

Early measures for prevention and containment of COVID-19 in the Maldives: A descriptive analysis

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Abstract

Introduction: The Maldives attracts more than one million travelers annually placing it at a high risk of imported epidemic-prone diseases; and it has one of the most congested capital cities in the world making it a conducive environment for infectious diseases. This study describes the early measures for prevention and containment of COVID-19 that contributed to delaying the pandemic entry into the country and helped contain the first wave of the outbreak in the Maldives.

Methods: This is a descriptive study of publicly available secondary data. Social media channels, websites of stakeholder agencies, developmental and technical agencies both nationally and internationally during 1st December 2019 to 30th March 2020 were analysed.

Results: The government of Maldives initiated its first public health measures as early as January and as of March 2020, levied more than two hundred interventions to combat the outbreak of COVID-19. Unlike many countries, which imposed restrictions for weeks at a stretch, Maldives applied a strategy of gradual intensification of measures, imposed localized restrictive measures compared to a national lockdown and used multiple communication mechanisms to educate and engage the community. The public-private partnerships explored were strategic in mitigating the loss of income to the tourist industry as well as in breaking the chain of transmission. Maldives delayed the entry of the pandemic into the country by about 90 days, and maintained its testing rate at fourth highest among United Nations Small Island Developing States and highest among the South East Asian countries.

Conclusion: The management of a global pandemic in a resource constrained, tourism reliant, and import-oriented vulnerable economy requires decisive leadership, collective effort of multiple stakeholders, strategic partnerships, and a precedence for public health measures over economic considerations. Further stringent measures and stricter compliancy are needed to combat community transmission of the disease.

KEY WORDS: COVID-19; Maldives; preventive measures; public health; Small Island Developing States.

Riassunto

Introduzione: Le Maldive attirano più di un milione di viaggiatori ogni anno e ciò li pone ad alto rischio di diffusione di malattie epidemiche; avere una delle capitali più congestionate del mondo li rende un ambiente favorevole per la diffusione di malattie infettive. Questo studio descrive le misure iniziali per la prevenzione ed il controllo del Covid-19 che hanno contribuito a ritardare l'ingresso della pandemia nel Paese ed hanno aiutato a contenere la prima ondata epidemica nelle Maldive.

Metodi: Questo è uno studio descrittivo di dati già resi pubblici. I canali dei social media, i website delle agenzie degli stakeholder, le agenzie tecniche e di sviluppo sia nazionali che internazionali nel periodo compreso tra il 1 Dicembre ed il 30 Marzo 2020 sono state studiate.

Risultati: Il governo delle Maldive ha iniziato a prendere le prime misure di sanità pubblica già in Gennaio ed a Marzo 2020 ha imposto più di duecento interventi per contrastare l'epidemia di Covid-19. Diversamente da molti Paesi, che hanno imposto restrizioni per settimane di fila, le Maldive hanno applicato una strategia di graduale intensificazione delle misure, hanno imposto delle misure restrittive localizzate a fronte di lockdown nazionali ed usato meccanismi di comunicazione multipli per educare e coinvolgere la comunità. Il partnership tra pubblico e private è stato strategico nel contenere la perdita di reddito per l'industria turistica così come per interrompere la catena di trasmissione. Le Maldive hanno ritardato l'ingresso della pandemia nel Paese di circa 90 giorni ed hanno mantenuto la portata dei test al quarto posto tra le isole del Pacifico facenti parte degli Small Island Developing States ed al primo posto tra i Paesi del sud-est asiatico.

Conclusione: La gestione di una pandemia mondiale in una economia vulnerabile orientata all'import, basata sul turismo e con risorse limitate, richiede una leadership decisiva, uno sforzo collettivo di diversi stakeholder, partnership strategiche, ed una precedenza per le misure di sanità pubblica rispetto a considerazioni di natura economica. Ulteriori stringenti misure ed una compliance più rigorosa sono necessarie per contrastare la trasmissione della malattia nella comunità.

TAKE-HOME MESSAGE

The early management of the COVID-19 pandemic in the Maldives, which is a resource constrained, tourism reliant, and import-oriented vulnerable economy, required decisive leadership, political commitment, collective effort of multiple stakeholders, strategic partnerships, constant communication and a precedence for public health measures over economic considerations.

Competing interests - none declared.

