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ORIGINAL ARTICLE

Hepatology Research

Effect of COVID-19 on hepatitis B and C virus countermeasures: Hepatologist responses from nationwide survey in Japan

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Abstract

Aim: Achieving hepatitis B virus (HBV) and hepatitis C virus (HCV) elimination requires continuous and sustained high volumes of diagnosis and treatment, which have been affected by the ongoing COVID-19 pandemic. This study assessed the effects of COVID-19 on hepatitis-related services in Japan and compared Japan's situation with a global survey.

Methods: We conducted an online cross-sectional questionnaire survey of hepatologists from the Japan Society of Hepatology from August to October 2021 by using the same questionnaire from which a survey was conducted globally to address the effects of COVID-19 on hepatitis-related services. Hepatologists responded based on own impressions of their affiliated institutions.

Results: In total, 196 hepatologists participated from 35 prefectures including 49.5% in managerial positions. Approximately 40% survey participants reported a 1%–25% decline in HBV and HCV screening and confirmatory testing. In addition, 53.6% and 45.4% reported no decline in HBV and HCV treatment initiation, respectively. Comparing any level of decrease with the global survey, there was less of a decline observed in Japan for screening (HBV: 51% vs. 56.3%, HCV: 51% vs. 70.9%) and treatment initiation (HBV: 32.7% vs. 52.4%, HCV: 41.8% vs. 66%). However, patient anxiety/fear (67.4%) and loss of staff due to COVID-19 (49.0%) were reported as challenges for resuming services to pre-COVID-19 levels.

Conclusion: Although in Japan all-inclusive decline in HBV- and HCV-related services were lower than in other countries, a greater decline was observed in HBV and HCV screening and diagnosis than in treatment initiation. Prolonged anxiety/fear

Abbreviations: COVID-19, Coronavirus disease 2019; HBV, hepatitis B Virus; HCC, hepatocellular carcinoma; HCV, hepatitis C virus; JSH, Japan Society of Hepatology; SARS-CoV-2, severe acute respiratory syndrome coronavirus 2; WHO, World Health Organization.

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among patients, and loss of staff and facilities from the COVID-19 response activities must be addressed to achieve elimination of hepatitis by 2030.

KEYWORDS
COVID-19, effect, HBV, HCV, Japan, response

INTRODUCTION

In 2016, the World Health Organization (WHO) set goals to eliminate hepatitis B virus (HBV) and hepatitis C virus (HCV) by 2030. Achievement of these goals requires a substantial scale-up of HBV and HCV screening and treatment, which is sustained over time.[1,2] In Japan, since 1995–2000, HBV and HCV have been recognized as major health problems particularly among those born before the adoption of routine hepatitis B vaccination of infants and recipients of blood and blood products before routine screening of the blood supply.[3] As for the viral hepatitis countermeasure, several initiatives have been adopted by government such as free HBV and HCV testing and screening among people ≥40 years old and a medical expense subsidy system for antiviral treatment of HBV and HCV under the Basic Act on Hepatitis Measures (2010).[3–6] In addition, the National Campaign Project for Hepatitis Measures (2013) for awareness and a routine three doses of hepatitis vaccine to all infants (2017) contributed to gradual decreases in the incidence and prevalence of HBV and HCV infections.[7,8] Indeed, until 2020, Japan was moving in the right direction to achieve HBV and HCV elimination by 2030.[9–11]

Unfortunately, on December 31, 2019, China reported 27 cases of a new viral infection with an unknown etiology in Wuhan City of Hubei Province.[12] On February 11, 2020, this disease was officially named coronavirus disease 2019 (COVID-19), caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2).[13] The virus quickly spread within China and to 24 additional countries, where in Japan the first case was detected on January 15, 2020.[14] On March 11th, 2020, the World Health Organization (WHO) Director-General officially declared COVID-19 as a pandemic. The COVID-19 pandemic hampered routine functions of the healthcare system, including access to HBV and HCV treatment, care, and prevention.[15–21] In 2020 (August–December), the Coalition for Global Hepatitis Elimination, a program of The Task Force for Global Health, conducted a global survey on the impact of COVID-19 on the interruption of HBV and HCV prevention, testing, treatment, and care.[22] The survey results highlighted a decline in HBV and HCV screening, confirmatory and baseline evaluation testing, and treatment across countries. Survey respondents were from 44 countries. However, Japan was not represented. Besides, several studies have been performed related to COVID-19 and liver disease[23–26] but, to our knowledge, there is no study on the impact of COVID-19 on HBV- and HCV-related services in Japan.

This study assesses the impact of COVID-19 on hepatitis prevention, testing, and treatment in Japan, and to understand the situation in Japan compared with other countries in the global survey. This survey was conducted by the Ministry of Health, Labour and Welfare (MHLW) Hepatitis Policy Research Project (Epidemiology Group, Expansion Group, and Hepatitis ICT Group) and the Task Force for Global Health, in cooperation with the Japan Society of Hepatology (JSH).

METHODS

Survey design

This study was an analytic cross-sectional questionnaire developed in Microsoft Forms. The questionnaire was adapted from the Task Force for Global Health survey.[22] In total, 46 questions aimed to assess the impact of the COVID-19 pandemic on access to HBV and HCV services and the response of programs in service delivery (Supplementary Table 1). The survey areas included (i) delivery of HBV- and HCV-related services during COVID-19, (ii) challenges to resuming services to pre-COVID-19 levels and COVID-19 mitigation strategies, (iii) clinical involvement in the response to COVID-19, and (iv) the potential benefits of the COVID-19 response on the hepatitis system (Figure 1).[22] Several questions were added, modified, and rearranged based on the Japanese context for each survey area. Electronic versions of the questionnaire were developed in both English and Japanese.

Targeted participants of the survey were medical doctors (hepatologist) affiliated with the JSH, which was established in 1959. The questionnaire web link was disseminated by JSH to members via e-mail as well as advertised on the official JSH website. Besides dissemination by the JSH, authors also sent 30 invitations about the survey to the head of regional core centers for the treatment of hepatitis in all prefectures and the members of MHLW Hepatitis Policy Research Project (Epidemiology Group, Expansion Group, Hepatitis ICT Group) by e-mail. The survey was open from August 24, 2021 to October 03, 2021 (40 days). During our survey period, the fifth wave of COVID-19 was ongoing in Japan.

