Research Square

Preprints are preliminary reports that have not undergone peer review.
They should not be considered conclusive, used to inform clinical practice,
or referenced by the media as validated information.

# Medical students' attitudes towards the use of video consultations in clinical genetics: A mixed-method study

**Aiah Taleb Agha**
Rigshospitalet
**Birgitte Rode Diness**
Rigshospitalet
**Elsebet Ostergaard**
elsebet.oestergaard.01@regionh.dk

Rigshospitalet

**Research Article**

**Keywords:** Telemedicine, video consultations, clinical genetics, medical students

**Posted Date:** November 3rd, 2026

**DOI:** https://doi.org/10.21203/rs.3.rs-11140378/v1

**License:** This work is licensed under a Creative Commons Attribution 4.0 International License.
Read Full License

**Additional Declarations:** No competing interests reported.

## Abstract

# Background

Video consultations are increasingly used across medical specialties, including clinical genetics. However, little is known about medical students' attitudes towards video consultations in this setting. This study aimed to explore medical students' attitudes towards video consultations in clinical genetics and whether these attitudes changed following participation in a video consultation.

# Methods

A mixed-methods study was conducted among sixth-semester medical students at the University of Copenhagen participating in a voluntary course in telemedicine. The course consisted of pre-reading and observation of a real-life video consultation in clinical genetics. Study participants completed questionnaires before and after the course. Qualitative data were collected through focus group interviews and analyzed using systematic text condensation, while quantitative data were analyzed descriptively.

# Results

A total of 11 medical students participated in the study. Prior to the intervention, attitudes towards video consultations were generally neutral to moderately positive. Following participation, students reported high satisfaction with the video consultation and generally positive experiences. Only minor changes were observed between pre- and post-intervention questionnaire responses. Qualitative analysis identified five themes relating to students' experiences of video consultations, including overall impressions, technological aspects, patient-related advantages, competencies required for effective video consultations, and the implications of digitalization for future medical practice.

# Conclusions

Medical students generally viewed video consultations in clinical genetics positively, although participation in a single consultation appeared to have limited impact on their overall attitudes. The findings suggest that video consultations may provide a relevant educational experience and highlight the importance of exposing medical students to telemedicine as part of their medical education.

## BACKGROUND

Telemedicine is utilized across various medical specialties, including endocrinology, cardiology, respiratory medicine, and clinical genetics (1, 2). According to the Danish Health Data Authority, telemedicine is defined as "a healthcare service performed using information and communication

technology, that allows the patient and the healthcare professional that delivers the healthcare service, to be independent of a physical meeting" (3). Telemedicine encompasses four major services:

1. Live video consultation
2. Remote patient monitoring
3. Store-and-forward telemedicine
4. Mobile health (mHealth) services

In clinical genetics, video consultations are the most commonly used form of telemedicine. They enable genetic counselors and specialists to communicate with patients and exchange information without the need for physical presence (1). This approach offers several benefits, including reduced costs and increased time efficiency. Additionally, video consultations can provide psychological comfort to patients who may feel uneasy about attending genetics consultations in a hospital setting (4).

While video consultations are associated with potential benefits, their value and applicability depend on how they are experienced and used in clinical practice. Healthcare professionals play a central role in conducting video consultations, and their experiences provide important insight into perceived advantages and limitations of this consultation format. A limited number of studies have examined healthcare professionals' and medical students' experiences and attitudes toward video consultations in clinical settings.

Healthcare professionals' experiences with video consultations

Existing research on healthcare professionals' experiences with video consultations has highlighted both opportunities and limitations. A Danish qualitative study on doctors' perspectives in a hematology outpatient clinic revealed that doctors could maintain professional patient contact and assess patients satisfactorily despite the physical distance. However, some doctors expressed concerns about the inability to perform physical examinations and the risk of missing information, such as observations related to patients' physical appearance, mobility, and general condition, which are normally obtained through physical presence. The study included participant observations and focus group interviews, with participants having engaged in at least one video consultation with hematological patients from a small Danish island South of Funen (5).

