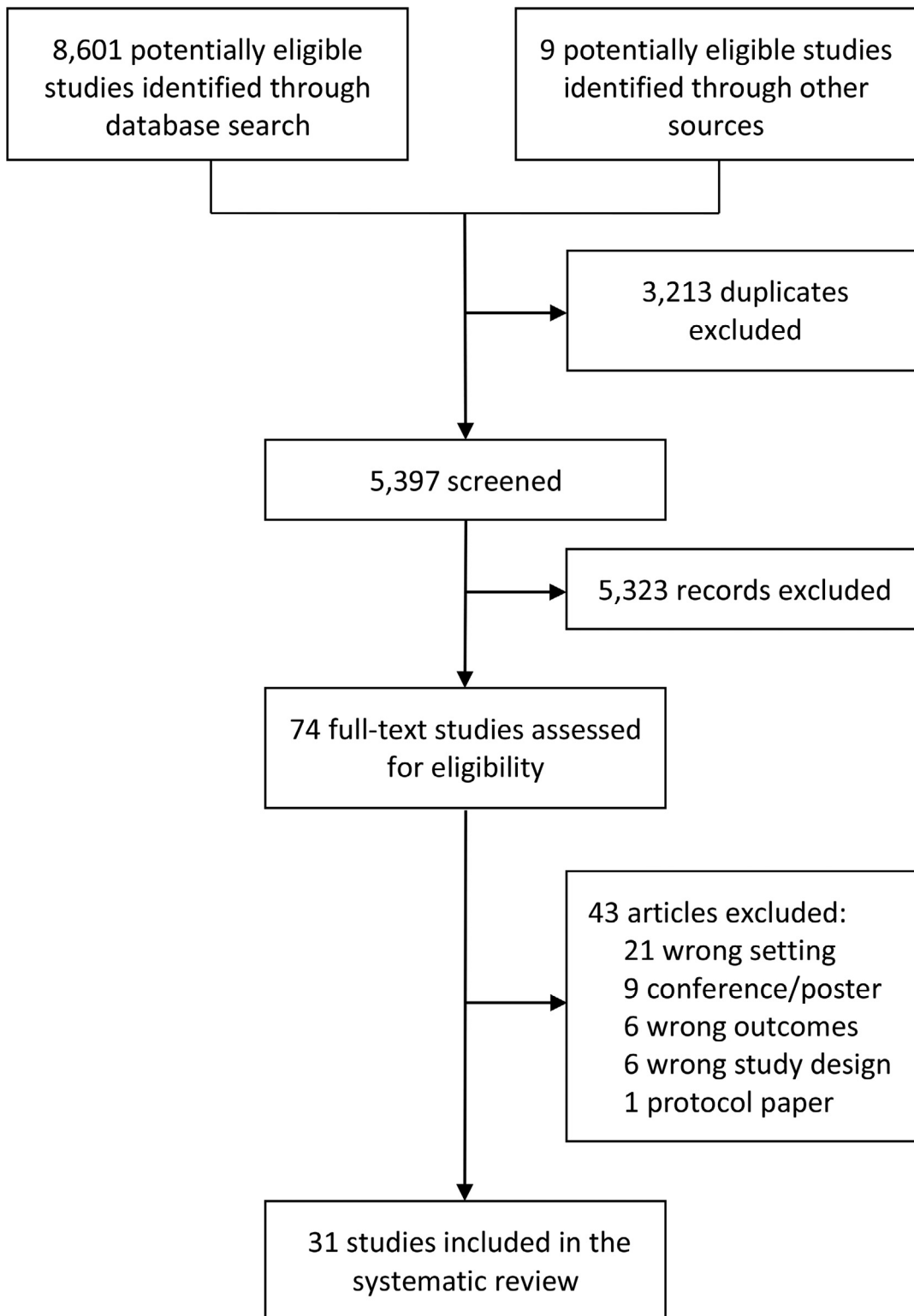


Figure 1. PRISMA diagram. Abbreviations: PRISMA, preferred reporting items for systematic reviews and meta-analyses.

