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Neurologists' perceptions of utilising tele-neurology to practice remotely during the COVID-19 pandemic.

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Abstract

Objectives : The COVID-19 pandemic enforced an almost complete switch from face-to-face clinical work to tele-neurology. This study explores neurologists' perceptions of telephone and videophone remote consultations.

Methods : Semi-structured interviews were conducted with neurologists and a GP with a specialist interest (n=22). Interviews were conducted remotely via Zoom®, audio-recorded, transcribed verbatim and analysed using the principles of thematic analysis.

Results : Four main themes emerged: 'unknown unknowns (risks / uncertainties)', 'better service', 'challenges', and 'beyond the pandemic'. Thematic saturation was achieved by interview 19. Participants highlighted a number of benefits of remote consultations but over 80% also complained of a reduction in work satisfaction.

Conclusion : The sudden introduction of tele-neurology is unlikely to be fully reversed when pandemic-related restrictions have been lifted. However, this study confirms tele-neurology cannot completely replace face-to-face consultations. Some patient groups and consultation types require direct contact. Moreover, significant administrative and infrastructural investment will be required to develop the full potential of tele-neurology.

Practice implications: Tele-medicine is capable of improving access and efficiency of specialist neurology services, but limited by lack of non-verbal communication and

technical problems. It could enhance service provision with sufficient infrastructural and administrative investment, but may reduce neurologists' job statisfaction.

Key words

Tele-neurology

Telemedicine

COVID-19

Remote

Telephone

Videophone

1. Introduction

Tele-neurology is defined by the use of electronic communication to aid the diagnosis and treatment of neurological conditions in physically separate locations

(1). Its use has increased steadily as technical advancements have made it easier for clinicians and patients to communicate remotely (2). Prior to the COVID-19 pandemic, tele-neurology was used successfully in acute stroke care and in rural and underserved areas, specifically with chronic conditions such as epilepsy and headache (2). Tele-neurology is particularly useful for patients who have difficulty travelling because of their disabilities. However, previous work has also reported a number of factors which restrict the more widespread implementation of tele-neurology such as technical issues, the limited scope for examinations and problems with the doctor-patient relationship (3).

The COVID-19 pandemic has dramatically accelerated the adoption of tele-neurology (4). Within the United Kingdom (UK) National Health Service (NHS), the pandemic led to an extremely rapid and almost complete conversion of hospital-based out-patient neurological care to remote consultations via tele- or videotelephony. As tele-neurology may never be abandoned again because of its potential benefits, the present time offers a unique opportunity to capture the experiences of clinicians familiar with both face-to-face (F2F) and tele-neurology services. A survey conducted during the pandemic suggests clinicians are “satisfied” utilising tele-neurology (5). However, this finding is based on a preformulated response option which cannot provide a detailed understanding of what this appraisal is based on or what it means.

Our study was designed to provide a more nuanced account of the experiences of clinicians with teleneurology. By collating these experiences, this project aims to

identify the successes and potential pitfalls associated with tele-neurology to inform future service development.

2. Methods

2.1 Participants

This study is based on interviews with clinicians (fully trained/in training neurologists / General Practitioners with a special interest in neurology) working at the Royal Hallamshire Hospital in Sheffield, UK. All 54 members of the Neurology Department were eligible and invited to participate. Some clinicians were approached twice (purposively sampled) to achieve good representation of subspecialities (including neurovascular disease, neuroinflammation, neuromuscular, epilepsy, headache, memory problems and movement disorders). All participants provided written informed consent.

This study was approved as a service evaluation by the Clinical Effectiveness Unit of Sheffield Teaching Hospitals NHS Foundation Trust (reference number 9935). Ethical approval was granted by the University of Sheffield (reference number 034680).

2.2 Interviews

Semi-structured interviews were conducted between June and July 2020, using a predetermined interview guide, which was based on the previous telemedicine literature (see appendix provides for interview details). Questioning was deliberately open, with flexibility to allow interviewees to discuss topics not previously thought of by the research team.

The median interview duration was 33 minutes (range 22 to 50). Interviews were conducted using the web-based videoconferencing software, Zoom®. The interviewees were in their own homes or their offices at Sheffield Teaching hospitals (STH) during the interviews. All interviews were audio-recorded and transcribed verbatim.

