

Telemedicine During the COVID-19 Pandemic: A Paradigm Shift in Non-Communicable Disease Management? – A Cross-Sectional Survey from a Quaternary-Care Center in South India

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Purpose: This study aims to gauge the perception and adoption rates of telemedicine amongst patients with non-communicable diseases (NCD) as opposed to in-person consultations in a quaternary care center in South India.

Patients and Methods: A web-hosted 21-item cross-sectional survey was distributed to 220 randomly selected patients with a routine appointment in one of the seven departments caring for NCDs in the study center. Descriptive analysis and inferential analyses were done. Paired samples *T*-test and Pearson's Chi-square test were used study associations.

Results: In-person consultations decreased by 1.9 ± 4.47 visits per year, in 2020 vs 2019. Most participants reported "fear of COVID-19" as the primary reason for this decline. Participants also reported that their consultation times had significantly decreased ($OR=6.43$, 95% $CI=1.7-24.08$, $p=0.006$). The decreased consultations time, difficulty in obtaining in-person appointments, along with the reduced physical examination during consultations have made participants more open to the idea of teleconsultations ($OR=3.88$, 95% $CI=1.21-12.47$, $p=0.022$). Eighty-five (38.63%) participants had already adopted telemedicine for their routine consultations during the pandemic. Whilst participants felt that telemedicine was an adequate surrogate for in-person consultations, a significant difficulty in obtaining medications was noted ($OR=6$, 95% $CI=1.34-26.81$, $p=0.019$).

Conclusion: In-person consultations were decreased primarily due to the perception of significant risk of COVID-19 exposure in the present scenario. Telemedicine adoption in the private sector may be sustainable throughout the pandemic and beyond, if patients are offered to continue their routine consultations with their regular doctors and ensured medicine availability. Integration of telemedicine by the public and private health sector of India into routine NCD care delivery is the need of the hour, but further studies are required to estimate the effectiveness of the systems.

Keywords: COVID-19, telemedicine, chronic disease, patient compliance, India

Introduction

Between the years 2000 to 2010, nations of the world made recognizable strides in addressing the global non-communicable disease (NCD) epidemic.¹ Regrettably, these gains were not sustained throughout 2019 to 2020 due to underinvestment in the prevention, early diagnosis, screening, treatment, and rehabilitation for NCDs, particularly in developing nations.¹ Health systems were unable to meet the health-care needs of people living with and affected by NCDs. The year 2020 and the

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COVID-19 associated restrictions catalyzed a rapid decline, with widescale disruption of essential healthcare services for patient's living with NCDs as reported by 122 countries to the World Health Organization.¹

It is well documented that the four major NCDs classified by WHO: i) Cardiovascular diseases (including stroke and hypertension), ii) cancers, iii) chronic respiratory diseases (eg, Bronchial Asthma, COPD), and iv) Type 2 Diabetes Mellitus (T2DM), demonstrate a significantly higher risk for morbidity and mortality when afflicted with COVID-19.^{2,3} People suffering from NCDs constitute a large and increasing section of urban population from all income groups across the globe.⁴

Telemedicine has been embraced internationally for its effectiveness to combat the challenges of in-person consultation during the COVID-19 pandemic.⁵ However, there is a need for an international consensus on how these services can be most effectively utilized by health-care providers.^{6,7} Kerala, a small, urbanized state in South India with a dense population of 34.6 million in 2018, was lauded nationally and internationally by the scientific community and the media, for a high recovery rate, low death rate, and slow progression of COVID-19 cases relative to other states in the country, despite having the highest burden of NCDs.⁸ As India braces for a third wave of a COVID-19 pandemic, the hospitals in Kerala are bolstering their telemedicine infrastructure, in anticipation of a prolonged lockdown scenario. Telemedicine services, from an Indian patient's perspective, remains a novel concept.^{9,10} There have been no studies from Kerala, or the rest of South India, which have studied the patient reported perceptions towards telemedicine services either in the public or private health sector. Furthermore, with a colossal burden of NCD on patients in Kerala, there is a need to assess a patient's preference for NCD care (telemedicine or in-person) during the pandemic.