Extending these findings, another more recent quantitative study among medical specialists indicates that healthcare professionals' experiences with video consultations vary considerably across specialties. The study was based on a nationwide survey distributed to all medical specialists in private practice in Denmark and included nearly 500 doctors across 15 medical specialties. While psychiatrists reported positive experiences and widespread use of video consultations, almost half of the respondents found video consultations medically irrelevant to their specialty, particularly within fields such as radiology and ophthalmology, which require physical examination and hands-on assessment. Overall, video consultations were considered suitable for follow-up consultations and for patients with an established

diagnosis, whereas establishing trust and conducting comprehensive clinical assessments were perceived as more challenging when video consultations were used as a first point of contact (6).

### Medical students' experiences and attitudes to video consultations

Previous research has also examined medical students' experiences with video consultations. A mixed-method study conducted during the COVID-19 pandemic compared senior medical students' experiences of face-to-face outpatient consultations with video and telephone consultations. While face-to-face consultations were consistently perceived as the preferred learning modality, video consultations were considered a valuable learning experience and were ranked second only to in-person consultations. The study further indicated that learning outcomes from video consultations were more positively perceived when a senior clinician was present to support discussion and reflection, highlighting the importance of supervision and active involvement in facilitating student learning during video consultations (7).

### Video consultations in clinical genetics practice

Clinical genetics represents a clinical context in which patient care is primarily delivered through outpatient consultations and relies heavily on communication and counseling. Physical examination is not required in a significant fraction of clinical scenarios. Given the established use of video consultations within the specialty (1), clinical genetics provides a relevant setting for examining medical students' experiences and attitudes toward video-based consultations.

At the University of Copenhagen, medical students do not have clinical rotations in clinical genetics, and consequently, they have limited opportunities to gain clinical insight into genetic counseling as practiced in outpatient consultations within this specialty, as well as limited exposure to the use of video consultations in general. In 2023–2026, medical students in year 3 were offered a short, voluntary telemedicine course hosted in clinical genetics. The course consisted of short introductory reading material and the opportunity to observe one real-life video consultations between healthcare professionals and patients in clinical genetics.

### Aim

The primary goal of this study is to explore medical students' perspectives on video consultations in clinical genetics and whether these perspectives change following participation in a video consultation.

## METHODS

### Study Design

This study applied a mixed-methods design, combining both quantitative and qualitative approaches to investigate medical students' attitudes toward video consultations. Quantitative data were collected

through two five-point Likert scale questionnaires, and qualitative data were obtained via focus group interviews for which an interview guide was developed (Supplementary file 1).

Telemedicine course

The video consultations took place at the Department of Clinical Genetics at Rigshospitalet with medical doctors from the department and were typically follow-up consultations with patients who had been found to carry a genetic variant associated with a high risk of cancer. They were scheduled as video consultations via Sundhedsplatformen (Epic), the Danish Electronic Healthcare Record (EHR) system used in hospitals in East Denmark.

To prepare students in advance, a written information guide was provided, introducing the concept of video consultations. The guide offered practical tips for conducting them effectively, outlined key considerations for healthcare professionals when interacting with patients in this format, and described both the advantages and limitations of video consultations.

A preliminary pilot study with two participants was conducted before the main study to gather feedback on the study design. The pilot study took place in August and September 2023.

Sample

The source population consisted of medical students in their sixth semester of the bachelor's program in Medicine at the University of Copenhagen (n =1.193). All students were invited to participate in the telemedicine course voluntarily. Recruitment was conducted through the university's online course platform, Absalon, over four semesters, from October 2023 to June 2025. Invitations were sent both at the start and during each semester.

A total of 23 students expressed interest in participating in the course and thus constituted the study population. All course participants were invited to participate in the present study. Eleven students completed questionnaires and/or participated in interviews and were included in the analysis. A flowchart illustrating the recruitment process, participation, and study completion is presented in Figure 1.

Figure 1: Flow diagram showing participant recruitment, enrolment, attrition, and inclusion in the final analysis.

Data Collection

The questionnaires were developed using an online tool, distributed via email, and based on items from previous research studies (8–10). The first questionnaire evaluated medical students' attitudes toward video consultations before attending and observing one, while the second assessed the impact of this observation on their attitudes afterward (Tables 1 and 2).

