

Satisfaction Survey of Patients and Medical Staff for Telephone-Based Telemedicine During Hospital Closing Due to COVID-19 Transmission

Hyung-Youl Park, MD,¹ Young-Mi Kwon, PhD,² Ha-Rin Jun, BS,³ Seung-Eun Jung, MD, PhD,⁴ and Soon-Yong Kwon, MD, PhD¹

¹Department of Orthopedic Surgery, Eunpyeong St. Mary's Hospital, The Catholic University of Korea, Seoul, Republic of Korea.

²Customer Happiness Team, Eunpyeong St. Mary's Hospital, The Catholic University of Korea, Seoul, Republic of Korea.

³K-School, Korea Advanced Institute of Science and Technology, Daejeon, Republic of Korea.

⁴Department of Radiology, Eunpyeong St. Mary's Hospital, The Catholic University of Korea, Seoul, Republic of Korea.

Abstract

Introduction: Telephone-based telemedicine was temporarily permitted in Korea during the COVID-19 pandemic. The purpose of this study was to assess satisfaction with the telemedicine done during temporary hospital closing when in-person visits were not allowed due to in-hospital COVID-19 transmission.

Methods: Survey questionnaires partially taken from a telehealth usability questionnaire (TUQ) were sent to 6,840 patients who used telephone-based telemedicine from February 24 to March 7, 2020. Questionnaires sent to patients and additionally created questionnaires to evaluate telemedicine were sent to medical staff (182 doctors and 138 nurses).

Results: Response rates of patients and medical staff were 13.2% and 17.2%, respectively. Patients' satisfaction with telemedicine was significantly greater than medical staff's satisfaction for all five components taken from TUQ (all $p=0.000$). In addition, created questionnaires showed good reliability, obtaining similar results between doctors and nurses (all $p>0.05$). More than 85% of medical staff replied that telemedicine was needed in COVID-19, whereas more than 80% of them worried about incomplete assessment and communication of medical condition. Overall satisfaction with telemedicine by medical staff was 49.7%. The strength of telephone-based telemedicine was patients' convenience (53.4%). However, incomplete assessment of patients' condition (55.0%) was its weakness.

Conclusion: Satisfaction with telephone-based telemedicine by patients was significantly greater than that by medical staff (doctors and nurses). Negative views for safety and inconvenience resulted in a greater proportion of dissatisfaction among medical staff. For safe application of telemedicine, medical staff insisted that developing a platform and creating guidelines should be needed.

Keywords: patient satisfaction, telemedicine, COVID-19, health facility closure

Introduction

The epidemic of 2019 novel coronavirus (severe acute respiratory syndrome coronavirus 2) or COVID-19 has expanded from Wuhan throughout China. It has been exported to a growing number of countries.¹ Six million peoples have been confirmed to be COVID-10 positive and more than 370,000 patients have died from it.² With a high transmission rates but no curative therapies or vaccine available, the current management focuses on prevention by social distancing.³

During the COVID-19 pandemic, health care systems have begun crisis to maintain effective patient care while preventing virus exposure.^{4,5} In this regard, telemedicine takes advantages of continuing to care for patients while isolating high-risk patients to avert further contact. Scheduled office visits are also converted to telemedicine visits in situation when health care workers are quarantined.⁶ Although telemedicine has not been readily adopted, widespread implementation has begun during the COVID-19 crisis.⁷

In Korea, telemedicine has not been legally allowed by the government. However, consultation and prescription through telephone were temporarily permitted by the Ministry of Health and Welfare from February 24, 2020, due to the COVID-19 pandemic. Telephone-based telemedicine was limited to stable patients to assure safety without emergent medical conditions.

The purpose of this study was to assess satisfaction with telemedicine by patients and medical staff during the 17 days

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of temporary hospital closing when in-person visits were not allowed by the city government fearing mass outbreak.

Methods

Two patients were diagnosed with community-acquired pneumonia from COVID-19 in our hospital. After two more patients (one hospital staff responsible for transporting patients and one caregiver) were confirmed to be positive for COVID-19, the city government took measures to temporarily close the entire outpatient clinic and emergency room for 17 days under guidelines set during the 2015 Middle East Respiratory Syndrome (MERS) outbreak.⁸ Because in-person visits were not allowed during the temporary hospital closing, 6,840 patients used telephone-based telemedicine from February 24 to March 7, 2020, as an alternative. Survey questionnaires through text messages were sent to 6,840 patients, because all patients had agreed to have personal information collected. Survey questionnaires were also sent to medical staff, including 182 doctors and 138 nurses. All doctors, including traumatologists and radiologists, were included in this survey. This study was approved by our Institutional Review Board (Approval No. PC20QASI0038).