NVivo 12 for Mac was used to facilitate the thematic analysis by EC (6). Themes emerged through an inductive approach (7). Initial analysis was conducted by the first author and included reading the transcripts repeatedly, line by line, recording any initial reactions. Transcripts were re-read and any quotes representing particular themes highlighted. New themes were added as each interview was assessed. Emerging themes and anonymised data were discussed within the research team for clarification of themes and sub-themes. Illustrative participant quotations expressing the views of a range of interviewees were selected and included in this report.

Following initial analysis, the research team presented their findings at the weekly meeting of the Neurology Department. The session was used as a focus group, with permission to audio-record from all attendees. The discussion was conducted remotely using Blackboard Collaborate software. The session lasted one hour, with

35 clinicians, both consultant and trainees, present. Clinicians were encouraged to share their thoughts on the findings and share any change in views or any relevant new experiences. Clinicians who were not interviewed were also able to contribute.

3. Results

We interviewed 23 clinicians, including 18 consultant neurologists and four trainees. One general practitioner with a specialist interest in neurology was also included (see Table 1 for further demographic and subspecialisation details). A total of twelve clinicians had used videotelephony software at least once during their clinics. One of the interviews did not record correctly, leaving 22 recordings for analysis. Thematic saturation was achieved by the 19th interview.

Insert table 1 here

Following thematic analysis of the transcripts, four main themes emerged. In order of prominence these were: (1) 'unknown unknowns (risks / uncertainties)', (2) 'better service', (3) 'challenges' and (4) 'beyond the pandemic'. Figure 1 provides a diagrammatic illustration of main and sub-themes, Table 2 a more detailed summary of the themes.

Insert figure 1 here

Insert table 2 here

3.1 ‘Unknown Unknowns (risks / uncertainties)’.

This theme illustrates the sense of risk clinicians associated with remote consultations. This was the most commonly re-occuring theme, emphasised in all 22 interviews.

3.1.1 Non-verbal Communication

Clinicians most frequently perceived risk in relation the lack of non-verbal communication. This sub-theme focussed on the need to clarify understanding with patients and difficulties recognising when patients are upset (Q1). Clinicans clearly perceived the ability to observe non-verbal communication as crucial to diagnosing patients accurately (Q2).

3.1.2 Lack of Examination

Clinicians were also concerned about the lack of examination. Without examination findings they felt at risk of missing important signs (Q3). Video was not considered a substitiue for F2F examination, at least not in all patients (Q4).

3.1.3 Unconfident Clinicians

The recurring comments about the lack of non-verbal communication and physical examination resulted in clinicians displaying a lack of confidence during remote consultations (Q5). Over one half described a lower level of confidence than in F2F consultations, causing problems with their ability to formulate diagnoses and to discharge patients. Many clinicians felt they were requesting more investigations to clarify questions not answered due to the lack of examination (Q6).

3.2 'Better Service'

This theme captures the potential improvements to the delievery of health care though the implementation of tele-neurology – 20/22 clinicians discussed at least some positives of integrating tele-neurology into their clinical practice.

3.2.1 Improved Patient Experience

The main reason for perceiving a potential for service improvements was that remote consultations would give patient a better experience by reducing patients' waiting or travelling times, especially considering the additional difficulties faced by those with distabilities (Q7). Remote consultations could reduce barriers for patients unable to drive themselves to their appointments. Clinicians had perceived their patients as more relaxed during remote consultations than in F2F consultations (Q8).

3.2.2 Efficiency

Clinicians perceived remote consultations as more ‘efficient’ (Q9). Twelve of the clinicians associated an improved efficiency with the length of times patients had to wait, either in the waiting room or for an appointment to see a neurologist.

3.2.3. Telephone Conversations

When asked to reflect on new techniques or skills learned in the context of the switch to remote consultations clinicians often commented on how they had adapted their clinic conversation to fit the telephone format and improve the consultations. This was attributed to the perception that telephone consultations were of a different style, more ‘*business-like’.* Ultimately this enabled clinicians to run their clinics more efficently. Clinicians commented on how they were able to “*take control*” of and to guide the consultations (Q10). This added control was presented as an advantage over traditional F2F clinic encounters (Q11).

