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Low uptake of COVID-19 prevention behaviours and high socioeconomic impact of lockdown measures in South Asia: Evidence from a large-scale multi-country surveillance programme

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ABSTRACT

Background: South Asia has become a major epicentre of the COVID-19 pandemic. Understanding South Asians' awareness, attitudes and experiences of early measures for the prevention of COVID-19 is key to improving the effectiveness and mitigating the social and economic impacts of pandemic responses at a critical time for the Region.

Methods: We assessed the knowledge, behaviours, health and socio-economic circumstances of 29,809 adult men and women, at 93 locations across four South Asian countries. Data were collected during the national lockdowns implemented from March to July 2020, and compared with data collected prior to the pandemic as part of an ongoing prospective surveillance initiative.

Results: Participants were 61% female, mean age 45.1 years. Almost half had one or more chronic disease, including diabetes (16%), hypertension (23%) or obesity (16%). Knowledge of the primary COVID-19 symptoms and transmission routes was high, but access to hygiene and personal protection resources was low (running water 63%, hand sanitisers 53%, paper tissues 48%). Key preventive measures were not widely adopted. Knowledge, access to, and uptake of COVID-19 prevention measures were low amongst people from disadvantaged socio-economic groups. Fifteen percent of people receiving treatment for chronic diseases reported loss of access to long-term medications; 40% reported symptoms suggestive of anxiety or depression. The prevalence of unemployment rose from 9.3% to 39.4% (P < 0.001), and household income fell by 52% (P < 0.001) during the

lockdown. Younger people and those from less affluent socio-economic groups were most severely impacted. Sedentary time increased by 32% and inadequate fruit and vegetable intake increased by 10% (P < 0.001 for both), while tobacco and alcohol consumption dropped by 41% and 80%, respectively (P < 0.001), during the lockdown.

Conclusions: Our results identified important knowledge, access and uptake barriers to the prevention of COVID-19 in South Asia, and demonstrated major adverse impacts of the pandemic on chronic disease treatment, mental health, health-related behaviours, employment and household finances. We found important sociodemographic differences for impact, suggesting a widening of existing inequalities. Our findings underscore the need for immediate large-scale action to close gaps in knowledge and access to essential resources for prevention, along with measures to safeguard economic production and mitigate socio-economic impacts on the young and the poor.

Background

South-Asia is the most densely populated region of the world (1.9 billion people, 25% of global population), with more than 98% of South Asians living in Bangladesh, India, Pakistan or Sri Lanka. In common with residents of many other lower-middle income countries (LMICs), the people of South Asia face multiple challenges, including high rates of both communicable and non-communicable disease, fragile health and education systems, food and financial insecurity, and limited formal economic or social support (Laxminarayan et al., 2017; Misra et al., 2017). Together, these characteristics are anticipated to make South Asian countries more vulnerable to major health and societal challenges such as COVID-19.

The first case of COVID-19 in South Asia was identified in January 2020, shortly before COVID-19 was declared a pandemic by the WHO (Reuters (2020) Sri Lanka, 2020). In response, Bangladesh, India, Pakistan and Sri Lanka implemented a range of highly restrictive national control measures to reduce the spread of COVID-19. This included closures of schools and non-essential workplaces, public transport bans, education campaigns for individual level behavioural interventions, isolation of symptomatic individuals, and contact tracing (Agoramoorthy, 2020; Anwar et al., 2020). However, since then more than 11.8 million cases have been detected, with over 173,500 deaths by 27th January 2021. The rate of new infections was rapidly accelerating in India up to mid-September 2020, which now still has the second highest numbers of COVID-19 cases globally, indicating that the control measures may have been less effective in the early stages of the pandemic than in other settings. However, the test of positivity rate and rate of increase in new cases has substantially lowered during mid-September and January 2021 (https://www.worldometers.info/coronavirus/). Furthermore, there is increasing evidence that national lockdowns may have adverse effects for physical and mental health, children's education, behaviours relevant to chronic disease, as well as severe social and financial consequences (Alvi & Gupta, 2020; Ceballos et al., 2020; Pieh et al., 2020; Rossi et al., 2020; Verma et al., 2020). There is an urgent need to understand how control measures can be further strengthened in South Asia, both to reduce the high rates of ongoing transmission, and to mitigate their unintended adverse consequences.

We interviewed 29,809 people participating in a long-term South Asian health surveillance study while restrictive national control measures were in place. We measured their knowledge of COVID-19, adoption of preventive practices, and impact of COVID-19 on their physical and mental health, health-related behaviours, non-communicable disease care, social circumstances, and economic well-being. The ultimate goal of the study was to inform the design and implementation of further COVID-19 prevention and control programs in South Asia.

Methods

We used our network of health surveillance sites to evaluate the impact of COVID-19 on people living in five study regions: Bangladesh, South India, North India, Pakistan, and Sri Lanka. In Bangladesh, we selected 18 rural and 12 urban surveillance sites, based on national administrative data. For rural sites, one district was randomly selected from each of the eight major administrative divisions, from which one sub-district was randomly chosen. One or more community clinics within each sub-district were randomly selected and the ward where those community clinics located were rural surveillance sites. For urban sites, one urban dispensary or community clinic was randomly selected from each of the 12 city corporations, and the mahalla (neighbourhood) in which the urban dispensary or community clinic was located was the urban surveillance site. All eligible residents in a surveillance site were invited to participate. The procedures were similar for South India (Chennai), North India (Delhi), Pakistan (Punjab province), and Sri Lanka. More details have been published elsewhere (Song et al., 2020). The surveillance sites include 52,813 South Asian men and women aged 18 years and above with comprehensive information on baseline health collected immediately prior to the COVID-19 pandemic (November 2018 to March 2020). We supplemented these baseline data with a telephone interview focussed on COVID-19, which was completed by 29,809 of the surveillance study participants, during the national lockdowns implemented between March and July 2020. The study was approved by IRBs in each country, and consent was obtained from all participants for each round of data collection.