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Cite this article as: Suzana M, Moosa S, Rafeeg FN, Usman SK. Early measures for prevention and containment of COVID-19 in the Maldives: A descriptive analysis. J Health Soc Sci. 2020;5(2):251-264

DOI 10.19204/2020/rlym10

Received: 13/05/2020

Accepted: 26/06/2020

Published Online: 30/06/2020

INTRODUCTION

Global estimates of confirmed cases and mortality rate due to COVID-19 shows a steep exponential curve since the novel Coronavirus (SARS-CoV-2) was first detected in Hubei Province of China in December 2019. Within five months of its recognition, more than 185 countries have been affected, with more than five million confirmed cases and 328,368 deaths reported [1]. Epidemiological studies on infectious diseases have identified that flattening and spreading the epidemic curve over a long period is the ideal way to permit national health systems of all the countries to manage the burden of such disease [2, 3]. Emerging literature on COVID-19 so far has largely focused on the clinical aspects of the disease [4, 5], its epidemiological aspects [6, 7], transmission modalities [8], diagnostics [9] and treatment strategies implemented by countries, as well as predictions of the disease patterns under different prevention strategies [10]. Studies about this disease in vulnerable, resource constrained, small island settings are sparse.

The Maldives is one of the United Nations Small Island Developing States (SIDS) that earns its major income from the global travel and tourism industry. Maldives is visited by more than one million travelers annually, which places it at high risk of import of epidemic-prone diseases; and it has one of the most congested capital cities in the world with 786 persons per hectare [11], making it a conducive environment for infectious diseases. Each year, Maldives encounters a number of seasonal and viral outbreaks of diseases such as acute respiratory and acute gastrointestinal infections. With this backdrop, the government of Maldives initiated the biggest multiagency emergency operation to combat the spreading of infectious diseases since the 2004 Tsunami crisis. This study aimed at describing the early measures for the prevention and containment of COVID-19 pandemic in the Maldives, which have contributed to the delaying of the disease entry into the country, buffering the negative effects of the first wave of the outbreak in our country.

METHODS

Study design and setting

This study was a descriptive analysis of publicly available secondary data. Social media channels, websites of stakeholder agencies, universities, developmental and technical agencies, both nationally and internationally, were approached.

Data sources and measurement

Five data sources were used in our analysis. To formulate the timeline of interventions, the social media accounts (i.e., Viber, Facebook and Twitter) of the stakeholder institutions in the Maldives were followed throughout 1st December 2019 to 30th March 2020. Maldives has excessive usage of mobile phones and internet utilization rate with 246.9 mobile subscriptions per 100 people [12]. Stakeholders include the following national institutions: Ministry of Health; Health Protection Agency; Presidents' Office; Ministry of Tourism; Ministry of Education; Ministry of Gender; Ministry of Foreign Affairs; Ministry of Economic Development; Maldives Immigration and Maldivian Customs Centers; Local Government Authority; Maldives Police Service; Maldives Red Crescent; and the Public Service Media. Descriptive statistics of COVID-19, like the total number of infected cases, the number of deaths and tests per 1 million population was obtained from the website of the Worldometer [13].

To estimate the number of days averted from the first national case since the onset of COVID-19 on 8th December 2019 in Wuhan city of China, the reporting date of the first case of COVID-19 by each country was obtained from the World Health Organization situation reports of COVID-19. Data on international tourism receipts as a percentage of exports was obtained from the World Bank Data Centre. Disease surveillance data from the Maldives Health Protection Agency was used to compare outbreaks.

Quantitative variables

Except for the textual data collected for the timeline, all other variables selected for analysis were quantitative and presented as counts, days and percentages.

The unit of analysis is the country and data of the 185 countries which have reported a case of COVID-19 were included. The interventions included in the timeline were selected on the basis that they had a direct effect on the public. For example, meetings held with donor agencies were excluded while donations from partner agencies were included.

Data access and cleaning methods

Publicly accessible information on the social media accounts of stakeholder institutions, websites of The World Bank, World Health Organization, Johns Hopkins University, were used to access data. Data were imported to excel spreadsheets, cleaned and analyzed. Interventions were chronologically ordered and presented on a timeline. Descriptive epidemiological measures such as the epidemic curves and the duration to onset of disease were estimated. Possible source of bias arises in the determination of interventions that affect the public. To minimize bias the researchers independently classified the interventions and, when there was discrepancy, interventions with consensus of two researchers were used.

RESULTS

The government of Maldives initiated its fight against the coronavirus as early as in January 2020 (Figure 1).

