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An evaluation of the awareness, perceptions, and practice of ultrasound and the use of telesonography among obstetrics and gynecologic sonologists in the Philippines during COVID-19 pandemic

Melissa D. Amosco[1], Lara Marie G. David-Bustamante[1], Maria Febi B. De Ramos[1], Ireene G. Cacas-David[2]

Abstract:

BACKGROUND: Major changes in the practice of medicine have been adopted due to the COVID-19 pandemic and have not spared the practice of ultrasound among obstetrician–gynecologists, considered to have higher risk due to unique attributes of an ultrasound examination.

OBJECTIVES: This study evaluated the awareness, attitudes, perceptions, and practices of the obstetric–gynecologic sonologists in the country during the pandemic, including the use of telesonography.

METHODOLOGY: A descriptive, cross-sectional survey was conducted through a self-administered, structured questionnaire using an online survey software.

RESULTS: There were 120 respondents with postresidency training in ultrasound (54.2%) or in maternal and fetal medicine (43.3%), practicing in different regions, and mostly with teaching affiliations (56.7%). Most are aware of the guidelines on the practice of ultrasound this pandemic and they perceived themselves to be especially vulnerable to the infection. They admitted having feelings of stress, sadness, and depression, and their concerns centered on being infected and potentially transmitting it to their family. These perceptions translated to specific practices that include use of level 3 personal protective equipment, patient screening, triaging, and use of physical barriers to minimize environmental and contamination. While most are consistent with guidelines, some practices are neither based on sound scientific evidence nor correctly adhered to, including noncompliance with appropriate ultrasound transducer cleaning and disinfection. Regarding telesonography, only half of the respondents had good knowledge, with most having informal sources of information on the technology. Although the respondents have a good attitude toward it, only a few (15.8%) admitted to using it, mainly to confer with an expert or colleague (38.3%), and for teaching purposes (11.7%).

CONCLUSIONS: Obstetric–gynecologic sonologists in the Philippines are aware of the risks and have the same attitudes and perspective on COVID-19 infection as other health-care providers. Specific practices have been modified; however, the use of telesonography is not among the changes adopted.

Keywords:

COVID-19, obstetrics, telemedicine, telesonography, ultrasound

[1]Division of Ultrasound, Department of Obstetrics and Gynecology, Philippine General Hospital, University of the Philippines, Manila, [2]Division of Maternal and Fetal Medicine, Department of Obstetrics and Gynecology, Philippine General Hospital, University of the Philippines, Manila

Address for correspondence:
Melissa D. Amosco, Department of Obstetrics and Gynecology,UP-PGH, Manila, Philippines.
E-mail: mdamosco@up.edu.ph

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Introduction

The COVID-19 pandemic which started in December 2019 rapidly spread to the whole world. The infection causes severe respiratory illness which results in varying degrees of complications and even death. With the severity and widespread infection, most countries had to implement immediate lockdown with the goals of minimizing spread and flattening the curve of the affected individuals. The generalized lockdown, which started locally in mid-March 2020 and eventually eased in the ensuing months, has led to major changes in the medical practice worldwide including in the Philippines. In anticipation of an increased number of COVID-19 cases, hospitals suspended normal activities to reallocate the resources and health-care personnel. A number of protocols have likewise been adopted to minimize spread, including physical changes in the clinic, the use of personal protective equipment (PPE) (either medical grade or locally modified), and the widespread telemedicine, previously unacceptable to a number of local healthcare professionals before the pandemic.

The practice of ultrasound in obstetrics and gynecology, a widely used diagnostic tool in the field, has not been spared from these changes. Performance of the scan requires extended and close interaction with the patient, hence the generalized fear of possible exposure and infection.[1] All procedures were stopped during the generalized lockdown in March 2020, and the obstetrics and gynecologist (OB-Gyn) sonologists remained hesitant to perform scans even during modified quarantine which started in June 2020. Eventually the different governing local and international professional societies issued their statements on the practice of ultrasound during this time of the pandemic.[2-11] These served as guidelines ensuring ways to minimize infection. These served as guidelines ensuring ways to minimize infection.

This study was conducted to evaluate the awareness, attitudes, perceptions and practices of the OB-Gyn sonologists in the country at the time of Covid-19 pandemic, including the use of teleradiology, or the use of telemedicine in the field of medical diagnostic imaging, specifically in ultrasound (telesonography). A review of current literature has shown limited studies evaluating this specific albeit unique aspect of targeted healthcare, although protocols have been described.[12-24] Information that will be obtained from this study will help in the assessment of response to the pandemic, compliance to the published guidelines and modifications adopted, and perceived problems during a contagious disease outbreak. Conclusions can be drawn which may possibly be used in the formulation of guidelines that may be beneficial not only at present but in similar situations in the future. Furthermore, misconceptions on the use of telesonography as established in this study may be used to formulate suggestions and guidelines on its use, both for clinical and educational purposes. Similarly, this will be the basis for future studies that will evaluate the acceptability and reliability of telemedicine in ultrasound.

Methodology

Research design and study population

This descriptive, cross-sectional survey was conducted through a self-administered, structured questionnaire using an online survey software. It was undertaken in accordance with the Declaration of Helsinki at the Department of Obstetrics and Gynecology of the University of the Philippines, Philippine General Hospital (UP-PGH) in Manila. The study was approved by the UP-PGH Ethics Review Board.

The study group consisted of 120 OB-Gyn sonologists who had their fellowship or preceptorial training from 1996 to 2020, at the Division of Ultrasound and at the Division of Maternal and Fetal Medicine, Department of Obstetrics and Gynecology, Philippine General Hospital, and the respective consultants of the divisions who are actively performing ultrasound in their practice and with updated contact number in the respective divisions' master list. They have been selected as a sample population of OB-Gyn sonologists since they are from the different parts of the country, and are affiliated with their respective regional ultrasound units. The sample size of 120 is just beyond the acceptable minimum sample size of 119 respondents, calculated using a single population proportion formula with finite population correlation, with 5% margin of error and 95% confidence level, and a proportion of 50%, since there is no similar previous study done in the same population.

Data acquisition and statistical analysis

A self-administered, structured questionnaire was formulated and adopted by the investigators based on the existing literature on the knowledge, attitude, and practices of healthcare workers during the Covid-19 pandemic[25-28] and on telemedicine in general,[29] modified according to the specific objectives of the study pertaining to the protocols on the practice of obstetrics and gynecologic ultrasound and the use of telesonography locally.