This study aims to estimate the prevalence of telemedicine adoption amongst routine NCD patients from out-patient departments of a premier quaternary-care center in South India. This study will also capture the trends and perception of these patients towards in-person consultations vs telemedicine consultations during the COVID-19 pandemic and feature the early adoptive phase of telemedicine in the institution. We attempt to analyze this early patient feedback and suggest improvements for continuing NCD care in tertiary/quaternary care hospital-based telemedicine services.

Methods

Study Design, Setting, and Sampling

This online survey was designed as a cross-sectional study between January 1, 2021 and January 30, 2021. Using systematic random sampling, every third patient who had a scheduled routine follow-up as an in-person or a telemedicine appointment in any of the departments of General Medicine, Geriatric Medicine, Endocrinology, Cardiology, Gastroenterology, Rheumatology, and Respiratory Medicine in a quaternary-care hospital in South India were asked to be part of the study. A central telemedicine support team coordinated patient appointments with the departments and the consultations were facilitated through a video teleconference software, "Zoom" (Zoom Video Communication, USA). The departments converted an existing out-patient room to a dedicated teleconferencing room with high-speed internet, high-definition video, and audio capturing devices.

Inclusion and Exclusion Criteria

The participants were only included in the study if they were over the age of 18 years and the current instance was a routinely scheduled consultation as part of the care of chronic illnesses (Cancers, T2DM, Cardiovascular diseases including Hypertension and Stroke, Chronic respiratory illnesses), under follow-up at the department for at least 1 year. They were only included if informed consent was provided and they were able to completely fill the survey hosted on Google Forms platform. Participants were excluded if they were a new or an emergency consultation at the departments, if they were non-permanent residents of India, and if the current visits were intended for non-routine advanced diagnostic tests or day time procedures such as imaging studies, endoscopic procedures, or physical function tests (Treadmill test or Pulmonary function test).

Ethical Consideration

The ethical approval for this study was obtained from the Institutional Ethics Committee of Amrita Institute of Medical Sciences-Kochi, India, vide ref. IRB-AIMS-2020-350. Deidentified data were collected from participants who provided informed consent to be part of this study.

Questionnaire Details, Development, and Validation

The self-reported survey questionnaire contained 21 questions in three different languages (English/Malayalam/Hindi). The questionnaire contained three sections: i) Demographic details;

ii) Characteristics of recent consultations; and iii) Perceptions towards routine consultations during the pandemic, in which responses were captured using a 3-point Likert Scale (Agree, Not sure, Disagree). The development of the questionnaire was overseen by the senior consultants of the Department of Rheumatology at the same hospital. Section 3 of the questionnaire was improved until the reliability measured by Cronbach's Alpha was determined to be 0.83 on pilot studies conducted on 30 participants and the questionnaire was validated by three senior academics and clinicians in our center. The validated questionnaire was then rolled out at seven departments simultaneously, aided by medical students posted in each department, for a period of 1 month.

From the pilot study conducted on 30 participants, the prevalence of teleconsultation use was detected in 15% of respondents, with a 5% margin of error and 95% confidence level. The sample size was calculated using the formula, $n = z^2 \hat{p}(1 - \hat{p}) / e^2$ where \hat{p} was the prevalence (25%), " e " was the margin of error (5%), " z " for 95% confidence level is a constant (1.96), and " n " is the minimum sample size, which was calculated to be 196.

Statistical Analysis

Survey data was retrieved as a MS Excel file and later was coded in SPSS version 18, for further descriptive and inferential analysis. Demographic factors are summarized using frequencies, percentages, and mean \pm standard deviation. Perceptions of participants were captured using a Likert scale and summarized using the Mode of the responses. Paired sample *T*-test was used to compare the differences in frequencies of in-person consultation visits made by the patient in 2019 vs 2020. Pearson's Chi-square test was used to analyse any correlations between the factors reported by the patients to their perception of in-person consultations versus teleconsultations. A $p \leq 0.05$ was taken as the threshold for statistical significance.

Results

A total of 289 responses recorded by the Google Form hosted survey. After filtering out incomplete, duplicate responses or multiple responses from a single device, applying the inclusion and exclusion criteria, 220 responses were considered for analysis. The demographic characteristics of the participants reported in Section 1 of the survey have been detailed in Table 1. The mean age of our sample population was 47.37 \pm 13.59 years.