By the end of March 2020, the government of Maldives had levied more than two hundred interventions to combat the outbreak of COVID-19. These included interventions to prevent COVID-19 ($n = 74$), contain and control the disease ($n = 98$) and measures taken to mitigate the impact of the pandemic ($n = 32$). As of March 06, 2020, the measures undertaken were primarily aimed to prevent the entry of the novel coronavirus into the country. These included screening of inbound travelers at all ports of entry, health education messages on social media

and traditional media channels, launch of hotlines for public inquiries, development of necessary guidelines and standard operating procedures for contact tracing, isolation, quarantine, testing, and press briefings carried out jointly by the Ministry of Health and the Ministry of Tourism. From the identification of the index case, containment measures were intensified. These included a structured contact tracing and monitoring exercise, deployment of trained 'Rapid Response' teams, intensified travel restrictions internationally and nationally, declaration of the state of Public Health Emergency, suspension of civil service, educational institutions, diners, cinemas, establishment of flu clinics, quarantine and isolation facilities across the country, disinfection of roads, among other.

The characteristics of the measures taken by the government of Maldives in the prevention and containment of COVID-19 in the Maldives have demonstrated a high level of planning, coordination, communication and leadership. Some of the decisive characteristics are discussed as follows.

The collaborative nature of the interventions

Maldives initiated its fight against COVID-19 by the formation of three committees; one at health sector level chaired by the Minister of Health (Health Emergency Coordination Committee, HECC), a technical advisory group (TAG) consisting of local health experts, and a third committee consisting of all stakeholder agencies (Multiagency Coordination Group, MACG) and activation of the Health Emergency Operation Centre (HEOC) for operations. These structures ensured the policy commitment required to put in place the necessary measures into action. For example, the idea and mobilization of resort islands as quarantine facilities by the Maldives government is a unique, creative and effective measure that gained international acknowledgement. This was a collaboration of the sectors of tourism, health, disaster management and the private sector.

Figure 1. Timeline of interventions levied by the government of Maldives to prevent, contain, control and mitigate COVID-19.

Date	Details
21-Jan-20	Travel advice issued for people returning from China.
22-Jan-20	Press release on steps taken to combat Coronavirus
23-Jan-20	Initiation of airport screening using thermal cameras
24-Jan-20	Health education on Corona virus
25-Jan-20	Screening at sea ports
26-Jan-20	Health education on preventive measures for 'nCov'
27-Jan-20	Health education on incubation period of 'nCov' Establishment of hotline 7377004
28-Jan-20	Press release on Coronavirus preparedness Awareness for migrants by Maldives Red Crescent on 'nCov'
30-Jan-20	Situation monitoring unit established at the Ministry of Tourism Travel restriction on China imposed Help desk established at the airport Establishment of Ministry of Tourism Hotline number
31-Jan-20	Statement on a suspected case of Coronavirus in Maldives
1-Feb-20	Initiation of contact tracing for suspected travelers Press statement on Coronavirus Health education on the transmission mode of 'nCov' Suspension of mass measles vaccination at Social Centre Established Health Emergency Coordination Committee Established Multi Agency Coordination Committee Established Technical Advisory Group Maldives Red Crescent begins community outreach work on COVID-19
2-Feb-20	Donation of 9,000 surgical masks by the Government of Japan
3-Feb-20	Isolation of suspected traveler and 7 contacts
4-Feb-20	Travel restrictions on China Public service announcements on protection from 'nCov'
5-Feb-20	Launching of new the hotline 1676
6-Feb-20	Coronavirus awareness session by K. Gaafaru Health centre/Customs service Public service announcement on ways to wear, remove and dispose masks
7-Feb-20	Awareness sessions by Lh. Atoll Hospital, Gn. Fuvahmulaku Hospital, and by Aa. Atoll Hospital
8-Feb-20	Isolation facility established at Farukolhu Fushi resort Awareness session for Ha. Atoll Hoarafushi Health Centre
9-Feb-20	Media briefing by Ministry of Economic Development for Ramadan and COVID-19
10-Feb-20	Awareness session for Hdh. Atoll Neykurendhoo School Parents
11-Feb-20	Public Announcement on limiting hospital visits Awareness session for kuramathi resort staff, and Faarufushi resort staff
12-Feb-20	New video on COVID-19 released
13-Feb-20	New research findings on Coronavirus shared among public
15-Feb-20	Daily press briefings on COVID-19 updates Continued contact tracing, home isolation, quarantine and testing
18-Feb-20	Evacuated Maldivians from Wuhan
20-Feb-20	World Health Organization donates 10 test kits for the diagnosis of 'nCov'
22-Feb-20	Screening of 3 Cruise lines
23-Feb-20	Advice for travelers to Japan, S. Korea, Hong Kong, Singapore, Thailand, Iran, Italy
25-Feb-20	Quarantine two Maldivians
26-Feb-20	Travel Restrictions on Iran
27-Feb-20	Temporary suspension of entry from selected cities of South Korea
29-Feb-20	Health education messages through social media
3-Mar-20	Travel restrictions on South Korea, Emergency drill for practitioners- stepping up preparedness for COVID-19, Established Public Health Risk Alert Levels, Establishment of the National Emergency Operation Centre at 'Dharubaaruge'

