

## **Impact of COVID-19 pandemic on Spine Surgeons: An APSS survey**

COVID-19 is an infectious disease caused by the SARS-CoV-2 virus. It was first identified in December 2009 and caused symptoms that ranged from mild cough, sore throat, and fever to severe viral pneumonia and multi organ failure. On 11 March 2020, the WHO declared the outbreak as a pandemic<sup>1</sup>. With large number of patients affected in the Asia Pacific countries such as China, Japan, Singapore and India, most governments had imposed movement restriction measures in an attempt to break the transmission chain of this disease<sup>2,3</sup>.

The disease itself coupled with these measures had led to profound worldwide social and economic impact<sup>4,5</sup>. In China, Industrial output fell 13.5% in January and February, compared with 2019. Year-on-year, fixed asset investment fell 24.5%, while private sector investment fell 26.4%. Retail sales reduced to 20.5% and the jobless rate rose to 6.2% in February, compared with 5.2% in December<sup>5</sup>. According to International Monetary fund (IMF), the current economic impact is expected to be as severe as that of Global Financial Crisis of 2009<sup>6</sup>.

For medical professionals, the large volume of patients threatens to overwhelm the resources available<sup>7,8</sup>. The strain on resources included the number of personnel required in the screening and/or treatment of suspected COVID-19 patients, to hospital inventories including ventilators, and consumable products such as personal protective equipment (PPE) for healthcare workers<sup>9,10</sup>. Although most spine surgeons are not directly involved in the treatment of COVID-19 patients during this pandemic, the burden to institutional resources would influence their clinical practices. In other medical disciplines, numerous reports on the effect of this pandemic on their patients or their practices had been published in recent months<sup>11-13</sup>.

Therefore, the aim of this this research was to investigate the impact of the COVID-19 pandemic on the clinical practices of spine surgeon within the Asia Pacific region. Other objectives of this study were to understand their concerns towards personal and family safety when carrying out their daily clinical practices.

### **Methodology**

This study was a survey carried out among spine surgeons in the Asia Pacific region. This cross-sectional survey was carried out from 4 May 2020 to 4 June 2020. The questionnaire was administered using REDCAP (Vanderbilt, Nashville, TN, USA).

#### *Survey Respondents*

222 surgeons from 19 countries completed the survey. The distribution of the number of surgeons according to their countries is illustrated in Figure 1. The highest number of respondents were from Japan. This comprised of 20.7% of the total number of respondents. This was followed by Malaysia with 38 respondents (17.1%) and India with 27 respondents (12.2%). 115 number of surveys were excluded, as they were incomplete. Respondents who did not practice spine surgery as their primary subspecialty were also excluded from the final analysis.

#### *Questionnaire*

The online questionnaire was divided into 4 sections. The first section were questions on the surgeon's demographics, background, and the type of clinical practice they were involved in at the time the survey was administered. They were also asked on the status of the pandemic in their respective countries and whether their hospital or they themselves were directly involved in the management of COVID-19 patients.

The second section included questions on the *volume* and the *type of spine surgery practice prior to the COVID pandemic*. Respondents were questioned on the number of patients in the outpatient clinic as well as the number of operations they carried out each week. They were also questioned on the type of surgeries they were normally performing; minimally invasive surgeries/ open surgeries as well as the type of conditions they treated; ranging from deformity surgery, surgery for degenerative conditions, trauma surgeries to pain intervention procedures.

The third section included questions on *the changes in their practice during the COVID pandemic*. Specifically, they were asked regarding their clinical practice during the month of April 2020. They were asked whether they were involved in elective, semi-emergency or only emergency spine surgery during the pandemic. We also documented the change in terms of the volume and the type of surgeries they performed. They were also asked on the impact of the pandemic on the volume of their outpatient clinics. The various reasons that could have led to reduction in clinic and surgical volume were also investigated.

The fourth section in the questionnaire included the respondents' concern with *the risk of COVID-19 transmission* within their families and being infected by the virus themselves. The type of questions that were administered in the survey consisted of three types. The first type of question required the respondents to input in a number or choose a number/percentage from the choices provided. The second type of question involved a stem with multiple choices whereby more than one answer could be chosen. The third type of question was a 5-point Likert scale-based questions. The respondents were required to stat their opinion ranging from *strongly agree* to *strongly disagree*.

#### *Statistical analysis*

The data obtained from the survey was entered into and analyzed using IBM SPSS ver. 23.0 (IBM Corp, Armonk, NY, USA). The distribution of categorical data was reported in numbers and percentages. Continuous data was reported as mean with its standard deviation. Comparison between categorical data was performed using the chi-square test. Fisher's exact test was used when the value within the parameter was less than 5. Comparison between continuous data was carried out using independent sample t-test. Statistical significance was set at p value < 0.05.

## **Results**

The mean age of the respondents was  $45.1 \pm 9.0$  years old (Table 1). Majority of the respondents were males (96.8%). The average number of years in practice was  $13.1 \pm 14.7$ . 42.8% were practicing in spine surgery only whereas 53.6 % and 3.6% were also practicing orthopedic surgeons and neurosurgeons, respectively. 38.9% of respondents worked in academic institutions, 28.5% worked in private institutions whereas 24.0% worked in government institutions. The number of patients seen in the outpatient clinic per week prior to the pandemic was more than 100

cases among 23.0% of respondents. Most surgeons (38.7%) operated on 11-20 patients/month prior to onset of the pandemic. Only 9.5% operated more than 30 cases/ month. Surgeries for degenerative conditions (40.3%) were the most performed followed by surgeries for traumatic conditions (14.7%). Most of the respondents' hospital (67.1%) was involved in treating COVID-19 patients and 12.6% of respondents were directly involved in the treatment of COVID-19 patients in the medical ward.