Initial face validity of the items included in the questionnaire was peer-reviewed to evaluate and correlate the adequacy of the items in documenting the intended data. A pilot study of the survey was carried out on ten participants who met the study inclusion criteria and were asked regarding the following: understandability and ambiguity of the questionnaire, potential problems with the content,

and logistics of conducting the survey. The respondents were asked the following question regarding each item in the tool: (1) Was there any difficulty understanding this question? (2) Is this question unacceptable in terms of its content? and (3) Are there any problems encountered while answering this survey? Modifications and corrections were done to ensure validity. The participants included in the pilot study were not included in the final study sample population.

The questionnaire consisted of three sections as follows: (a) participant demographics (10 items); (b) questions on the practice of ultrasound during the pandemic, in relation to their awareness (3 items), attitude and perceptions (2 items with total of 14 choices), and practices (4 items with multiple choices); and (c) questions on the use of telesonography, including awareness and knowledge (3 items), attitude (1 item), and practices (4 items). For the ultrasound practice scoring system, the first 2 statements are correct and were given 1 point each if checked or chosen by the respondent; the third item is incorrect and was given 1 point if not checked. We arbitrarily assigned a respondent having a good level of awareness if with a total score of 3; fair level if with score of 2; and poor level if with a score of 1. The scoring system used for the evaluation of the knowledge and attitude on telesonography was adopted from the same study from which the contents were based.[29] For the evaluation of the level of knowledge on telesonography, there were 10 statements presented, each to be checked by the respondents if it is true or they agreed with it. A score of 1 is given for every statement checked, and 0 if not checked, except for the 9th item ("there are implementing rules and regulations on the use of telesonography in the Philippines") which was given a score of 1 if not checked, and 0 if checked. The total score can range from 0 to 10, and an arbitrary score of >5 was set as a cut-off point to determine the level of knowledge. If the score is >5, the respondent was considered having average knowledge, while a score of ≤5 indicates poor knowledge. For the evaluation of the attitude toward telesonography, there were 22 statements related to telemedicine, but modified for telesonography, and covered the following attributes: relative advantages (7), compatibility (4), complexity of deploying it (5), trial ability of its application's ease of use (4), and observability (2). Each statement was rated on a 5-point Likert scale that ranged from "1 = strongly disagree" to "5 = strongly agree," except for complexity attributes which were reversely scored (1 = strongly agree and 5 = strongly disagree). Scores for all statements were averaged to create the specific mean score. Similar to the original study, a mean score of <2.5 (50%) was labeled as poor attitude, 2.6 (51%)–3.0 (60%) as moderate, and > 3.0 (60%) as good attitude. All data were analyzed using descriptive statistics and using Excel (Microsoft Corporation, Redmond, WA, USA).

Results

A total of 171 study subjects were invited to join the online survey from December 26, 2020, to Feb 10, 2021. Of these, 120 replied, and the response rate was 70.2%. Majority of the respondents were female (94%), 41–50 years of age (51.7%), had been performing ultrasound for 10 years or more (44.2%), and doing both obstetrics and gynecologic cases (91.7%). The respondents are based in the national capital region (n = 40; 33.3%), Calabarzon (n = 16; 13.3%), and Central Luzon (n = 14; 11.7%), while some are based in Visayas (n = 20, 16.7%) and Mindanao (n = 12; 10%). The respondents finished fellowship training in ultrasound (54.2%) and fellowship in maternal and fetal medicine (43.3%). Only 3 (2.5%) had preceptorship in ultrasound. Majority are board certified, with only 15% underboard. Only 43.3% (n = 52) are not involved with teaching ultrasound. The rest are affiliated with a teaching hospital in private (20%), in the government (25%), or both (11.7%). The demographic profiles of the respondents are summarized in Table 1.

Before the pandemic, the majority had ultrasound practice in both a private and a government institution (43.3%). The rest were practicing only in a private hospital (25.8%), private clinic (25%), and government hospital (5.8%). During the pandemic, only 34 (28.3%) continued their ultrasound practice, while most resumed only after the generalized lockdown was lifted (62.5%). Only 3 (2.5%) have not resumed their practice until the time the survey was conducted.

Awareness, perceptions, attitude, and practice of ultrasound during the COVID-19 pandemic

The sources of information related to COVID-19 infection and performance of ultrasound were mostly from the guidelines released by local professional organizations (Philippine Obstetrical and Gynecological Society or POGS; Philippine Society of Ultrasound in Obstetrics and Gynecology or PSUOG; and Philippine Infectious Disease Society of Obstetrics and Gynecology or PIDSOG) [90%]. The other sources of information were from the websites of international official entities such as the World Health Organization (WHO), Centers for Disease Control and Prevention, professional organizations (e.g. International Society of Ultrasound in Obstetrics and Gynecology or ISUOG) (85%), from local government agencies including Department of Health (83.3%), and online events such as seminars/meetings/webinars/congresses held by institutions (80%).

To evaluate the awareness level of the respondents, they were asked about specific statements on ultrasound practice during the pandemic and the guidelines. Majority of the respondents (58.33%; n = 70) had good level of awareness, 38.33% (n = 46) with fair level, and 3.33% (n = 4)

Table 1: Demographic profile of respondents (*n*=120)