Study settings and recruitment

Recruitment to our health surveillance study took place at 93 surveillance sites (range 2–33 per study region, 74% urban, Supplementary Table 1). Governmental census data and available household listings were used, together with house-house visits by research teams and local primary care workers, to identify (enumerate) the resident population. Resident adults (age 18 years and above) were invited to take part; exclusion criteria included current pregnancy, or serious illness expected to reduce life expectancy to less than 12 months. We worked closely with community senior members (e.g. teachers, employers, religious leaders) to support and facilitate engagement in the study. Explanations of the project's purpose were provided in writing and using videos, in relevant South Asian languages, supported by bilingual translators. Recruitment started in November 2018, and by March 2020 we had completed evaluation of 52,813 people (Bangladesh: 13,955; North India: 9469; South India: 8621; Pakistan: 5833; Sri Lanka: 14,935).

Baseline evaluation

An interviewer-administered health and lifestyle questionnaire was used to collect information on behavioural risk factors (smoking, alcohol use, physical activity and consumption of fruits/vegetables), personal and family medical history, medications, and socio-economic status. Physical measurements included: a) Anthropometry (height, weight, waist and hip circumference and bio-impedance for body fat composition); b) Blood pressure by Omron digital device; c) Cardiac evaluation by 12 lead ECG to identify arrhythmia, left ventricular hypertrophy and previous myocardial infarction; d) Retinal photography for assessment

of retinal disease, including hypertensive and diabetic retinopathy; and e). Respiratory evaluation by spirometry to assess for smoking/environment-related lung injury. Fasting glucose, and cholesterol were measured by point of care tests. Aliquots of blood and urine are stored for future molecular analyses. Equipment, protocols and training was standardised across sites (Song et al., 2020).

Follow-up COVID-19 questionnaire

As part of an integrated effort, co-ordinated by the Wellcome Trust, we developed a questionnaire aimed at assessing (i) prevalence, knowledge and uptake of behaviours relevant to COVID-19; and, (ii) impact of COVID-19 on access to healthcare, behaviours linked to non-communicable disease risk, social interactions and financial circumstances (De Silva et al., 2020). The questionnaire, available in full on our study website (www.ghru-southasia.org), included new COVID-19 questions (e.g. knowledge, practice, and symptoms) and existing questions from our surveillance/baseline evaluation (e.g. health related behaviours). We implemented the questionnaire by telephone during the national lockdown period, using a bespoke data capture tool based on KoBoToolbox, an open source data collection software. The study instruments included validated tools where these existed, for example the GAD and PHQ schema. We also built on question sets used in analogous conditions (e.g. Flu survey). The question set was developed jointly by an expert working group sponsored by the Wellcome Trust, and has been deployed across multiple cohorts, with the goal of creating interoperable datasets. We also carried out a pilot study to test the acceptability and validity of the questionnaire. The average duration of a telephonic interview was 25 min. The study team attempted to contact all 52,813 participants of our surveillance study. Training for questionnaire administration, and quality control of data collection were co-ordinated centrally.

Statistical analysis

Descriptive statistics are presented as mean (SD) or as % for continuous and categorical variables, respectively. Participants were clustered geographically in surveillance sites. To account for heterogeneity in outcomes between sites due to unobserved contextual factors, we used a multilevel modelling regression approach with random effects (intercept) at the study site level to quantify the relationships between outcomes and potential predictors such as age, gender, education, prior income, and prior chronic condition. For analyses where the baseline (pre-pandemic) and follow-up (during the pandemic) data (e.g. behaviours linked with chronic disease risk, social and financial circumstances) were available, we examined the changes between the two time points. We conducted all analyses in STATA 15.

We analysed three groups of dependent variables: (i) COVID-19 burden, knowledge and preventive behaviours of COVID-19, (ii) Impact of COVID-19 on chronic disease and behaviours linked with chronic disease risk, and (iii) Impact of COVID-19 on social and financial circumstances. The prevalence of COVID-19 was estimated from reported symptoms, such as fever and cough; knowledge was tested for disease symptoms and transmission mechanism; and preventive behaviours included washing hands, wearing masks, and following social distancing. Impact on chronic disease included running out of routine medications, symptoms of psychosocial distress (e.g. anxiety and depression), and risk factors for chronic conditions (e.g. alcohol drinking, tobacco use, physical inactivity, and inadequate diet). Current drinking is whether a person drink alcohol; tobacco use is whether a person currently smoke any cigarettes, cigars or pipes or use any snuff, chewing tobacco or betel; inadequate diet is whether a person had total serving of fruit or vegetable less than 5 servings per day; and physical inactivity is how much time a person usually spends sitting or reclining on a typical day. Finally, impact on social and financial circumstances included household income, employment, and working hours.

Results

Study population

The baseline characteristics of all 52,813 participants in our surveillance study are summarised in Supplementary Table 2. Of these, 29,809 people successfully completed the COVID-19 questionnaire (Table 1, response rate 57%), with little evidence for responder bias (Supplementary Fig. 1). Participants were 61% female, mean age 45 years, and living in Bangladesh (8,807), North India (6,152), South India (3,834), Pakistan (2,534) or Sri Lanka (8,382). Almost half of participants had at least one chronic disease, including diabetes (16%), hypertension (23%) or obesity (16%). Participants from South India and Sri Lanka were older, and had higher prevalence of diabetes, compared to other settings (P < 0.001). Cigarette smoking was highest, whilst education and indicators of socio-economic status were lowest, in Bangladesh and Pakistan (P < 0.001). The 'lockdown' control measures for each country during the survey period included major restrictions on movement outside the house, closure of schools and non-essential workplaces, and cancellation of public and religious events (Supplementary Table 3).

COVID-19: burden, knowledge and preventive behaviours

Only 1.0% of people reported the combination of fever and cough during the study period, while 4.6% reported one or more of the recognised COVID-19 symptoms (Supplementary Table 4). Testing rates were consistently low, with just 0.9% of people reporting having had a swab test for COVID-19, including <10% of people with suggestive symptoms. People with known chronic disease and with higher levels of education were 50% more likely to report suggestive symptoms, even after adjustment age, gender, education and income status (P < 0.01, Supplementary Table 5).