5-Mar-20	Isolation of Italian tourists with symptoms
6-Mar-20	Two Cases Positive for COVID-19: Lockdown of the resort for contact tracing and testing
7-Mar-20	Developed Standard Operating Procedures for suspected COVID-19 cases in Guest house establishments, Lockdown of 3 islands, 1 case Positive for COVID19
8-Mar-20	Maldives changes public health alert level to 'Yellow', Travel restrictions on Italy, 2 cases positive for COVID-19, Established quarantine facility at K. Atoll Vilivaru island
9-Mar-20	lockdown of 1 island for contact tracing, EIC Video messages, Minister of Health Briefs Parliament on interventions to combat COVID-19, Internet Provider 'Dhiraagu' donates phones, SIM cards and facilitates WIFI connections for disseminating health education messages, Maldives Red Crescent begins press briefing on MRC work on COVID-19, Immigration issues travel advisory to Maldives from selected countries regarding COVID-19, Prosecutor general issues an order investigation of the alleged criminal misconduct surrounding the index case of COVID-19
10-Mar-20	Travel restrictions on Bangladesh, 2 cases Positive for COVID-19
11-Mar-20	World Health Organization declares COVID-19 as a global pandemic, Lifting of temporary suspension measures from 3 islands
12-Mar-20	State of Public Health Emergency declared across the country under the Public Health Act 07/2012, COVID-19 updates on mobile phones through telephone providers 'Ooredho' and 'Dhiraagu', President addresses the nation on COVID-19 Health Protection Agency partners with 'SunBrk' to promote health education of migrants, Temporary suspension of schools
13-Mar-20	Suspension of the use of public grounds and parks, Health education on mobile phone cleaning, Suspension of tourist excursions to Greater Male region, Team of Indian Doctors and other health professionals arrive in the Maldives, Media briefing by Ministry of Education on online classes, Immigration exempts the medical report criteria for visa application
14-Mar-20	Temporary suspension of tourist check-in at Guest houses and city hotels in Greater Male region, Suspension of movement of people from resorts to other islands, Closure of all universities, colleges and other academic institutions, Restriction of entry to all passengers whose travel originates from transits through or has a 14 day travel history Maldivian Red Crescent conducts awareness at Maldives Water and Sewerage Company, Private Hospital establishes online flu clinic, Quarantine facility established on Aa Atoll. Velidhoo island India donates 3 months pharmaceuticals, Health education by Raa Atoll. Uligam, Additional quarantine facilities established with capacity of 641 persons, COVID-19 test kits arrive Maldives
15-Mar-20	Travel restrictions on Germany, Spain, France, Suspension of movement of people from resorts to other islands, Travel clinic established, Flu clinic established for migrants, Press conference on tele classes, 'Dhiraagu', 'Ooredoo' and Ministry of Education collaborates for tele classes, Maldivians residing in Philippines advised to register with the HC, Tourist support Centre established, Bank of Maldives loan scheme for tourist industry, Ministry of Health seeks retired health workers and experts, 212 million Rufiyaa allocated as contingency budget for COVID-19
16-Mar-20	Flu clinic established for locals at SenaHiya Hospital, World Health Organization donates 50 test kits which can run 5000 tests, Society for health education (SHE) conducts awareness session, Customs Maldives exempts prior chemical permit needed to import surgical masks and sanitizers. India donates essential medicine, Ease on visa application for migrant workers- medical to be submitted later, Cinema closure extended, Religious messages on COVID-19 to the public, Aasandha (government health insurance) arranges medicine availability without renewing prescriptions, Restrictions on entry to Indhira Gandhi Memorial Hospital
17-Mar-20	Formulated COVID-19 Quick Reference Guidelines, Ministry of Education launches cyber safety guidelines with parents, Initiation of Maldivian Rufiya 1billion cuts in government expenses, Passport applications accepted through email, Travel restriction on United Kingdom and Malaysia, Flu clinic established at Tree Top hospital, Released staff of Gili Lankan Fushi resort from 14day monitoring, Gender provides awareness session in Gdh Atoll Family and Child Support Center, Joint Social Media campaign on 'My responsibility' by Maldivian Red Crescent, Health Protection Agency, Maldives Immigration and Ministry of Education, Initiates online application of passports Temporary suspension of tourist check ins at guest houses and city hotels,