Survey analysis

Microsoft Excel for Microsoft 365 MSO (Version 2112 Build 16.0.14729.20254) was used to store survey responses. Statistical analyses were conducted using JMP15.0.0 software (SAS Institute Inc., Cary, NC, USA). Descriptive analyses of background characteristics of participants and responses were conducted; frequencies and percentages were calculated and reported. Chi-squared tests were performed to compare data between the Japan survey and global survey,[22] and $p < 0.05$ was regarded as statistically significant.

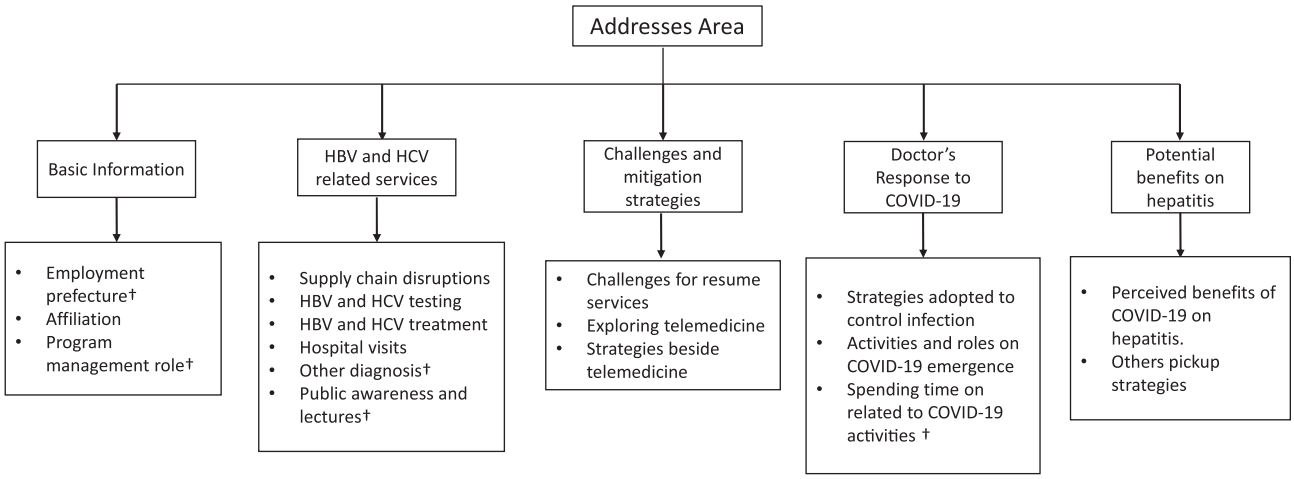


FIGURE 1 Questionnaire designed to assess the impact and response of coronavirus disease 2019 (COVID-19) on hepatitis B virus (HBV) and hepatitis C virus (HCV). Shows the areas addressed by our cross-sectional questionnaire survey and key points of the questionnaire. The questionnaire was similar to the global survey but on highlighted (†) sections some questions were erased and the Japan perspective was added

Ethical consideration

This cross-sectional survey received ethics approval for data collection and analysis. The ethics committees for epidemiological research at Hiroshima University waived the need for further informed consent, as no patient or patient health information was collected, and approved the study (approval number, E-2530). All study activities were performed in accordance with relevant guidelines and regulations.

RESULTS

Survey respondents

In total, 196 medical doctors (hepatologists) affiliated with the JSH responded. Participants were from 35 of the 47 prefectures of Japan (Figure 2). Among participants, 52.6% were affiliated with university hospitals, 27.6% public hospitals, 14.3% private hospitals, 3.6% clinics, and 1.0% from government agencies and other institutions (Table 1). About half of the respondents (49.5%) held managerial positions related to liver disease or hepatitis control at their institution. Hepatologists responded based on their experiences of own institutions.

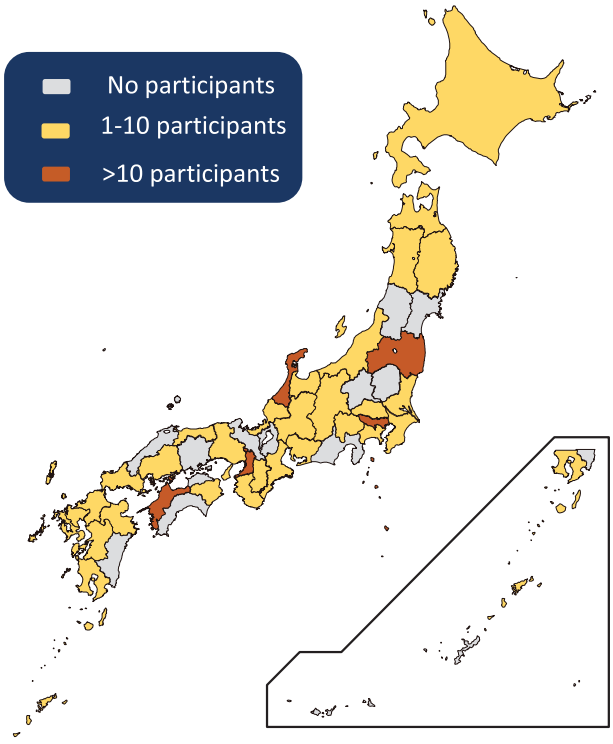


FIGURE 2 Distribution of participants by prefecture. Represents the distribution of 196 medical doctors from the Japan Society of Hepatology (JSH) by prefecture in Japan. Gray color prefectures represent no participants, yellow color prefectures represent 1–10 participants and orange color prefectures >10 participants

Hepatitis B and C virus related screening, confirmatory testing, and treatment

Declines were noted at nearly every stage of HBV and HCV screening, diagnosis, and treatment during the months of highest COVID-19 impact, compared with pre-COVID-19 levels. Decreased levels in HBV and HCV screening and confirmatory testing were greater than declines in treatment. A 1%–25% decline in screening rates was reported by 38.8% for HBV and 39.8% for HCV while 8.7% and 7.7% reported a decrease of 26%–50%, respectively. For HBV and HCV confirmatory testing, 43.9% and 43.4% reported between a 1% and 25% level of patient volume decline, respectively. In

TABLE 1 Affiliated facility/institution types of participating medical doctors from the Japan Society of Hepatology (JSH)

Participant's affiliation	*N*	%
Public hospital	54	27.6
Clinic	7	3.6
University hospital	103	52.6
Private hospital	28	14.3
Government agency	2	1.0
Others	2	1.0
Total	196	100

comparison, 28.1% and 32.1% participants reported a 1%–25% decrease in HBV and HCV treatment. About 40% of participants reported a 1%–25% decrease in volume of patients for monitoring in HBV and HCV treatment. However, 60.7% of medical doctors reported no decline in sustained virologic response 12 for HCV treatment (Figure 3).