Characteristics	*n* (%)
Gender	
Male	7 (6)
Female	113 (94)
Age (years)	
31-40	44 (36.7)
41-50	62 (51.7)
51-60	12 (10.0)
>60	2 (1.7)
Type of training	
Fellowship in ultrasound	65 (54.2)
Fellowship in MFM	52 (43.3)
Preceptorial in ultrasound	3 (2.5)
Subspecialty certification status	
Underboard	18 (15.0)
FPSUOG	55 (45.8)
FPSMFM	17 (14.2)
Both FPSUOG and FPSMFM	30 (25.0)
Length of ultrasound practice (years)	
0-2	23 (19.2)
2-<5	21 (17.5)
5-<10	23 (19.2)
10 or more	53 (44.2)
Type of patients seen for scan	
Gynecologic cases only	0
Obstetrics cases only	10 (8.3)
Both cases	110 (91.7)
Place of ultrasound practice	
Region I - Ilocos Region	6 (5.0)
Region II - Cagayan Valley	3 (2.5)
Region III - Central Luzon 3	14 (11.7)
Region IV-A - Calabarzon	16 (13.3)
MIMAROPA region	1 (0.8)
Region V - Bicol Region	2 (1.7)
Region VI - Western Visayas	8 (6.7)
Region VII - Central Visayas	10 (8.3)
Region VIII - Eastern Visayas	2 (1.7)
Region IX - Zamboanga Peninsula	2 (1.7)
Region X - Northern Mindanao	6 (5.0)
Region XI - Davao Region	6 (5.0)
Region XII - SOCCSKSARGEN	6 (5.0)
Region XIII - Caraga	0
NCR	40 (33.3)
CAR	1 (0.8)
ARMM Region	0
Affiliation with a teaching hospital in ultrasound	
Government teaching hospital	30 (25.0)
Private teaching hospital	24 (20.0)
Government and private hospital	14 (11.7)
No teaching affiliation	52 (43.3)
Place of ultrasound practice before COVID pandemic (before March 15, 2020)	
Government hospitals	7 (5.8)
Private hospitals	31 (25.8)
Private clinics	30 (25.0)
Both private and government	52 (43.3)
Resumption of ultrasound practice	
Totally stopped/no resumption	3 (2.5)
Continued even while on complete lockdown	34 (28.3)
After complete lockdown*	75 (62.5)
Others	8 (6.7)

*Resumed May 15 onward in NCR, other dates for other provinces. NCR: National Capital Region, CAR: Cordillera Administrative Region, ARMM: Autonomous Region in Muslim Mindanao, MFM: Maternal fetal medicine, FPSUOG: Fellow, Philippine Society of Ultrasound in Obstetrics and Gynecology, FPSMFM: Fellow, Philippine Society of Maternal and Fetal Medicine

with poor level of awareness. Majority (90%) agreed that the ISUOG guidelines are based on the principles of mitigating the risk of spread of infection and protecting the sonologist from infection. Ninety (75%) respondents agreed that the guidelines were based either on scientific evidence and/or expert opinion, while 81.8% correctly believed that the guidelines define what constitutes an emergency or elective procedure for ultrasound.

Most sonologists perceived that they were especially vulnerable to COVID infection due to unique attributes of an ultrasound examination (79.2%). About half of the respondents had episode/s of discomfort and/or difficulty in breathing due to PPE use and lack of ventilation (58.3%) or had difficulty performing ultrasound due to the partitions and PPE (47.5%). About half of them perceived that patients' awareness of the COVID-19 infection was low (43.3%). Majority of the respondents also thought that their fellow physicians' awareness of this subject has reached the sufficient level (74.2%), but few thought that the awareness level was low among the secretaries and assistant health-care professionals (25.8%). Only a small percentage of the respondents had difficulty accessing protective equipment (mask, face shield, etc.) (4.2%). About half of the respondents perceived that they have been unknowingly exposed or had face-to-face contact during an ultrasound procedure with someone who was eventually confirmed to have COVID-19 (40.8%). However, only a number of them felt that they may have been infected with COVID-19 most likely acquired from ultrasound practice (2.5%) or have encountered any other problems (5%).

Regarding their attitude to COVID-19 infection [Table 2], most respondents either strongly agreed (47.5%) or agreed (41.7%) that they were concerned about being infected with this virus as a professional group (sonologist) at high risk for COVID-19 infection. However, most respondents are worried about transmitting the disease to their immediate family as a risky occupational group for COVID-19 (92.5%). About half of the respondents either agreed (48.3%) or strongly agreed (29.2%) that current events about COVID-19 have

Table 2: Attitude to COVID-19 infection among obstetrics and gynecologic sonologists while performing ultrasound

	Strongly disagree (%)	Disagree (%)	Neutral (%)	Agree (%)	Strongly agree (%)
I am concerned about being infected with this virus as a profession group (sonologist) at high risk for COVID-19	4.2	1.7	5	41.7	47.5
I am worried about transmitting this disease to my immediate family as a risky occupational group for COVID-19	5.8	0	0.8	29.2	63.3
I think that current events about COVID-19 have affected me spiritually	5	10	7.5	48.3	29.2
I think that current events about COVID-19 have affected me emotionally and had feelings of stress, sadness, and depression at any one time	5	5	10	60	20

affected them spiritually. Similarly, the majority either agreed (60%) or strongly agreed (20%) to being affected emotionally and had feelings of stress, sadness, and depression at any one time.

Changes in the practice of ultrasound during the COVID-19 pandemic

Most of the respondents have made changes regarding patient admissions to the ultrasound unit as precautionary measures against COVID-19 infection. These included limiting the following: clinic hours per week (83.3%), number of patients seen per clinic (81.7%), and the scanning time per patient (73.3%). Only half of the respondents had to limit the choice of ultrasound procedures done (52.5%). Most sonologists used PPE level 3 or at most PPE level 4 when doing the scans. The following specific measures were personally and strictly implemented by the sonologists on themselves: use of either surgical mask or equivalent (45.8%), N95 mask or equivalent (82.5%), double masks (27.5%), half mask respirator (30.8%), or full mask respirator (5.8%). Only 32 (26.7%) respondents used personal air filtration gadgets. There was no preference in the use of either single gloves (49.2%) or double gloves (45%). Protective goggles or face shields were used by most (96.7%) of the respondents together with head caps (73.3%), while only a few used disposable aprons (18.3%) and shoe covers (37.5%). Protective clothing (isolation gown) was used by a majority (84.2%) of the respondents, while less than half preferred bunny suits (41.7%). Frequent hand washing (82.5%) and hand sanitizing (89.2%) were observed by most of the respondents. Only 25% of the respondents had been tested for COVID-19 as a requirement by the institution they work with. However, 40.8% of the respondents voluntarily submitted self to COVID-19 testing.

Several measures were strictly implemented either in the private ultrasound clinic or hospital-based unit to avoid COVID-19 infection. All health staff members including secretaries were required to wear PPE (85%) in both hospital and clinic settings. While most of the respondents placed partitions between patient and ultrasound machine/sonologist with minimal cross-access (83.8%), only 51 (42.5%) placed acrylic hood over the patient. Cleaning of partition or hood every after patient examination, however, was not performed by 27.4% of the respondents. Single use of drapes and bed cover were not routinely done by 22.2% of the respondents.