SURVEY QUESTIONNAIRE FOR PATIENTS

Demographic data such as sex, age, department (medical or surgical), and route to access telemedicine were collected. Questionnaires for patients were taken from the telehealth usability questionnaire (TUQ) with slight changes. TUQ has 21 items in six components (usefulness, ease of use and learnability, interface quality, interaction quality, reliability, satisfaction, and future use).⁹ Representative five questionnaire items in four components (ease-of-use, interaction quality, reliability, satisfaction, and future use) were selected to increase response rate and reflect the limit of telephone-based telemedicine. Five items are presented in *Table 1*. All items were found to have good ($0.7 \leq \alpha < 0.9$) or excellent ($0.9 \leq \alpha$) reliability based on Cronbach’s coefficient alpha.^{9,10}

SURVEY QUESTIONNAIRE FOR MEDICAL STAFF

Demographic data of telemedicine for medical staff included department (medical or surgical), time spent on each patient, and total calls per day. Same questionnaires taken from the TUQ were also sent to medical staff, including doctors and nurses.⁹

In addition, 12 questions in four components (perception, safety, satisfaction, and necessity) of telemedicine were developed and asked (*Table 1*). Strengths and weaknesses of telephone-based telemedicine were asked in forms of open-ended questions to assess medical staff’s opinions. Prerequisites and difficult medical fields to apply telemedicine were also asked.

Table 1. Questionnaire for Patients and Medical Staff	
SURVEY QUESTIONNAIRE FOR PATIENT AND MEDICAL STAFF	
1. Ease-of-use	"It was convenient to use this system"
2. Interaction quality	"I felt I was able to express myself effectively as in-person visits"
3. Reliability	"I think the visits provided over the telemedicine system are the same as in-person visits"
4. Satisfaction	"Overall, I am satisfied with this telemedicine system"
5. Future use	"I would use telemedicine services again"
SURVEY QUESTIONNAIRE FOR MEDICAL STAFF	
1. Perception	"I know the purpose of telemedicine"
	"I understand advantages and disadvantages of telemedicine"
2. Safety	"I can check patients' condition through telemedicine as in-person visits"
	"Emergent situation hardly ever happens, although I cannot see patients"
	"I can explain patients' medical condition well enough as in-person visits"
	"I think patients can understand their condition during telemedicine as in-person visits"
3. Satisfaction	"Telemedicine is convenient to use compared with the in-person visits"
	"Overall, I am satisfied with this telemedicine system"
	"I would use telemedicine services again"
4. Necessity	"Telemedicine is needed in emergent situations such as COVID-19"
	"Telemedicine is needed regardless of emergent situations such as COVID-19"
	"Telemedicine can replace partially in-person visits"

STATISTICS

Categorical variables of the questionnaire were compared using Pearson’s chi-square test or Fisher’s exact test depending on expected frequency. Cronbach’s alpha was calculated to assess the degree of internal consistency and homogeneity among the four components developed in this study. Statistical analyses were conducted using SPSS software (Version 24.0; IBM SPSS Statistics, Armonk, NY) with a level of significance of 0.05.

Results

DEMOGRAPHICS OF PATIENTS USING TELEMEDICINE

Demographic data of patients are summarized in *Table 2*. Nine hundred six patients ($N=906$) responded to the survey among 6,840 patients who used telephone-based telemedicine.

Table 2. Demographic Data of Telephone-Based Telemedicine in the Patients

PARAMETERS	VARIABLES	PATIENTS (N=906), N (%)
Response to survey	Sent	6,840
	Responded	906
	Response rate	13.2%
Sex	Male	381 (42.1)
	Female	511 (56.4)
	Unresponded	14 (1.5)
Age	10–20	3 (0.3)
	20–30	24 (2.7)
	30–40	52 (5.7)
	40–50	119 (13.1)
	50–60	217 (24.0)
	60–70	292 (32.2)
	≤70	184 (20.3)
	Unresponded	15 (1.7)
Department	Medical	441 (48.7)
	Surgical	313 (34.5)
	Unresponded	152 (16.8)
Route to telemedicine	Outpatient clinic nurses	624 (68.9)
	Attending physicians	122 (13.4)
	Media report	64 (7.1)
	Others	76 (8.4)
	Unresponded	20 (2.2)
Medical complications		0 (0.0)

The response rate was 13.2%. There were 511 (56.4%) female patients and 381 (42.1%) male patients. More than 50% (52.5%) of patients who used telemedicine were older than 60 years. About 50% (48.7%) of patients used telephone-based telemedicine for medical care, followed by surgical care (34.5%) and unresponded (16.8%). The most common route to telemedicine was through guidance of outpatient clinic nurses (68.9%), followed by attending physicians (13.4%) and media report (7.1%). All patients reported no medical complication from using telemedicine.