The pandemic was peaking in 5.9% of the respondents' country (Figure 2). This was in comparison with 16.2 % who felt the pandemic was plateauing and among 51.4% of respondents, they felt the number of cases were reducing. Movement restriction measures were undertaken in 85.1% of the respondents' country.

#### *Changes in clinical practice during the COVID-19 pandemic (April 2020)*

92.3% of them felt their clinical practice was affected by the pandemic. In 58.5% of respondents, the outpatient clinic hours were reduced by the hospital administration whereas in 74.6% of respondents, a similar reduction in operating theatre hours was enforced. During the pandemic, only 27.0% still performed elective surgeries, whereas 53.6% of respondents would perform semi-emergency and 71.6% would perform emergency surgeries (Figure 3).

In 123 (55.4%) respondent's hospital, COVID screening was required for all patients who were listed for emergency surgery preoperatively (Table 2). 55.4% respondents would proceed with surgery for emergency indications even when the patient was diagnosed as COVID-19 positive. However, 30.2% respondents would not proceed with emergency surgery in COVID-19 positive patients. For semi-emergency surgeries, 60.4% respondent's hospital require screening and only 42.3% respondents will proceed with surgery for positive COVID patients. For elective surgical indications, 53.2% require pre-operative screening. However, only 19.8% respondents will proceed with elective surgery in COVID-19 patients.

The mean reduction of clinic volume among all the countries in the Asia-Pacific region was 48.1% (Figure 4). In most of the countries, the clinic volume reduced by at least 30%. Taiwan experienced the lowest reduction in clinic volume (21.6%). This highest reduction in clinic volume was in New Zealand. However, there was only one respondent from this country.

There was significant reduction in the number of surgeries performed in Japan, Malaysia, India, Philippines, and South Korea for the month of April 2020 (Table 3). In Japan 29/41(70.7%) surgeons had 0-10 cases/ month during the pandemic. This was in comparison to their usual practices whereby most of them 22/46 (47.8%) had 11-20 surgeries/month. A similar trend was observed in Malaysia, India, Philippines, South Korea with most surgeons having only 0-10 surgeries during the month of April. The change in surgical volume did not reach statistical significance in Taiwan and Hong Kong.

The main reason for reduction in surgical volume was reduced patient load (Figure 5). 63.5% of surgeons agreed this was one of the reasons for reduced surgeries. 48.2% of surgeons also experienced reduction in their usual operation theatre time during the pandemic whereas 29.7% of surgeons agreed that reduction in the number of available intensive care unit (ICU) beds could

have affected their surgical volume. Inadequate blood products were only a significant factor among 18.9% of respondents.

There was a significant change in the type of cases that surgeons operated on during the pandemic (Figure 6). Prior to the pandemic, degenerative conditions constituted 39.6% of the respondents' surgeries. In contrast, trauma cases constituted 29.1% of operated cases during the pandemic whereas 26.8% of operated cases were for degenerative conditions. Deformity cases constituted only 4% of surgeries during the pandemic. There was also a significant increase in proportion of operated cases for spinal oncology and infections.

#### *Personal and family health during COVID-19 pandemic*

When we analyzed surgeon's concern regarding risk of being infected by COVID-19 virus during their clinical practice, 65.3%, 62.2% and 62.2% of surgeons were at least moderately worried of this risk when conducting clinic, ward rounds and surgery (Figure 7). However, a bigger percentage of surgeons (30.6%) were extremely worried about this risk when performing surgery. In contrast, majority of surgeons were extremely concerned about transmission of COVID-19 virus to members of their family. 41.0% were extremely worried about the risk of transmission to family members due to conducting surgery on patients.

### **Discussion**

To date, COVID-19 has infected more than 6 million patients worldwide. This outbreak had a case fatality rate ranging from 0 to 19.0%. In India, the number of infected cases is rising rapidly. As of 31<sup>st</sup> May 2020, the number of infected cases is 190609 with recorded death of 5408. In Singapore, the total cases are 34884 with 23 deaths. Japan recorded 16851 cases and 891 deaths. Malaysia accumulated to 7819 cases and 115 cases<sup>14</sup>. As of mid-April, over 50% of the global population is under lockdown<sup>5</sup>. However, by end of May the lockdown or movement control order had been eased in many countries including Japan, India, Singapore and Malaysia<sup>15-18</sup>. In contrast, Hong Kong and South Korea shows a decreasing trend in the number of new infected case despite not implementing lockdown<sup>19</sup>.

The impact of COVID-19 pandemic toward surgical practice is evident. In general surgery, most outpatient clinics were suspended, elective non-urgent and non-cancer related surgeries were stopped and certain cancers related surgeries were delayed after risk stratification<sup>20,21</sup>. In orthopaedic surgery, clinical work similarly had been scaled down and only patients who required urgent or early orthopaedic care will be attended. Many centres had their electives and non-urgent surgeries postponed or cancelled, limiting only to emergency surgeries<sup>22,23</sup>. In spine surgery, clinical practice were mainly confined to emergency surgeries or surgeries prioritizing on minimally invasive and endoscopic procedures that generally has less blood loss and requires shorter hospital stay<sup>24</sup>.