The use of double probe covers for transvaginal and transabdominal transducers was variably done depending on the setting, but most respondents did not implement these (52.5% and 54.7%, respectively, for the 2 transducers). Cleaning of ultrasound transducers routinely with soap and running water was not practiced by 84.1% of sonologists. Instead, most of the respondents used disinfection wipes (87%). Disinfection of probes using chemical 'wet' disinfection was not used in 41.7% of the respondents, while only 39.1% used it in both private and hospital settings. The use of automated high-level disinfection machines was not an option for most (77.8%) of the respondents, with only 3.7% practicing it in either a private clinic or hospital and 14.8% for both settings. However, most of the respondents practiced cleaning and disinfection of machine and cables (83.9%), installed high-efficiency particulate air (HEPA) filter or air purifier (87.3%), used UVC lamps (77%), or made sure of adequate ventilation of ultrasound room, e.g. intermittent opening of doors or windows for ventilation (80.8%).

In terms of patient triaging, prioritizing appointments of women in need of ultrasound (by case or urgency) was observed by most (95.8%) of the respondents, while creation of ultrasound unit isolation room for confirmed or suspected cases was not done by 36.3% of respondents. Not all ultrasound providers underwent infection control training (56%), and mostly did not undergo fit tests for respirators (76.8%). The following measures (>90%) were required of the patients either in private ultrasound clinic or hospital-based ultrasound unit to avoid COVID-19 infection: set an appointment, sign health declaration form, temperature check before procedure, use masks, goggles, or face shields, and were routinely asked if they were having symptoms such as fever and cough. The number of patients seen in a day/clinic schedule had been

Table 3: Attitude to perceived attributes of telesonography among obstetrics and gynecologic sonologists, (*n*=120)

	Strongly disagree (%)	Disagree (%)	Neutral (%)	Agree (%)	Strongly agree (%)
Relative advantages: The use of telesonography					
1. Reduces medical errors	3.3	21.7	43.3	30	1.7
2. Facilitates diagnosis and treatment	0	1.7	20.8	70.8	6.7
3. Increases communication among health care providers	0	2.5	11.7	71.7	14.2
4. Reduces the number of visits to health care centers	0	5.8	16.7	67.5	10.0
5. As a sonologist, it enables me to accomplish my task more quickly	0	8.3	45.0	40.8	5.8
6. Improves clinical decisions	0	3.3	37.5	54.2	5.0
7. Provides more comprehensive health care services	0	6.7	38.7	50.4	4.2
Total mean score	3.61				
Compatibility					
8. In my opinion, telesonography is compatible with all aspects of my work	0	21.7	47.5	28.3	2.5
9. Telesonography is completely compatible with the current situation (during pandemic)	0	4.2	24.2	61.7	10.0
10. I think telesonography fits well with the way I like to work	1.7	26.7	45.8	24.2	1.7
11. Using telesonography fits well into my work style	1.7	31.7	41.7	24.2	0
Total mean score	3.19				
Complexity					
12. It requires a lot of mental effort	0	13.3	32.5	50.0	3.3
13. Learning to use telesonography is hard for me	0	32.5	50.0	16.7	0
14. I think telesonography increases work load	0	23.3	42.5	33.3	0
15. I think telesonography creates new responsibilities for doctors	0	6.7	19.2	63.3	10.8
16. In my opinion, it threatens information confidentiality and patient privacy	0	14.2	33.3	47.5	5.0
Total mean score	2.68				
Trial ability					
17. I believe that now is a great opportunity for trying telesonography applications	0	2.5	26.9	65.5	5.0
18. I do not have to take too much effort to try out telesonography	0.8	16.8	40.3	40.3	1.7
19. I believe, using telesonography on a trial basis is enough to see what it could do	0	0.8	18.3	75.0	5.8
20. I would like to try out telesonography applications before using it	0	0	13.3	75.0	11.7
Total mean score	3.71				
Observability					
21. I have seen what other sonologists do with telesonography	5.0	27.5	35.8	30	1.7
22. Telesonography is very visible in the hospital where I work	20.0	45.0	18.3	14.2	2.5
Total mean score	2.65				

Each statement is rated on a 5-point Likert Scale that ranged from "1=strongly disagree" to "5=strongly agree," except for complexity attributes which are reversely scored (1=strongly agree and 5=strongly disagree). Scores for all statements were averaged to create the specific mean score. A mean score of less than 2.5 (50%) was labeled as poor attitude, 2.6 (51%)-3.0 (60%) as moderate, and greater than 3.0 (60%) as good attitude. (Adopted from Biruk K, Abetu E. knowledge and attitude of health professionals toward telemedicine in resource-limited settings: A cross-sectional study in North West Ethiopia. J Healthc Eng. 2018:2,389,268)

limited (95.7%) and no companion was allowed inside the ultrasound room for most settings (96.6%). Patients were mostly not required to bring their own drapes (79.3%), nor were they asked to undergo reverse-transcription polymerase chain reaction (RT-PCR) before ultrasound for urgent cases (75.9%), and for nonurgent cases (87.1%). They were also not required to undergo rapid antibody tests before ultrasound for urgent (81%) and nonurgent cases (90.4%).

Knowledge, attitudes, and practices on the use of telesonography during the COVID-19 pandemic

The results of the survey showed moderate awareness of telemedicine in ultrasound. A large portion of the respondents were not familiar with telesonography (43.3%) or have heard of it before this survey (50.8%); similarly, only 50 (41.7%) respondents were familiar with the Data Privacy Act of 2012 and its application to telemedicine in general. Only a small fraction of the respondents have seen other hospital staff use it (10.8%) or have seen a telesonography system. A small percentage are familiar with the requirements of a telesonography system (5.8%) or its infrastructure (5%) or know other applicable tools for telesonography like teleconsultation and teleconferencing (30.8%). Similarly, only some of the respondents claim it to be used in their institution (7.5%).

When respondents were given statements that will evaluate their level of knowledge, exactly half of them (50%) had good knowledge on the telesonography (obtained >50% in the knowledge questions). Most of the respondents knew that it is a useful clinical tool for remote interpretation of ultrasonographic images (75.8%), and for educational purposes (or tele-mentoring) (70%), and that it offers the possibility of providing expert sonographic interpretation and diagnosis (68.3%). Most of the respondents were also aware that securing informed consent for its use is required (66.7%). Only a portion of the respondents knew that it has already been in use in other countries for the past three decades (30.8%), and that it has many advantages, including the following: helps save clinicians' time (55%), reduces the cost (39.2%), and has clinical applications that help improve health-care quality (49.2%). Only a fraction of them incorrectly agreed that there were implementing rules and regulations on the use of telesonography in the Philippines (21.7%). However, only 47 (39.2%) respondents knew that social media platforms and messaging applications are tools that can be used in telesonography.