Awareness of COVID-19 symptoms, and of the pathways to transmission, was moderate to high for the primary components (Supplementary Table 4). Fever and cough were recognised as COVID-19 symptoms by 90.1% and 79.5% of people respectively. However only ~50% of people recognised sore throat or breathlessness, and <25% tiredness, myalgia or gastrointestinal disturbance, as being potential features of COVID-19. The proportions of people unaware that COVID-19 transmission is facilitated by contaminated surfaces, or by touching the face were high (45% and 33% respectively, Supplementary Table 4). Weaker knowledge of symptoms and transmission was more common in women, and also strongly associated with lower levels of education, lower income status and with increasing age (Supplementary Table 5; odds ratio for weaker knowledge: 2.2 (95%CI: 1.9–2.4) for age >60 years, and 2.7 (95%CI: 2.4–3.3) for no formal education, compared to youngest age group and highest education group respectively (both P < 0.001).

Knowledge of the personal preventive measures recommended to reduce transmission of COVID-19 was high in all settings (>95% for most metrics, Supplementary Table 4). However, implementation of these measures in daily life was only moderate, representing both environmental and behavioural factors (Supplementary Table 4). Approximately 50% of people did not have access to hand sanitisers or tissues, and 70% had no access to gloves. Almost 40% of participants did not have access to clean running water in the home, and 59% did not have access to a room that could be used for self-isolation of people with known or suspected COVID-19. In addition, 10% of people reported not wearing masks or following social distancing when outside, 25% went outside for non-essential reasons, and 75% of people continued to join meetings with people from across different households. Poorer access to and implementation of preventive measures was 2.9 (95%CI: 2.6–3.1) fold more common amongst women compared to men, and also more common amongst people from lower educational and financial backgrounds (all P < 0.001; Supplementary Table 5).

Table 1

Characteristics of 29,809 study participants prior COVID-19 pandemic in South Asia.

	Total		Bangladesh		North India		South India		Pakistan		Sri Lanka	
	n/mean	%/SD	n/mean	%/SD	n/mean	%/SD	n/mean	%/SD	n/mean	%/SD	n/mean	%/SD
(a) Basic characteristics												
Female (n, %)	18111	60.8%	4622	52.5%	3745	60.9%	2330	59.2%	1644	64.9%	5770	68.8%
Age (year, SD)	45.1	14.1	42.8	13.6	41.6	13.6	48.9	12.9	42.6	12.6	49.1	14.5
Household income (USD, SD)	240.0	203.9	219.2	188.7	307.9	247.9	234.0	179.4	176.6	184.7	235.3	187.7
Education (year, SD)	7.3	4.7	5.7	4.7	7.1	4.6	7.1	3.9	3.7	4.9	10.4	2.8
Employment												
Government employee (n, %)	1064	3.6%	156	1.8%	83	1.4%	95	2.4%	213	8.5%	517	6.2%
Non-government employee (n, %)	4792	16.3%	606	6.9%	1724	29.0%	1024	26.1%	163	6.5%	1275	15.4%
Self-employed (n, %)	7624	25.9%	3455	39.4%	848	14.3%	1300	33.2%	344	13.7%	1677	20.2%
Non-paid (n, %)	60	0.2%	3	0.03%	20	0.3%	17	0.4%	6	0.2%	14	0.2%
Student (n, %)	729	2.5%	157	1.8%	274	4.6%	23	0.6%	61	2.4%	214	2.6%
Homemaker (n, %)	10953	37.2%	3983	45.4%	2551	42.9%	1164	29.7%	1525	60.9%	1730	20.8%
Retired (n, %)	1116	3.8%	179	2.0%	147	2.5%	150	3.8%	41	1.6%	599	7.2%
Unemployed (able to work) (n, %)	2142	7.3%	72	0.8%	163	2.7%	117	3.0%	115	4.6%	1675	20.2%
Unemployed (unable to work) (n, %)	970	3.3%	164	1.9%	138	2.3%	32	0.8%	36	1.4%	600	7.2%
(b) Chronic diseases/clinical risk factors												
At least one (n, %)	13840	46.4%	3202	36.4%	2652	43.1%	2019	51.3%	1392	54.9%	4575	54.6%
Raised blood pressure (n, %)	6621	22.6%	1841	21.2%	1272	21.4%	816	20.8%	710	28.4%	1982	23.9%
Obese (n, %)	4844	16.3%	647	7.3%	1035	16.8%	925	23.5%	874	34.5%	1363	16.3%
Diabetes mellitus (n, %)	4642	15.8%	783	8.9%	741	12.5%	974	24.8%	414	16.5%	1730	20.8%
Raised cholesterol (n, %)	3029	10.4%	364	4.3%	333	5.6%	247	6.3%	107	4.3%	1978	23.8%
CVD (n, %)	2697	9.2%	587	6.7%	478	8.0%	123	3.1%	109	4.4%	1400	16.9%
Lung (n, %)	1470	5.0%	581	6.6%	278	4.7%	18	0.5%	28	1.1%	565	6.8%
Renal (n, %)	174	0.6%	86	1.0%	29	0.5%	20	0.5%	8	0.3%	31	0.4%
Cancer (n, %)	96	0.3%	16	0.2%	31	0.5%	2	0.1%	2	0.1%	45	0.5%
(c) Behavior/risk factors												
Current smoking (n, %)	7185	24.4%	4457	50.8%	1245	20.9%	281	7.2%	219	8.7%	983	11.8%
Current drinking (n, %)	3247	11.0%	231	2.6%	1128	19.0%	440	11.2%	2	0.1%	1446	17.4%
Body mass index (kg/m2, SD)	25.4	5.7	23.6	5.1	25.5	5.4	27.1	6.6	28.1	6.5	25.6	5.2
Systolic BP (mmHg, SD)	121.3	19.8	117.4	19.7	116.2	18.0	130.4	20.1	125.3	18.1	123.7	19.6
Diastolic BP (mmHg, SD)	76.1	12.2	73.4	11.8	73.5	11.1	83.7	12.1	82.2	11.7	75.4	11.4
N, %	29809	100%	8807	29.5%	6152	20.6%	3934	13.2%	2534	8.5%	8382	28.1%

Note: N=Sample, SD=Standard deviation, USD=United States Dollar, CVD=Cardiovascular diseases, BP=Blood pressure, mmHg = millimeters of mercury.