In this survey, we found that amongst the factors that led to reduction of clinical practice was due to the directive of hospital administration. Outpatient clinics hour were reduced by the hospital administration in 58.5% of respondents. Operation theatre hours were reduced by the hospital administration in 74.6% of respondents. Most of the respondent of every country had reported a reduction of outpatient clinic ranging from 21.6 % to 90% with a mean of 48.1%. Amongst the top

7 countries with the most respondents, 5 countries (Japan, Malaysia, India, Philippines, and South Korea) had significant reduction in the number of surgeries performed. Majority of surgeons would only perform emergency or semi-emergency surgeries during this period thus increasing the percentage of trauma, oncologic and infection cases with the reduction in degenerative and deformity cases.

Healthcare workers are exposed to the risk of contracting this viral infection. Their risk factors increase if they work in high risk departments, have longer duty hours, do not practice optimal hand hygiene, were not trained to handle PPE, were not wearing an N95 respirator and had severe fatigue<sup>25-27</sup>. This had impacted the psychological wellbeing of healthcare workers who are still required to continue providing their clinical services during this outbreak<sup>28-30</sup>. The fear of being infected with COVID-19 and potentially spreading it to their family members are clearly apparent. This survey found that spine surgeons were moderately worried of contracting the infection during their practice in the clinics, wards, and operation theatre. However, they were extremely worried to transmit this infection to their family members.

The main limitation was the fact that this study was merely just a survey and the data acquired may be estimates given by the respondents. We do not think that this study had much bias as most of the questions were factual data acquired from respondents on what had occurred in their clinical practice. There were no questions that had ordinal preferences that may lead to bias. Another limitation was that there was lack of participation from some countries which led to underrepresentation of this study to be generalized to all countries in the Asia Pacific region.

## **Conclusions**

We can conclude that the COVID-19 pandemic had significantly affected the clinical and surgical practice of spine surgeons in the Asia Pacific region. Clinics were closed or the practice hours reduced. Similarly, surgical theaters were closed, reduced, or limited to semi-emergency and emergency surgeries. Spine surgeons were moderately concerned of contracting COVID-19 during their clinical practice but were extremely concerned to transmit this disease to their family members.

## References

1. WHO. WHO Director-General's opening remarks at the media briefing on COVID-19], 2020 March 11. Available at: <https://www.who.int/dg/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-covid-19---11-march-2020>.
2. Samantha Kiernan and Madeleine DeVita. Travel restrictions on China due to Covid-19. A new global tracker mapping the impact of the new coronavirus on movement around the world], 2020 April 6. Available at: <https://www.thinkglobalhealth.org/article/travel-restrictions-china-due-covid-19>.
3. Chen S, Yang J, Yang W, et al. COVID-19 control in China during mass population movements at New Year. *Lancet (London, England)* 2020;395:764-6.
4. Menickella B. COVID-19 Worldwide: The Pandemic's Impact On The Economy And Markets. *Forbes*, 2020 April 8.
5. UNDP. The social and economic impact of Covid-19 in the Asia Pacific Region], 2020 April 28. Available at: <https://www.undp.org/content/undp/en/home/librarypage/crisis-prevention-and-recovery/the-social-and-economic-impact-of-covid-19-in-asia-pacific.html>.
6. Georgieva K. The Great Lockdown: Worst Economic Downturn Since the Great Depression: IMF, 2020 March 23.
7. Remuzzi A, Remuzzi G. COVID-19 and Italy: what next? *Lancet (London, England)* 2020;395:1225-8.
8. Mannelli C. Whose life to save? Scarce resources allocation in the COVID-19 outbreak. *Journal of medical ethics* 2020;46:364-6.
9. AFP. Covid-19: Medical frontliners worldwide struggling with fatigue, fear. *News Straits Times*, 2020 April 15.
10. Ranney ML, Griffeth V, Jha AK. Critical Supply Shortages - The Need for Ventilators and Personal Protective Equipment during the Covid-19 Pandemic. *The New England journal of medicine* 2020;382:e41.
11. Spinelli A, Pellino G. COVID-19 pandemic: perspectives on an unfolding crisis. *The British journal of surgery* 2020;107:785-7.
12. Pellino G, Spinelli A. How COVID-19 Outbreak Is Impacting Colorectal Cancer Patients in Italy: A Long Shadow Beyond Infection. *Diseases of the colon and rectum* 2020.
13. Søreide K, Hallet J, Matthews JB, et al. Immediate and long-term impact of the COVID-19 pandemic on delivery of surgical services. *The British journal of surgery* 2020.
14. Worldometers. Reported Cases and Deaths by Country, Territory, or Conveyance], 2020 June 02. Available at: <https://www.worldometers.info/coronavirus/?referer=app>.
15. Normile D. Japan ends its COVID-19 state of emergency. *American Association for the Advancement of Science*, 2020 May 26.
16. AFP. India extends world's largest Covid-19 lockdown. *News Straits Times*, 2020 May 17.
17. BBC. Coronavirus: The world in lockdown in maps and charts. *BBC*, 2020 April 07.
18. Tho XY. Malaysia's movement control order to be extended further until Jun 9, says PM Muhyiddin. *Channel News Asia*, 2020 May 10.
19. Lee D. Coronavirus: lockdowns are not the reason Hong Kong and South Korea are beating Covid-19. Model citizens might be. *South China Morning Post*, 2020 April 22.
20. Spinelli A, Pellino G. COVID-19 pandemic: perspectives on an unfolding crisis. *Br J Surg* 2020.
21. Tuech JJ, Gangloff A, Di Fiore F, et al. Strategy for the practice of digestive and oncological surgery during the Covid-19 epidemic. *Journal of Visceral Surgery* 2020.