DEMOGRAPHICS OF MEDICAL STAFF WHO PARTICIPATED IN TELEMEDICINE

Demographic data of medical staff are shown in *Table 3*. Fifty-five of 182 doctors and 100 of 138 nurses who had

Table 3. Demographic Data of Telephone-Based Telemedicine in the Medical Staff Including Doctors and Nurses

PARAMETERS	VARIABLES	DOCTORS (N=55), N (%)	NURSES (N=100), N (%)	P
Response to survey	Sent	182	138	0.000
	Responded	55	100	
	Rate	30.2%	72.5%	
Department	Medical	24 (43.6)	46 (46.0)	0.777
	Surgical	31 (56.4)	54 (54.0)	
Time spent on each patient	<5 min	26 (47.3)	24 (24.0)	0.011
	5–10 min	24 (43.6)	51 (51.0)	
	10–15 min	4 (7.3)	17 (17.0)	
	≥15 min	1 (1.8)	8 (8.0)	
Total calls a day for telemedicine	<10	49 (89.1)	60 (60.0)	0.000
	10–20	4 (7.3)	14 (14.0)	
	20–30	2 (3.6)	12 (12.0)	
	30–40	0 (0.0)	7 (7.0)	
	≥40	0 (0.0)	7 (7.0)	
Medical complications	Medical	0 (0.0)	0 (0.0)	1.000
	Surgical	0 (0.0)	0 (0.0)	

participated in telephone-based telemedicine responded to the survey. The response rate of nurses was significantly higher than that of doctors (72.5% vs. 30.2%, $p=0.000$). Departments that medical staff belonged to were similar between doctor and nurse groups. About three-quarters (76.0%) of nurses spent more than 5 min for prescribing telemedicine, whereas 47.3% of doctors spent less than 5 min ($p=0.011$). Almost 90% of doctors reported less than 10 calls per day for telemedicine, whereas 40% of nurses reported greater than 10 calls per day ($p=0.000$). All medical staff reported no medical complication resulting from using the telemedicine.

SATISFACTION WITH TELEMEDICINE BETWEEN PATIENTS AND MEDICAL STAFF

Results of satisfaction with telemedicine between patients and medical staff are shown in *Table 4* and in *Figure 1*. Almost 80% of patients reported the convenience of telemedicine, whereas only 38.2% of doctors and 30.0% of nurses replied that telemedicine was convenient to use (both $p=0.000$ compared with patients). For interaction quality, 87.1% of

Table 4. Comparison of the Satisfaction of Telephone-Based Telemedicine Between Patients and Medical Staff

PARAMETERS	PATIENTS (N= 906), N (%)	DOCTORS (N= 55), N (%)	p^a	NURSES (N= 100), N (%)	p^b
Ease of use	724 (79.9)	21 (38.2)	0.000	30 (30.0)	0.000
Interaction quality	789 (87.1)	4 (7.3)	0.000	9 (9.0)	0.000
Reliability	789 (87.1)	8 (14.5)	0.000	14 (14.0)	0.000
Satisfaction	779 (86.0)	29 (52.7)	0.000	48 (48.0)	0.000
Future use	771 (85.1)	18 (32.7)	0.000	37 (37.0)	0.000

^a p -Value between the patients and doctors.

^b p -Value between the patients and nurses.

patients reported effective expression as in-person visits, whereas less than 10% of doctors and nurses could express themselves effectively ($p=0.000$ for both doctors and nurses compared with patients). Regarding reliability, 87.1% of patients thought telemedicine had the same reliability as in-person visits. However, only 14.5% of doctors and 14.0% of nurses reported that telemedicine had the same reliability ($p=0.000$ both for doctors and nurses compared with patients). Overall satisfaction was reported by 86% of patients, whereas only 52.7% of doctors and 48.0% of nurses were satisfied with telemedicine ($p=0.000$ for both doctors and

nurses compared with patients). Finally, 85.1% of patients were willing to use telemedicine service again, whereas only 32.7% of doctors and 37.0% of nurses reported such willingness ($p=0.000$ both for doctors and nurses compared with patients).

SATISFACTION WITH TELEMEDICINE BETWEEN DOCTORS AND NURSES

The questionnaire developed for medical staff is shown in Table 5. Cronbach’s alpha values for its four components (perception, safety, satisfaction, and necessity) were 0.725, 0.695, 0.752, and 0.714, respectively. These four components had acceptable ($0.6 \leq \alpha < 0.7$) or good ($0.7 \leq \alpha < 0.9$) reliability based on Cronbach’s coefficient alpha.¹⁰

Regarding perception, 98.2% of doctors and 98.0% of nurses replied that they knew the purpose, pros, and cons of telemedicine. However, more than 80% of doctors and nurses reported difficulties checking patients’ condition, explaining patients’ conditions, and obtaining patients’ understanding (85.5% vs. 86.0% for checking; 85.5% vs. 83.0% for explaining, and 85.5% vs. 83.0% for patients’ understanding). Moreover, 60% of doctors and 70% of nurses reported that an emergent situation could happen because they could not see patients. Regarding satisfaction, 61.8% of doctors and 70.0% of nurses reported the inconvenience of the telemedicine system compared with in-person visits. Regarding overall satisfaction with the telemedicine system, 52.7% of doctors