Table 1. Pre-intervention questionnaire items and response options that are shown with their corresponding numerical scores.

| | Question | Response options |
|---|---|---|
| 1 | How familiar are you with video consultations? | 1. Very familiar = 5<br>2. Relatively familiar = 4<br>3. Somewhat familiar = 3<br>4. Slightly familiar = 2<br>5. Not at all familiar = 1 |
| 2 | How familiar are you with healthcare applications such as MinSP, MinSundhed etc.? | 1. Very familiar = 5<br>2. Relatively familiar = 4<br>3. Somewhat familiar = 3<br>4. Slightly familiar = 2<br>5. Not at all familiar = 1 |
| 3 | How often have you used video consultations to consult a doctor or healthcare professional? [1] | 1. Very often = 5<br>2. Often = 4<br>3. Occasionally = 3<br>4. Rarely = 2<br>5. Never = 1 |
| 4 | How has your general experience with video consultations been? | 1. Very positive = 5<br>2. Positive = 4<br>3. Neutral = 3<br>4. Negative = 2<br>5. Very negative = 1 |
| 5 | Have you previously participated in a video consultation during clinical training or as a substitute doctor? | 1. Yes = 1<br>2. No = 0 |
| 6 | What is your general attitude toward video consultations? | 1. Very positive = 5<br>2. Positive = 4<br>3. Neutral = 3 |

| | | |
|---|---|---|
| | | 4. Negative = 2<br>5. Very negative = 1 |
| 7 | How much do you agree with the following statement: video consultations are an effective way to communicate with patients | 1. Strongly agree = 5<br>2. Agree = 4<br>3. Partially agree = 3<br>4. Disagree = 2<br>5. Strongly disagree = 1 |
| 8 | How much do you agree with the following statement: video consultation is less satisfying for the doctor | 1. Strongly agree = 5<br>2. Agree = 4<br>3. Partially agree = 3<br>4. Disagree = 2<br>5. Strongly disagree = 1 |
| 9 | How much do you agree with the following statement: video consultations are convenient to use compared to in-person visits | 1. Strongly agree = 5<br>2. Agree = 4<br>3. Partially agree = 3<br>4. Disagree = 2<br>5. Strongly disagree = 1 |
| 10 | How much do you agree with the following statement: video consultations can partially replace in-person consultations | 1. Strongly agree = 5<br>2. Agree = 4<br>3. Partially agree = 3<br>4. Disagree = 2<br>5. Strongly disagree = 1 |
| 11 | How much do you agree with the following statement: in some cases, video consultation is the best solution for the patient | 1. Strongly agree = 5<br>2. Agree = 4<br>3. Partially agree = 3<br>4. Disagree = 2 |

| | | |
|---|---|---|
| | | 5. Strongly disagree = 1 |
| 12 | If video consultations become widespread, how do you think it will affect your future work life as a doctor? | 1. Very positive = 5<br>2. Positive = 4<br>3. Neutral = 3<br>4. Negative = 2<br>5. Very negative = 1 |

Table 2. Post-intervention questionnaire items and response options shown with their corresponding numerical scores.

| | Question | Response options |
|---|---|---|
| 1 | Overall, how satisfied are you with the overall quality of the video consultation you attended? | 1. Very satisfied = 5<br>2. Satisfied = 4<br>3. Somewhat satisfied = 3<br>4. Not very satisfied = 2<br>5. Not satisfied at all = 1 |
| 2 | Overall, how satisfied are you with the technical quality of the video consultation you attended? | 1. Very satisfied = 5<br>2. Satisfied = 4<br>3. Somewhat satisfied = 3<br>4. Not very satisfied = 2<br>5. Not satisfied at all = 1 |
| 3 | How much do you agree with the following statement: the video consultation has been a positive experience | 1. Strongly agree = 5<br>2. Agree = 4<br>3. Partially agree = 3<br>4. Disagree = 2<br>5. Strongly disagree = 1 |
| 4 | How much do you agree with the following statement: the video consultation was easy to use | 1. Strongly agree = 5<br>2. Agree = 4<br>3. Partially agree = 3<br>4. Disagree = 2<br>5. Strongly disagree = 1 |
| 5 | How much do you agree with the following statement: I will prefer to use video consultations rather than in-person consultations, when clinically possible | 1. Strongly agree = 5<br>2. Agree = 4 |