No major supply chain disruption related to HBV and HCV was noticed. Syringe-injection equipment (7.1%) was reported as supply chain disruption during the COVID-19 period. On others (free description), mask, disinfection equipment and PPE (18.9%), and sedatives and drugs (4.6%) were reported as disruption of the supply chain during COVID-19. Unfortunately, 11.7% of respondents indicated that during the survey period supply chain disruptions remained ongoing. In addition, 73.5% participants responded that program management meetings related to hepatitis were canceled during the COVID-19 pandemic in Japan.

Other services deferred during COVID-19

The majority of respondents reported delays in imaging for the diagnosis of all types of liver disease, including hepatocellular carcinoma (HCC) (65.8%), lab testing (68.4%), HCC screening (55.1%), and gastrointestinal endoscopy (87.2%) during the COVID-19 pandemic. As part of public awareness and lectures, 38.8% of clinicians reported that nutritional guidance on diet for patients in hospital were deferred as well as 55.6% liver disease-related lectures for patients and the public during the month of the greatest impact of COVID-19 (Table 2).

For HCC-related services, 26.0% and 25.5% of clinicians reported a decline of between 1% and 25% in patient volumes receiving HCC treatment and monitoring of patients with HCC, respectively. Only 2.0% reported a decline of 26%–50% in patients with HCC receiving treatment and being monitored (Figure 3). For drug addiction treatment, 30.1% of respondents reported no decline in patient numbers during the month of greatest impact of COVID-19 compared with a typical month pre-COVID. Only 10.2% of participants reported a decline of 1%–25% in patient numbers receiving drug addiction treatment.

Challenges to resume services and mitigation strategies

Patient anxiety and fear (67.4%), limited availability of staff (46.4%), loss of staff to COVID-19 response activities (49.0%), loss of clinic space to COVID-19 response activities (34.7%), and loss of funding (16.3%) were reported as key challenges to resuming services to pre-COVID-19 levels. Of note, 11.7% of clinicians described no challenges to resuming hepatitis services (Table 3).

Respondents reported adopting strategies to mitigate the COVID-19 situation, including telemedicine. More than 55% of clinicians responded that they relied on audio-only telemedicine appointments, while 9.7% conducted video telemedicine appointments via phones. However, 28.6% reported no use of telemedicine. Beyond telemedicine, 59.2% extended prescription lengths and 23.5% referred patients to a family doctor to reduce the burden of hospital visits (Figure 4).

Response to COVID-19

Patients were routinely assessed for fever via phone before the appointment or upon arrival to the hospital (60.2%), and other COVID-19 symptoms were regularly checked (50.0%). During the hospital visit, there was an increased frequency of wearing gloves and masks (54.1%), and increased frequency of surface cleaning (54.1%). Over 78% of respondents indicated face masks were required for patients. During the month of the greatest impact of COVID-19, 78.6% doctors reported spending between 1% and 25% of their time on COVID-19 patient care. For the month before the survey, 74.5% doctors reported spending a similar amount of time on COVID-19 patient care. The most common activities requiring their involvement included SARS-CoV-2 testing (51.5%) and COVID-19 vaccination (61.2%). The response to COVID-19 is shown in Supplementary Figure 1.

Potential benefits of the COVID-19 response to hepatitis elimination

Clinicians reported that despite the setbacks from the COVID-19 pandemic, potential benefits to hepatitis elimination efforts in the long-run could include an overall strengthening of infectious disease control (45.9%), raising awareness of medical institutions during infectious disease epidemics (44.4%), including improved training of primary care professionals in infectious disease testing and management (35.7%), and an improved referral network (29.1%) (Table 3).

Comparison with results from global survey

In comparison with the global survey, decreases in HBV and HCV treatment were significantly lower in Japan (HBV: 32.7% vs. 52.4%,

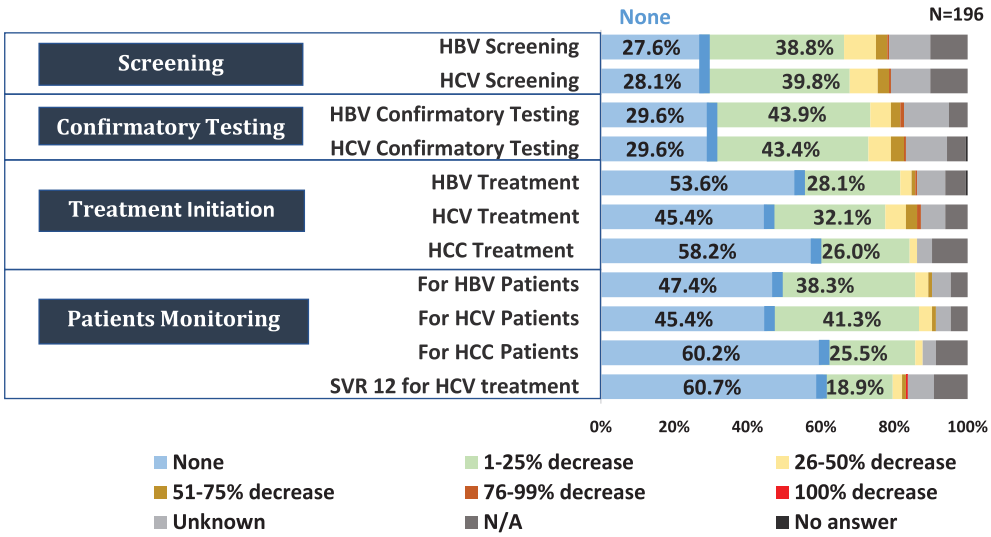


FIGURE 3 Impact of COVID-19 on hepatitis B virus (HBV) and hepatitis C virus (HCV) related screening, testing, and treatment in Japan. Shows the responses of JSH medical doctors on the level of decline of HBV and HCV screening, testing, and treatment compared with a typical month pre-COVID to the month with the most substantive change during the epidemic (in percentage of patients numbers). COVID-19, coronavirus disease 2019; SVR 12, sustained virologic response 12

TABLE 2 Medical doctors from the Japan Society of Hepatology (JSH) responded about deferring different services during COVID-19

N = 196					
Aspects	**During COVID-19 service deferred**	**Yes (%)**	**No (%)**	**N/A (%)**	**No answer (%)**
Diagnosis related	Imaging[a]	65.8	29.6	4.6	0
	Lab testing	68.4	27.6	4.1	0
	HCC screening	55.1	39.8	4.6	0.5
	Liver biopsy	43.4	42.9	13.3	0.5
	Gastrointestinal endoscopy	87.2	8.7	3.1	1
Public awareness and lectures related	Nutritional guidance	38.8	49	12.2	0
	Liver disease related lecture for patients	55.6	10.7	33.2	0.5
	Enlightenment activities by public lectures	55.6	27.9	26	0.5
Hospital visits related	Referral for viral hepatitis from other departments	33.7	54.6	11.2	0.5
	Extend the interval between hospital visits	65	28.6	6.1	0
	Extend the prescription interval	51	40.3	6.1	2.6

Abbreviation: HCC, hepatocellular carcinoma.