Table 1 Demographics of Study Population (N=220)

Demographics	Categories	N	Percentage (%)
Gender	Female	75	34.09
	Male	144	65.45
	Other	1	0.45
Age (years)	0–20	12	5.45
	21–40	34	15.45
	41–60	134	60.90
	61 and above	40	18.18
Native State	Kerala	117	53.18
	Non- Keralite	103	46.81
NCDs, risk factors, and comorbidities	Cancer	25	11.36
	Cardiovascular diseases	17	7.72
	Chronic Respiratory diseases	21	9.54
	T2DM	81	36.81
	Dyslipidaemia	47	21.36
	Obesity	24	10.90
	Chronic Kidney disease	5	2.27
	Misc. Endocrine and G.I disorders	45	20.45
Co-morbidity count	Single comorbidity	150	68.18
	Multiple comorbidities	70	31.81
Departments	General Medicine	33	15
	Geriatric Medicine	35	15.9
	Endocrinology	29	13.2
	Cardiology	32	14.5
	Gastroenterology	29	13.2
	Rheumatology	34	15.5
	Respiratory Medicine	28	12.7

Using paired sample *t*-test, participants reported frequency of routine consultations, prior to the onset of pandemic lockdown (Mean=3.47 \pm 3.68 visits/year) and after the pandemic (Mean=1.56 \pm 3.16 visits/year) lockdowns were instituted; had a statistically significant decrease of 1.9 \pm 4.47 visits per year, 95% CI=1.31–2.50, $t(219)=6.326$, $p<0.001$. The responses of Sections 2 and 3 of the survey are summarized using the Mode of the responses in Table 2.

In-Person Consultation and Telemedicine Consultation

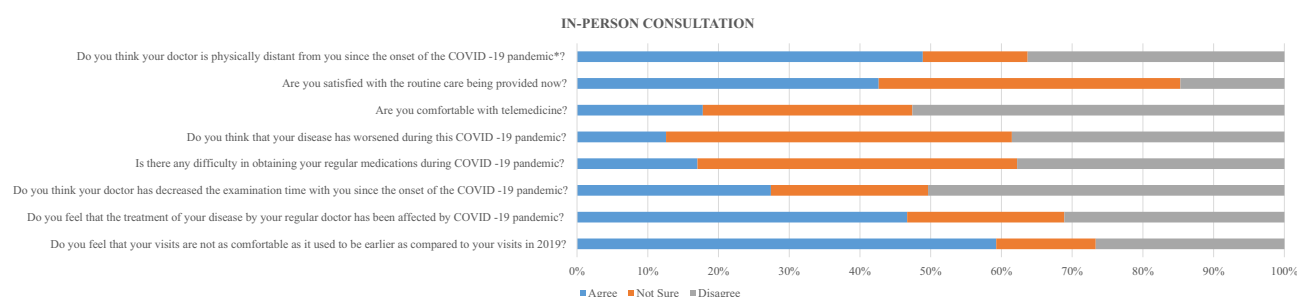
Depicted as bar graphs in Figure 1, the patients who came in for an in-person consultation reported being far less satisfied

Table 2 Responses of the Survey (N=220)