Author, Year	Country	Study design	Setting	Disease area	Sample size	Control period	Pandemic period
Akhtar 2020	India	Cross sectional analysis	Single-site	Cancer	NR	Apr to Sept 2019	Apr to Sept 2020
Basu 2021	Bangladesh	Cross sectional analysis	National	Cancer	1,070,713	Jan to Dec 2018, 2019	Jan to Dec 2020
Cherian 2020	India	Cross sectional analysis	6 radiology centres	Cardiovascular disease	NR	Apr 1 to June 30, 2019	Apr 1 to June 30, 2020
Choubey 2021	India	Cross sectional analysis	24 paediatric cardiac centres	Cardiovascular disease	NR	Apr 1 to Aug 31, 2019	Apr 1 to Aug 31, 2020
Choudhary 2020	India	Cross sectional analysis	4 hospitals	Cardiovascular disease	2,607	Jan 25 to Feb 24, 2020	Feb 25 to Mar 24, 2020
Choudhary 2021	India	Cross sectional analysis	2 hospitals	Cardiovascular disease	1,023	Dec 5, 2019 to Mar 24, 2020	Mar 25 to July 14, 2020
Das 2021	India	Cross sectional analysis	Single-site	Cancer	281	Apr 1 to June 30, 2019	Apr 1 to June 30, 2020
Deshmukh 2021	India	Cross sectional analysis	Single-site	Cancer	NR	Mar 22 to May 31, 2019	Mar 22 to May 31, 2020
Dewi 2021	Indonesia	Cross sectional analysis	Single-site	Cancer	5,412	Oct 2019 to Feb 2020	Mar to July 2020
Dharma 2021	Indonesia	Cross sectional analysis	Single-site	Cardiovascular disease	324	Mar 1 to May 31, 2019	March 1 to May 31, 2020
Hasan 2021	Bangladesh	Cross sectional analysis	Single-site	Cardiovascular disease	1,394	Jan 1 to Mar 25, 2020	Mar 25 to June 25, 2020
Hewamana 2021	Sri Lanka	Cross sectional analysis	Single-site	Cancer	1,633	Apr 1 to Dec 31, 2019	Apr 1 to Dec 31, 2020
Jayagopal 2021	India	Cross sectional analysis	7 hospitals	Cardiovascular disease	1,582	Mar 25 to July 25, 2019	Mar 25 to July 25, 2020
Kawthalkar 2021	India	Cross sectional analysis	Single-site	Cancer; Cardiovascular disease; Respiratory	NR	Feb 22 –Mar 24, 2020	Mar 25 to June 25, 2020
Kumanan 2020	Sri Lanka	Cross sectional analysis	3 hospitals	Cancer; Cardiovascular disease	NR	Mar to Apr 2019	Mar to Apr 2020
Kute 2021	India	Prospective observational study	Single-site	Nephrology	NR	2019	2020
Mallick 2021	India	Cross sectional analysis	Single-site	Cancer	10,381	Jan 1 to Mar 23, 2019	Mar 23 to May 16, 2020
Pareek 2021	India	Cross sectional analysis	Single-site	Cancer	5,258	Jan 1 to May 31 2019	Jan 1 to May 31 2020
Prajapati 2021	India	Cross sectional analysis	Single-site	Cancer	304	Mar 16 to June 30, 2019	Mar 16 to June 30, 2020
Ramakrishnan 2021	India	Cross sectional analysis	Single-site	Cancer	NR	Apr 1 to Sept 30, 2019	Apr 1 to Sept 30, 2020
Ranganathan 2021	India	Ambidirectional cohort study	41 cancer centres	Cancer	NR	Mar 1 to May 31, 2019	Mar 1 to May 31, 2020
Rangashamaiah 2021	India	Cross sectional analysis	Single-site	Cardiovascular disease	NR	Feb 11 to Mar 24, 2020	Mar 25 to May 7, 2020
Reddy 2021	India	Retrospective matched cohort study	Regional	Cardiovascular disease	NR	July to Sept 2019	Jan to June 2020
Riju 2021	India	Cross sectional analysis	Single-site	Cancer	NR	Apr 2019 to Mar 2020	Apr to June 2020
Sapkota 2021	Nepal	Prospective descriptive study	Single-site	Cancer	50	NR	1 Mar to 1 Aug 2020
Senthilkumaran 2020	India	Cross sectional analysis	12 hospitals	Cardiovascular disease	20,878	Feb 2020, Apr 2019	Apr 2020
Sharma 2021	India	Prospective mixed-quantitative methods study	30 cancer centres	Cancer	1,146	Jan 1 to Mar 23, 2020	Mar 24 to May 31, 2020
Subbiah 2020	India	Cross sectional analysis	Single-site	Cancer	10,996	Oct 2019 to Feb 2020	Mar to July 2020
Tyagi 2021	India	Cross sectional analysis	Single-site	Respiratory	203	Jan 2020	Mar 24 to Jul 23, 2020
Yalamanchi 2020	India	Cross sectional analysis	Single-site	Cardiovascular disease	845	Mar 22 to Aug 1, 2018, 2019	Mar 22 to Aug 1, 2020
Zachariah 2021	India	Emulated natural interrupted time series	187 hospitals	Cardiovascular disease	41,832	Mar 15 to June 15, 2019	Mar 15 to June 15, 2020