18-Mar-20	Legal action to be taken against those who do not follow the quarantine / isolation advice, Travel restrictions on United States of America, Gender Issues guidelines on Family and Child Support Center operations due to COVID-19, Suspension of mass prayers at mosques, Thermal cameras installed at Indhira Gandhi Memorial Hospital, 20% cut on the salaries of Parliament Members Suspension of travel to Cochin and Chennai/India, All inbound Maldivian travelers to be home isolated, Arrival of International Emergency Medical Response Team
19-Mar-20	Travel restrictions on United Kingdom, Suspension of entry of Yacht, safari, Suspension of on arrival entry visa, Suspension of inter-island transport Caution messages to people travelling to Kazakhstan, Vietnam, Egypt, Sri Lanka, United Arab Emirates, Russia, European Union, New Zealand, Ukraine, Australia, India, Malaysia, Thailand, Postponed the repayment of loans by Small and Medium Enterprises for 6mths, Public encouraged to do online purchases,
20-Mar-20	Suspension of sale and use of sheesha at restaurants, 2 patients positive for COVID-19 recovers, Released 32 staff of Kurehdhoo Island Resort from 14day monitoring, Health education on social distancing measures, Central Bank announces \$150m credit facility for local banks to combat foreign currency shortage, Closure of all spas with the exception of such establishments in resorts, Government subsidize 40% of electricity and 30% of water supply services Audio awareness messages in multiple messages broadcasted on moving vehicles
21-Mar-20	Health Protection Agency partnered with viber to bring the latest on Covid19, Suspension of all food service providers in the Greater Male region except home delivery, Ministry of Economic Development establishes special mechanism via jobcenter.mv to report any COVID-19-related employee issues, Ministry of Foreign Affairs begins evacuation of Maldivians living abroad
22-Mar-20	Quarantine of all passengers to Maldives by air except for tourists Training on enhancing capacity for critical care regarding Covid-19, Flu Clinic established in Addu City, Established psychosocial support services through 1676 hotline, Waiver of import duty on Masks, protective gloves, face shields and disinfectants. Travel advisory to Malaysia, Spain, S. Korea, Sri Lanka, Germany, Bangladesh, Iran, UK, France, Italy, Mainland China, Release of the retained passports of undocumented migrants to facilitate their return, 11 resorts turned into quarantine facilities
23-Mar-20	Disinfection of roads, Flu clinic established on ViliMale' Island, Disinfection of the International Airport, Hand washing facilities established at the fish market
24-Mar-20	Exemption of rent from food service providers to the government, Hulhule Island Hotel turned as a quarantine facility, Extension of closure of public institutions, \$10million aid by World Bank Stimulus package for businesses and entrepreneurs
25-Mar-20	Training of clinicians, health care workers on COVID-19, Ministry of Gender collects data on elderly, Suspension of on-arrival visa to the Maldives, Full scale emergency exercise conducted at Male' city to refine multi agency coordination
26-Mar-20	President addresses the nation on COVID-19 updates of new measures imposed, Extension of closure of government institutions
27-Mar-20	1 case Positive for Covid-19 - local, Yunan/China donates epidemic prevention materials, Immigration guidelines on extension of visa during COVID-19 crisis, Disinfection of roads of Male' city, Hulhumale' city, Vili Male' city and Addu city, President inspects the work of isolation facilities
28-Mar-20	Maldivians in Philippines and Bangladesh to be evacuated, Skype meetings for prisoners with family
29-Mar-20	Aid from India: 500 metric ton sugar, 990 rice metric ton, Online Schooling – Tele-classes begin, Private Hospital begins home visits for consultations, Transport Ministry opens transport over the bridge to the capital city, Receive Disaster response grant - 100,000\$
30-Mar-20	>1000 samples tested, Discounts on storage fee, demurrage fee, bonded warehousing fee for importers, Closure of cinemas and theatres, suspension of gyms and exercise classes, Completed data collection of all migrants living in Male', Control of sale of onion, eggs and potatoes, All quarantined persons to be tested before release, Telecom companies give discounts on internet
31-Mar-20	Extension of suspension of civil service institutions, Educational institutions, shops, food providers to be closed from 11pm-6am, Ban of construction work from 5pm to 6am, 97 ventilators on Covid-19 service sites, Housing Development Corporation exempts 30% of rent, Ban on tourist check-in at guest houses and city hotels, Testing of all arrivals after 14th March