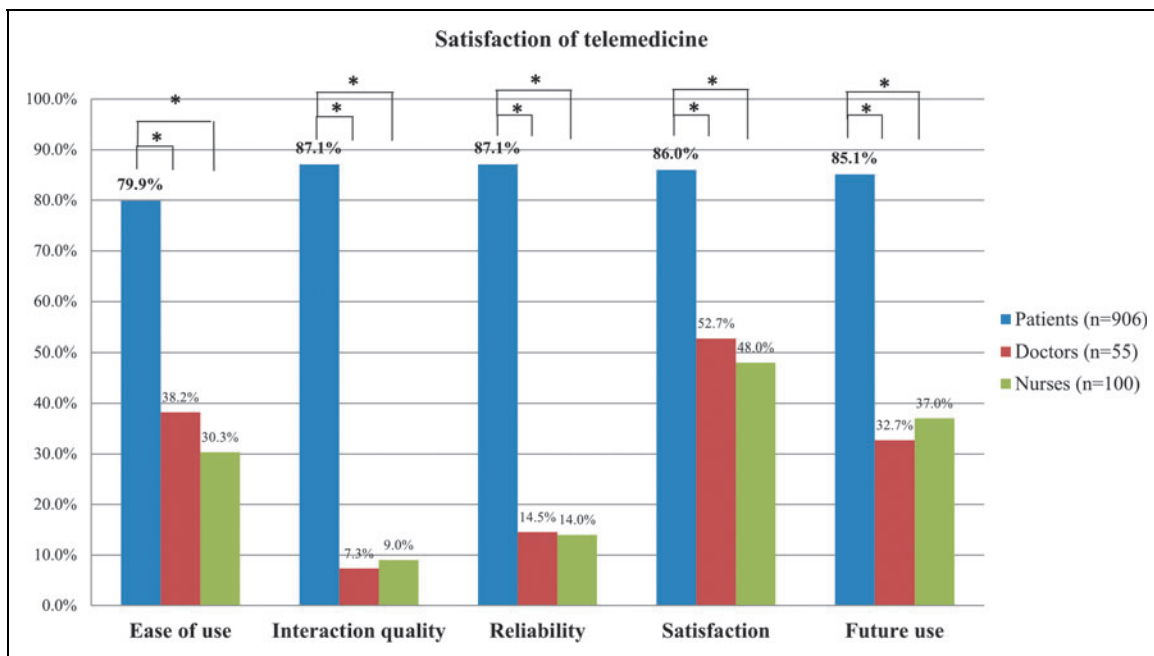


Fig. 1. Comparison of patients’ and medical staff’s satisfaction with telephone-based telemedicine. * $p < 0.05$.

Table 5. Questionnaire for Medical Staff Regarding Telephone-Based Telemedicine

PARAMETERS	VARIABLES	DOCTORS (N= 55), N (%)	NURSES (N= 100), N (%)	P	TOTAL (N= 155), %
Perception					
I know the purpose of telemedicine	Yes	54 (98.2)	98 (98.0)	1.000	98.1
	No	1 (1.8)	2 (2.0)		1.9
I understand advantages and disadvantages of telemedicine	Yes	54 (98.2)	98 (98.0)	1.000	98.1
	No	1 (1.8)	2 (2.0)		1.9
Safety					
I can check patients' condition through telemedicine as in-person visits	Yes	8 (14.5)	14 (14.0)	0.926	14.2
	No	47 (85.5)	86 (86.0)		85.8
Emergent situation hardly ever happens although I cannot see patients	Yes	22 (40.0)	30 (30.0)	0.207	33.5
	No	33 (60.0)	70 (70.0)		66.5
I can explain patients' medical conditions well enough as in-person visits	Yes	4 (7.3)	9 (9.0)	1.000	8.4
	No	51 (92.7)	91 (91.0)		91.6
I think patients can understand their condition during telemedicine as in-person visits	Yes	8 (14.5)	17 (17.0)	0.691	16.1
	No	47 (85.5)	83 (83.0)		83.9
Satisfaction					
Telemedicine is convenient to use compared with the in-person visits	Yes	21 (38.2)	30 (30.0)	0.300	32.9
	No	34 (61.8)	70 (70.0)		67.1
Overall, I am satisfied with this telemedicine system	Yes	29 (52.7)	48 (48.0)	0.573	49.7
	No	26 (47.3)	52 (52.0)		50.3
I would use telemedicine services again	Yes	18 (32.7)	37 (37.0)	0.595	35.5
	No	37 (67.3)	63 (63.0)		64.5
Necessity					
Telemedicine is needed in emergent situations such as COVID-19	Yes	44 (80.0)	89 (89.0)	0.124	85.8
	No	11 (20.0)	11 (11.0)		14.2
Telemedicine is needed regardless of emergent situations such as COVID-19	Yes	13 (23.6)	30 (30.0)	0.397	27.7
	No	42 (76.4)	70 (70.0)		72.3
Telemedicine can replace partially in-person visits	Yes	24 (43.6)	52 (52.0)	0.319	49.0
	No	31 (56.4)	48 (48.0)		51.0

and 48.0% nurses expressed such satisfaction. Regarding reuse intention of the telemedicine system, 32.7% of doctors and 37.0% of nurses expressed such reuse intention. More than 80% of doctors and nurses reported that the telemedicine system was necessary for emergent situations such as COVID-19, whereas less than 30% of the medical staff replied that telemedicine was necessary for usual situations (doctors and nurses: 80.0% vs. 89.0% for emergent situations; 23.6% vs. 30.0% for usual situations). For substitution of in-person visit,

43.6% of doctors and 52.0% of nurses reported that telemedicine could replace in-person visits partially. For all questions developed in this study, comparisons between doctors and nurses showed similar results (all $p > 0.05$).