3.3 ‘Challenges’

This theme encompasses the common pitfalls faced during the tele-neurology encounters. This theme is important, providing insight to the challenges clinicians faced while adopting the tele-neurology consultation formats and the consequences of these challenges on the clinicians. These pitfalls inhibit a better serving being achieved with tele-neurology.

3.3.1 Technical issues

This was the most pominent challenge, mentioned in 20/22 interviews. Technical issues were partly due to the limitations of the technology available and partly to how tele-neurology was implemented. Due to policies intended to reduce hospital footfall and reduce potential COVID-19 exposure of administrative staff during the pandemic, clinicians were without paper patient notes during the initial implementation phase of tele-neurology. Consequently, clinicans had to rely on existing software to retrieve old letters or look up investigation findings. For most clinicians this change highlighted the inadequency of their information technology systems (Q12). Futhermore, clinicians explained how the introduction of tele-neurology, particularly video consultations, demonstrated their hospital was unable to provide adequate technology support to use the available equipment and software to its full potential (Q13). More technical issues were reported utilising video conferencing software than telephone technology (Q14).

3.3.2 Administrative Points

The administration of tele-neurology clincs provided further frustration for 18 of the clinicians. During the interviews, clinicians described how it was not uncommon for the patient contact number to be missing, or for an incorrect number to have been provided (Q15). This resulted in clinicians spending their clinic time searching for patient contact details across multiple platforms. Additionally, clinicians believed patients were often unprepared for a telephone or video consultations, attributable to the failure of the clinic booking team to get in touch with patients prior to their appointments. To avoid this frustration, clinicians highlighted the importance of not

only contacting patients prior to clinic, but of preparing them better for their consultations (Q16).

3.3.3 Difficult Consultations

Clinicians perceived some specific groups of patients as particularly challenging to assess in remote consultations (Q17-19). Concerns were also voiced about consultations in which difficult decisions had to be made because clinicians perceived they had to be more direct to advance decision-making over the telephone and they were less able to take account of patients' own views. This was attributed to a greater risk of misunderstandings over the telephone with select patient groups. (Q20). Furthermore, new patients were frequently perceived as difficult to manage remotely (Q17), attributable to clinicians needing to examine such patients but also the greater ease with which rapport may be built in F2F consultations.

This limited ability to build rapport was also described as posing a challenge in encounters involving the delivery of bad news to patients. Twelve clinicians described how breaking bad news to patients via tele-neurolgy made them feel uncomfortable (Q21). A specific difficulty for clinicians in Sheffield, being a tertiary centre for neurology, are situations where patients require specific tests only performed at the centre. Being unable to peform these tests, and progress in the management of conditions, could cause clinicians to feel the consultation was unfinished (Q22).

3.3.4 Clinician Satisfaction

Prompted by open questions regarding the future, 18/22 clinicians (81%) stated the use of tele-neurolgy would have a negative impact on their job satisfaction (Q23). The main reason for this seemed to be their concerns about the lack of interaction with patients, although 6/22 clinicians noted this was mitigated to some extent by the use of video-clinics.

3.4 'Beyond the pandemic'

This theme describes clinicians' percetions on their thoughts about the future use of tele-neurology. Despite the challenges clinicians have experienced adopting tele-neurology, all 22 clinicians anticipate tele-neurology will continue to be utilised.

3.4.1 Added Value of Video

Whilst highlighting that video is not a substitue for F2F consultations, 16 of the clinicians described situations in which video benefited their remote consultations. When not disrupted by technical issues, video was viewed as superior to telephone on many occasions. This was thought to be an important consideration for the future. Better interaction between clinicians and patients, and the use of video to enable a degree of examination led to an improved experience (Q24). Importantly, six of the

clinicians commented on how utilising video had improved their job satisfaction (Q25).