| | | |
|---|---|---|
| | | 3. Partially agree = 3<br>4. Disagree = 2<br>5. Strongly disagree = 1 |
| 6 | How important is it for you in your future work as a doctor to be able to offer patients video consultations? | 1. Very important = 5<br>2. Important = 4<br>3. Somewhat important = 3<br>4. Not very important = 2<br>5. Not important at all = 1 |
| 7 | How much do you agree with the following statement: as a patient, I might request video consultations | 1. Strongly agree = 5<br>2. Agree = 4<br>3. Partially agree = 3<br>4. Disagree = 2<br>5. Strongly disagree = 1 |
| 8 | What is your general attitude toward video consultations? | 1. Very positive = 5<br>2. Positive = 4<br>3. Neutral = 3<br>4. Negative = 2<br>5. Very negative = 1 |
| 9 | How much do you agree with the following statement: video consultations are an effective way to communicate with patients | 1. Strongly agree = 5<br>2. Agree = 4<br>3. Partially agree = 3<br>4. Disagree = 2<br>5. Strongly disagree = 1 |
| 10 | How much do you agree with the following statement: video consultation is less satisfying for the doctor | 1. Strongly agree = 5 |

| | | |
|---|---|---|
| | | 2. Agree = 4<br>3. Partially agree = 3<br>4. Disagree = 2<br>5. Strongly disagree = 1 |
| 11 | How much do you agree with the following statement: video consultations are convenient to use compared to in-person visits | 1. Strongly agree = 5<br>2. Agree = 4<br>3. Partially agree = 3<br>4. Disagree = 2<br>5. Strongly disagree = 1 |
| 12 | How much do you agree with the following statement: video consultations can partially replace in-person consultations | 1. Strongly agree = 5<br>2. Agree = 4<br>3. Partially agree = 3<br>4. Disagree = 2<br>5. Strongly disagree = 1 |
| 13 | How much do you agree with the following statement: in some cases, video consultation is the best solution for the patient | 1. Strongly agree = 5<br>2. Agree = 4<br>3. Partially agree = 3<br>4. Disagree = 2<br>5. Strongly disagree = 1 |
| 14 | If video consultations become widespread, how do you think it will affect your future work life as a doctor? | 1. Very positive = 5<br>2. Positive = 4<br>3. Neutral = 3<br>4. Negative = 2<br>5. Very negative = 1 |

During the first year of data collection, participation in a focus group interview was required before accessing the second questionnaire. These interviews were conducted prior to distributing the second questionnaire to assess the effect of the overall intervention. However, because this requirement led

some students to drop out, focus group interviews were discontinued for the remainder of the study. In study years 2 and 3, students received the second questionnaire directly after attending the video consultation.

The first questionnaire consisted of 15 questions: three demographic questions and 12 items evaluating the students' knowledge, experience, and attitudes toward video consultations. Demographic questions collected data on age, gender, and place of upbringing. The remaining items were primarily presented as Likert scales, with responses ranging from "strongly disagree" to "strongly agree" or similar gradations (Table 1).

The second questionnaire consisted of 14 questions, seven of which were repeated from the first questionnaire to measure changes in attitudes following the intervention. The remaining questions evaluated students' overall impressions, satisfaction, and expectations regarding the future use of video consultations (Table 2).

The focus group interviews were conducted virtually and aimed to assess the students' experiences with the video consultations they had attended. Additionally, the goal was to engage them in a collective discussion about how live video consultations might influence their future roles as doctors and to explore student's views on what constitutes a good video consultation. An interview guide was used to facilitate these discussions (Supplementary file 1).