Impact of COVID-19 on chronic disease

Access to healthcare, including consultations, diagnostic tests and medications was compromised in all settings during the implementation of control measures (Fig. 1). Approximately 24% of people were taking one or more regular medication, amongst whom 15% reported running out of supplies. Drugs for diabetes and hypertension were most commonly affected (61% and 44% respectively). Restrictions to movement and financial pressures were identified as the primary reasons for impaired access to healthcare and medications (Supplementary Table 6). The impact on access to medication was greatest in the young (OR 1.62 [95%CI:1.17–2.64] for age 18–29 years, vs age >60 years, P < 0.001), in those with lower levels of income (OR 1.41 [95%CI: 1.14–1.84] for bottom vs top quintile of income, P < 0.001), and education (OR 1.48 [95%CI: 1.12–2.19] for no vs 13+ years education, P < 0.001), and 1.54 (95%CI: 1.12–1.95) higher amongst those with chronic disease (Supplementary Table 5).

COVID-19 also impacted behaviour patterns relevant to chronic disease (Fig. 2). Physical activity patterns deteriorated during the pandemic, with a 32% (from 3.8 h to 5.0 h) increase in sedentary time, and there was a 10% (from 70% to 77.2%) increase in the proportion of people reporting inadequate fruit and vegetable intake (both P < 0.001). Respondents reported weight loss in all study regions (average 3% from 62.5 kg to 62.1 kg, P < 0.001). The deterioration in diet and physical activity was most marked in men (Supplementary Table 5). Lower levels of education were also associated with a greater negative impact of pandemic on physical activity, but a lesser effect on diet (P < 0.001). Self-reported alcohol intake fell by 81% (from 11.0% to 2.2%), and smoking rates by 41% (from 24.4% to 14.5%) compared with pre-pandemic levels (both P < 0.001). Alcohol intake fell by 81% and

76% while tobacco use fell by 43% and 35% among males and females, respectively (Supplementary Table 7). Continued tobacco and alcohol consumption were more than five-fold higher in men than women, while continued alcohol consumption was 1.7 fold (95%CI: 1.17–2.24) more common in the most affluent quintile compared to the lowest quintile of income (both P < 0.001). If the reduction in cigarette smoking can be maintained long term, this might reduce the future risk of CVD in the population by 13%, and of lung cancer by 25% (Supplementary Table 8). Almost 40% of participants reported symptoms consistent with anxiety or depression (Fig. 3). The prevalence of anxiety and depression was higher in people aged 30–49 years, amongst people with chronic disease, and in people with lower education and income (all P < 0.05, Supplementary Table 5).

Impact of COVID-19 on social and financial circumstances

The impact of COVID-19 control measures on employment and incomes was high. Compared to pre-pandemic, the proportion of respondents unemployed increased 3.5 fold from 9.3% to 39.4% (P < 0.001). Time in work decreased by 29% (from 41.1 to 29.2 h) while household monthly income fell by 52% (from USD 240.0 to 114.4, P < 0.001, Fig. 4). The negative economic impact was greatest among younger participants, and amongst people with lower income and educational status at baseline (Supplementary Table 5). People with no formal education were 1.7 fold (95%CI: 1.53–1.97) more likely to report loss of employment, and 3.2 fold (95%CI: 2.82–3.63) more likely to report a fall in income, compared to the well-educated (both P < 0.001). About 3.2% of participants had to relocate during the lockdown; of these over 70% travelled over 100 miles to their new location (Supplementary Table 9).
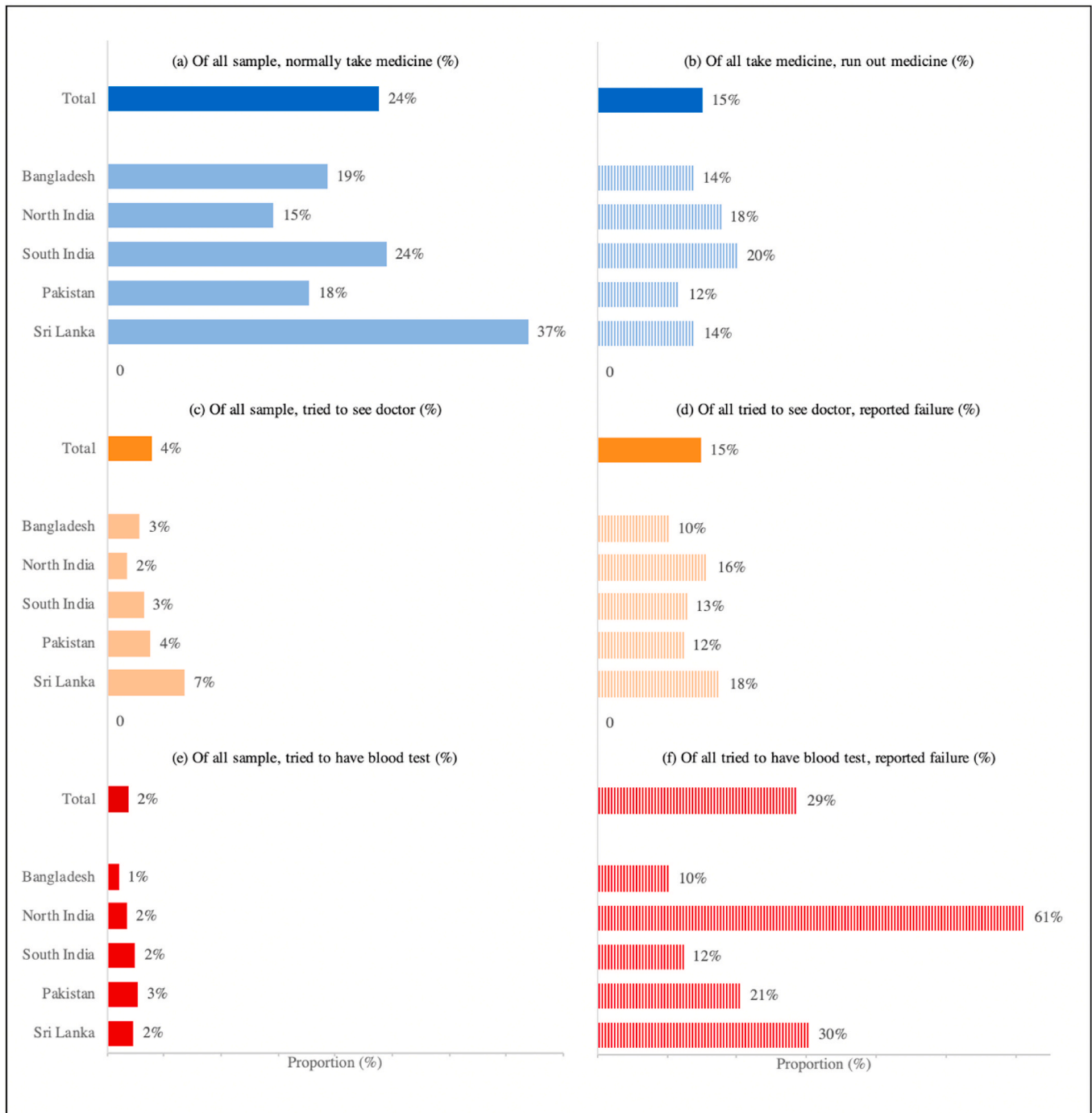
Fig. 1. Impact of COVID-19 and control measures on access to healthcare for chronic disease.