3.4.2 Utilisation of Tele-neurology

When asked about the utilisation of tele-neurology in the future, clinicians felt tele-neurology has obvious benefits in follow-up appointments, particularly of patients with a well-established diagnosis requiring regular monitoring (Q26). Remote consultations with patients with epilepsy were highlighted as a particular succes of tele-neurology, at least from the clinicians' perspective (Q27). In contrast to follow-up patients, clinicians felt remote consultations were inappropriate for new patients (Q28).

3.4.3 Triage

Half of the clinicians thought tele-neurology will have an important role in patient triage or stratification. Although several clinicians expressed concerns about the use of tele-neurology for new patients, the suggestion was also made that patients could initally be contacted remotely via tele-neurology, and that only pre-selected patients would be seen F2F (Q29-30). This suggestion reflected clinicians concerns about service pressures and increasingly long waiting times within their department.

3.4.4 Sustainability

When discussing the positives of implementing remote consultations, 6/22 clinicians commented on the advantages for the environment (Q31). Clinicians perceived changes to the delivery of healthcare are necessary in the longer term, by reflecting on how their existing practice was not environmentally sustainable.

3.5 Focus group

During the focus group clinicians strongly emphasised the administrative problems they face in their routine practice and how these have interacted negatively with the enforced introduction of tele-neurology (F1-2). These comments reflected perceptions of insufficient staffing as well as infrastructural deficits undermining an optimal adoption of tele-neurology. One comment highlighted how better clinic planning was particularly important for patients with hearing impairments, for whom tele-neurolgy appointments may not be appropriate (F3). The challenge tele-neurology is posing to the job satisfaction of clinicians was reconfirmed, with some clinicians re-stating video-encounters being more enjoyable than telephone conversations (F4). The adoption of video, when not affected by technical issues, was regarded a success with clinicians feeling better able to formulate new diagnoses using this modality (F5-6).

Regarding difficult consultations, clinicians reiterated that breaking bad news to patients via tele-neurology was not acceptable and emphasised the importance of unimpeded non-verbal communication. Patients with functional neurological disorder or dissociative seizures were named as being especially difficult to advise successfully using tele-neurology (F8-9).

Concerning the future, clinicans commented on how tele-neurology may be a useful screening tool allowing services to manage some patients remotely (F10-11). Furthermore, it was felt there was a definite place for tele-neurology in the management of patients with relatively stable and predictable long-term or chronic neurolgoical conditions. (F12-13) A new idea outlined the potential of tele-neurology to support new ways of collaboration between general practitionners, neurologists and patients or their relatives (F14). Participants also discussed how teaching and neurology training may be facilitated if clinics were held over telephone. Remote participation of learners in video or telephone clinics should be technically feasible. Future clinical teaching will need to include remote consultation and communication skills. Table 3 provides an overview of quotes, Table 4 summarises clinicians experiences with teleneurology – positive and negative.

Insert table 3 here

Insert table 4 here

4. Discussion and Conclusion

4.1 Discussion

Our study captured nuanced perceptions of a group of clinicians shortly after an almost complete switch of their mode of service delivery from F2F outpatient clinics to tele-neurology using tele- or videotelephony. Four key themes emerged: (1)

'unknown unknowns (risks / uncertainties)', (2) 'better service', (3) 'challenges' and (4) 'beyond the pandemic'.

The most prominent theme highlighted clinicians' awareness of the risk associated with remote consultations, attributable to the lack of examination and non-verbal communication and generating 'unknown unknowns'. Previous studies provide some justification for these concerns. One analysis of telephone consultations for instance showed how clinicians acquire significantly less information helping them to exclude serious conditions in telemedicine encounters (8). Although the safety of video assessment has previously been suggested, this relies on trained clinicians assessing the patient in person immediately following a video call with a consultant neurologist (9). Prior tele-neurology research has utilised disease-specific modified assessments tools (2), however, the present suggests these may not be applicable in routine clinical practice. Most importantly, they would not fully address concerns about 'unknown unknowns'.

Our study suggests that tele-neurology cannot become a complete substitute for F2F appointments, especially in the initial diagnostic process. However, even in the assessment of new patients tele-neurology contacts could make the investigation process more efficient by helping with triage or patient stratification. Clinicians' views on the use of tele-neurology in the follow-up of patients with long term conditions were much more positive, in keeping with other research suggesting the feasibility of tele-neurology consultations, for on-going long term follow-up patients, this has been established throughout the pandemic (10,11).