STRENGTHS AND WEAKNESSES OF TELEPHONE-BASED TELEMEDICINE

Strengths and weaknesses of telephone-based telemedicine based on medical staff's response to open-ended questions

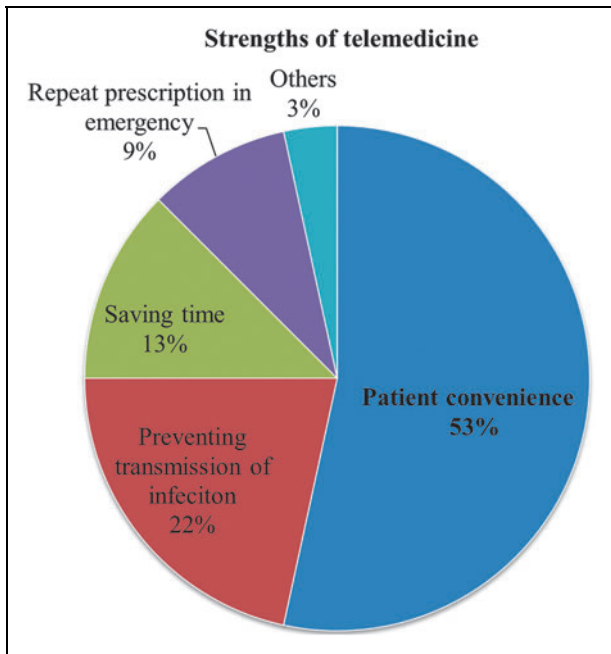


Fig. 2. Strengths of telephone-based telemedicine answered by medical staff (n=88).

are shown in Figures 2 and 3. Strengths of telephone-based telemedicine included patients' convenience (53.4%), preventing transmission of infection (21.6%), saving time (12.5%), and repeat prescription in emergency (9.1%) based on a total of 88 medical staff's responses. Weaknesses of tele-

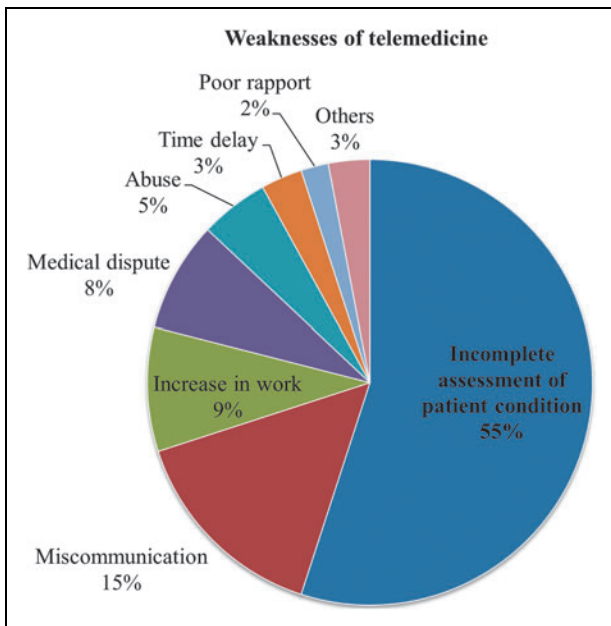


Fig. 3. Weaknesses of telephone-based telemedicine answered by medical staff (n=100).

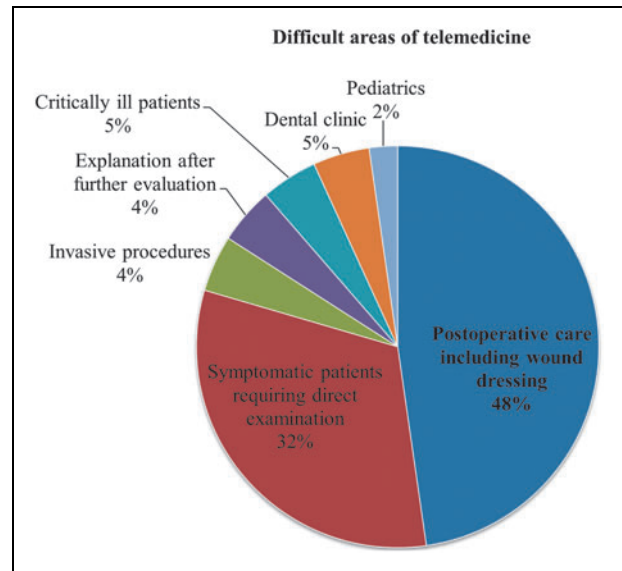


Fig. 4. Difficult areas to apply telemedicine pointed out by medical staff (n=44).

medicine based on responses of medical staff (n=100) included incomplete assessment of patients' condition (55%), miscommunication (15%), increase in work (9%), medical dispute (8%), and abuse (5%).