Table 2: Studies included in the systematic review.

NR=not reported.

Author, Year	Country	Service of interest	Control period	Pandemic period	Percentage change (95% CI)**
Akhtar 2020	India	Outpatient visits	20,822	7,973	-62
		Inpatient admissions	2,840	1,184	-58
		Surgical treatment provisions	598	410	-31
		Pharmacological treatment	4,896	2,150	-56
Basu 2020	Bangladesh	Diagnostic services	2018: 379,006	336,407	2018: -11.2
			2019: 391,531		2019: -14.1
Das 2021	India	Surgical treatment provisions	209	72	-66 (p<0.05)
Deshmukh 2021	India	Surgical treatment provisions	929	28	-97
		Pharmacological treatment	8,392	525	-94
Dewi 2021	Indonesia	Outpatient visits	5,399	1,927	-35
Hewamana 2021	Sri Lanka	Outpatient visits	1,059	977	-8 (6.2%, 9.5%)
		Inpatient admissions	574	422	-26 (22.9%, 30.3%)
Kawthalkar 2021	India	Diagnostic services	62	17	-72.6
Kumanan 2020	Sri Lanka	Pharmacological treatment	342	274	-20
Mallick 2021	India	Outpatient visits	5,291	5,090	-58
Pareek 2021	India	Outpatient visits	4,363	895	-80
		Pharmacological treatment	3,051	308	-90
Prajapati 2021	India	Outpatient visits	235	69	-70
		Surgical treatment provisions	132	66	-50
Ramakrishnan 2021	India	Inpatient admissions	796	681	-14.4
		Surgical treatment provisions	1,871	1,427	-23.7
Ranganathan 2021*	India	Outpatient visits	634,745	340,984	-46
		Inpatient admissions	88,801	56,885	-36
		Diagnostic services	398,373	246,616	-38
		Surgical treatment provisions	17,120	8,677	-49
		Pharmacological treatment	173,634	109,107	-37.5
Riju 2021	India	Outpatient visits	5,904	549	-63
		Inpatient admissions	288	35	-51.4
		Surgical treatment provisions	192	26	-86
Sapkota 2021	Nepal	Outpatient visits	NR	NR	-80
		Inpatient admissions	796	681	-50
Sharma 2021	India	Outpatient visits	797	349	-56.3
Subbiah 2020	India	Outpatient visits	4,096	2,602	-63.5
		Inpatient admissions	749	462	-61.6
		Surgical treatment provisions	1,972	1,115	-60

Table 3: Change in cancer service provision by study and patient pathway.

NR=not reported.

* Study presents a range of service utilisation and disruption measures;

** Where available, p-values and confidence intervals reported.

(n=1), paediatric (n=1), oral (n=1), blood (n=1), gastrointestinal (n=1) and head and neck (n=1) cancers.

Studies commonly reported on multiple services of interest. Eleven reported on outpatient services, of which 10 found a >40% reduction in service delivery post the onset of COVID-19 as compared to a pre-pandemic period (range 8 to 80%). Seven studies reported on inpatient admissions finding reductions ranging from 14.4 to 61.6%. To some extent, the magnitude of service reduction reported, depended on the timeline of the study. Studies that only analysed service provision during a lockdown period were likely to report higher reductions than those that covered the whole of 2020. For instance, in Bangladesh the national cervical cancer

screening program dropped 94.9% in the first month of the lockdown yet only 14.1% across the whole year.⁹

Of these 17 studies, only two reported on the impact of mitigation measures to maintain service provision during the pandemic.^{18,23} In the absence of any national guidelines in India, Mallick and colleagues prioritised radiotherapy treatment for oncology patients, continued services for patients already undergoing treatment and deferred new starts for adjuvant therapy.²³ Additionally, a staff rotation policy was implemented to ensure that human resources could be redeployed to prevent delays and deliver full services for those with the highest priority. Although outpatient consultations dropped by 58% during lockdown, more than 90% of high-priority