Our study suggests tele-neurology will be more or less appropriate for different patient groups and also types of consultations. Patient groups in which tele-neurology is felt to be particularly limited include those with neuromuscular, functional and cognitive disorders. Consultations less suitable for tele-neurology include those in which clinicians have to break bad news to patients and those in which they have to negotiate complex joint decisions. Clinicians expressed the need for strong personal connections in such consultations, depending on physical proximity and non-verbal body language unavailable during remote consultations (12).

The adoption of tele-neurology could facilitate a more efficient method of delivering healthcare. However, at present the remote consultations generate more work for clinicians and administrative staff. What is more, diagnostic uncertainty is causing clinicians to request a greater number of investigations (13). Efficiency savings through tele-neurology are likely only to accrue after significant investment in improvements of clinic organisation, tele-neurology technology (better and more reliable access to videophone encounters) enhances patient selection.

These investments should not only be justifiable on the basis of the potential to lead to efficiency savings in the long term but also because of the potential of tele-neurology to improve the patient health care experience. Previous studies have demonstrated that over 85% of patients were satisfied with tele-neurology encounters (and that, from patients' point of view, tele-neurology has many advantages over F2F encounters), although these studies were conducted among more highly selected patient populations prior to the COVID pandemic (14–18). The

improved access to specialist advice through tele-neurology has been particularly appreciated by patients in rural locations, or those with disabilities (2). One study showed this improved convenience for patients can still be demonstrated when potentially confounding variables such as reduced travel, cost and overall waiting time were removed (19). Our study contributes to this topic by reflecting the perception of clinicians that patients seem to be more relaxed during remote consultations. This observation resonates with previous research suggesting patients prefer more informal environments for clinical interactions, enabling them to feel more comfortable and thus communicate more effectively (20).

The perception of clinicians that they may be more direct during telephone conversations involving treatment choices, which should take account of patients' views, is somewhat concerning. Clinicians felt they were restricting patients' choices, a change attributed to a greater risk of misunderstandings. These findings may reflect previously reported problems with the doctor-patient relationship in tele-neurology encounters. Previous interviews with patients suggest some felt less in control and less able to speak up about their concerns during remote consultations (21). So far, there is no research that has compared actual tele-neurology and F2F consultations directly, for instance by using the methodologies of Conversation or Discourse Analysis, to raise awareness of possible deficiencies of tele-communication and to identify optimally effective shared decision making approaches for tele-neurology consultations.

In keeping with evidence prior to the pandemic, the most prominent challenges reported by clinicians related to technical issues (3). At present, the appropriate

infrastructure is not in place for tele-neurology to work smoothly, particularly in relation to video consultations (11). Furthermore, our study suggests the software currently in use within the NHS does not optimally support clinicians. Our data therefore further emphasises the need to push on with the 'technology revolution' set out in the NHS long-term plan 2019 (22).

Another important obstacle to successful tele-neurological practice identified here was insufficient administrative support. Previous work has demonstrated patients are particularly likely to struggle with video-call software (18). An improved tele-medicine service, has been demonstrated during the pandemic following the addition of medical assistants who educate patients on using telecommunication software and arrange necessary interpreters (11).

The urgency of improvements to current telemedicine practices is underlined by our finding that 18/22 clinicians experienced their work involving remote tele-neurology as less rewarding than their previous F2F practice. The lack of patient interaction and the inability to discuss uncertain cases easily with fellow clinicians were the main contributors to this lack of satisfaction, which could increase the risk of physician 'burn out' at a time when physicians are in particularly high demand. This effect of the COVID pandemic has, so far, not been picked up in studies of 'burn-out', which have focussed on clinicians exhausted by the challenges of caring for patients with COVID infection rather than on those whose working practices may have changed profoundly, but who have 'only' been affected by the COVID pandemic in an indirect fashion (23–26).