Data Analysis

Quantitative data analysis

Responses from the questionnaires were analyzed descriptively, as statistical testing was not appropriate given the limited sample size. The analysis aimed to identify patterns and potential changes in participants' knowledge, perceived usability, satisfaction, clinical relevance, and attitudes toward video consultations. Descriptive measures (mean, median, and standard deviation) were calculated for each Likert-scale item to summarize responses at baseline and after participation. Items repeated across the two questionnaires were examined to explore possible individual shifts in attitude following the intervention.

Qualitative data analysis

The qualitative data were analyzed following the principles of Systematic Text Condensation (STC) as described (11). Systematic text condensation is inspired by phenomenological ideas but represents a pragmatic and descriptive approach to thematic cross-case analysis of qualitative data, without requiring adherence to a specific theoretical framework.

The method provides a descriptive and stepwise approach for thematically organizing and interpreting qualitative data across cases. Initially, all transcripts were read repeatedly to gain an overall impression

and to identify preliminary themes related to the research aim. In the next step, meaning units representing relevant statements were identified and coded to facilitate the organization of the data.

Subsequently, meaning units within each code group were condensed into short, synthesized formulations (condensates) that captured participants' experiences in their own words. Finally, these condensates were recontextualized and synthesized into analytic descriptions representing the key themes that characterized the students' reflections on video consultations.

An example of the analytic process is provided in Supplementary file 2.

[1] Early in the study, we modified question 3 by changing the original response option "don't know" to "never" to provide a more relevant choice for participants who had not used video consultations before.

# RESULTS

Quantitative findings

A total of 11 medical students participated in the study. Baseline characteristics and pre-intervention questionnaire responses are presented in Table 3. The mean age of participants was 26 years, and the majority were female (91%). Seven students participated in follow-up interviews. None of the participants had previously taken part in a video consultation during medical training or while working as a substitute doctor.

Table 3. Baseline characteristics of participants and pre-intervention questionnaire responses (n = 11)

| Variable | n (%) / Mean ± SD / Median |
|---|---|
| **Demographics** | |
| Age (years) | 26.0 ± 5.98 Median = 23 |
| Sex (F / M) | 10 (91 %) / 1 (9 %) |
| Upbringing | Suburb of a university town (4); Countryside (3); University town (2); Small town (2) |
| **Participation and experience** | |
| Participated in interview (Yes / No) | 7 (64 %) / 4 (36 %) |
| Previously participated in a video consultation during clinical training or as a substitute doctor (Q5) | No = 11 (100 %) |
| How often have you used video consultations to consult a doctor or healthcare professional? (Q3) | 1.82 ± 0.98 Median = 2 |
| Familiarity with healthcare applications such as MinSP, MinSundhed etc. (Q2) | 3.45 ± 0.82 Median = 3 |
| **Knowledge and attitudes toward video consultations (pre-intervention)** | |
| Familiarity with video consultations (Q1) | 2.27 ± 1.10 Median = 2 |
| General experience with video consultations (Q4) | 3.67 ± 1.03 Median = 4 |
| General attitude toward video consultations (Q6) | 3.55 ± 0.93 Median = 3 |
| Video consultations are an effective way to communicate with patients (Q7) | 3.36 ± 0.81 Median = 3 |
| Video consultation is less satisfying for the doctor (Q8) | 3.09 ± 0.54 Median = 3 |
| Video consultations are convenient to use compared to in-person visits (Q9) | 3.82 ± 0.75 Median = 4 |
| Video consultations can partially replace in-person consultations (Q10) | 3.45 ± 0.69 Median = 4 |
| In some cases, video consultation is the best solution for the patient (Q11) | 4.36 ± 0.50 Median = 4 |
| If video consultations become widespread, how do you think it will affect your future work life as a doctor? (Q12) | 2.91 ± 0.54 Median = 3 |

Prior to the intervention, participants reported limited familiarity with video consultations (mean 2.27, SD 1.10), however general experience with video consultations was rated positively (mean 3.67, SD 1.03). Overall attitudes toward video consultations were neutral to moderately positive (mean 3.55, SD 0.93). Video consultations were generally perceived as convenient compared with in-person visits (mean 3.82,

SD 0.75), and many participants agreed that video consultations could partially replace in-person consultations (mean 3.45, SD 0.69). Agreement was highest for the statement that, in some cases, video consultations may represent the best solution for the patient (mean 4.36, SD 0.50).