Author, Year	Country	Service of interest	Control period	Pandemic period	Percentage change (95% CI)**
Cherian 2020	India	Diagnostic services	186	76	-59
		Surgical treatment provisions	874	273	-55 (p <0.001)
Choubey 2021	India	Outpatient visits	54,213	13,878	-74.4 (p <0.001)
		Inpatient admissions	5,766	1,910	-66.8 (p <0.001)
		Diagnostic services	3,454	887	-74.3 (p <0.001)
		Surgical treatment provisions	4,586	1,238	-73 (p <0.001)
Choudhary 2020*	India	Inpatient admissions	1,488	pre-lockdown: 830 lockdown: 289	pre-lockdown: -45 lockdown: -81
Choudhary 2021	India	Inpatient admissions	241	782	-69
Dharma 2021	Indonesia	Inpatient admissions	208	116	-64
Hasan 2021	Bangladesh	Inpatient admissions	907	487	-46.3
Jayagopal 2021	India	Inpatient admissions	1,056	526	-50
Kawthalkar 2021*	India	Diagnostic services	73	48	-34.3
Kumanan 2020	Sri Lanka	Inpatient admissions	54.5	47.5	-13
		Diagnostic services	221	124.5	-44
Rangashamaiah 2021	India	Inpatient admissions	NR	NR	-31.0
Reddy 2021	India	Follow-up service provision	Intervention: 86%	Intervention: 78%	Intervention: -5
			Control: 74%	Control: 36%	Control: -51
Senthilkumaran 2020*	India	Surgical treatment provisions	Feb 2020: 4,068	3,341	Feb 2020: -17.9
			Apr 2019: 4,674		Apr 2019: -28.5
Yalamanchi 2020*	India	Inpatient admissions	2018: 307	216	2018: -30
			2019: 322		2019: -33
Zachariah 2021	India	Inpatient admissions	25,418	16,414	-35.4
		Surgical treatment provisions	8,855	14,738	-4
		Diagnostic services	21,176	11,973	-10.4

Table 4: Change in cardiovascular disease service provision by study and patient pathway.

NR=not reported.

* Study presents a range of service utilisation and disruption measures.

** Where available, p-values and confidence intervals reported.

cancer treatments (specifically radiotherapy and chemotherapy) were implemented as planned.

Similarly, Hewamana documented mitigation strategies used in a tertiary blood cancer centre in Sri Lanka.¹⁸ These included triaging patients via telephone prior to attendance, monitoring patients following discharge via telephone to reduce attendance, and providing prophylaxis and oral antibacterial medications to minimize presentations. Compared to same period in 2019, the number of outpatient services reduced by 8% (p=0.002, 95% CI: 6.2 to 9.5%) during the pandemic period, while inpatient admissions decreased by 26% (p=0.002, 95% CI: 22.9 to 30.3%).

Impact of COVID-19 on patient pathways for cardiovascular diseases

Fourteen studies assessed the impact of the pandemic on cardiovascular related services – 11 were conducted in India, and one each in Bangladesh, Indonesia, and Sri Lanka (Table 4). Most studies (n=10) reported on disruption to inpatient admissions, of which five found a reduction of 50% or greater (range: 13 to 81%). Four studies reported on disruption to the number of

surgeries conducted (range: 10.4 to 73%), four studies on diagnostic procedures (range: 48 to 73.4%) and one on outpatient services (74.4%).

Nine studies reported gender disaggregated data, four of which reported large discrepancies in access by gender. Two multi-site studies in India found a reduction in the proportion of women accessing cardiovascular care during the COVID-19 pandemic. Among four hospitals during lockdown the proportion of women accessing cardiovascular services reduced from 28.1 to 11%;¹² and among two hospitals patients admitted with acute heart failure during the lockdown were more commonly male (82.6 vs 71.6%; p value <0.02);¹³ Two other studies reported low levels of females patients before and during the pandemic. A cross-sectional analysis of 187 Indian hospitals reported that across 2019 and 2020 only 21.6% (9,018/41,832) of hospitalised patients with acute myocardial infarction were female;³⁷ similarly, of 324 patients undergoing primary angioplasty in a tertiary care hospital in Jakarta, Indonesia, approximately 90% were male.³⁸