Our study has a number of important limitations. First and foremost we were only able to describe the perceptions of clinicians and not those of patients. However, clinicians experiences of tele-neurology represent a particular gap in the literature on tele-neurology, although it is well recognised that the views of clinicians are important for the successful implementation of this practice (27). We also acknowledge that the present study captured clinicians' perceptions of tele- and F2F clinical practice of neurology in a very particular historical and geographic context (during and just after the "lock-down" of social, educational and economic activities during the COVID-19 pandemic in the UK). The personal hardships associated with the pandemic and the suddenness of the switch to the almost complete provision of services via tele-neurology may have influenced interactions with patients and clinician's perceptions on utilising tele-neurology. While this observation may limit the generalisability of our findings, the unique context also provided us with a possibly unique opportunity to sample views of clinicians across a broad range of neurological subspecialities engaged in initial and follow-up patient contacts. What is more, the fact that they had, until a few weeks prior to the interviews, been used to F2F practice means the participants were in a particularly good position to reflect on their experiences with both consultation modalities.

A further limitation is that perceptions were collated at a single neuroscience centre. Although participating neurologists would also have been able to reflect on their experiences involving the provision of services in outlying district hospitals across South Yorkshire, North Derbyshire and Lincolnshire served by the Sheffield Neurology Service in a hub-and-spoke fashion, their perceptions are likely to have been affected by local organisational and infrastructural particularities.

4.2 Conclusion

Despite these limitations and in line with previous research, our interviews with clinicians about tele-neurology identified a number of reasons why it is likely that tele-neurology will remain a much more important mode of service delivery in the future than it was before the COVID-19 pandemic (5,20). Clinicians found themselves positively surprised about the number and nature of interactions with patients, which can be successfully conducted remotely. They recognise the potential for tele-neurology to make their expertise much more accessible, especially to patients with chronic neurological disorders and disabilities making it difficult for them to travel to outpatient appointments. However, their statements suggest that considerable administrative and infrastructural investments will be required to allow them fully to use the potential of tele-neurology. What is more, their experiences with tele-neurology during the pandemic indicate that tele-neurology cannot completely replace F2F neurology. Some patient groups and some encounters are likely always to require direct contact, especially those requiring examination. Further research of tele-neurology encounters is urgently needed to find out more about the possible effects of 'unknown unknowns' and to explore how patients can be optimally engaged in joint decision-making processes in tele-consultations.

4.3 Practice Implications

Tele-medicine is capable of improving access and efficiency of specialist neurology services, but limited by lack of non-verbal communication and technical problems. Verbal interaction may also be curtailed during tele-neurology encounters with a

negative impact on shared decision making practices. While tele-neurology could enhance service provision, this would require infrastructural and administrative investment. Especially without such investment tele-neurology may reduce neurologists' job satisfaction. A framework to improve the implementation and sustainability of technology into healthcare has been suggested (28).

Declaration of Competing Interest:

None

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Legends

Table 1. Characteristics of Clinicians Interviewed.

Demographic characteristic	**N**
Age at interview	
20-29	1
30-39	6
40-49	6
50-59	6
60-69	3
Gender	
Female	6
Male	16
English first language	
Yes	17
No	5
Medical Grade	
Consultant	18
General practitioner	1
Trainee	3

Years since initial qualification	
5-9	4
10-14	3
15-19	3
>20	12
Subspecialities	
Epilepsy	4
Dementia	2
Neuro-oncology	1
Multiple Sclerosis	1
Behavioural neurology	1
Vascular and Cognitive neurology	1
General neurology	5
Movement disorders	4
Ataxia, Immune mediated neurological diseases, Neuropathies	1
Functional neurology	1
GP with a specialist interest in neurology	1

Table 2. Overview of Themes, Subthemes and illustrative quotes from interviews (Q).