[a]Imaging includes all kind of diagnosis of liver diseases, including HCC.

$p = 0.0009$; HCV: 41.8% vs. 66.0%, $p < 0.0001$). In addition, the number of clinicians deferring HCV screening and confirmatory laboratory testing was significantly lower in Japan compared with the global survey (51% vs. 70.9%, $p = 0.0010$: 68.4% vs. 50.5%, $p = 0.0024$). In contrast, challenges to resuming services to pre-COVID-19 levels, such as anxiety and fear, limited staff, loss of staff to COVID-19 activities, and loss of space and funds were all more commonly reported in our survey than the global survey (67.4% vs. 37.9%, $p < 0.0001$; 46.4% vs. 17.5%, $p < 0.0001$; 49.0% vs. 6.8%, $p < 0.0001$; 34.7% vs. 19.4%; $p = 0.0059$; 16.3% vs. 6.8%, $p = 0.0201$). Compared with respondents globally, in Japan they reported that after the spread of COVID-19 infection, mask wearing of staff and clinicians increased 54.1% versus 82.5% ($p < 0.0001$) and for patients, mask wearing was increased by 78.6% and 55.3% (p-value <0.0001). As for the perceived benefits of COVID-19 for hepatitis elimination, expanded laboratory testing platforms were less commonly reported in Japan than in the global survey (17.9% vs. 41.8%, $p < 0.0001$). Other comparisons were shown in Table 3.

For the month of the greatest impact of COVID-19 in Japan, 57.1% of clinicians used telemedicine for the treatment of between 1% and 25% patients, while for the global survey the proportion was 29.2% of clinicians. A similar comparison was noted for the month

TABLE 3 Comparison of Japan Survey and global survey

Area	Aspect	Facility/issue	*N* = 196 Japan survey (%)	*N* = 103 Global survey[a] (%)	*p*-value
Hepatitis-related services	Screening	Decrease reported any level of HBV screening	51	56.3	0.3834
		Decrease reported any level of HCV screening	51	70.9	0.0010
	Treatment	Decrease reported any level of HBV treatment	32.7	52.4	0.0009
		Decrease reported any level of HCV treatment	41.8	66.0	<0.0001
	Testing	Lab testing deferred	68.4	50.5	0.0024
		Imaging deferred	65.8	60.2	0.3362
Mitigation strategies and challenges	Challenges to resume services at pre-COVID-19 level	Patient fear/anxiety	67.4	37.9	<0.0001
		Limited staff	46.4	17.5	<0.0001
		Loss of staff	49.0	6.8	<0.0001
		Inadequate PPE	12.2	13.6	0.7396
		Loss of space	34.7	19.4	0.0059
		Loss of funding	16.3	6.8	0.0201
		Supply shortage	13.8	7.8	0.1246
Response to COVID-19	Changes in infection control	Staff masks	54.1	82.5	<0.0001
		Patient masks	78.6	55.3	<0.0001
		Rigorous cleaning	54.1	50.5	0.5539
		Spacing patient visits	30.6	45.6	0.0100
		Patients checked for COVID-19 symptoms	60.2	47.6	0.0366
Potential benefits of COVID-19	Perceived benefits of COVID-19 on hepatitis	Increase lab testing platforms	17.9	41.8	<0.0001
		Improved training	35.7	42.7	0.2360
		Improved referral network	29.1	22.3	0.2101
		Improve contact tracing	13.8	25.2	0.0136
		Improved surveillance	14.3	24.3	0.0317
		Improved reporting	19.9	18.5	0.7630

Note: Japan survey on medical doctors from August 24, 2021 to October 03, 2021.

Abbreviations: COVID-19, Coronavirus disease 2019; HBV, hepatitis B virus; HCV, hepatitis C virus.

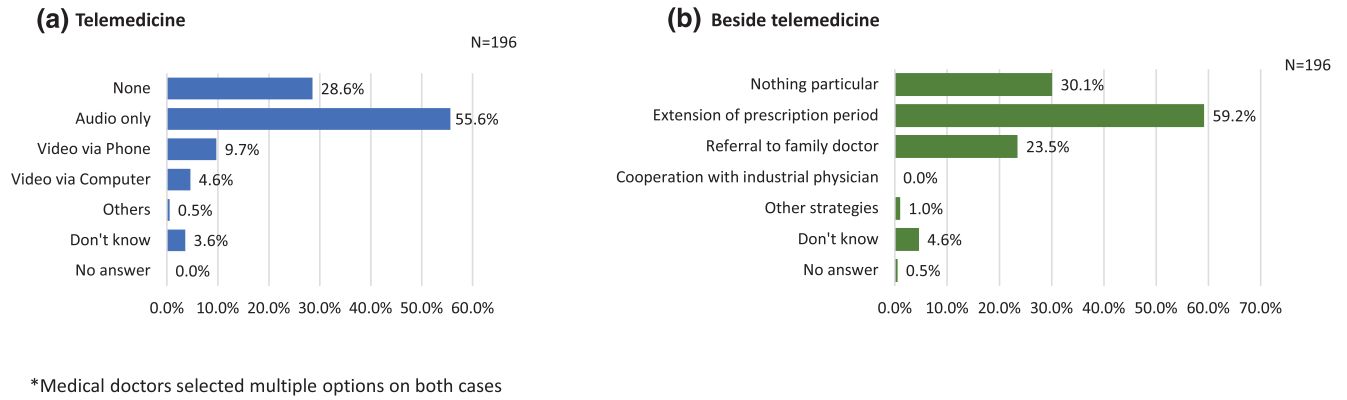
[a]Global survey on medical doctors from August 12, 2020 to December 16, 2020.[22]

before the survey completion ($p < 0.0001$). The rest of the results are shown in Figure 5.