Only one study examined the impact of the pandemic on the availability of condition management and follow-up services. Reddy et al (2021) examined whether

Author, Year	Country	Condition of interest	Service of interest	Control period	Pandemic period	Percentage change
Kawthalkar 2021	India	Respiratory	Diagnostic services	118	25	-78.9
Kute 2021	India	Nephrology	Outpatient visits	132,181	109,572	-20
			Inpatient admissions	7,471	5,157	-31
			Surgical treatment provisions	412	183	-56
			Pharmacological treatment	56,699	56,312	-1
Tyagi 2021	India	Respiratory	Surgical treatment provisions	174	29	-83

Table 5: Change in other service provision by study and patient pathway.

the decentralization of hypertension follow-up services improved continuity of care for hypertensive patients and helped to mitigate disruption during the pandemic.³¹ In the decentralised group, registered hypertensive patients received free medication and care from an auxiliary nurse midwife at subcentres, the most peripheral component of the primary healthcare system. In the control group, registered hypertensive patients were required to travel to the primary health centre to receive free medication and care from a nurse. During the pandemic, follow-up services under the decentralized model of care reduced by 5% compared to 51% under the centralised model.³¹

Impact of COVID-19 on patient pathways for other NCD services

Only one study, conducted in India, examined the impact of the pandemic on access to nephrology services, specifically in terms of outpatients, inpatient admissions, and kidney transplant services (Table 5). Kute et al found reported that these measures reduced by 20%, 31% and 56%, respectively, during 2020.²² Regarding respiratory services, Tyagi and colleagues reported that, in India, the number of interventional pulmonology procedures reduced by 83% from March 24 to July 23, 2020, compared with January 2020.³⁵

Discussion

This review finds that the provision of NCD services in the SEA Region was substantially affected by the COVID-19 pandemic. The provision of cancer services was consistently reported to be 50% less when compared to the pre-pandemic period including disruptions to all aspects of care, such as outpatient services, inpatient admissions, surgical procedures, and pharmacological treatments. The provision of services for cardiovascular disease was similarly impacted, with 7 out of 14 studies reporting >50% reductions in service provision. Evidence of the pandemic's impact on nephrology and respiratory services was limited yet the available information reports service reductions ranging from 20% to 83%.

Whilst some level of health service disruption is an expected impact of the COVID-19 pandemic, our findings document a magnitude of disruption potentially greater than previously postulated. A recent systematic review of disruptions in cancer care, which included studies mostly (84%) from high income countries, found reductions in hospitalization rates of up to 30% compared to the pre-pandemic period.³⁹ Our findings also highlight a potentially higher level of service disruption than that reported in large scale surveys, such as the WHO PULSE survey.^{4,5,40} For example, the first PULSE survey (2020) reported that much of the disruption to NCD services was incurred in prevention activities with reductions in inpatient services observed to be 'generally less affected', however we identified data from multiple studies in this review that highlighted substantial reduction in the use of inpatient services, as well as NCD-related surgical services.

One of the difficulties in interpreting these findings is in disentangling the effect of such disruption from supply-side and demand-side factors, the latter related to lockdowns, social distancing regulations, financial burden, and fear of infection within patient populations. Based largely on data from multiple studies in India, reductions in service provision appeared greatest when national lockdowns were first announced, which coincided with stricter restrictions, but with less COVID-19 cases.^{10-13,19,29,37} However, by the time India's first national lockdown ended in June 2020, case numbers were rapidly increasing. As a result, anticipated rebounds in patient load were limited due to continuing travel restrictions and fear of infection.¹⁰ For instance, Jayagopal et al (2021) reported a surge in patient admissions following the end of India's national lockdown in June 2020, yet this was followed by another drop in late June as the number of COVID-19 cases rapidly increased.¹⁹

It is worth noting that service utilisation by gender was rarely reported by studies. Three studies from India found reductions in access to cardiovascular services among females, contrasted with the increase in service utilisation amongst males.^{12,13,37} This aligns with evidence of gender discrimination in healthcare access in the country.^{41,42} Decision makers need to ensure that disparities in access to care, particularly by gender, are not exacerbated by the pandemic and further research is needed to track how access to services may have been

affected across sub-populations such as rural, the poor and displaced populations.