Main theme	Sub-theme	Illustrative quote
Unknown unknowns (risks / uncertainties)	Non-verbal communication	"…especially explanation, you can't check to understand that they've taken it in and they understand or they agree with what you're saying." (Q1) "...I think it's massive and I think you, you miss out on diagnostic cues; and so I think there's a risk that we're gonna misdiagnose some new patients." (Q2)
	Lack of examination	"You always have this worry that you might be missing something because you spoke to them rather than examining them." (Q3) "Really it's power, tone, reflexes, sensation; that's the most difficult bit, cos you can't really test it very well over the, you know, over a visual medium." (Q4)
	Unconfident clinicians	"I'm often less confident as to the actual diagnosis as when I see someone face-to-face." (Q5) "I probably have a lower threshold for arranging investigations as a result; so I can sort people out with scans and nerve conduction studies, if it's felt sufficiently urgent, in the place of doing a physical assessment, just to make sure I'm not missing anything sinister." (Q6)
Better service	Improved patient experience	"I kinda feel a little guilty that I've been dragging people to clinic all this time, particularly if you can't drive and have had to come long distances, where we've actually been able to do the consultation very easily, very quickly over the telephone." (Q7) "When I was discussing with new patients I generally found that they were less stressed than they would be ...generally they seemed a little bit more comfortable." (Q8)
	Efficiency	"I think the advantages of, of telephone consultations are such that nobody's ever going to go back to them means, that the estate [resources] can be used much more efficiently." (Q9)
	Telephone conversations	"I'm very much pigeon-holing the patient into where I want them to be." (Q10) "I guess there are some patients that, on a face-to-face basis take a long time and the phone calls, they just seemed to be a bit more structured and quicker. So that was a positive experience." (Q11)

Challenges	Technical issues	“I think the IT systems are a hindrance to the way that we practice.” (Q12) “I don’t know whether our infrastructure in the hospital would really support that sort of bandwidth to have so many video calls going at the same time.” (Q13) “…the video’s quality’s not very good and the audio quality’s not very good,, it can actually be jarring and that, can prevent you from making a good connection and in those circumstances you’re generally better off over the telephone.” (Q14)
	Administrative points	“The most irritating ones are, are the wrong telephone numbers...” (Q15) “I think we do need to not just phone people in advance of the clinic and tell them that they’re having a telephone appointment but also explain to them what the telephone appointment will involve.” (Q16)
	Difficult consultations	“So with the new patients it’s, it’s been very, very unsatisfactory.” (Q17) “I think that the particularly challenging group is functional.” (Q18) “...what you can’t do is really communicate sufficiently with people who have cognitive impairment.” (Q19) “I found myself restricting choices a little, not negotiating choices quite as much, being more directive ultimately.” (Q20) “So breaking bad news on the phone was always a bit of a no-no; I’ve had to do that once or twice and I really don’t like doing that; that feels very uncomfortable...” (Q21) ““A lot of the blood tests we are doing are very specialised and therefore they’re only done in Sheffield.” (Q22)
	Clinician satisfaction	“I am pleased that I’m nearing the end of my career .. I’m not somebody who’s particularly fearful of change and, and I quite like it, but I think losing that sort of physical contact with patients is going to make our job less rewarding in a sense.” (Q23)
Beyond the pandemic	Added value of video	“There’s a much more seamless dialogue, whereas over the phone sometimes you end up speaking over one another and, because there’s a slight delay perhaps on the line ...I think clinically it’s much easier to assess someone on, on video but in terms of the therapeutic rapport which is important, I think establishing that when you can see the person is much easier.” (Q24) “I’ve only done one video clinic; so if the video clinic works then that has a chance of being a bit, much more enjoyable than a telephone consultation.” (Q25)
	Utilisation of tele-neurology	“...I think it’ll be very useful for people on a long-term follow-up where I need to see a brief overview of things and there’s a diagnosis that’s been made.” (Q26) “I can say with confidence that for epilepsy it’s excellent…” (Q27) “I don’t ever want to work in an NHS/STH environment where I would be forced to see new patients over the phone only.” (Q28)
	Triage	“I think we’ll be screening a lot more patients, particularly through video; so have a look, can you assess adequately, if

	not, bring them in." (Q29) "I've seen patients with conditions that I thought would, would be impossible to manage without an examination that actually have been, it's not affected the management at all." (Q30)
Sustainability	"You know, we need to reduce road travel and car parking, cos it's not sustainable to, to practice in the way we've been practising." (Q31)

Table 3 Overview of Quotes from Focus Group (F).