22. Chang Liang Z, Wang W, Murphy D, et al. Novel Coronavirus and Orthopaedic Surgery: Early Experiences from Singapore. *J Bone Joint Surg Am* 2020.
23. Tay K, Kamarul T, Lok WY, et al. COVID-19 in Singapore and Malaysia: Rising to the Challenges of Orthopaedic Practice in an Evolving Pandemic. *Malaysian Orthopaedic Journal* 2020;14:10.5704/MOJ.2007.001.
24. Lee Ting Soh T, Loong Ho SW, Quan Yap WM, et al. Spine Surgery and COVID-19. *The Journal of Bone and Joint Surgery* 2020;Latest Articles:1.
25. Ran L, Chen X, Wang Y, et al. Risk Factors of Healthcare Workers with Corona Virus Disease 2019: A Retrospective Cohort Study in a Designated Hospital of Wuhan in China. *Clin Infect Dis* 2020.
26. Guo X, Wang J, Hu D, et al. Survey of COVID-19 Disease Among Orthopaedic Surgeons in Wuhan, People's Republic of China. *J Bone Joint Surg Am* 2020.
27. Wang J, Zhou M, Liu F. Reasons for healthcare workers becoming infected with novel coronavirus disease 2019 (COVID-19) in China. *J Hosp Infect* 2020.
28. Chen Q, Liang M, Li Y, et al. Mental health care for medical staff in China during the COVID-19 outbreak. *Lancet Psychiatry* 2020;7:e15-e6.
29. Duan L, Zhu G. Psychological interventions for people affected by the COVID-19 epidemic. *Lancet Psychiatry* 2020;7:300-2.
30. Greenberg N, Docherty M, Gnanapragasam S, et al. Managing mental health challenges faced by healthcare workers during covid-19 pandemic. *BMJ* 2020;368:m1211.

## **Figures' legend**

Figure 1. Survey respondents according to country

Figure 2: Trend of COVID-19 pandemic in survey respondents' countries

Figure 3: Type of surgery performed during pandemic

Figure 3: Reduction in outpatient clinic volume in Asia Pacific countries

Figure 4: Reasons for reduction in surgical volume

Figure 5: Distribution of the type of surgical cases before and after the pandemic

Figure 6. Personal and family concerns on the risk of being infected by COVID-19 infection