Section 2: Characteristics of Current Consultation	Mode (Response)	Percentage
1. How often did you used to go for in person consultation in 2019?	Once in a year (79)	35.90%
2. How often did you go to hospitals for in person consultations in 2020?	No visits (157)	71.36%
3. What is/are the disease(s) that you are diagnosed with?	T2DM (81)	36.81%
4. When were you last diagnosed for the above-mentioned disease?	More than 2 years (87)	39.54%
5. Do you think there has been any difficulty in consulting your doctor since the onset of the COVID-19 pandemic?	Yes (145)	65.90%
6. If yes, what are the difficulties you face?	Fear of COVID-19 (97)	44.09%
Section 3: Perceptions about Consultations during the Pandemic		
7. Do you feel that your visits are not as comfortable as it used to be earlier as compared to your visits in 2019?	Agree (84)	38.18%
8. Do you feel that the treatment of your disease by your regular doctor has been affected by the COVID-19 pandemic?	Agree (91)	41.36%
9. Do you think your doctor has decreased the examination time with you since the onset of the COVID-19 pandemic?	Agree (75)	34.09%
10. Do you think your doctor is physically distant from you since the onset of the COVID-19 pandemic?	Agree (95)	43.18%
11. Is there any difficulty in obtaining your regular medications during the COVID-19 pandemic?	Agree (87)	39.54%
12. Do you think that your disease has worsened during this COVID-19 pandemic?	Not sure (87)	39.54%
13. Have you used telemedicine for your consultation during this COVID-19 pandemic?	No (136)	61.81%
14. If yes, do you feel telemedicine is an adequate substitute/surrogate for in-person consultations?	Not Sure (72)	32.72%
15. Are you comfortable with telemedicine?	Agree (84)	38.18%
16. Are you satisfied with the routine care (Telemedicine/In-person) being provided now?	Agree (111)	50.45%

with the routine care being provided to them than those who used telemedicine services (Figure 2). Disproportionately more of them also reported that doctors spent less time examining them and more physically distant from them. Almost all of them also reported being unsure or uncomfortable with telemedicine services being offered.

On the other hand, patients who used telemedicine services mostly reported that they were comfortable and felt that telemedicine was an adequate substitute for in-person consultations. However, they were more likely to report difficulty in obtaining their regular medications compared to the patients who chose in-person

**Figure 1** Responses from patients who chose in-person consultation (n=135), *Question only asked to the in-person group.

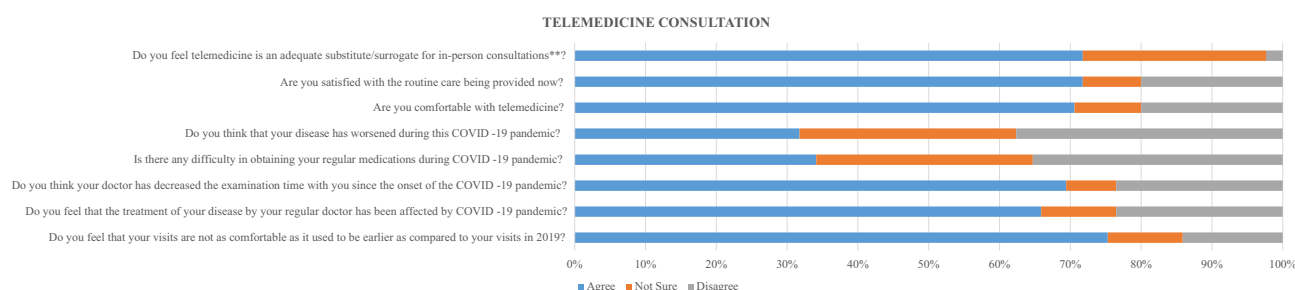


Figure 2 Responses from patients who chose telemedicine consultation (n = 85), **Question only asked to the telemedicine group.

consultations. They were also more likely to report that their disease worsened during the pandemic. A large proportion (~45–65%) in both in-person and telemedicine groups reported that their treatment was affected, since they could not get an appointment with their regular doctor. A majority of both groups also reported that the current consultation was not as comfortable as it was in the preceding year.

The variables that affected in-person consultation and telemedicine consultations of a participant were analysed to reveal correlations, and the results are depicted in Tables 3 and 4, respectively.

Discussion

This study looks into the availability of routine in-person follow-up consultations and the acceptability of telemedicine amongst 220 randomly sampled patients in a quaternary-care facility in South India. Patients were generally less satisfied with their current consultation modality than their in-person consultations in 2019, and were also dissatisfied that they could not continue to consult their regular doctors. Patients

who chose an in-person consultation were dissatisfied with their current routine care but seemed hesitant to adopt telemedicine. Those who used telemedicine services seemed to embrace this new modality for consultations during the pandemic. Regardless, telemedicine consultations were often associated with a difficulty and delay in obtaining medicine, and this phenomenon may result in these patients reporting that their disease worsened during the pandemic. However, there are several confounders that may lead to the perception of worsening disease, hence no strong conclusions can be drawn.