Some respondents claimed not to have heard about telesonography (30.83%). If familiar with it, the sources of information were public media/internet (44.2%), colleagues (35%), or introduced during ultrasound training (15%).

The respondents had a moderate to good attitude toward telesonography [Table 3]. They had good attitudes in terms of relative advantages (mean score of 3.61), compatibility (mean score of 3.19), and trial ability (mean score of 3.71). They had a moderate attitude in terms of complexity and observability.

When asked if they practice telesonography, the results showed that only a few (15.8%) were using it, and the reason/s given for not practicing it before pandemic, were mostly because they did not think of using it (52.5%). Other reasons are summarized in Table 4. However, when asked about specific technologies used before and during the pandemic [Table 5], the responses were varied, but with percentages much higher than when initially asked if they were using it. Less than half were not practicing any of these technologies before (42.5%) and during (45.8%) the pandemic. After these technologies were presented, the respondents were asked again as to how to describe themselves regarding their use of telesonography [Table 6]. This time, only 54 (45%) claimed to never have used it [from an initial of 84.2% nonusers or 15.8% users, as shown in Table 4]. A number of them used it for clinical/diagnostic purposes in their cases to confer with an expert or colleague (39.3%) or for teaching purposes (11.7%). Only one of the respondents does not plan to use it in the future [Table 6].

Table 4: Reasons for not practicing telesonography either before or during COVID-19 pandemic

Statement	*n* (%)
I did not think of using it	63 (52.5)
It is not allowed by institution/hospital	6 (5.0)
It is not allowed by society	0
It is not legally allowed	1 (0.8)
It does not give reliable readings	18 (15.0)
The internet connection is not reliable	31 (25.8)
It is not necessary	6 (5.0)
None of the above because I am using telesonography	19 (15.8)
Others, unspecified	8 (6.7)

Discussion

The group of respondents in this survey is a good representation of obstetrics and gynecologic sonologists in the Philippines, as they are from different regions of the country, of different age group and subspecialization (Ultrasound and Maternal and Fetal Medicine), and are involved with private practice, teaching hospitals, or both. Despite these differences, notably in geographic locations, their responses pertaining to the sources of knowledge on the COVID-19 infection and performance of ultrasound during the pandemic are similar, with most coming from guidelines of local societies (POGS, PSUOG, and PIDSOG). Awareness of these guidelines translated to specific practices in private clinics and in hospitals, which may have been modified by institutional guidelines.

A number of changes in the practice of ultrasound have been adopted per institution, with specific objectives in mind. The objectives are mainly to protect the health-care providers (sonologist and allied staff) from being infected and preventing them from becoming vectors of transmission when they are exposed to cases of COVID-19; to protect the patient from acquiring infection; to continue providing efficient service to the patients; and to sustain the institution, financial, or otherwise (e.g. training of students/residents/fellows in the case of PGH) with proper planning.

Several unique attributes of an ultrasound examination have been identified that potentially increase the risk of transmission between patients and ultrasound operators and vice versa. The ISUOG in one of its guideline guideline statements,[1] described most of them. Foremost is the physical proximity of the doctor to the patient, which is <2 m or 6 feet (and can be as close as 30–50 cm). The ultrasound rooms/enclosed areas are typically small and often have restricted ventilation, with some having closed loop air-conditioning systems and/or absence of windows, all of which are undesirable physical factors for prevention of infection. The prolonged examination

Table 5: Technologies used in the performance of ultrasound before and during the pandemic

Technology	Before pandemic, *n* (%)	During pandemic, *n* (%)
Storing image and sending forward still images and video clips for analysis/diagnosis	69 (57.5)	64 (53.3)
Live video conferencing or phone conference calling to discuss previously internet-transmitted images	22 (18.3)	23 (19.2)
Live video conferencing to discuss real time internet-transmitted imaging	22 (18.3)	25 (20.8)
None	51 (42.5)	55 (45.8)

Table 6: Statements on the use of telesonography among obstetrics and gynecologic sonologists before and during the pandemic

Statements	*n* (%)
I have never used it	54 (45.0)
I rarely use it before pandemic	22 (18.3)
I rarely use it now during pandemic	12 (10.0)
I use it sometimes before pandemic	21 (17.5)
I use it sometimes now during pandemic	17 (14.2)
I use it frequently before pandemic	5 (4.2)
I use it frequently now during pandemic	13 (10.8)
I don't plan to use it in the future	1 (0.8)
I use it for clinical/diagnostic purposes on my cases to confer with an expert or colleague	46 (38.3)
I use it for teaching purposes	14 (11.7)

time, which may range between 10 and 60 min, the conduct of invasive or transvaginal procedures, and therapeutic or interventional ultrasound-guided procedures may increase the risk of exposure to bodily fluids. Furthermore, as part of the procedure, the patient may be asked to inhale or exhale deeply and hold her breath, and sometimes, even without asking them, the patient may also be coughing, sneezing, or exhaling heavily. Similarly, the surfaces of the ultrasound machine, especially the keyboard, touch screen and trackball, are touched frequently, and may be potential sources of the pathogen. Finally, due to the need to limit the number of sonologists inside the cubicle, the system in place in local training hospitals is for the less experienced fellows-in-training or younger consultants to initially evaluate the patients. When expert opinion is required especially in difficult cases, there is a need to either require the presence of an expert inside the cubicle, or use other means of image transmission for the expert to simultaneously examine the patient electronically, both of which may further prolong the examination. All these factors may potentially contribute to increase the risk for infection, hence the need to assume specific practices.