The role of the security forces

As with all other disasters, the Military and the Police Services played a critical role in the prevention and containment of the outbreak in the Maldives. Establishing, equipping, staffing and the daily management of all the state quarantine facilities in the Maldives was headed by the Maldives National Defense Force (MNDF). The logistics and transport of suspected cases to and from airports, sea ports to quarantine facilities and back was an extensive operation with a total of 866 persons quarantined and tested within 3 weeks of detection of the first case [14]. As a result, among the 26 Small Island Developing States, Maldives reported the fourth highest number of tests (21,831 per 1 million population) after Bahrain, Mauritius and Singapore and the highest among the South East Asian countries (Table 1).

Trust in the local medical and health expertise

Maldives depends heavily on its donors for technical and professional assistance. However, the COVID-19 operation displayed a profound confidence on the local team of medical and public health experts, despite the novelty of the strain of the novel Coronavirus outbreak. The medical team was composed of specialists in internal medicine, respiratory medicine, emergency medicine, infectious disease and public health experts who developed 32 standard operating procedures and guidelines related to the identification, tracing, diagnosis, management and treatment of cases, 6 guidelines focusing on tourist facilities, workplace and environmental aspects, and conducted numerous Trainings of Trainers (TOTs) for urban and peripheral health care professionals, which enabled country wide consistency across health care providers. Majority of the cases were mild, two had moderate severity requiring oxygen therapy and none required ventilation; the case fatality rate by mid-May 2020 was 0.34%. The decision to quarantine all inbound travelers and the investment on contact tracing was proved to be one of the most effective and timely in-

terventions as many of them tested positive while in quarantine or under monitoring.

Constant risk communication

A clearly laid out communication strategy was one of the prime features of the COVID-19 operation in the Maldives. During an outbreak, lack of information makes populations more vulnerable to the mass panic, which can only be fought with information [15]. As early as in January 2020, awareness and education messages for the public were transmitted in multiple languages. From the onset of the operation, a high level commitment was apparent in the communication approach, while the Ministries of Tourism and Health personally briefed the press on updates and policy decisions, which was later managed by the President's Office as twice daily briefings where all the local channels were invited. Inclusion of local medical doctors and public health experts in each press briefing instilled confidence among the public. Literature has shown that pandemics of this scale can lead to misinformation, distrust, unverifiable content that may endanger public safety and undermines the response effort by governments [16, 17]. Social media accounts of all relevant government authorities and a community Viber-group created at the onset of the outbreak, which had more than 95,000 members of the public, was used as a central hub for daily updates, awareness and instructions from the government.

Prioritization of the health of the public over the detrimental effects on the economy

The Maldivian economy depends heavily on its tourism industry accounting for 28% of its Gross Domestic Product, 82% of its export receipts, and provides 60% of the foreign exchange receipts required to manage the import oriented economy [12]. The high reliance on tourism as a lifeline for economic survival makes it harder for policymakers to enforce the public health measures needed. Yet, among the countries with more than 10% of its exports dependent on tourism, Maldives has performed at par or better than countries

Table 1. Statistics of Covid-19 per 1m population among Small Island Developing States of UN and South East Asian countries of WHO by April 2020.

Country	Total cases per 1m population	Deaths per 1m population	Tests per 1m population
Small Island Developing States of UN			
Bahrain	4,354	7	146,549
Mauritius	261	8	72,955
Singapore	4,926	4	42,132
Maldives	2,119	7	21,831
Grenada	196		21,509
Barbados	306	24	13,935
Cuba	166	7	7,404
Saint Kitts and Nevis	282		7,356
Dominica	222		6,017
Bahamas	244	28	4,649
Dominican Republic	1,220	41	4,625
Saint Lucia	98		4,283
Jamaica	176	3	2,931
Belize	45	5	2,629
Trinidad and Tobago	83	6	1,944
Antigua and Barbuda	256	31	1,871
Cabo Verde	591	5	1,606
Guyana	158	13	1,549
Fiji	20		1,451
Sao Tome and Principe	1,125	32	800
Guinea-Bissau	526	2	764
Suriname	19	2	689
Timor-Leste	18		561
Papua New Guinea	0.9		269
Haiti	47	2	186
South East Asia Region of WHO			
Maldives	2,119	7	21,831
Bhutan	27		18,457
Thailand	43	0.8	4,099
Nepal	14	0.07	3,689
Sri Lanka	48	0.4	2,119
India	75	2	1,744
Bangladesh	153	2	1,177
Indonesia	68	4	743
Timor-Leste	18		561
Myanmar	4	0.1	268

Source: [13]

with no such reliance, in delaying the entry of the pandemic (90-100 days) (Figure 2). This level of prevention was achieved at the expense of the country's two largest industries. Fifty resorts had to be closed down by 25th March 2020 and fish export to Europe was suspended. Statistics show that in March 2019, 510 million Maldivian Rufiyaa (MVR) (equivalent to 33 million US dollars) was earned in tourism revenues, which gives a crude estimate of the opportunity cost of preventing Maldivians from COVID-19 [12].