During the month of the greatest impact of COVID-19, most clinicians indicated that either 1%–25% or 26%–50% of patients deferred clinic or hospital visits in Japan while in the global survey, most respondents reported that more than 26%–50% deferred. In the month before survey completion, higher numbers of clinicians reported deferring between 1% and 25% of hospital visits in Japan whereas for the global survey the majority of clinicians reported deferring between 26% and 50% of hospital visits (Supplementary Figure 2).

DISCUSSION

To our knowledge, this is the first study to assess the impact of COVID-19 on hepatitis services in Japan. Members of JSH belonged to different professions, institutions and positions related to liver diseases but in our analysis, we have included the responses of medical doctors (hepatologists). The infection severity of COVID-19 varied by region and prefecture in Japan. However, we have not found any significant differences of the impact of COVID-19 on hepatitis-related services among the 35 prefectures that responded.



*Medical doctors selected multiple options on both cases

FIGURE 4 Telemedicine and other adopted strategies during the COVID-19 pandemic. Shows telemedicine and other strategies that were adopted by the Japan Society of Hepatology (JSH) medical doctors besides telemedicine. In both cases, the participants (JSH medical doctors) were allowed to select multiple options on (a) telemedicine and (b) beside telemedicine. COVID-19, coronavirus disease 2019; JSH, Japan Society of Hepatology

Although no major supply chain disruptions related to hepatitis were noted, most of the clinicians reported a decrease of 1%–25% in HBV and HCV screening and confirmatory testing. Anxiety and fear among patients and lack of staff were given as contributors to the decline in screening and testing volumes. Among all the services related to HBV and HCV, the decreased screening, confirmatory testing, and monitoring was reported to be higher than treatment. A similar trend of a greater reduction in screening and testing than treatment and monitoring had been noticed for HCC in our survey. It indicates that the patients who met the criteria for diagnosis were given treatment according to the results. Besides the global survey, the trend of decreases in hepatitis-related services during COVID-19 was similar to other studies conducted in the Netherlands for diagnosis[20] and Ontario (Canada) for HBV and HCV testing.[21] However, the decline of any types of service related to HBV and HCV might hamper the ability to meet the set elimination goal.[2,9,18,19,22] From the impressions of participating hepatologists, screening and confirmatory testing were observed as more greatly affected than other services during the COVID-19 pandemic; our results recommend further study to evaluate the impact of COVID-19 on HBV and HCV health screening facilities.

Telemedicine was commonly used in developed countries such as Japan from pre-pandemic onwards[27] but was adopted more during the COVID-19 pandemic.[28] However, beyond telemedicine, clinicians also adopted other strategies, such as the extension of prescription lengths and referral to primary care physicians. It was a positive sign, which could be used during other pandemic or crisis periods in the future.

In our survey, the clinicians reported that as a part of changes during COVID-19, staff in Japan wore masks less than other countries from the global survey result; however, before the COVID-19 outbreaks, mask wearing was common for medical care staff in Japan. Thus, the percentage of change was lower compared with the other countries. However, 40.8% of clinicians in our survey reported wearing face shields regularly during patient encounters, which was a remarkable result.

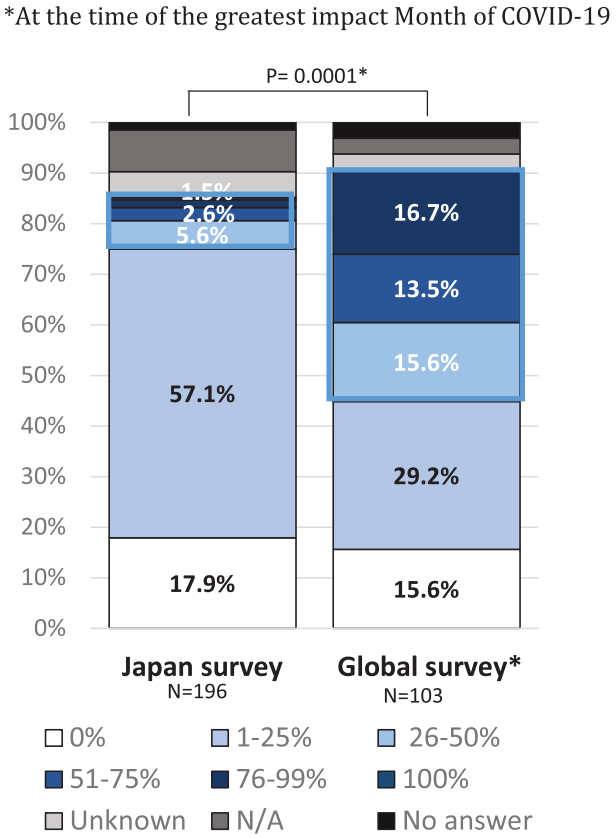


FIGURE 5 Comparison of telemedicine usage from the Japan and global survey. Shows the comparison of using telemedicine during the month of greatest impact in Japan and globally. (From participated doctors' impression from their affiliated institution)

In our survey, clinicians reported that the time spent caring for patients with COVID-19 was similar during the month of greatest impact and the month before the survey. The probable reason was that the fifth wave was ongoing during the survey period.[29]

In comparison with results of the global survey, the situation in Japan was better than in other countries in terms of impact on

screening and treatment. The most reported challenges to resuming care to pre-COVID-19 levels were limited availability of staff and loss of staff to the COVID-19 response in Japan, but the top responses differed in the global survey. A possible reason might be that 61.2% of respondents were engaged in COVID-19 vaccination whereas during the global survey, COVID-19 vaccination had not yet been rolled out.

HBV and HCV are substantial public health problems with high mortality and morbidity rates that will require continuous and relentless dedication to reach the goals for elimination.[1,2,11] COVID-19 has affected funding and healthcare systems across the world.[16,17,30,31] The impact of the pandemic on services and interventions for chronic disease must be thoroughly assessed given their high morbidity and mortality. This study highlights new gaps and challenges for long-running services for HBV and HCV because of the pandemic, such as declines in HBV and HCV screening and confirmatory testing whereas treatment and monitoring were not affected as much; this suggests most of the patients who were diagnosed could access treatment and monitoring during the pandemic and clinicians continued to prioritize providing care to these patients. This trend indicates in Japan once a patient attends a hospital or institution for treatment purposes, they are less likely to be lost to follow up. This trend could be adopted and utilized by clinicians to connect and link patients with hepatitis screening and confirmatory testing to the treatment directly after the COVID-19 pandemic. In addition, a possible reason for a greater drop-off in screening and confirmatory testing could be anxiety and fear of COVID-19 and loss of staff to the COVID-19 response. This situation is alarming because unscreened asymptomatic carriers would remain undiagnosed and untreated and could progress to liver cirrhosis, HCC, or even death. Declines in screening, confirmatory testing, and diagnosis could hinder the progress of HBV and HCV elimination in Japan. This information must inform efforts by policymakers and related authorities to develop actions to address this issue. In addition, delays in HCC screening might hinder the early detection of cancer and increase the additional burden of cancer.