DIFFICULT AREAS AND PREREQUISITES FOR THE APPLICATION OF TELEMEDICINE

Difficult areas and prerequisites for the application of telemedicine are shown in Figures 4 and 5. Difficult areas to

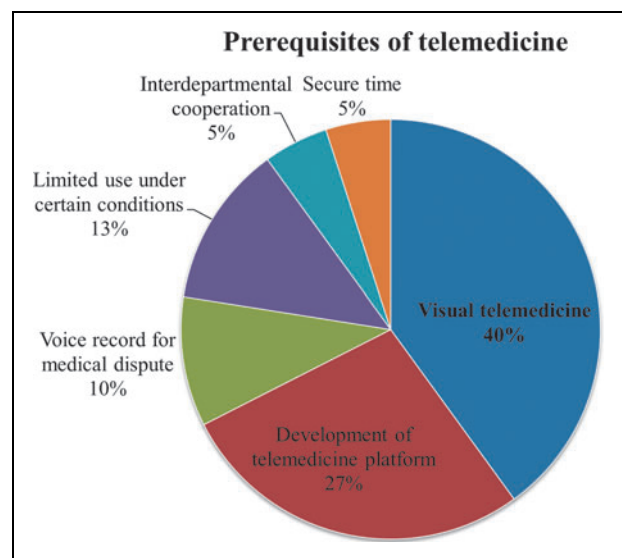


Fig. 5. Prerequisites of telemedicine suggested by medical staff (n=40).

apply telemedicine were postoperative care including wound dressing (47.7%), followed by symptomatic patients requiring direct examination (31.8%), invasive procedures (4.5%), explanation after further evaluation (4.5%), critically ill patients (4.5%), and dental clinic (4.5%). Prerequisites for application of telemedicine included video telemedicine (40.0%), development of platform (27.5%), limited use under certain conditions (12.5%), voice record for medical dispute (10.0%), interdepartmental cooperation (5.0%), and secure time (5.0%).

Discussion

COVID-19 has completely changed the paradigm of health care systems. The current dilemma is how to provide service not only for those afflicted with COVID-19 but also for patients suffering from other acute and chronic diseases while protecting medical staff.¹¹⁻¹³ In this regard, telemedicine must be one of game changers during the COVID-19 pandemic. Although telemedicine has been legally prohibited in Korea, telephone-based telemedicine was temporarily permitted from February 24, 2020, due to the COVID-19 pandemic. After our hospital was temporarily closed on February 21, 6,840 patients used telephone-based telemedicine from February 24 to March 7, 2020. According to the Ministry of Health and Welfare, about 27,000 patients used telemedicine in the whole country from February 24 to April 1, 2020.¹⁴ During early COVID-19, 25.3% of patients used telephone-based telemedicine in a single hospital. Thus, this study was designated to evaluate the advantages and disadvantages of telephone-based telemedicine and suggest a supplementation for safe application of telemedicine based on our early experiences.

In this study, satisfaction with telemedicine by patients was significantly greater than that by medical staff. Although elderly patients older than 60 years counted for half of our subjects, more than 80% of patients replied that telemedicine was convenient, interactive, and reliable. Thus, 86.0% and 85.1% of patients reported overall satisfaction and future use. Similarly, López et al.¹⁵ have reported that 80% of responders are satisfied with teleconsultation and 63% would use telemedicine again in a telephone survey of patient satisfaction with telemedicine in a rural community. Medical staff also pointed out that strengths of telemedicine were associated with patient's factors including patients' convenience (53.4%), preventing transmission of infection (21.6%), saving time (12.5%), and repeat prescription in emergency (9.1%). This finding was consistent with previous studies reporting that telemedicine was an effective form with benefits such as increased convenience and time saving for patients.^{16,17}

Moreover, patients' higher satisfaction with telemedicine might be associated with the emergent situation due to

COVID-19. Lewis et al.¹⁷ have reported that patients' great appreciation and satisfaction are due to improved efficiency and cost-effectiveness without the risk of direct person-to-person transmission. More than 98% of medical staff also replied the purpose of telemedicine and 85.8% of them insisted that telemedicine was needed in an emergent situation such as COVID-19. Similarly, Moazzami et al.¹⁸ have demonstrated that telemedicine could provide advantages for medical staff to overcome patient flow and reduce the workload of physicians as well as minimizing the risk of exposure of health care providers to pathogens.