Lockdown with localized restrictions

Complete lockdowns of countries and major cities inversely affect the economy especially the small businesses and entrepreneurs [18-20]. Singapore, which has demonstrated exemplary management of the disease, did not lock down the country until April 2020. Despite public pressure to lock down, the government of Maldives also applied other localized restrictive measures. These included lockdown of only islands where suspected cases were located, suspension of travel between resorts and other inhabited islands, closure of all schools, universities, colleges, other academic institutions and civil service institutions, ban on dining out at restaurants, notice for public to stay indoors, which imposed social/physical distancing and legal action was taken against people and businesses who violated the measures under the State of Public Health Emergency. As of April 15, the private sector businesses, shops, supermarkets and takeaway services were in operation. To ensure that the import-oriented economy stays afloat, mitigation measures to counter the detrimental effects on the economy were introduced one week after the first confirmed case. These included the introduction of credit facility for local banks and tourist industry, the stimulus package for businesses, subsidized electricity and water, waive of import duty on selected goods, a contingency budget of MVR 212 million and public-private partnerships. The handover of the Treetop Hospital (a privately owned tertiary hospital with a monthly cost of MVR 43 million – equivalent of 2.7 million USD dollars)

that was used as a COVID-19 isolation facility is one of such exemplary partnership.

Coordinated intensification of interventions

Table 1 shows that the measures were intensified by numerous interventions during March 2020 after the first few imported cases. Maldives changed its public health alert level to 'Yellow' and declared the state of Public health emergency. Travel restrictions were imposed on many of the affected countries namely Italy, Korea, Germany, Spain, France, USA and UK. Unlike many countries which imposed restrictions for weeks at a stretch [21], Maldives applied a strategy of gradual intensification. For example, closure of schools and civil service was extended week by week after diagnosing the status of the previous week and projections for the near future. Infectious diseases with person to person transmission modes display epidemic curves with a series of successively large peaks, which are one incubation period apart, such as the blue curve in Figure 3 which represents the outbreak of Acute Respiratory Infection in 2017 in the country. The sporadic nature of the Maldives epidemic curve at the onset of COVID-19 and the flatness of the curve in comparison to previous outbreaks is evidence of the successful effects of the extensive control measures that have been implemented by the government to break the chain of infection.

Opportunities from the natural containment measures

Evidence of association between climate indicators and COVID-19 have been observed with high temperature and high relative humidity showing significant reduction in the reproduction rate of the virus [22-24]. The geographic dispersion of the Maldives islands and the warm weather during January to March (average temperature = 85.6 F) have offered additional natural containment measures for the Maldives taskforce managing the COVID-19 outbreak. The first 13 cases were all foreigners, 5 of them were staff working at resort, in one cluster, all others were tourists vacationing in different resort islands