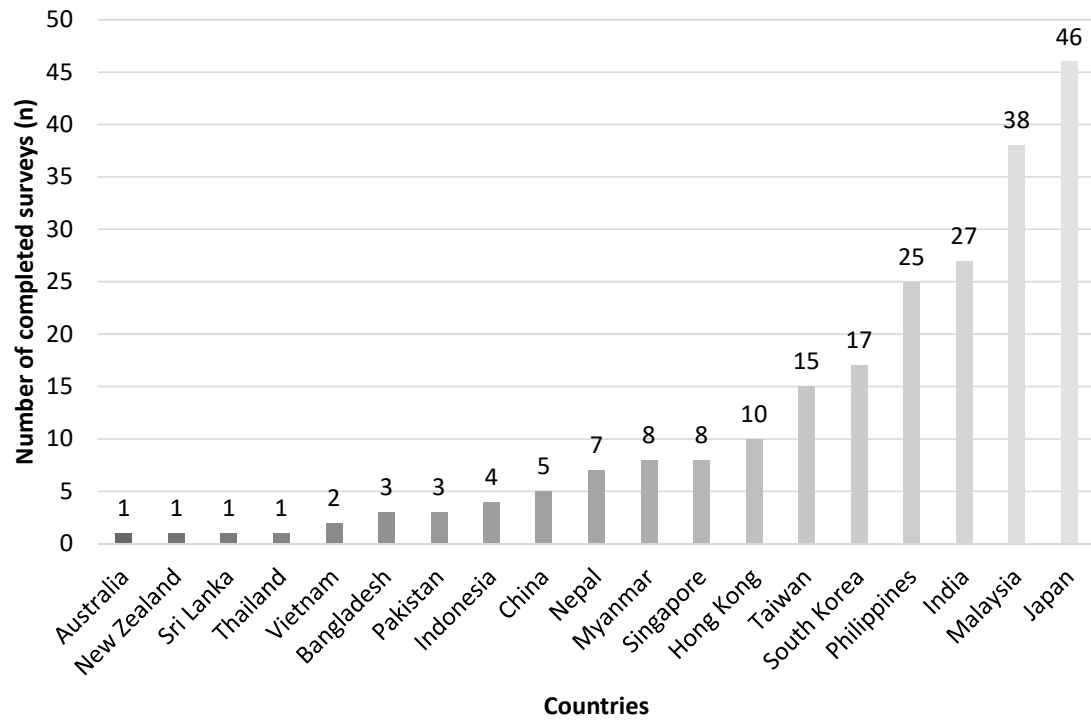


Figure 1

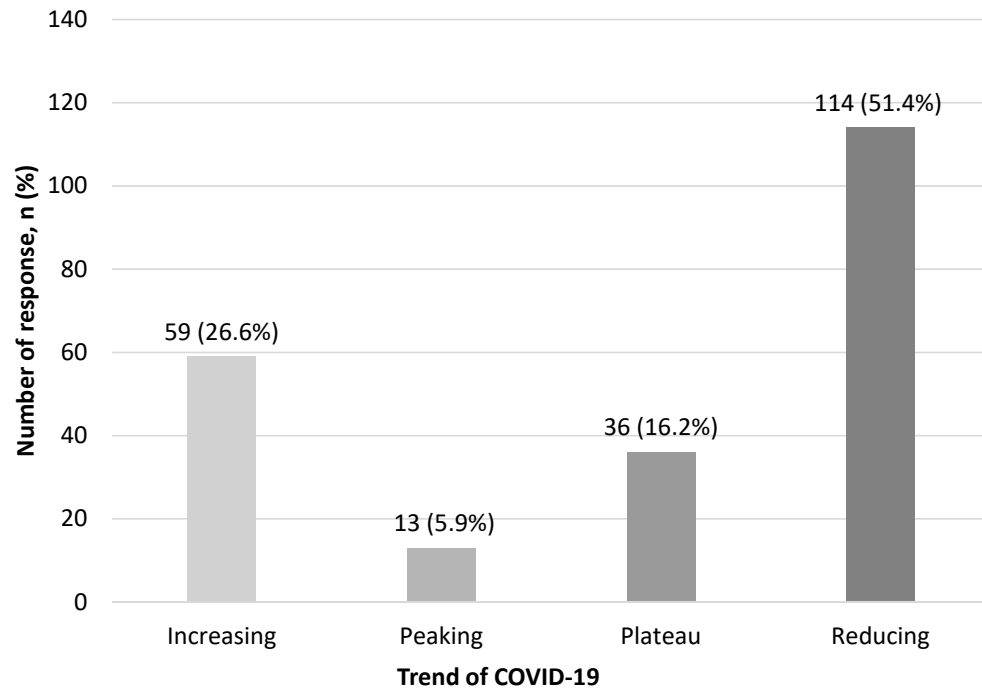


Figure 2

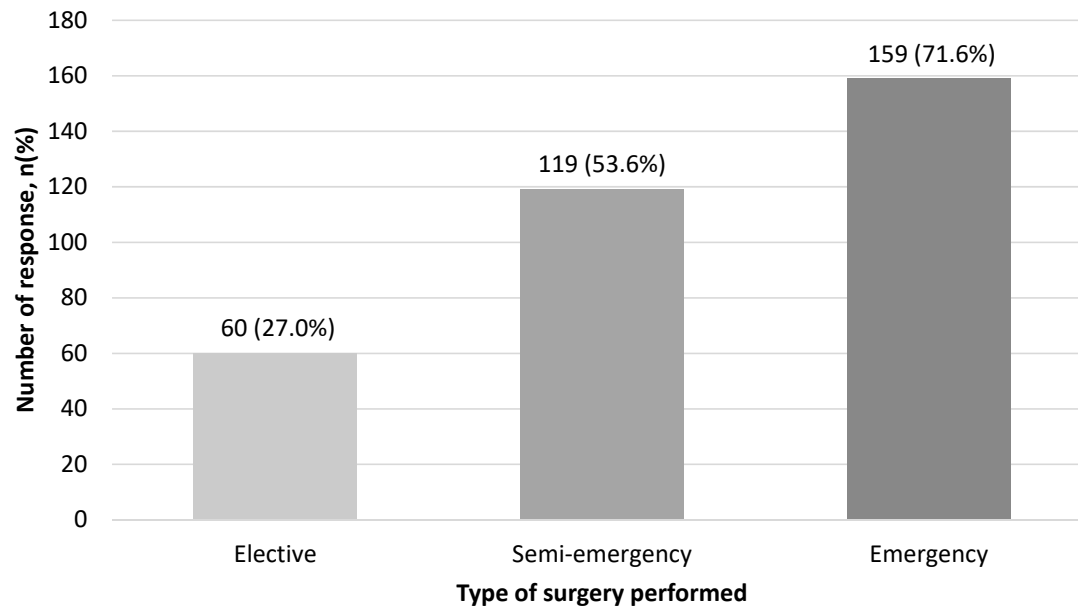