Meanwhile, both doctors and nurses reported significantly lower satisfaction for all questionnaire items compared with patients. Medical staff showed more negative responses to interaction and reliability components. For the questionnaire developed in this study, doctors and nurses were concerned about safety aspects. More than 80% of medical staff reported the difficulty of checking and explaining patients' conditions. Although no medical complication had been noted in this study, 60% of doctors and 70% of nurses were worried about emergent situations that might happen because of limited visualization in telephone-based telemedicine. This result was consistent with a previous study reporting that telephone visits typically conveyed less information, which could be risky compared with video visits, although telephone-based telemedicine was preferred over video visits by providers and/or patients who were less technologically inclined.¹⁹ Medical staff also reported that weaknesses of telephone-based telemedicine were incomplete assessment of patients' condition (55.0%) and miscommunication (15.0%). Regarding this, Jayawardena et al.²⁰ have demonstrated that the nature of telemedicine can limit a provider's ability to obtain a comprehensive physical examination, although physical examination is fundamental in physician's diagnostic armamentarium. In addition, medical staff noted that it was difficult to apply telemedicine to postoperative wound care, invasive procedures such as dental clinic, and critically ill patients requiring in-person visits.

However, if such drawbacks are improved and complemented, telemedicine could be helpful for both patients and medical staff because telemedicine also has substantial benefits as mentioned above. First of all, 40% of medical staff insisted that video telemedicine rather than telephone-based telemedicine was needed to check patients' conditions for safe application. Recently, several studies have demonstrated that visual physical examination can be conducted accurately and comprehensively despite inherent weaknesses due to the absence of direct physical contact.^{21,22} Tanaka et al.²² have reported protocols and methods to maximize the benefit and

efficiency of virtual orthopedic examination. Moreover, 27% of medical staff reported the inconvenience for connection with patients and pointed out the need for platform development. Especially, nurses took more time and total calls a day for telemedicine compared with doctors. Khairat et al.²³ have demonstrated that telemedicine platforms can be utilized to improve primary care efficiently by allowing medical staff to follow-up with their patients in a time and place that would be the most convenient for both groups. Voice record and recognition are also needed for telemedicine to be saved as electronic medical records and prevent any medical dispute. For successful development of telemedicine, Yellowlees²⁴ already emphasized that clinical documentation and further voice-recognition typing systems would remain a crucial part of communications for clinicians using telemedicine in the future. Finally, diseases and medical conditions that can be treated and followed by the telemedicine should be clarified through expert discussion and guidelines. Similarly, repeat prescriptions through telemedicine should be done with routine follow-up in accordance with appropriate guidelines.²⁵

This study has some limitations. First, patients' satisfaction with telephone-based telemedicine might have been overestimated because in-person visits were not allowed during temporary hospital closing due to in-hospital COVID-19 transmission. Satisfaction by patients may be different when both in-person visits and telemedicine are available. Second, selection bias, including only satisfied patients, might have influenced the results, because the response rate of patients was low (13.2%). Third, the possibility of medical complications should be considered because telephone-based telemedicine was limited to stable patients to assure safety and most patients wanted repeat prescriptions. Finally, satisfaction survey of telemedicine was done in a single university-affiliated hospital in this study. The medical condition and situation of patients could be different depending on the role and size of clinics and hospitals. Thus, further trials considering different roles of clinics and hospitals are needed to validate and extend the results of this study. Despite these limitations, the strength of this study is that it is the first study to assess satisfaction of telephone-based telemedicine done as an alternative during temporary hospital closing when in-person visits are not allowed.

Conclusion

Response rates of patients and medical staff were 13.2% and 17.2%, respectively. Patients' satisfaction with telephone-based telemedicine was significantly greater than satisfaction by medical staff, including both doctors and nurses. Medical staff reported good perception of the purpose and necessity of

telemedicine during the COVID-19 pandemic. However, negative view for safety and inconvenience by medical staff resulted in a greater proportion of dissatisfaction. Patients' convenience was a strength of telemedicine, whereas incomplete assessment of patients' conditions was its weakness. For direct procedures and examination that are only possible in in-person visits, it is difficult to apply telemedicine. For safe application to reduce the potential risk of untact medical care, medical staff insisted that the development of a telemedicine platform including visual displays and voice record was needed. Moreover, diseases and medical conditions that can be followed by telemedicine should be clarified through expert discussion and guidelines.

Authors' Contributions

Conceptualization: S.-E.J. and S.-Y.K. Data curation: H.-Y.P., Y.-M.K., and H.-R.J. Formal analysis: H.-Y.P. Methodology: H.-Y.P., Y.-M.K., and H.-R.J. Project administration: S.-Y.K. Supervision: S.-E.J. and S.-Y.K. Writing—original draft: H.-Y.P. Writing—review and editing: S.-E.J. and S.-Y.K.

Disclosure Statement

No competing financial interests exist.