There were several limitations to this study and interpretation of results. First, among 47 prefectures nationwide, respondents were only from 35 prefectures with a smaller number of responses by hepatologists. Secondly, on several aspects such as deferred clinic visits and reduction in number of patients, medical doctors may have provided their impression of the experience at their institutions, which may not have been verified. Thirdly, as the survey time period and stage of the pandemic were not the same for the Japan survey and the global survey, comparisons may have been biased.

CONCLUSION

The level of decline on hepatitis-related services in Japan was lower than other countries. However, in Japan, substantial declines were reported in HBV and HCV screening and confirmatory testing than for treatment initiation. Immediate action is needed to return HBV and HCV screening and confirmatory testing back to pre-pandemic levels. To do so the anxiety and fear among patients about COVID-19 infection, and the loss of healthcare staff and facilities redirected to the COVID-19 response, must be overcome. In addition, efforts should be made to leverage possible benefits of the COVID-19 response to the national hepatitis program, including improved training of clinicians in infectious disease testing and management, and for medical institutions to raise awareness about dealing with infectious disease epidemics. To achieve HBV and HCV elimination by 2030, Japan must recover from the setbacks caused by the COVID-19 pandemic.

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CONFLICT OF INTEREST

The authors have no conflict of interest.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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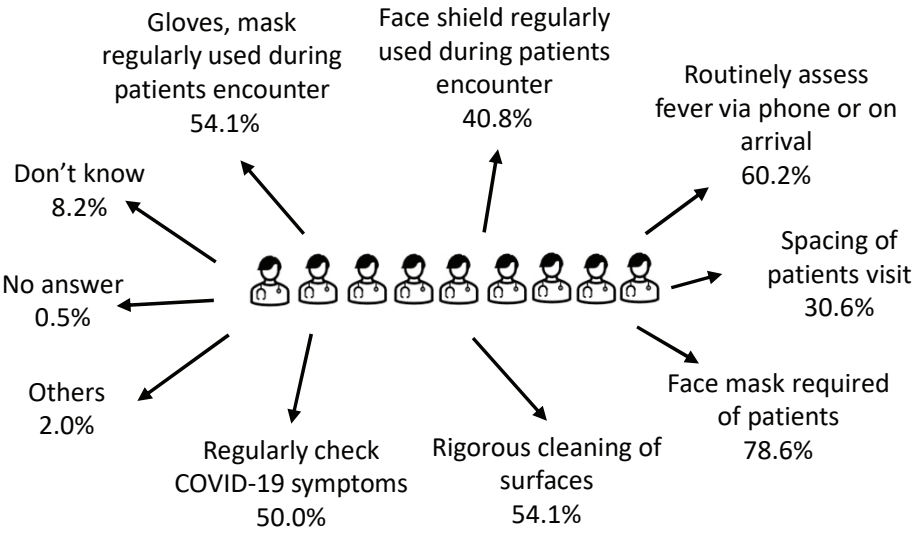
Changes on infection control among staff for caring patients