Figure 3

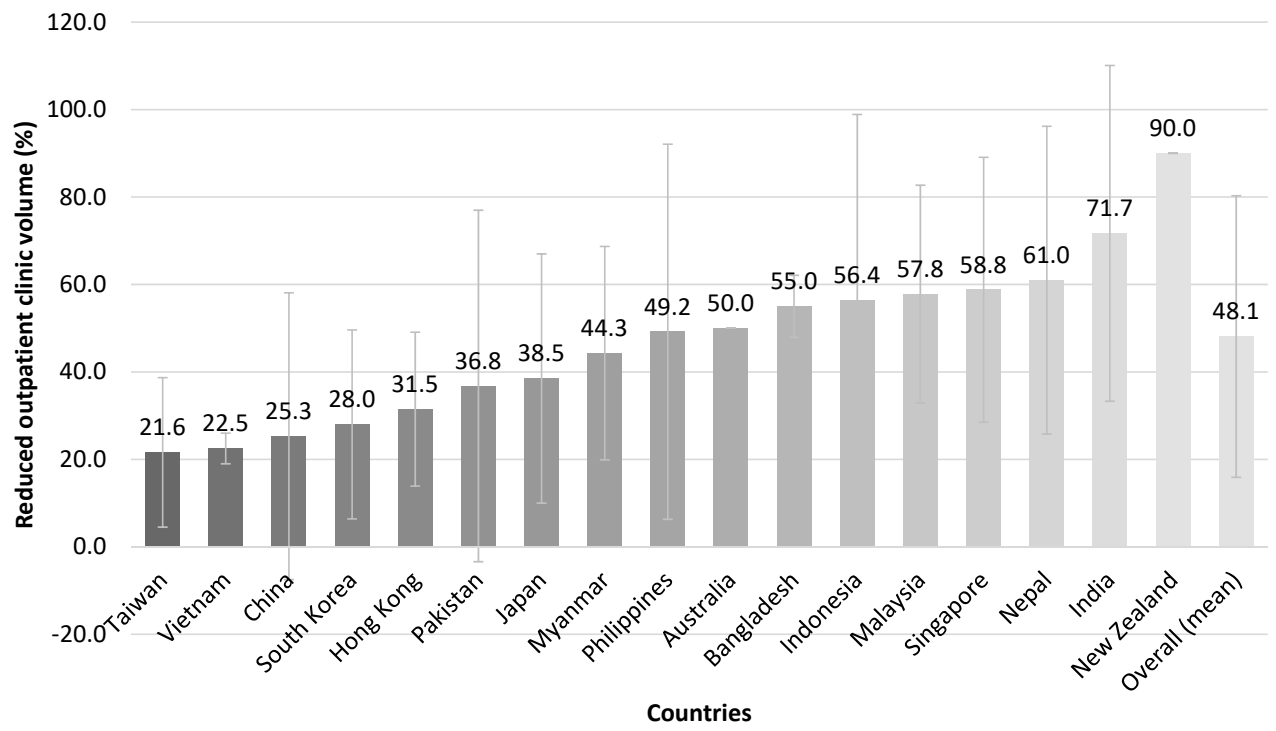


Figure 4

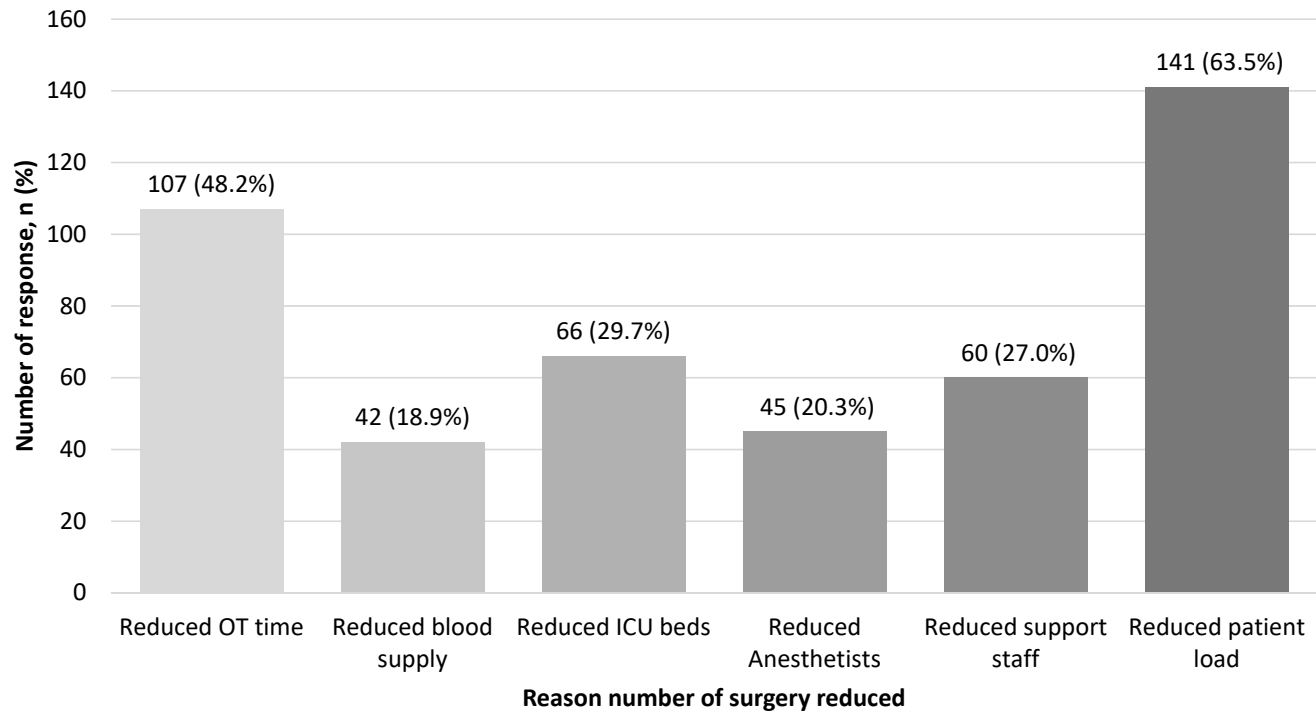


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