A majority (93.63%, N=206) of the study population did attend their routine in-person consultations prior to the pandemic in 2019, which had significantly decreased to 27.27% (n=60) in 2020. A significant proportion of our patients reported “fear of COVID-19” as their primary concern for skipping their routine in-person consultations, as depicted in Figure 3. A similar trend was noted in a study from Brazil, where participants postponed or cancelled their appointments (38.4%, n=653) due to fear of COVID-19 infection from hospitals/clinics.¹¹ This is

Table 3 Correlations Between Patients That Opted for an in-Person Consultation Since the COVID-19 Pandemic (N=135)

Patients who had difficulty in consulting their doctor since the onset of the COVID-19 pandemic	Participant Responses	Z statistic	Odds Ratio	95% CI	df	p-value
	Gender	0.58	0.730	0.25–2.12	1	0.56
	Co-morbidity count	0.804	0.65	0.23–1.85	1	0.421
	Decreased examination Time	2.76	6.43	1.7–24.08	2	0.006*
	Obtaining medicines	0.92	1.9	0.48–7.44	2	0.357
	Worsening of NCD	1.27	2.41	0.62–9.49	2	0.205
	Comfortable with Telemedicine	2.28	3.88	1.21–12.47	2	0.022

Notes: df, Degrees of Freedom, *p-value<0.05 is significant with 95% CI, NCD, Non-communicable diseases.

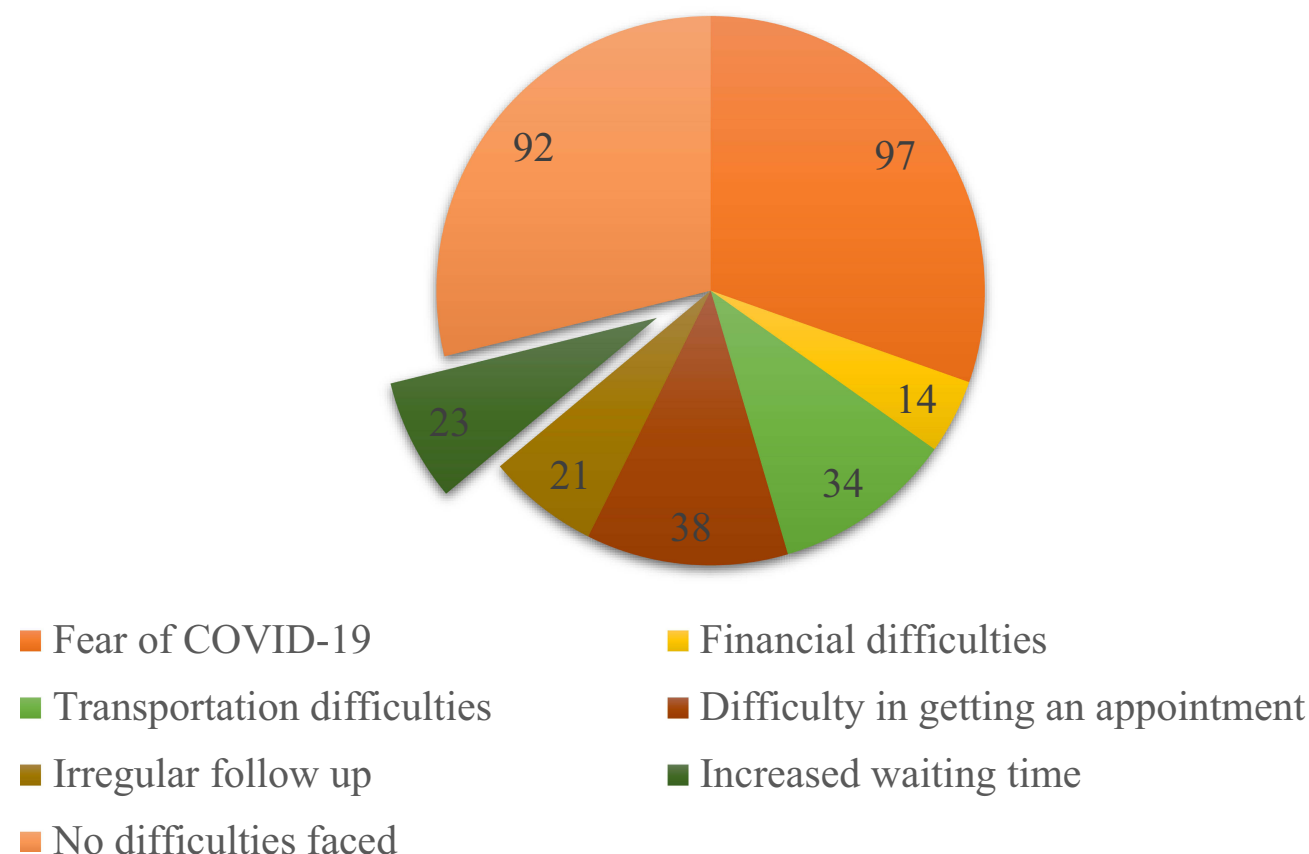
Table 4 Correlations Between Patients That Used Telemedicine for Consultation During the COVID-19 Pandemic (N=85)