Guidelines on the performance of ultrasound during pandemic

Different societies both local and international have therefore released their statement guidelines on the performance of ultrasound during the COVID-19 pandemic.[2] opinion-based guidance to ensure that standard procedures are in place to mitigate the risk for infection and to provide specific recommendations for ultrasound examinations in suspected or confirmed cases of COVID-19.[3-7] The local counterpart society, PSUOG also released its own safety statements and recommendations.[8]

Specific PPE is recommended for use by ultrasound Specific personal protective equipment (PPE) is recommended for use by ultrasound providers based on risk assessment of patients for COVID-19.[1] The respondents in this survey generally used at least PPE level 3 in the performance of scan, and this ensured their safety especially when the status of patients is unknown or when there is the possibility of non-disclosure among patients. While proper donning and doffing of PPE and fit testing of masks are required, not all ultrasound providers underwent infection control training including the proper use of PPE, and mostly did not undergo fit tests for respirators. We can surmise that the lack thereof may be due to affiliation to clinics or institutions that may not offer these training and fitting services. Nevertheless, the respondents are well informed and aware of the significance of the infection in relation to their line of profession, based on their response to the statements about the guidelines, and on their sources of information.

Patient screening before ultrasound and use of physical barriers

Triaging and limiting of the cases have been adopted by most doctors, in accordance with the recommendations.[4,5] Interestingly, only half of the respondents had to limit the choice of ultrasound procedures done. This may not be easy to comprehend considering that some procedures are not regarded as high necessity and yet requires prolonged scanning time. Extended scanning time not only exposes the sonologists to the patients longer, but with much inconvenience. In fact, the survey revealed that about half of the respondents had episodes of discomfort and difficulty in breathing due to PPE use and lack of ventilation or had difficulty performing ultrasound due to the partitions and PPE. Although not included in the survey, it is also possible that the patients may have experienced the same discomfort, as they were also required to wear masks and shields during the long procedures with the air-conditioning turned off.

Routine screening of patients by history taking and temperature check were observed by most respondents

in accordance with the guidelines. Patients were not asked to undergo RT-PCR or rapid antibody test before ultrasound similarly for urgent and nonurgent cases. While the ISUOG guidelines recommend delaying the ultrasound assessment of nonurgent cases for the duration of the pandemic,[6] this triaging was followed by most sonologists, and most ultrasound units had no separate rooms to evaluate COVID suspect or positive cases. The setup of most institutions and the unavailability of the appropriate test, mainly RT-PCR, preclude proper laboratory screening of patients before scanning. Fortunately, for the sonologists in the Philippine General Hospital where this study was conducted, all patients for admission are required to undergo RT-PCR tests. When referred for ultrasound, they are triaged based on the urgency and results of the test which become available in 2–3 h. When results are not available and the ultrasound procedure is classified as urgent, the patient is scanned in a designated room for suspected and positive cases. To minimize exposure of personnel, the scans done by fellows in training may be referred to the consultants through telesonography, which will be discussed in the succeeding sections. Screening of sonologists with RT-PCR after inadvertent unprotected exposure or as routinely offered by PGH is also part of the standard practice. In the survey, only a quarter has been tested for COVID-19 as a requirement by the institution they work with, while a good number voluntarily submitted themselves to COVID-19 testing.

Most respondents placed partitions between patient and ultrasound machine/sonologist with minimal cross-access, or less commonly, placed acrylic hood over the patient [Figures 1 and 2]. While these measures are consistent with the PSUOG recommendations,[8] and may seem theoretically protective to both parties, there is no scientific evidence that demonstrates its beneficial effects. At most, safety statements from international ultrasound societies have suggested the use of a physical barrier between the console/keyboard and the sonologist. This may be in the form of a console or keyboard cover which is meant to help facilitate low level disinfection after each examination. It must be noted that presence of the cover does not preclude the need for regular cleaning/disinfection. COVID-19 is viable on plastic surfaces for up to 72 h.[9-11] Furthermore, cleaning of the partition or hood every after patient examination was not performed by some of the respondents, defeating its intended purpose. Similarly, single use of drapes and bed cover were not routinely observed by a portion of the respondents, essentially placing the patients at relatively higher risk for cross-contamination. While no study has evaluated the effectiveness of these measures in preventing infection, due diligence and prudence on the part of the health-care provider can prevent unnecessary exposures.

Disinfection of the machine and preventing environmental contamination

The ISUOG provided a detailed recommendation on the preparation and cleaning of the ultrasound equipment, which consist of 2 critical steps, cleaning and disinfection before and after removal of the disposable probe covers.[3,30] For the first step of cleaning the transducers, the guidelines recommend the use of running water and a small amount of mild nonabrasive liquid soap to remove any residual gel or debris. For the second step, disinfection requires specific agents or methods based on the classification system of medical devices, which, in turn, is according to the infection risk they present. Transabdominal transducers are considered low risk since it is in contact with intact skin, and hence low- or intermediate-level disinfection is recommended. In contrast, transvaginal transducers are considered semi-critical or medium-risk devices with relatively higher risk for infection because of contact with non-intact skin or mucous membranes. Hence, a high-level disinfection is recommended to destroy all microorganisms including SARS-CoV-2. This can be achieved with the use of solutions containing sodium hypochlorite or other disinfectants. It is noteworthy that cleaning of ultrasound transducers routinely with soap and running water was not practiced by almost all sonologists, and mostly relied on disinfection wipes (87%), considered a low-level disinfection method. The recommended disinfection method for the transvaginal transducers is rarely used by the sonologists, a practice that may already have been in place even before the pandemic. This is an important point of consideration for the infection control committee of the different institutions. The need to impose strict implementation of appropriate disinfection methods is highlighted in the results of a local study carried out in the PGH ultrasound unit confirming the presence of pathologic organisms in the transducers (Niemann DL and Amosco MD 2019, unpublished data).

The same ISUOG guidelines also recommend that the highly touched surfaces of the ultrasound machine, including the keyboard, cord, and screen, are thoroughly are thoroughly cleaned after each examination,[3,30] by most respondents. Of interest is the local society's recommendation of covering the keyboard with plastic or cling-wrap which must be replaced after each scan,[8] but which was not among the questions included in the survey. As mentioned under the use of physical barriers, this measure can be considered to minimize surface contamination, but should be disposed of after each to be followed by cleaning and disinfection.[9-11] use of this method may seem impractical and tedious, and just like the plastic barriers and hoods, may prove to be useless if not properly placed as covering, if not replaced per patient, or not cleaned and disinfected after each procedure.