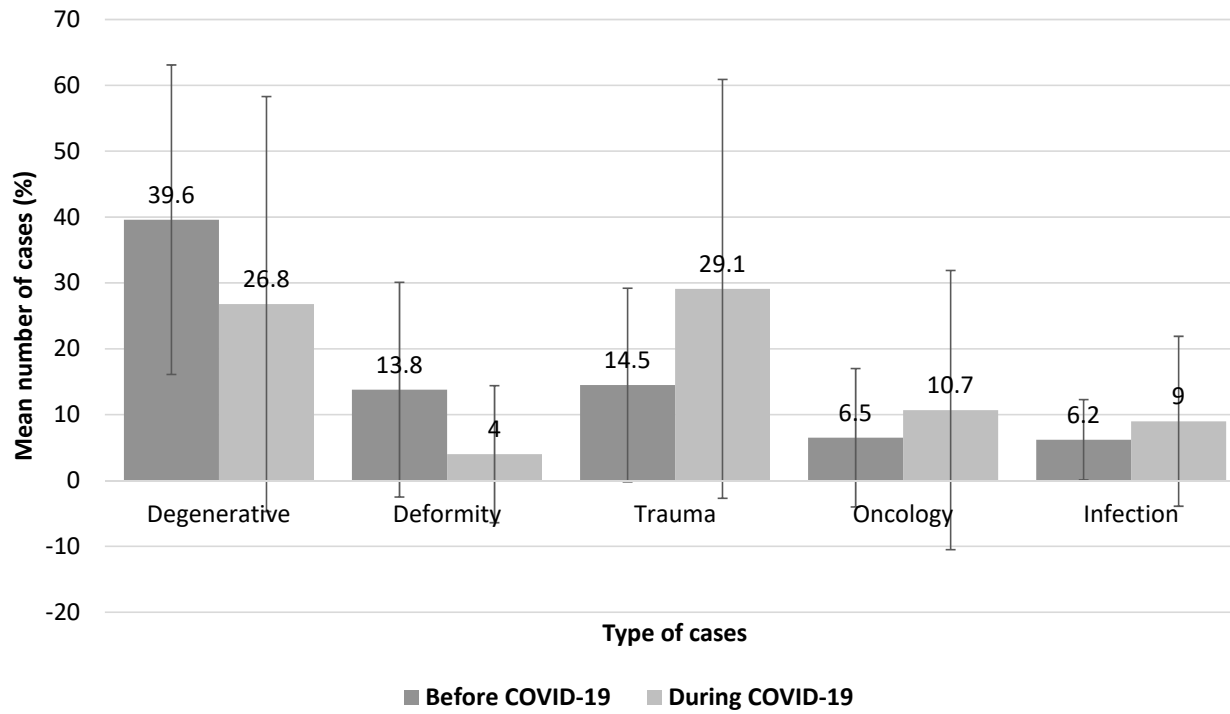


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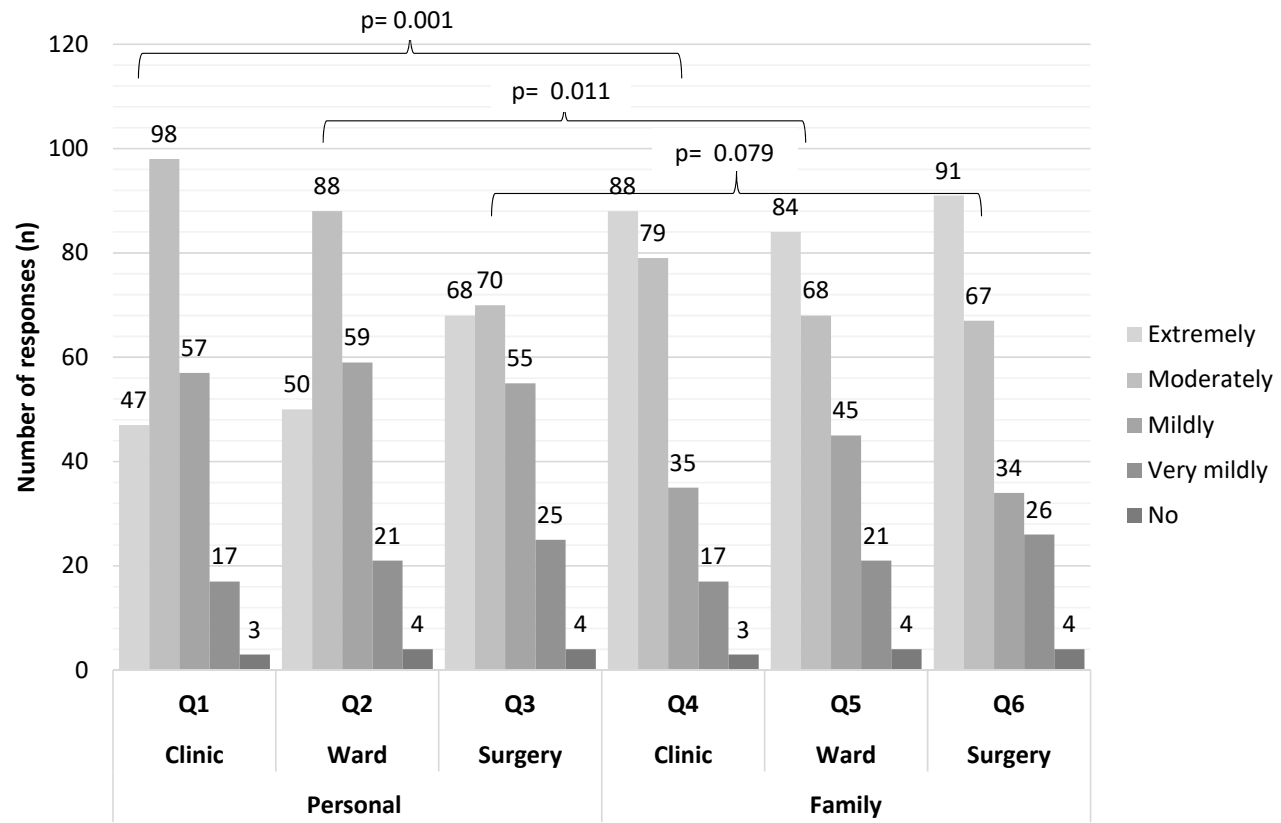