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REFERENCES

- Lipsitch M, Swerdlow DL, Finelli L. Defining the epidemiology of Covid-19—Studies needed. *N Engl J Med* 2020;382:1194–1196.
- WHO. Coronavirus disease 2019 (COVID-19). Situation Report—133. 2020. Available at https://www.who.int/docs/default-source/coronavirus/situation-reports/20200601-covid-19-sitrep-133.pdf?sfvrsn=9a56f2ac_4 (last accessed June 1, 2020).
- Singh AP, Berman AT, Marmarelis ME, et al. Management of lung cancer during the COVID-19 pandemic. *JCO Oncol Pract* 2020;16:579–586.
- Makhni MC, Riew GJ, Sumathipala MG. Telemedicine in orthopaedic surgery: Challenges and opportunities. *J Bone Joint Surg Am* 2020;102:1109–1115.
- Viswanathan VK, Subramanian S, Rao AK. Principles for managing patients with spinal ailments in the coronavirus disease 2019 era: What do we know so far? An evidence-based, narrative review. *Asian Spine J* 2020;14:572–580.
- Hollander JE, Carr BG. Virtually perfect? Telemedicine for Covid-19. *N Engl J Med* 2020;382:1679–1681.
- Loeb AE, Rao SS, Ficke JR, et al. Departmental experience and lessons learned with accelerated introduction of telemedicine during the COVID-19 crisis. *J Am Acad Orthop Surg* 2020;28:e469–e476.
- Lee H, Heo JW, Kim SW, et al. A lesson from temporary closing of a single University-affiliated Hospital owing to in-hospital transmission of coronavirus disease 2019. *J Korean Med Sci* 2020;35:e145.

9. Parmanto B, Lewis AN, Jr., Graham KM, et al. Development of the Telehealth Usability Questionnaire (TUQ). *Int J Telerehabil* **2016**;8:3–10.
10. Tavakol M, Dennick R. Making sense of Cronbach's alpha. *Int J Med Educ* **2011**;2:53–55.
11. Bashshur R, Doarn CR, Frenk JM, et al. Telemedicine and the COVID-19 pandemic, lessons for the future. *Telemed J E Health* **2020**;26:571–573.
12. Yadav SK, Kar BK, Banta A, et al. Creating backup management resources for spine care during the coronavirus disease 2019 pandemic. *Asian Spine J* **2020**; 14:382–384.
13. Um SH, Kim DH, Youn MY, et al. Protection of surgical team from COVID-19 during bipolar hemiarthroplasty in an infected elderly patient. *Clin Orthop Surg* **2020**;12:286–290.
14. Ministry of Health and Welfare. Press release. 2020. Available at www.korea.kr/common/download.do?fileId=190858709&tblKey=GMN (last accessed May 12, 2020).
15. López C, Valenzuela JI, Calderón JE, et al. A telephone survey of patient satisfaction with realtime telemedicine in a rural community in Colombia. *J Telemed Telecare* **2011**;17:83–87.
16. Hjelm NM. Benefits and drawbacks of telemedicine. *J Telemed Telecare* **2005**; 11:60–70.
17. Lewis GD, Hatch SS, Wiederhold LR, et al. Long-term institutional experience with telemedicine services for radiation oncology: A potential model for long-term utilization. *Adv Radiat Oncol* **2020**;5:780–782.
18. Moazzami B, Razavi-Khorasani N, Dooghaie Moghadam A, et al. COVID-19 and telemedicine: Immediate action required for maintaining healthcare providers well-being. *J Clin Virol* **2020**;126:104345.
19. Contreras CM, Metzger GA, Beane JD, et al. Telemedicine: Patient-provider clinical engagement during the COVID-19 pandemic and beyond. *J Gastrointest Surg* **2020**;24:1692–1697.
20. Jayawardena ADL, Mankarious LA, Keamy DG, Jr., et al. Pediatric, family-centered, "At-Home" otologic physical examination in the COVID-19 era. *Otolaryngol Head Neck Surg* **2020**. [Epub ahead of print]; DOI: 10.1177/0194599820934776.
21. Blue R, Yang AI, Zhou C, et al. Telemedicine in the era of COVID-19: A neurosurgical perspective. *World Neurosurg* **2020**;139:549–557.
22. Tanaka MJ, Oh LS, Martin SD, et al. Telemedicine in the era of COVID-19: The virtual orthopaedic examination. *J Bone Joint Surg Am* **2020**;102:e57.
23. Khairat S, Tirtanadi K, Ottmar P, et al. Would geriatric patients accept using a telemedicine platform for post ICU-discharge follow-up visits? *Stud Health Technol Inform* **2019**;264:1233–1237.
24. Yellowlees P. Successful development of telemedicine systems—Seven core principles. *J Telemed Telecare* **1997**;3:215–222; discussion 22–23.
25. Iyengar K, Jain VK, Vaishya R. Pitfalls in telemedicine consultations in the era of COVID 19 and how to avoid them. *Diabetes Metab Syndr* **2020**;14: 797–799.

Address correspondence to:
Soon-Yong Kwon, MD, PhD
Department of Orthopedic Surgery
Eunpyeong St. Mary's Hospital
The Catholic University of Korea
1021, Tongil-Ro
Eunpyeong-gu
Seoul 03312
Republic of Korea

E-mail: sykwon@catholic.ac.kr

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