Patients that felt telemedicine is an adequate surrogate/substitute for in-person consultations.	Participant Responses	Z statistic	Odds Ratio	95% CI	df	p-value
	Gender	0.202	0.90	0.31–2.57	1	0.84
	Co-morbidity count	0.927	0.61	0.22–1.72	1	0.354
	Difficulty in consultation	0.37	0.80	0.24–2.62	1	0.354
	Treatment of NCD affected	0.081	0.94	0.20–4.47	2	0.71
	Obtaining Medicines	2.35	6.00	1.34–26.81	2	0.019*
	Worsening of disease	0.88	1.85	0.47–7.32	2	0.38

Notes: df, Degrees of Freedom, *p-value<0.05 is significant with 95% CI, NCD, Non-communicable diseases.

indicative of the global disruption of continuity of NCD care, particularly in developing nations, as reported by the WHO.¹ Seventeen percent (n=38) of participants reported difficulty in acquiring an appointment for an in-person consultation in this study. Twenty-three percent (10.5%) also reported they had anticipated increased waiting times (Figure 3). There was an acute shortage of HCPs as departments were run by only a skeletal number of staff,

who worked in rotation to minimize exposure, whilst a portion (usually senior staff) were kept as standby. Furthermore, participants were 6-times as likely (OR=6.43, $p=0.0058$) to report a consultation being difficult when the physician reportedly decreased the duration of physical examination. This could be attributed to the hesitancy of physicians to interact with patients for a prolonged duration in a closed environment for fear of

**Figure 3** Responses to Q6: What are the difficulties in consulting your doctor since the onset of the COVID-19 pandemic? (N=220).

droplet/airborne transmission of SARS-nCoV-2.¹² The patients who reported difficulty in routine in-person consultation were almost 4-times more likely (OR=3.88, $p=0.022$) to report that they are comfortable with telemedicine as a viable way for their routine follow-up (Table 3). This acceptability of telemedicine is also observed in a study conducted in Western China where its use illustrated effectiveness and positive healthcare outcomes.⁵

The newly rolled out teleconsultation facility for both new and routine patients of outpatient departments in this hospital were adopted by only 38.63% ($n=85$) of the study population for their routine follow-up. The participants in this study who reported that teleconsultations were an adequate surrogate for in-person consultations, by statistically significant margins, did not report difficulty in consultation, did not report subjective worsening of their disease, and reported that their treatment plan was not adversely affected (Table 4). Only 38.18% ($n=84$) reported being comfortable to use telemedicine, whereas a large proportion of the study participants were not sure ($n=48$, 21.81%).

Telemedicine can be used as a medium to deliver adequate patient care, provided healthcare policy-makers can employ the necessary infrastructure that is needed to improve its accessibility.¹³ Amongst those who felt telemedicine is an adequate substitute for in-person consultation, an association (OR=6.00, $p=0.019$) was noted in difficulty in obtaining medicines. Most studies done in similar populations reported derangement of NCD disease indicators of patients and noted disruption in medication supply.^{11,14–17} This medication distribution discrepancy is exacerbated in areas beyond the urban centers.¹⁸ This lack of efficient medication delivery to both the urban and especially rural populace remains a barrier in delivering effective care.