Social and financial support were heterogeneous across the regions (Supplementary Table 3). More than 50% of people in Sri Lanka reported receiving financial support. Support with supply of medications increased 45%, whilst delivery of grocery shopping almost tripled, and access to subsidized food increased more than 6-fold. Sri Lanka also had the lowest proportion of people reporting anxiety and depression. In other settings, fewer people reported receiving direct support from state or community sources (Supplementary Table 9).

Discussion

We assessed the knowledge, behaviours, health and socio-economic circumstances of 29,809 men and women, from 93 surveillance sites in four South Asian countries, during the national lockdowns that were implemented for COVID-19 between March and July 2020. Our findings provide a comprehensive assessment of the impact of COVID-19 and pandemic response measures on the health and wellbeing of South Asian
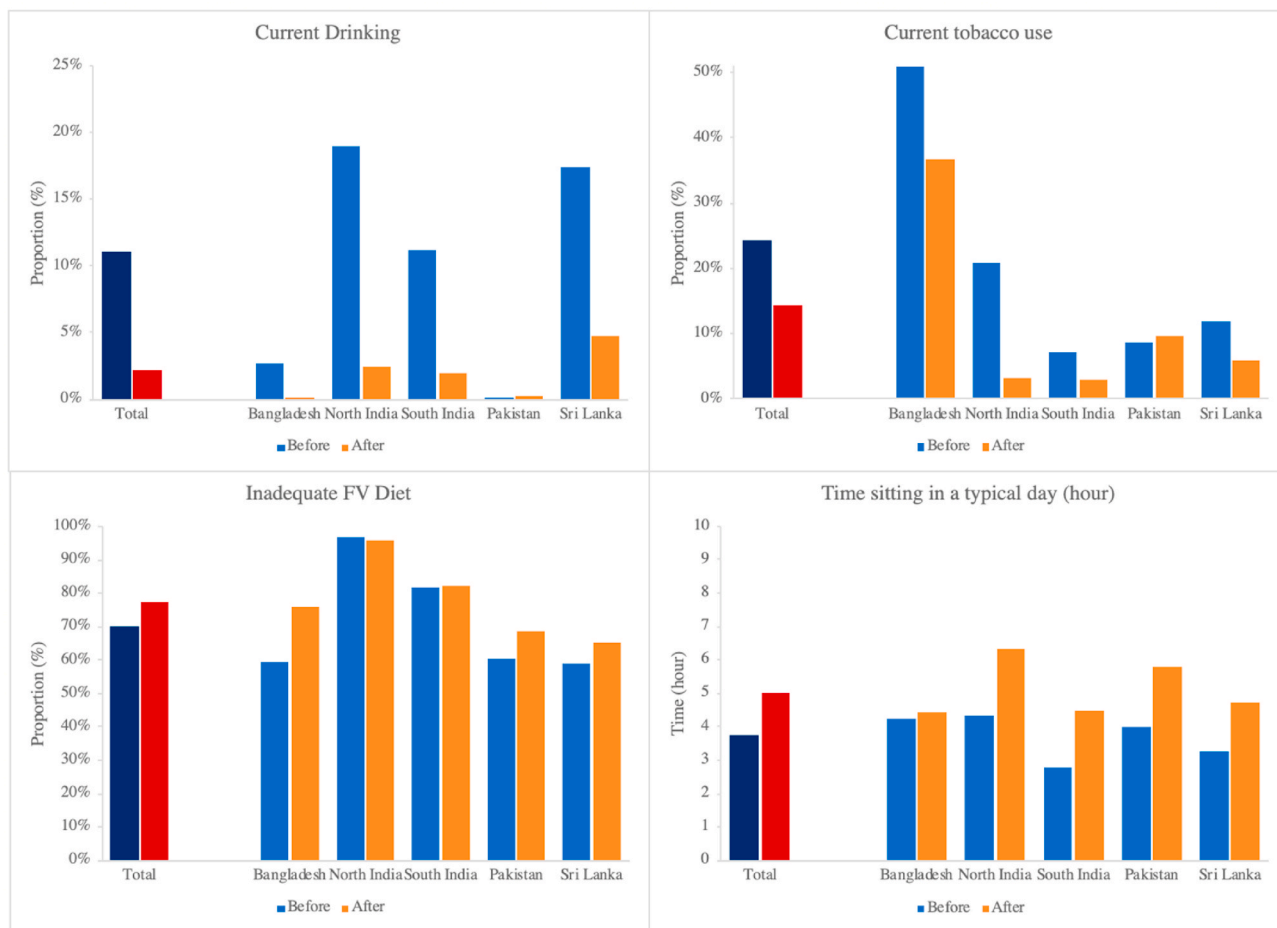
Note:

- FV=Fruit and vegetable. Currently drinking = 1 if answered yes to
- Currently drinking=1 if answered yes to the question "Do you drink alcohol?"
- Current tobacco use=1 if answered yes to either or both questions "Do you currently smoke any tobacco products daily, such as cigarettes, cigars or pipes?" and "Do you currently
- use any snuff, chewing tobacco or betel?"
- Inadequate FV diet = 1 if total serving of fruit or vegetable is less than 5 servings per day.
- Time sitting in a typical day = How much time a person usually spends sitting or reclining on a typical day.
- P-values for each of the four total comparisons (dark blue and dark red) < 0.001

**Fig. 2.** Impact of COVID-19 and control measures on behaviours relevant to chronic disease.

communities. We found that many South Asians had poor access to essential resources for personal protection, and that uptake of recommended preventive measures was low, especially among people from modest educational and socio-economic backgrounds. We also found major negative impacts of COVID-19, and pandemic response measures, on chronic diseases, mental health and household finances. Access to healthcare for chronic diseases was compromised, including consultations, diagnostic tests and medications. Employment, income, and working hours fell substantially in all settings, and these were accompanied by a high prevalence of anxiety and depression. Younger people, and people from lower socio-economic groups were impacted the most. Although tobacco and alcohol consumption fell, so too did physical activity levels and fruit and vegetable intake. Our findings identify factors likely to have fuelled the continued progression of COVID-19 in South Asia. They also highlight the unanticipated, inequitable and unsustainable impacts of COVID-19, and pandemic responses, on chronic disease management, mental health and socio-economic circumstances. Our findings can inform the design of future policies aimed at preventing further spread of COVID-19 in South Asia, and mitigating adverse socio-economic impacts, especially on vulnerable population groups.

COVID-19: burden, knowledge and preventive behaviours

The prevalence of COVID-19 symptoms in the study population was low. Our results are consistent with an assessment of flu-like symptoms amongst healthcare workers in India during the same period (Jha et al., 2020), but contrast with the findings of serology studies in Delhi and other urban South Asian settings, which indicate a high proportion of the populations tested may have been infected with COVID-19 during the lockdown (ero-prevalence st, 2020; (2020). TheR, 2020; Zaidi et al., 2020). These observations suggest that a high proportion of people in South Asia may be infected asymptomatically, in keeping with the younger age distribution of South Asian populations, compared to European or North American countries. A high proportion of individuals with asymptomatic COVID-19 represents an additional barrier to the identification and isolation of cases, underscoring the importance of molecular diagnostic assays. We note that COVID-19 testing was low during the assessment period. Although testing capacity has subsequently increased, there remain wide variations in availability, cost and uptake.

We found high knowledge for typical COVID-19 symptoms and transmission routes, positive attitudes towards preventive measures, and high adoption of hand washing with soap and water, consistent with
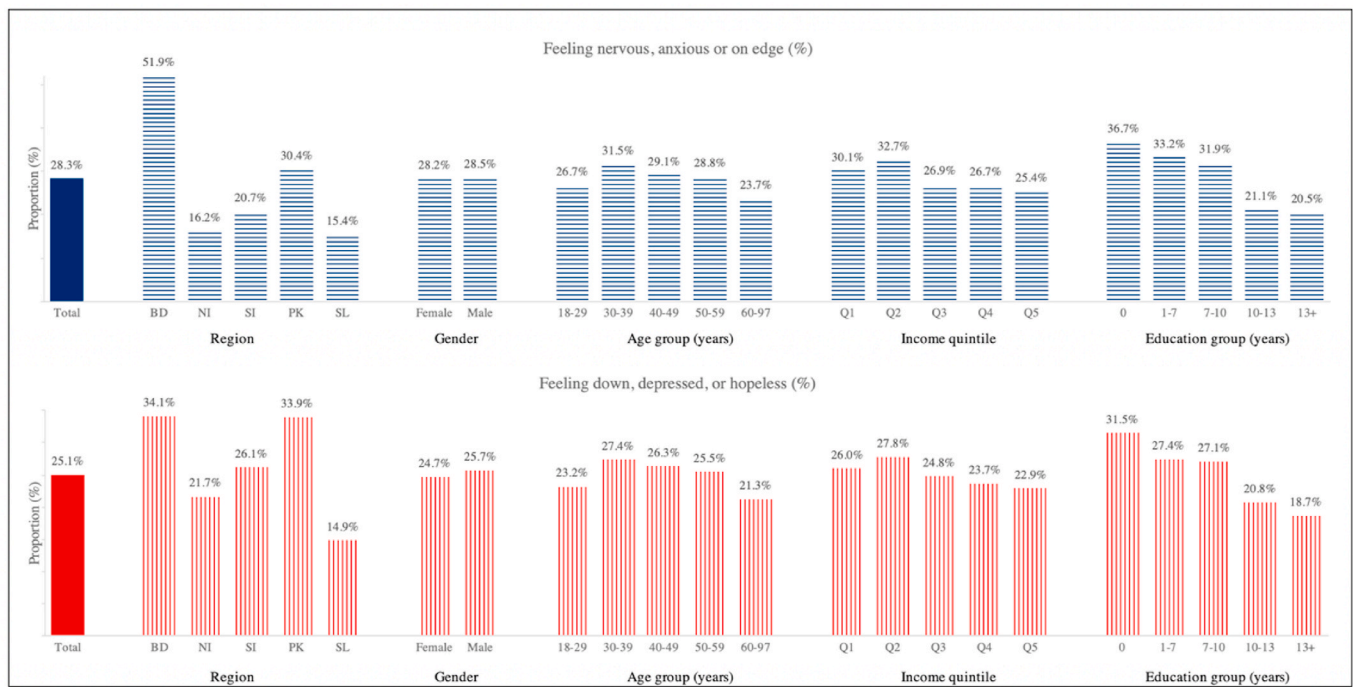
Note: BD=Bangladesh, NI=North India, SI=South India, PK=Pakistan, SL=Sri Lanka. All values are after lockdown.