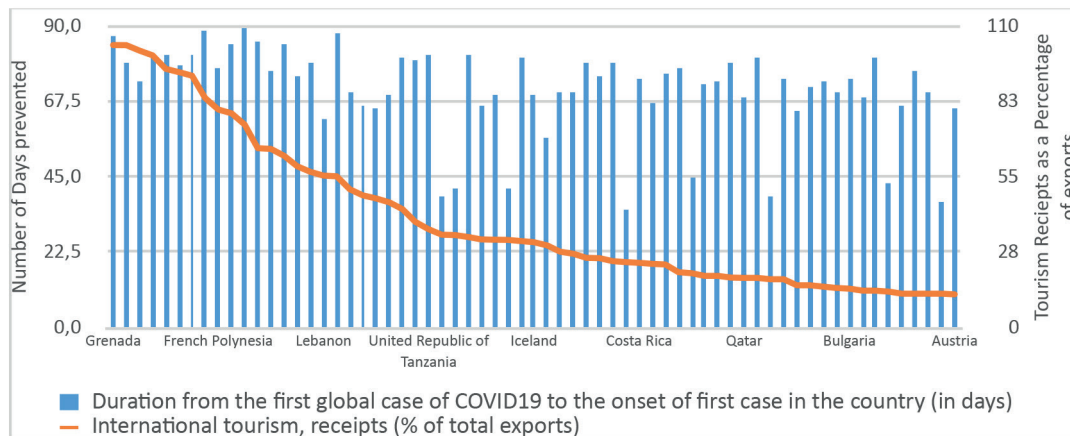
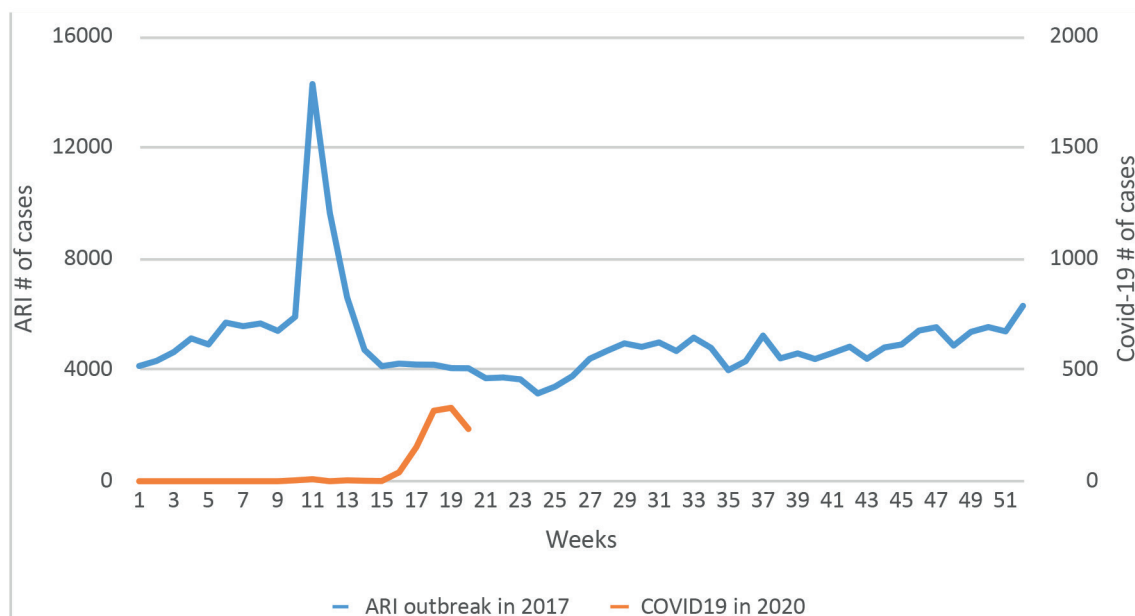


Figure 2. Days averted from the onset of the first case of COVID-19 among countries with higher than 10% of its exports dependent on tourism [Source: World Health Organization and World Bank Group, modified].



ARI outbreak with essential interventions 2017

COVID19 outbreak with intensive multiagency interventions 2020

Figure 3. Comparison of the epidemic curves of the outbreaks of Acute Respiratory Infection in 2017 and COVID-19 in 2020 [Source: Health Protection Agency of Maldives, modified].

of the country, which enabled the Rapid Response Teams to lockdown each resort separately and trace all the contacts on the island. The eleven quarantine facilities were also set up on different islands, which allowed minimal transmission. Lessons from this analysis can be applicable to similar demographic and geographic settings such as the other Small

Island Developing States (SIDS). However, this analysis is vulnerable to all the limitations relating to secondary data analysis. Data was collected from different databases with differing purposes which may lead to incomplete information, differences in measurement sources, methods and timelines. Since all the interventions implemented by the govern-

ment were not included, it may have missed on beneficial ripple effects created by some interventions. Further studies are needed on the effectiveness of the interventions and the impact of the government's interventions on specific industries as well as the economy as a whole.

CONCLUSION

Management of a global pandemic in resource constrained, tourism reliant, import-oriented vulnerable economy requires bold political will, commitment and leadership, which can achieve high levels of coordination, planning and mobilization of resources towards the operation to fight the disease. The engagement and collaboration of mul-

tipl stakeholders specifically the exemplary public-private partnerships that Maldives government explored for this outbreak are creative and proved effective in minimizing a community spread. Constant risk communication strategy used in the operation has bombarded the Maldivian population with daily updates of the disease eliminating any room for misinformation. Despite the novelty of the virus and the limited research and literature on the virus, the local medical teams have achieved low Case Fatality Rates (CFR), a high testing rate and managed a flat spread of the epidemic in the Maldives. Further stringent measures will be needed to combat the community transmission of the disease.

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