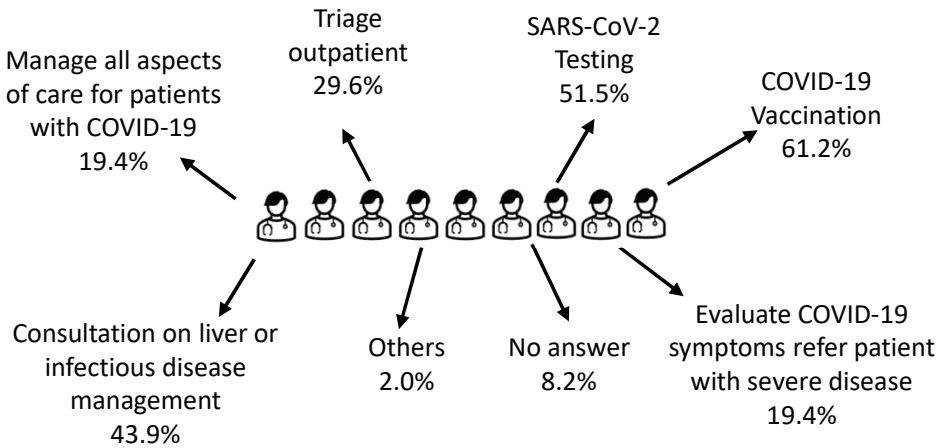


Doctor's spent time related to COVID-19

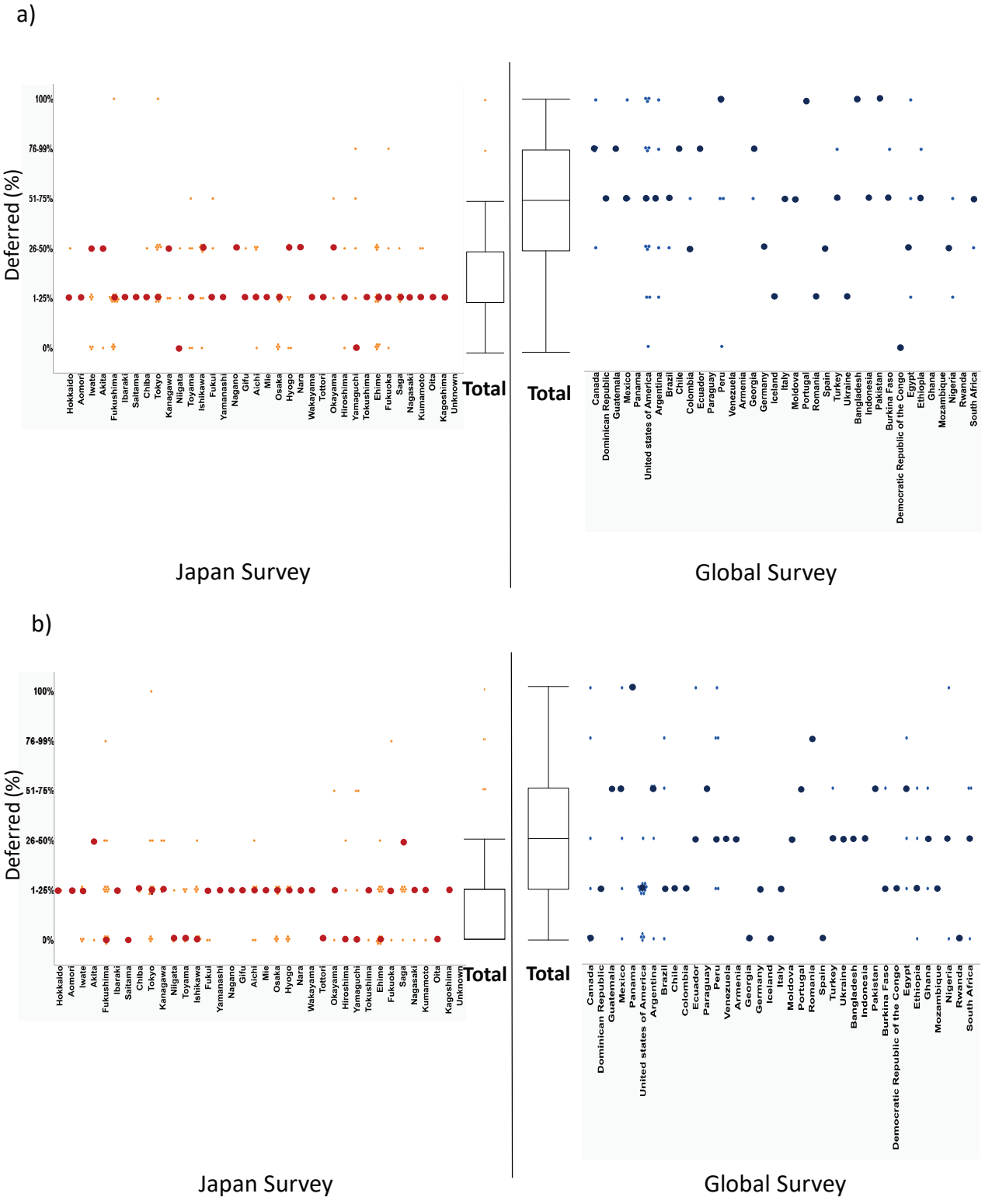
N=196

Time	0%	1-25%	26-50%	51-75%	76-99%	100%	unknown	N/A	No answer
Greatest Impact month	5.1%	78.6%	7.7%	1.0%	3.1%	0.0%	1.5%	2.6%	0.5%
Before survey Month	14.8%	74.5%	3.1%	1.0%	2.6%	0.0%	1.0%	2.6%	0.5%

Doctor's role in providing care related to COVID-19



Supplementary figure 1: Clinician's responses on COVID-19 in Japan



Supplementary figure 2: Hospital or clinic visit deferred due to COVID-19 in a) Greatest month of COVID-19 impact in Japan and global on hospital visit, b) Past month impact of COVID-19 in Japan and global on hospital visit

Supplementary table 1: Questionnaire

Section 01 (Basic Information)

No.	Question	Answer(s)/ Options/ Select/ comment
1†	Are you a member of the Japan Society of Hepatology?	Yes/ No If select "No", the questionnaire will end. "Thank you for your cooperation"
2	E-mail Address	
3†	Occupation	Medical doctor/ Nurse/ Pharmacist/ Laboratory technician/ Clinical radiologist/ Physical therapist, Occupational therapist/ Government official/ Company Staff/ Student/ Others
4	Prefecture of Employment	
5	What type of institution/facility are you affiliated with?	University-University Hospital/ Public Hospital/Private Hospital/clinic/Health checkups center/ Government agency/ Company/Others ( )
6†	Are you in a managerial position such as a department chief, medical director, hospital director, professor, center director, etc. regarding liver disease or hepatitis control at your facility?	Yes/ No

Section 02 (HBV and HCV related services)

No.	Question	Answer(s)/ Options/ Select/ comment
7	(Impact of COVID-19 on hepatitis service delivery) Please indicate which product supply chains have been disrupted during the COVID-19 response? (Select all that apply)	HBV Vaccine/ HBV diagnosis/ HCV diagnosis/ HBV Treatment/ HCV Treatment/syringe-Injection equipment/ OST Medication/ Others ( )/ Unknown/ None
8	Are disruptions in the supply chain on going?	Yes/ No/ Unknown/ NA
9	(Impact of COVID-19 on hepatitis service delivery) Have hepatitis-related program management meetings been deferred or cancelled?	Yes/ No/ NA
10	(Changes in patient volumes comparing a typical month pre-COVID to the month with the most substantive change during the epidemic, in your care setting what was the approximate decline) In number of persons screened for HBV?	None/ 1-25%/ 26-50%/ 51-75%/ 76-99%/ 100%/ Unknown/ NA
11	(Changes in patient volumes comparing a typical month pre-COVID to the month with the most substantive change during the epidemic, in your care setting what was the approximate decline) In number of persons receiving HBV confirmatory testing?	None/ 1-25%/ 26-50%/ 51-75%/ 76-99%/ 100%/ Unknown/ NA
12	(Changes in patient volumes comparing a typical month pre-COVID to the month with the most substantive change during the epidemic, in your care setting what was the approximate decline) In number of persons screened for HCV?	None/ 1-25%/ 26-50%/ 51-75%/ 76-99%/ 100%/ Unknown/ NA
13	(Changes in patient volumes comparing a typical month pre-COVID to the month with the most substantive change during the epidemic, in your care setting what	None/ 1-25%/ 26-50%/ 51-75%/ 76-99%/ 100%/ Unknown/ NA