To our knowledge, this is the first systematic review to comprehensively assess the evidence base for service disruption due to COVID-19 across the SEA Region. The study design is advantageous in that it focuses on quantitative estimates of service disruption rather than commentary and qualitative assessment. As such, this review provides a much needed means of validating the enormous amount of commentary that has surrounded this topic and in informing policy responses. The systematic search also incorporates a review of the grey literature, which is important given the rapidly changing epidemiology and policy environment and the potentially slow process of academic peer review. Lastly, this review was commissioned by WHO SEARO and was conducted with a rapid turnaround time with the aim of providing real time evidence to not only support the WHO and country response to the pandemic, but also provide clear and timely guidance on research priorities.

A primary limitation of this review is the relatively limited published literature, and the retrospective design of the identified included studies, many of which were single-site studies. The nature of the pandemic and the associated extreme burden on the clinical workforce has undoubtedly had a detrimental impact on the ability and motivation of clinical academic staff to take time out of their challenging schedules to identify, analyse, write-up and publish any findings in relation to service delivery disruptions, necessarily limiting the published literature on this topic. Second, the small number of studies conducted outside of India, and the dearth of relevant studies in Bhutan, North Korea, Maldives, Myanmar, Thailand, or Timor-Leste, means that the generalisability of our conclusions to the SEA Region is extremely limited. This review searched studies published in English language only, which is a potentially important limiting factor in our ability to identify and assess all possible relevant literature across the region.

Furthermore, by adopting a regional perspective, our ability to analyse the contextual dynamics of the pandemic as it evolved in each country was limited. This is especially relevant in relation to country-specific health system configuration, quality, accessibility, and resilience, and to local policies and baseline characteristics of the provision of essential health services for the prevention, detection, treatment, and ongoing management of NCDs. We were also unable to make a comprehensive assessment of the impact of any local service protection or pandemic mitigation measures put into place over the course of the time period of interest. Only two studies provided a detailed account of mitigation measures and their subsequent impact on service disruption.^{18,23} This finding is not unique and reinforces the need for greater research to monitor the impact of mitigation strategies to reduce the impact of COVID-19 on health services.⁴³

This review raises a number of important insights in relation to the need for more robust, representative, and

timely research into the impact of COVID-19 on essential health services for NCDs across the South East Asia Region. Analysis of evidence from those numerous SEA countries absent from this review is an essential first step to recognising which services may have been most disrupted by the pandemic, and in which countries. Our findings further highlight an imbalance in research in relation to specific NCDs. This should also be rectified by comprehensive research into the impact of COVID-19 on essential services for high-burden conditions such as respiratory diseases and chronic kidney diseases, for which few studies were identified. Quantitative estimates of service disruption should be supplemented with a focus on gender and equity issues as well as local qualitative studies to understand the true nature of any service disruptions, reasons for these, and identify promising opportunities for service recovery and strengthening. As the evidence base grows, reviews such as this study should be updated to incorporate new evidence and offer a 'living' resource to inform future pandemic preparedness policy. Finally, as this review only found studies reporting on the first wave of COVID-19 in 2020, research analysing the impact of later 'waves' of COVID-19 infection would provide valuable information about the impact of subsequent waves and strains of COVID-19 on SEA populations and whether services were able to recover, and to what extent, between and post major waves of infection.

In summary, the COVID-19 pandemic has significantly disrupted the provision of essential health services for noncommunicable diseases in the South East Asia Region. This systematic review found substantial evidence of disruptions to services for cancer and cardiovascular disease, primarily in India but also including Indonesia and Sri Lanka. A small number of studies suggest ophthalmology services in India were similarly affected. Mitigation measures in response to the pandemic, such as national lockdowns and movement restrictions, were primarily responsible for reductions in service access. These reductions will likely result in delayed diagnosis, and suboptimal treatment for at least a proportion of patients and downstream effects will likely include more advanced disease.

Contributors

Conceptualisation: SJ, LD, VDRV, DP, TG; Data collection: TG, LD; Data analysis and interpretation: TG, LD, SJ; Drafting the article: TG, LD, SJ; Critical revision of the article: DP, VDRV.

Declaration of interests

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Data sharing statement

All data generated or analysed during this study are included in this published article (and its supplementary information files).

Supplementary materials

Supplementary material associated with this article can be found in the online version at doi:10.1016/j.lansea.2022.04.006.

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