Focus Group Illustrative Quotes
"I think that is the real problem, that there isn't the staffing and infrastructure on that side, if everyone could be rung and given the information beforehand, that would be great, but at the moment there isn't that facility to do that. " (F1)
"..yeh so I had two patients yesterday that didn't know they were booked for an appointment, four I couldn't get hold of and one that had the wrong number." (F2)
"I had a booking with someone who was very deaf yesterday, and his son wasn't there so there was no point doing the consultation, a complete failure of a consultations." (F3)
"I do video consultations, I find them more interesting if you are talking about personal interests, more engaging, you are seeing someone, you might be seeing their home environment, their expressions, so it's just a more engaging experience than just being on the phone." (F4)
"The video, when it was working well, it did feel like you were almost as if you were in the same room as someone… But I did have some bad days when it froze, I've tried to convert some telephone consultations to the attend anywhere, it just hasn't worked very well, they just didn't feel able to read the instructions, or their browser hasn't worked. But the video does work better, and it is a lot more satisfying than a telephone consultations." (F5)
"I diagnosed hemibalismus on video - don't think I could have done that on the telephone - I am not quite that good yet !" (F6)
"I think there is a real issue I think about breaking bad news… After having just spending an hour with someone, who I had broken the news that they had MS on the phone a few weeks ago, who'd actually see one of my colleges on the ward. Made me realise we are missing all that body language, which you might get to a degree with video, but is not satisfactory really over the phone." (F7).
"So, I find it quite difficult, to to have a virtual consultation with a patient who I think has non epileptic attack disorder, urm quite often when I do face to face clinics I rely a lot of the physical, non-verbal ques, also the people who accompany the patient to clinic." (F8).
"I find that when I do the functional clinic, it often takes considerably longer to do the counselling because you can't demonstrate the signs, you just don't have the same rapport as if you had the patient in-front of you." (F9).
"I think we need to find ways of individually finding those that need face-to-face clinics." (F10).
"I think the lack of body ques, means that sometimes, the telephone consultations can sometimes take longer. I had a few patients were it

was impossible to finish the conversation over the phone." (F11)
"The way I see it is, there will be patients who require long term follow-up with chronic neurological conditions, that er you could potentially alternative between face to face and a phone consultation. These are patients who are, maybe stable, with a normal disease entity that changes over time. I certainly think there is a place for the phone consultations but not to replace face-to-face consultations." (F12).
"In the cognitive clinic… it's quite good to screen people on the telephone first, and then you might be able to manage a few of those who are younger patients, who have a functional cognitive disorder, you may be able to manage them more easily, so it's hard to predict who you really need to see, apart from patients you know well, but for new patients its not a clear cut rule." (F13).
"I think what we haven't discussed, is the future of tele-neurology perhaps being a mixture of ourselves taking to GPs who then speak to patients or their relatives so there's a three way communication going on." (F14).

Table 4: Clinician's experiences with tele-neurology – positive and negative.

Positive	**Negative**
Convenience for patients - Travel - Access - Waiting time	Risk of lack of examination and diagnostic uncertainty - Cranial nerves - Tone - Sensation
Patients more relaxed during consultations	Lack of non-verbal communication
Video improves interaction and examination	Technical issues - Inadequacy of existing software - Bandwidth and connection problems
Video improved clinicians' job satisfaction	Negative impact of tele-neurology on job satisfaction overall9
Success in patients with epilepsy and patients requiring long term follow up	Challenging patient groups – functional, cognitive, neuromuscular, deaf and new patients
Consultations seem efficient (possibly shorter)	Important information may not be provided or sought, clinicians' communication style possibly more directive
Certain consultations may be particularly suitable for tele-neurology (e.g. check-ups of relatively stable patients with chronic conditions)	Certain consultation types may be particularly challenging (e.g. delivering bad news)
Potential triage patients	Poor administration of tele-neurology clinics
Facilitates delivery of specialised services to patient groups with access problems	Inability to perform neurodiagnostic tests e.g. antibodies for gluten ataxia

Figure 1. Themes and Sub-themes within the data

Appendices

A Interview guide

B Digital Consent form

C Service Evaluation Approval

D University of Sheffield Ethics Approval