Figure 7

**Table 1: Demographic data and spine surgery practice prior to COVID-19 pandemic.**

Parameters	Mean± SD/ n(%)
Age (years old)	45.1 ± 9.0
Gender (n, %)	
Male	215 (96.8)
Female	7 (3.2)
Spine surgery experience (years)	13.1 ± 14.7
Specialty (n, %)	
Spine surgery	95 (42.8)
Orthopedic and spine surgery	119 (53.6)
Neurosurgery and spine surgery	8 (3.6)
Type of clinical institution (n, %)	
University	86 (38.9)
Government	53 (24.0)
Private	63 (28.5)
University and government	3 (1.4)
Government and private	5 (2.3)
University and private	4 (1.8)
University, government and private	7 (3.2)
Type of practice (n, %)	
Individual	78 (35.3)
Group	140 (63.3)
Individual and group	3 (1.4)
Number of patients seen in outpatient clinic/week (n, %)	
0-20	23 (10.4)
21-40	40 (18.0)
41-60	48 (21.6)
61-80	31 (14.0)
81-100	29 (13.1)
>100	51 (23.0)
Number of surgeries /month (n, %)	
0-10	78 (35.1)
11-20	86 (38.7)
21-30	37 (16.7)
31-40	10 (4.5)
41-50	4 (1.8)
>50	7 (3.2)
Type of surgery (%)	
Minimal invasive local anesthesia surgeries	7.2 ± 12.4
Minimal invasive general anesthesia surgeries without instrumentation	13.3 ± 16.4
Minimal invasive general anesthesia surgeries with instrumentation	11.1 ± 13.5
Conventional open surgeries without instrumentation	21.0± 19.1
Conventional open surgeries with instrumentation	36.8 ± 23.7
Type of cases (%)	
Degenerative	40.3 ± 23.5
Deformity	13.8 ± 16.2
Trauma	14.7 ± 14.8
Oncology	6.7 ± 10.6
Infection	6.2 ± 6.1
Pain intervention	6.9 ± 11.8
Others	1.8 ± 4.0



**Table 2: Clinical practice during pandemic COVID-19 for the month of April 2020**

Clinical practice	Yes (n, %)	No (n, %)	I am not doing surgeries (n, %)
Pre-operative COVID-19 screening for emergency surgeries	123 (55.4)	83 (37.4)	16 (7.2)
Emergency surgeries for COVID-19 +ve patients	123 (55.4)	67 (30.2)	22 (14.4)
Pre-operative COVID-19 screening for semi-emergency surgeries	134 (60.4)	65 (29.3)	23 (10.4)
Semi-emergency surgeries for COVID-19 +ve patients	94 (42.3)	103 (46.4)	25 (11.3)
Pre-operative COVID-19 screening for elective surgeries	118 (53.2)	67 (30.2)	37 (16.7)
Elective surgeries for COVID-19 +ve patients	44 (19.8)	144 (64.9)	34 (15.3)

**Table 3: Number of surgeries performed before and during COVID-19 stratified by country**

Country	Number of cases	Before COVID-19 (%)	During COVID-19 (%)	P value
<b>Japan</b>	<b>0-10</b>	34.8	70.7	0.003
	<b>11-20</b>	47.8	17.	
	<b>&gt;20</b>	17.4	12.2	
<b>Malaysia</b>	<b>0-10</b>	28.9	92.1	<0.001
	<b>11-20</b>	52.6	7.9	
	<b>&gt;20</b>	18.4	0.0	
<b>India</b>	<b>0-10</b>	18.5	96.2	<0.001
	<b>11-20</b>	37.0	0.0	
	<b>&gt;20</b>	44.4	3.8	
<b>Philippines</b>	<b>0-10</b>	64.0	100.0	0.004
	<b>11-20</b>	28.0	0.0	
	<b>&gt;20</b>	8.0	0.0	
<b>South Korea</b>	<b>0-10</b>	17.6	63.6	0.023
	<b>11-20</b>	52.9	36.4	
	<b>&gt;20</b>	29.4	0.0	
<b>Taiwan</b>	<b>0-10</b>	46.7	69.2	0.248
	<b>11-20</b>	20.0	23.1	
	<b>&gt;20</b>	33.3	7.7	
<b>Hong Kong</b>	<b>0-10</b>	60.0	90.0	0.121
	<b>11-20</b>	40.0	10.0	

\*Only countries with responses more than 10 are included