Fig. 3. Measures of mental health during the COVID-19 pandemic.

previous reports (Afzal, Khan, & Qureshi, 2020; Dkhar et al., 2020; Gambhir et al., 2020). We found incomplete knowledge for atypical COVID-19 symptoms and transmission routes, and important failures in the uptake of protective measures, in particular avoiding interactions between households and non-essential out-of-home activities. While knowledge on COVID symptoms and preventive measures was high in most participants, it was lower among people from disadvantaged socio-economic groups. This is consistent with health communication strategies being effective to improve knowledge. However, we find that the uptake of many preventative measures was low, suggesting that the communication strategies were less successful in achieving behaviour change. Also, we found that uptake of protective measures is inversely related to education and socio-economic status, and also poorer amongst women and older people. A high proportion of respondents reported their households do not have access to running water, or suitable spaces for self-isolation. Our observations can contribute to explaining a continued sustained spread of the COVID-19 epidemic in some South Asian communities, and highlight the population groups that may benefit the most from further awareness raising measures and improved access to personal protection resources.

*COVID-19, non-communicable disease and healthy behaviours in South Asia*

Almost half of participants reported at least one non-communicable disease, most commonly diabetes or hypertension, conditions known to increase morbidity and mortality from COVID-19 (Basu, 2020; Ofor-i-Asenso et al., 2020). In keeping with this, COVID-19 symptoms were more common amongst South Asians reporting a chronic condition. The well documented high burden of diabetes and hypertension in South Asians is contributing to the high impact of COVID-19 in this population. (Anjana et al., 2017; Chambers et al., 2015).

Our study design, which includes an assessment of key social and health metrics both prior to and during the pandemic, enables us to quantify the impact of COVID-19 on healthcare in different population sub-groups. We found adverse impacts on routine clinical care for people

with chronic disease, reflecting a combination of reduced mobility, impaired supply of services, weakened financial circumstances and avoidance of healthcare settings (Garg et al., 2020). The impact was greatest amongst the more vulnerable in society, in particular those from lower socio-economic backgrounds. Our results expand the evidence base on the impacts of COVID-19 on access to healthcare in South Asia (Deshmukh, Naik, & Zade, R, 2020; Khader et al., 2020; Khare & Jindal, 2020; Nachimuthu et al., 2020)-(Deshmukh, Naik, & Zade, R, 2020; Khader et al., 2020; Khare & Jindal, 2020; Nachimuthu et al., 2020), making a strong case for measures to protect routine health services, increase the use of digital platforms and provide medication support. (Joshi et al., 2020).

Our baseline and follow-up data also enable an accurate assessment of the impact of the COVID-19 pandemic on health behaviours. We document a modest increase in inadequate fruit and vegetable consumption, and a more substantial increase in physical inactivity. Previous reports had shown increased carbohydrate consumption and snacking and reduced physical activity amongst Indians with type-2 diabetes during the pandemic (Ghosh et al., 2020). However, there were also steep declines in smoking and alcohol consumption in most settings. India had the highest decline in tobacco use, which might be attributed to the policy to ban sales of tobacco products when the country went into lockdown in April 2020 (Ahluwalia et al., 2020). If sustained, these might translate into a substantial reduction in the risk of chronic diseases such as cardiovascular disease and lung cancer in the population. Understanding what drove the drop in tobacco and alcohol consumption could support the development of new policies to maintain those improvements in the future, but insights will also be needed to prevent further deterioration of diet and physical activity patterns while pandemic response measures last, and to promote a return to healthy lifestyles as measures are released.

We identified a high prevalence of anxiety and depression symptoms during the study period, highest in Bangladesh. While the absence of baseline data for our participants is a potential limitation to claim impact, we note that the prevalence for anxiety and depression is reported to be <10% in South Asia (World Health Organization, 2017). In
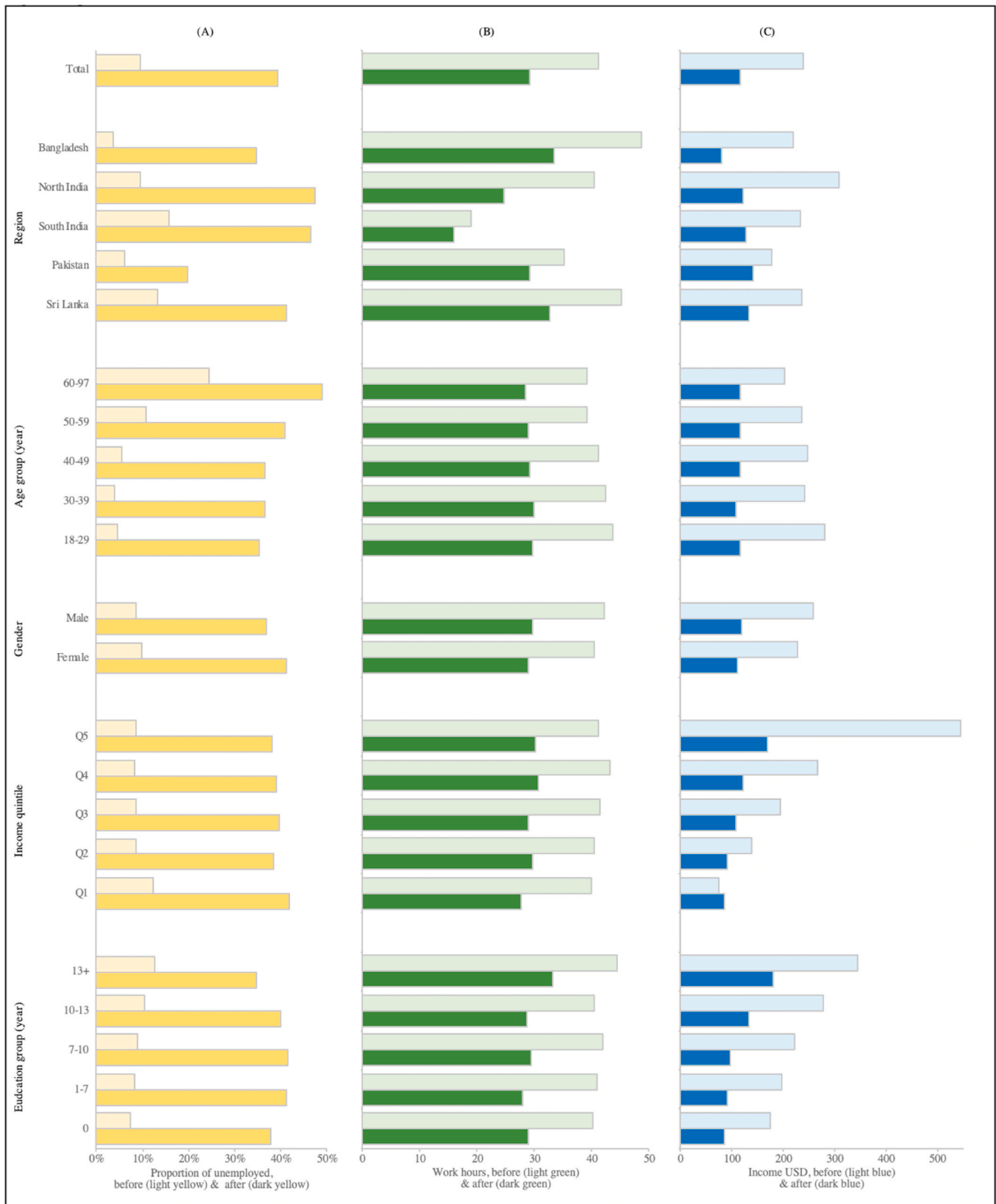
Note:
In panel A, light and dark yellow are the proportions of unemployment before and after lockdown; In panel B, light and dark green are the working hours before and after lockdown;
In panel C, light and dark blue are the income in USD before and after lockdown
P-values for each of the three total comparisons (light and dark yellow/green/blue) < 0.001