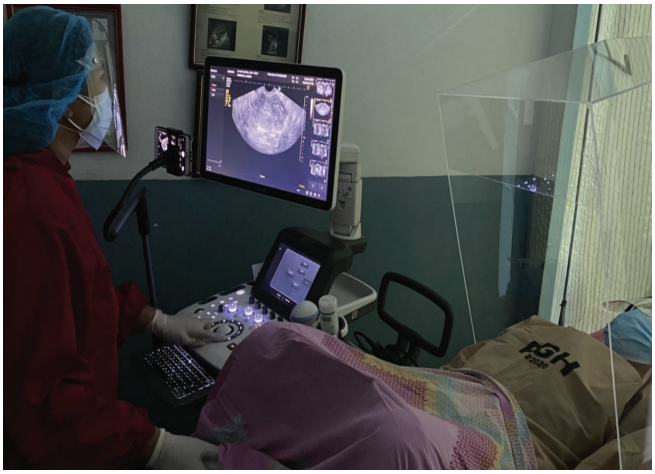

Figure 1: Set-up integrating the use of personal protective equipment, physical barriers, and telesonography apparatus in an ultrasound unit.

Figure 2: A closer look on the set-up of telesonography apparatus and use of Powered Air Purifying Respirator (PAPR) in a COVID-19 ultrasound unit.

Some authors have attempted to evaluate environmental contamination as an important route for transmission route for transmission of SARS CoV-2,[31] andassumed to be the main means of reducing it. No specific guidelines are provided by ISUOG, which recognizes that each ultrasound unit is different and may have varying may have varying requirements.[1] While aerosol-generating procedures may not be of main concern in the performance of ultrasound, an enclosed space will benefit from the use of HEPA filter, or in its absence, turning off air-conditioning and opening windows for good ventilation have been ventilation have been recommended by WHO,[32] and implemented by most practitioners locally.

Mental health of personnel

An important but often underrecognized issue among health-care providers during this pandemic is their pandemic is their mental health.[33] and depression among health-care workers caring COVID-19 patients is high.[34] This is true sonologists who have to evaluate mostly patients with no prior RT-PCR tests, as shown in the results of this survey. Whether they are directly providing service to COVID-19 positive patients or not, their lingering fear of being infected and the potential to transmit the disease to their immediate family are of their utmost concerns. This fear is probably the reason why most of the respondents admitted to have been affected spiritually, most likely as their coping mechanism. Nevertheless, regular screening for mental health issues and well-being evaluation should be routinely performed among medical personnel including sonologists.

Use of telesonography among OB-Gyn sonologists

The same group of sonologists were surveyed on their knowledge, attitude, and practice of telesonography, especially since its use seems very appropriate at this time of the pandemic as an alternative method for evaluating patients and for teaching purposes. The use of telemedicine in general is one of the major shifts in the practice of the medical profession. The use of modern telecommunications and information technology for the exchange of medical information between physically separated sites of clinical practice has been advocated due to its potential to enhance health care to distant underserved areas and to optimize existing medical areas and to optimize existing medical resources.[12] The National Telehealth Center (NTHC) is the primary institution in the country that helps both the patients and the health-care providers maximize the use of tools in information and communications technology, in order to improve healthcare delivery services especially to the underserved communities. Since 2008, the NTHC has been at the forefront of telemedicine, supporting the Department of Health Doctors to the Barrios and the Municipal Health Officers, allowing consultation with specialists via short messaging system (SMS using cellular phones) or electronic mail, and through electronic transmission of radiographs and other diagnostics which are interpreted by specialists based in the Philippine General Hospital and other regional centers.

Only about half of the respondents are aware and have good enough knowledge on telesonography, i.e. they were able to correctly answer >50% of the questions evaluating their knowledge. Of interest is that despite social media among Filipinos,[35] less than half of them are aware that social media platforms (e. g. Facebook, Instagram, and twitter) and messaging applications (e.g. Viber, Telegram, and WeChat) are tools that can be used in telesonography. The minimum requirements to set up telemedicine, including a summary of a comparative review of applications and the list of HIPAA (Health Insurance Portability and Accountability Act) compliant video platforms, have all been included in the telemedicine review published

online by the University of the Philippines Medical University of the Philippines Medical Informatics Unit.[13] This paper may likewise serve its purpose for telesonography. No specific application/platform has been endorsed by the unit, and ultimately, it is still the responsibility of the health-care provider to inform patients of the potential privacy risks when using these specific applications. These should also be among the points discussed when obtaining an informed consent before the performance of telesonography.

The respondents' limited knowledge on the clinical application of telesonography and even with regards to its decades-long use in other countries, may partly be due to the informal sources of information and the absence of formal training on its applications, with only 15% having actually used them during ultrasound training. The relative lack of knowledge translates to only a small number of the respondents who are actually practicing it, both for clinical and teaching purposes. In fact, when they were asked about specific technologies they used, but with the statements describing the technology, the percentage of affirmative replies were higher than when initially asked if they are using telesonography, which probably means they are actually using it without them knowing it. Among the three technologies mentioned, "store-and-forward technology" is the most commonly used. This is probably because it is a low-cost method that is readily available for everyone to use, as it requires initial storing of information on a computer (or an equivalent device), before transmitting it subsequently to the other relevant participant for analysis. This technology is the one often used by hospitals and clinics for storage and subsequent transmission for expert advice on the evaluation of on the evaluation of the images.[14] In contrast respondents have used interactive telemedicine. This technology requires interaction between health care professionals, or between health-care professionals and the patient, and involves a live video conference or a phone conference call to discuss internet-transmitted images either synchronously (real-time transmission) transmission) or asynchronously (previously transmitted images).[14] For practical reasons, an increase in use of any of these platforms is expected during this pandemic, which however was not the case as reflected in the results of the survey [Table 6]. There were less users of store-and-forward technology, and more nonusers during the pandemic, probably due to a generalized decrease in the number of patients seen in the ultrasound units.