The public health sector in Kerala overcomes this predicament by investing in a reliable supply of medications from state-owned pharmaceutical manufacturers, effectively mobilizing their volunteer corps and decentralized public health employees to home deliver this medication free of cost, especially to vulnerable elderly and patients with multiple comorbid NCDs.^{8,19} The private health sector is still to implement such a reliable supply network at the community level.

This can be attributed to the lack of telemedicine advocacy amongst the physicians and the mitigated regulations that are susceptible to data privacy/security risk.

The policymakers can further strengthen the virtual telemedicine delivering platform by lessening the disparity in broadband Internet accessibility, better IT infrastructure and insurance coverage to include telemedicine services.^{6,7} The need for expanding the repertoire of medical personnel to telemedicine and digital care solutions will further reinforce patient support during and beyond the pandemic.²⁰ Patients may have had limited options to consult their routine doctors, as several senior consultants were unavailable for telemedicine services, perhaps due to their unfamiliarity with the technology or limited connectivity features at their residences (as they were requested to isolate) – leading to their junior consultants exclusively running the telemedicine services, possibly leading to patient dissatisfaction. To add to patient woes, although internet connectivity has massively improved in urban and semi-urban sectors of the state of Kerala in the past decade, it is still yet to penetrate the rural (especially remote hilly) regions. This may limit accessibility to economically, socially, or geographically disadvantaged patient populations in these areas.

There are several strengths and limitations to this study. The probability sampling used to select participants over seven departments handling NCD care delivers a reasonably representative hospital-based population in Kerala. The selected institute for study, being a quaternary-care center, receives patients from a fairly large multicultural population residing in Kerala, and provides valuable insight into the perceptions of in-person telemedicine amongst them. Internal validity is restricted as there might be significant confounders such as patient rapport with the HCP, severity of the disease, and erratic network issues that may have affected perception towards telemedicine. As it was a self-reported anonymous survey, the responses are more likely to be authentic but may be limited by recall bias. The external validity of the results and the conclusions may be limited to hospitals of tertiary or quaternary care centers in India. A far vaster population can now be served by the primary/secondary public as well private healthcare centers, which is already happening by limited teleconsultations. In that scenario, a population-based survey, inclusive of the public health sector, may be required to further quantify and improve the cost-effectiveness of telemedicine as a sustainable healthcare alternative to in-person consultations.

This is a unique study conducted in India, that captures a snapshot of the patient preferences about in-person/telemedicine routine NCD consultations during the COVID-

19 pandemic. In the context of this study, we arrive at the short-term implication that the hospital-based telemedicine services were quickly adopted by patients with good levels of satisfaction, during the pandemic. However, further improvements can be made at the health policy level, the hospital level, and the community level – by expanding the use of telemedicine amongst all grades of physicians and their patients, ensuring easy medicine availability. As a majority of patients still preferred in-person consultations as it was in 2019, it is yet to be seen if telemedicine for routine NCD care is here to stay after the pandemic.

Conclusion

Globally, there has been neglect in NCD care for patients since the beginning of the pandemic and it is implied that the COVID-19 pandemic has taken a definitive toll on the frequency of in-person consultations. The pandemic has led to a decrease in consultation availability, fear of in-person examinations, and reduction in consultation time. Championed by the public health sector during the COVID-19 pandemic to cater to non-COVID chronic diseases and ushered in by the recent advances in internet connectivity in the country, tele-medicine in India is gathering momentum, etc. Although not a majority, our patients demonstrated some willingness to consider telemedicine as an adequate substitute for their routine NCD care during the pandemic. There is considerable evidence that telemedicine, if offered as a part of the routine follow-up consultations, can help better manage patients with chronic NCDs, democratizing the continuity of care. Future studies can look into the effectiveness of telemedicine in delivering NCD care in the public health sector which caters to the majority of the Indian population. The long-term impact and sustainability of this innovation is yet to be determined as the global burden of NCDs increase exponentially every year.

Data Sharing Statement

The data used to support the findings of this study are available from the corresponding author upon request.

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Disclosure

The authors report no conflicts of interest in this work.

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