	was the approximate decline) In number of patients receiving HCV confirmatory VL tests?	
14	(Changes in patient volumes comparing a typical month pre-COVID to the month with the most substantive change during the epidemic, in your care setting what was the approximate decline) In number of persons initiated on HBV treatment?	None/ 1-25%/ 26-50%/ 51-75%/ 76-99%/ 100%/ Unknown/ NA
15	(Changes in patient volumes comparing a typical month pre-COVID to the month with the most substantive change during the epidemic, in your care setting what was the approximate decline) In number of persons initiated on HCV treatment?	None/ 1-25%/ 26-50%/ 51-75%/ 76-99%/ 100%/ Unknown/ NA
16†	Did you have to extend the interval between hospital visits?	Yes/ No/ NA
17	(For the month with most substantive change during the covid-19 epidemic and for the current month, what were the trends in clinic visit deferrals and in the use of telemedicine?) For the month with the greatest COVID-19 impact, what percent of clinic visits for routine care were deferred?	None/ 1-25%/ 26-50%/ 51-75%/ 76-99%/ 100%/ Unknown/ NA
18	(For the month with most substantive change during the covid-19 epidemic and for the current month, what were the trends in clinic visit deferrals and in the use of telemedicine?) For the past month, what percent of clinic visits for routine care were deferred?	None/ 1-25%/ 26-50%/ 51-75%/ 76-99%/ 100%/ Unknown/ NA
19	Did you have to extend the prescription interval?	Yes/ No/ NA
20	During the response, for some or all patients did you Defer imaging?	Yes/ No/ NA
21	During the response, for some or all patients did you Defer lab testing for patients?	Yes/ No/ NA
22	(During the response, for some or all patients did you…) Did you have to defer HCC screening for patients?	Yes/ No/ NA
23†	Did nutritional guidance for patients decrease?	Yes/ No/ NA
24†	Did gastrointestinal endoscopy decrease?	Yes/ No/ NA
25†	Did the number of liver biopsy hospitalizations decrease?	Yes/ No/ NA
26†	Did the number of referrals for viral hepatitis patients from other departments in the hospital decrease?	Yes/ No/ NA
27†	Did the liver disease lectures for patients decrease?	Yes/ No/ NA
28†	Did the enlightenment activities by public lectures decrease?	Yes/ No/ NA
29	(Changes in patient volumes comparing a typical month pre-COVID to the month with the most substantive change during the epidemic, in your care setting what was the approximate decline) In number of persons monitored for HBV treatment?	None/ 1-25%/ 26-50%/ 51-75%/ 76-99%/ 100%/ Unknown/ NA
30	(Changes in patient volumes comparing a typical month pre-COVID to the month with the most substantive change during the epidemic, in your care setting what was the approximate decline) In number of persons monitored for HCV treatment?	None/ 1-25%/ 26-50%/ 51-75%/ 76-99%/ 100%/ Unknown/ NA
31	(Changes in patient volumes comparing a typical month pre-COVID to the month with the most substantive change during the epidemic, in your care setting what	None/ 1-25%/ 26-50%/ 51-75%/ 76-99%/ 100%/ Unknown/ NA

	was the approximate decline) In number of patients who receive SVR12 for HCV treatment?	
32	(Changes in patient volumes comparing a typical month pre-COVID to the month with the most substantive change during the epidemic, in your care setting what was the approximate decline) In number of persons treated for drug addiction?	None/ 1-25%/ 26-50%/ 51-75%/ 76-99%/ 100%/ Unknown/ NA
33†	(Changes in patient volumes comparing a typical month pre-COVID to the month with the most substantive change during the epidemic, in your care setting what was the approximate decline) In number of patients who receive treatment for HCC?	None/ 1-25%/ 26-50%/ 51-75%/ 76-99%/ 100%/ Unknown/ NA
34†	(Changes in patient volumes comparing a typical month pre-COVID to the month with the most substantive change during the epidemic, in your care setting what was the approximate decline) In number of patients monitored for HCC treatment?	None/ 1-25%/ 26-50%/ 51-75%/ 76-99%/ 100%/ Unknown/ NA

Section 03 (Challenges and Mitigation Strategies)

No.	Question	Answer(s)/ Options/ Select/ comment
35	What are the top 3 challenges for resuming services to pre-COVID levels? (Please select 3 options)	Patient anxiety or fear/ Limited staff available/ Inadequate PPE/ Loss of clinic space to COVID-19 response/ Loss of staff to COVID-19 respones/ Supply shortage/ Loss of funding,with direction to COVID-19/ Others/ The level of medical services has not changed since pre-COVID/ I don't know
36	What type of telemedicine has been used?	Audio only/ Video via Phone/ Video via Computer/ Other（ ）/No
37	For the month with the greatest COVID-19 impact, what percent of clinic visits were conducted by telemedicine?	None/ 1-25%/ 26-50%/ 51-75%/ 76-99%/ 100%/ Unknown/ NA
38	For the past month, what percent of clinic visits were conducted by telemedicine?	None/ 1-25%/ 26-50%/ 51-75%/ 76-99%/ 100%/ Unknown/ NA
39	Besides telehealth, what other strategies have you or your care setting used to maintain or return HBV and HCV testing and treatment to typical volumes?	Extension of prescription period (long-term administration) / Referral to family doctor (reduction of burden on hospital visit) / Cooperation with industrial physician / Others ( ) /Nothing particular/ Don't know

Section 04 (Doctor's Response to COVID-19)

No.	Question	Answer(s)/ Options/ Select/ comment
40	How did infection control change among staff caring for persons tested or treated for hepatitis? (Select or enter value)	face mask, face shield routinely used during patients encounter/ Gloves, mask routinely used by staff during patients encounter/ Patient routinely check for COVID symptoms/Rigorous cleaning of surfaces/ face mask required of patients/ spacing of patients visit/ patient routinely assessed about fever via phone call or on

		arrival/ Other（ ）
41	Have your work activities changed in response to the emergence of COVID-19?	Yes/ No
42	Please indicate your role in testing, and providing clinical care for persons with possible COVID-19 (Select all that apply)	Triage outpatient /COVID-19 Vaccination / Sars-CoV-2 Testing/ Evaluate COVID-19 symptoms or sign and refer patients with severe disease/ Manage all aspects of care for patients with COVID-19/ Consultation on liver or Infectious disease management/ Other（ ）
43	For the month with the greatest COVID-19 impact, what percent of your time is spent on testing and providing clinical care for persons with possible COVID-19?	None/ 1-25%/ 26-50%/ 51-75%/ 76-99%/ 100%
44†	For the past month, what percent of your time is spent on testing and providing clinical care for persons with possible COVID-19?	None/ 1-25%/ 26-50%/ 51-75%/ 76-99%/ 100%

Section 04 (Potential benefits on hepatitis)

No.	Question	Answer(s)/ Options/ Select/ comment
45	As a result of the COVID-19 response, do you see any of the following as immediate or possibly future benefits to hepatitis testing and treatment?	Increased laboratory platforms for HBC and HCV testing/ Improved training of primary care in infectious disease testing and management/ Improved reporting of laboratory result/ Improved referral networks for complex patients/ Improved disease surveillance/ Improved contact tracing that could be used for hepatitis prevention/ Strengthening in infectious disease control/ Raising awareness of medical institutions to deal infectious disease epidemic/ Other（ ）/ Nothing particular/ Don't know
46	Please provide other strategies and comment	