Among those who replied of actually using telesonography, most of them use it for clinical or diagnostic purposes to confer with an expert or colleague. This is understandable since the sonologists have obtained basic training in ultrasound and, most likely, may need to refer only difficult cases to their more experienced colleagues. In other countries where the health system is completely different from ours and which relies on referral systems, patients are referred directly to specialized centers. However, the use of this technology provides an avenue for expert sonographic interpretation and diagnosis from tertiary centers to less experienced clinical centers or physician's offices, thereby precluding the need for women to go to these need for women to go to these specialized tertiary centers.[14,15] Cost analysishas shown that patients can save up on expenses that may be incurred when there is a need for them to travel to need for them to travel to specialized centers.[16-18] Some authors clinical scenarios or indications that will benefit from real-time ultrasound telemedicine consultation, most of most of which are high risk pregnancies.[19]

Alternatively, only a small number of the respondents use it for teaching purposes. One function of telemedicine that is implied although not always explicitly included in the definition is its educational capacity, either in a teleconference setting or in a face-to-face interaction. It can be used for educating health professionals and trainees at a distant clinical site, and they can participate with experts in arriving at diagnoses and formulating treatment plans. This is true even with the use of real time ultrasound.[14,20] Both technologies (store-and-forward and interactive) can be used for education, however, the preference for one platform depends on the availability of the facilities and the health-care providers' judgment providers' judgment on which is better in a particular situation.[14,20,21] The authors of this paper have personally witnessed abroad ultrasound specialists coming from different countries giving lectures and expert opinions when evaluating patients in real time. In the local setting, however, the use of telemedicine in ob-gyn ultrasound for both clinical and educational purposes is not encouraged; in fact, it is frowned upon even before the pandemic. This attitude may have stemmed from inadequate knowledge, and hence incorrect perception on the use of telesonography, as reflected in the results of this study.

Despite this relative lack of knowledge and few practicing telesonography, the respondents' moderate to good attitude toward it may actually mean that they may opt to use it when necessary. In fact, among them, only one has actually replied of not planning to use it in the future. It is interesting to know that among the reasons given for not using it, the respondents mainly did not think of using it, and not due to limitations imposed by the society which regulates the practice of ultrasound in obstetrics and gynecology. One of the responses for not using the technology is the belief that it does not give reliable readings, which has been proven wrong

by previous studies.[16-19] Even during the early years of use of telesonography, it has been demonstrated that transmission via satellite and integrated services digital network for interpretation of fetal anatomy in low-risk populations is comparable between standard and videotape review.[16] The diagnostic real-time tertiary fetal ultrasound consultation has been found in only 4% of patients, most of which were considered minor differences.[19] More than the quality of the readings however, is the ability of telesonography to correctly diagnose and improve patient outcome. A study has shown that the use of remote ultrasound can dramatically change the diagnosis and treatment of patients, some of them needing urgent referral for surgical evaluation. This was done by comparing the clinical data before and after the performance of remote performance of remote scanning.[22] The implementation in Australia allowed the evaluation of emergency ultrasound performed by a trainee and transmitted to a more experienced sonologist in a tertiary care prenatal ultrasonography center. In more than half of the patients, additional data were obtained from the readings of the experienced sonologist. There was also a change in the quarter of the cases.[23] These results These results proved that the use of the technology provided satisfactory images that allowed appropriate diagnosis. At present, there is a paucity in data in the use of telesonography in other settings, with most studies and remote rural settings.[24] Future studies must also evaluate its use, applicability, and reliability in evaluating gynecologic cases, and in ultrasound units that cater to mostly COVID-19 suspects and cases, with many limitations imposed in the performance of ultrasound.

The other reason given for not using the technology is due to unreliable internet connection. This may be a major problem only if using live streaming and synchronous telesonography, with the patient examination being done in real time together with the teleconferencing. Otherwise, this may not be a problem for asynchronous platforms, where retrieval and reading of stored images can be done at the most convenient time, including the availability of internet connection. The Office of the National Coordinator for Health Information Technology has set the minimum bandwidth speed requirements to meet the demand for clear audio and video needed for telemedicine consults, with multiple factors taken into consideration, among them, the number of users, the location, and enabling of real time image transfers.[36] The other reasons given for not using it, although rare, are not being allowed by institutions/hospitals, or the belief that it is not legally allowed. Unlike in other countries, where the practice of telemedicine is already governed by rules and regulations, in the Philippines, there is no law that specifically regulates telehealth. However, there are existing laws that have an impact on telemedicine and it is imperative that concerned health practitioners should be familiar with them.[37] The proponents of telehealth in the Philippines, in their telemedicine guidance, have extensively reviewed the minimum and core competencies required for its practice that is applicable to physicians.[13] It also emphasized medical informatics is included among the curricular content in the Doctor of Medicine program, under the Commission on Higher Education (CHED) Memorandum Order 18, series of 2016. Needless to say, there is a need for medical educators to develop and include telemedicine training in order to educate present and future doctors the appropriate knowledge and skills for effective and ethical practice of telehealth. Likewise, there is a need to enact a law governing the use of this technology to protect foremost the welfare of the patients. While the use of telesonography in the Philippines is at its infancy, eventually its increasing practice may be a welcome change among the sonologists, and will become more acceptable especially in these times when the end of the pandemic is still far from reality.

Conclusions

The study found that like all other healthcare providers, OB-Gyn sonologists in the Philippines are aware of the guidelines on the practice of ultrasound this pandemic and perceived themselves to be especially vulnerable to the infection. These awareness and perceptions were translated to specific practices in the performance of ultrasound that include the use of level 3 PPE, proper screening of patients, triaging, limiting number of patients seen, and the use of physical barriers and measures to minimize environmental and cross-contamination. Although these practices have been adopted to mitigate infection and cross-contamination, most sonologists were not compliant with proper ultrasound transducer cleaning and disinfection, a practice that most likely has been the standard even before the pandemic. Furthermore, some of the recommendations and practices are not based on sound scientific evidence and hence do not merit support for their use. There may be disagreements about the basis; hence, a review of their use may be warranted which should be validated by acceptable research findings. While this study may not have dealt with an in-depth analysis on the mental well-being of the sonologists, it has shown that a certain level of stress, anxiety, and depression can be observed among the sonologists. Just like other medical personnel, regular screening for mental health issues and well-being evaluation are warranted among sonologists and should be considered as part of future guidelines on the practice of ultrasound.

Regarding the use of telesonography, a dismal half had good knowledge, with most having informal sources of information on the technology. Although the respondents

have a good attitude toward it, only a few admitted to using it, either to confer with an expert or colleague or less often for teaching. Despite its potential benefits especially at this time of the pandemic, telesonography is not among the changes adopted by most local sonologists both for clinical and teaching purposes. With the CHED directive to include medical informatics in the medical curriculum, it is but appropriate that doctors will be taught and trained on appropriate knowledge and skills for effective and ethical practice of telehealth including the use of telesonography.

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There are no conflicts of interest.

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