Fig. 4. Impact of COVID-19 and control measures on employment and financial wellbeing.

addition studies using the GAD and PHQ tools report that <10% of South Asians have raised test scores (Hanwella, Ekanayake, & De Silva, 2014). These observations support the view that levels of anxiety and depression were high during the control period. Also, studies in other countries have shown that the COVID-19 lockdown measures are linked and impacted mental health of the population (Pan, Kok, & Eikelenboom, 2020; O'Connor et al., 2020). By subgroup, symptoms of psychosocial distress were more common in women, and amongst people with lower income and education. All this emphasises a potential negative impact of the COVID-19 pandemic on mental health in South Asia, a region that has some of the highest suicide rates globally. (Jordans et al., 2014).

Impact of COVID-19 on social and financial circumstances

We found evidence of a high negative impact of the COVID-19 pandemic and response measures on social and economic circumstances in South Asia. We documented a substantial increase in unemployment, decreased work hours and a major reduction in household income. The adverse effects on financial circumstances were greatest for younger people, and those from less educated backgrounds. Governments throughout the world have identified the risks to economic wellbeing, and in many settings have implemented mitigation measures. Bangladesh re-opened the garment industry after just one month of lockdown; Sri Lanka implemented a national financial support system and assistance with food supplies; and India provided direct cash and food grains to protect poor people from lockdown impact due to COVID-19. However, these measures were insufficient to mitigate the tremendous impact of COVID-19 control measures on economic wellbeing. Our findings provide evidence of the scale of such impact for South Asian communities, and a strong case for robust social, organisational and fiscal measures to avoid long-lasting negative effects on the livelihoods of South Asian people.

Whilst the impacts of the COVID-19 pandemic and control measures were largely shared across the South Asian countries evaluated, there were also some differences. Smoking and alcohol consumption declined in most settings, but India had the highest decline in both, likely reflecting the ban sales of alcohol and tobacco products when the country went into lockdown in April 2020 (Ahluwalia et al., 2020). The rise in unemployment and loss of income were lowest in Pakistan, perhaps reflecting use of lighter control measures on economic activities. The impact of COVID-19 on treatment for chronic disease was also lowest in Pakistan. Baseline fruit and vegetable intake was poor in India, but did not change materially during the pandemic, perhaps reflecting the provision of nutritional support to vulnerable individuals. Elsewhere fruit and vegetable intakes were favourable at baseline, but deteriorated. Financial and social support measures were strongest in Sri Lanka, coinciding with favourable mental health and a less marked drop in income and access to chronic disease medication, compared to India and Bangladesh. Our future surveillance of the study participants will provide insights into how these changes in nutrition, economics, mental health and healthcare access impact future chronic disease outcomes.

Strengths and limitations

We have assessed the impact of COVID-19 on behaviours, health, and wellbeing in a large representative sample of South Asians from 93 sites across four countries. This brings precision and generalisability to our findings. We benefited from the existence of comprehensive data from participants collected just before the onset of the pandemic, enabling us to accurately assess people's changing situation. We used internationally validated questionnaires to ensure comparability with other studies. Although we recognise that the use of telephone surveys may introduce bias in recruitment, the characteristics of responders and non-responders were similar. Telephone surveys may also lead to response bias, however reliable baseline data collected pre-pandemic provided opportunities for validation in several instances. Our study was carried out at the height of the implementation of control measures. Restrictions varied during the study interval, and have eased subsequently. Our current cross-sectional study does not enable understanding of secular changes, or of the longitudinal relationships between the control measures and participant outcomes. However, our results provide objective evidence of the impact of control measures on the population, and can inform the design and implementation of further local or national restrictions, for COVID-19 or emerging viral pandemics.

Conclusions

Our study provides a comprehensive assessment of South Asian communities during the COVID-19 pandemic. We found a low uptake of recommended preventive measures among people from lower educational and socio-economic backgrounds, in women and in older age groups, and poor access to the resources needed for personal protection. We also found negative impacts of the pandemic on healthcare for chronic diseases, on diet and physical activity, employment and personal finances, and mental health. Impacts have been unequal, with younger people and people from lower socio-economic backgrounds impacted the most. Our results can contribute to explaining the continued progression of COVID-19 in South Asia, and provide a basis for the development of more effective, equitable and sustainable public health interventions for COVID-19 in the region.

Contributions

JCC, RMA, KIK, MKM, SJ, AK, PK, FS, DK conceived the study. RP, RBK, VM, SM, SB, MH, AAMH, MS, SS, ML AM, AT, SW, SMAS, ATR, SA, CKDS, VPR, LDS, MG, BK, IYG collected and cleaned the data. DK, RP, JCC, and FS conducted data analyses. JCC, MKM, DK, and FS drafted and ML, JSK provided inputs to the manuscript. All authors approved the final version of the manuscript.

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Declaration of competing interest

None.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ssmph.2021.100751.

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