Individual pre-post responses to the repeated questionnaire items are presented in Figure 2. The largest individual changes were observed for five items: general attitude toward video consultations (Q6;Q8), perceived effectiveness of video consultations for patient communication (Q7;Q9), convenience compared with in-person visits (Q9;Q11), perceptions of video consultations as the best solution for the patient in some cases (Q11;Q13), and their perceived implications for future work life as a doctor (Q12;Q14). For these items, changes occurred in both positive and negative directions across participants.

Figure 2. Individual pre–post changes for overlapping questionnaire items (n = 11). Heatmap colours indicate the direction of pre–post changes, with darker shading indicating larger changes. NA indicates missing post-intervention data.

Overall, most students showed stable responses following participation, with only minor individual changes; greater individual variation was observed among students who also participated in interviews, compared with those who did not.

Post-intervention responses further illustrated students' experiences of observing video consultations. As shown in Table 4, students generally reported positive evaluations across the post-intervention items with an overall high satisfaction with the quality of the video consultation they attended (mean 4.45, SD 0.69), and the video consultation was generally perceived as a positive experience (mean 4.36, SD 0.67). In addition, the video consultation was rated as easy to use (mean 4.18, SD 0.75).

Table 4. Post-intervention evaluation of the video consultation (n = 11)

| Question (post-only) | Mean ± SD / Median |
|---|---|
| Overall, how satisfied are you with the overall quality of the video consultation you attended? (Q1) | 4.45 ± 0.69<br>Median = 5 |
| Overall, how satisfied are you with the technical quality of the video consultation you attended? (Q2) | 4.36 ± 0.81<br>Median = 5 |
| The video consultation has been a positive experience (Q3) | 4.36 ± 0.67<br>Median = 4 |
| The video consultation was easy to use (Q4) | 4.18 ± 0.75<br>Median = 4 |
| I will prefer to use video consultations rather than in-person consultations, when clinically possible (Q5) | 3.36 ± 0.92<br>Median = 3 |
| How important is it for you in your future work as a doctor to be able to offer patients video consultations? (Q6) | 3.73 ± 0.47<br>Median = 4 |
| As a patient, I might request video consultations (Q7) | 4.09 ± 1.14<br>Median = 5 |

Students were more neutral regarding preferences for video consultations compared with in-person consultations (mean 3.36, SD 0.92). However, many students indicated that video consultations may be relevant for their future work as doctors (mean 3.73, SD 0.47).

Findings in the interviews

The qualitative interviews provided detailed insight into how medical students experienced observing video consultations in clinical genetics. Through systematic text condensation, five themes were identified. These themes describe students' expectations, their impressions of the consultations, and their reflections on the skills and future work practices associated with video-based clinical encounters.

Theme 1: From expectation to experience: overall impressions of video consultations

Before attending, several students had limited expectations of how video consultations would unfold. Despite this, their overall impressions were positive, and many described being surprised by how natural the interaction felt. One student explained:

"I don't know if I had given much thought to what the advantages might be […] We didn't have any technical problems. But yes, I think I was actually a bit positively surprised by how good the contact with the patient was."

Another student had initially imagined that video consultations might feel like an "easy solution" from the clinician's side, but their experience challenged this assumption:

“I think I was also positively surprised. I think I had a bit of an idea beforehand that it might be an easy solution from the staff’s side […] But I felt it was the opposite.”

Across interviews, students emphasized that the consultations “worked quite well,” and that their expectations were met or exceeded.

Theme 2: The role of technology: stability, flow, and minor disruptions

Students described the technical aspects of the video consultations as largely unproblematic. Most reported stable connections and no significant issues:

“I didn’t experience any technical problems or anything. I actually think it worked quite well.”

However, they did notice small interruptions, typically related to sound or the need to repeat certain points. These minor disturbances influenced the tone slightly but not the overall quality:

“The only thing I found a bit problematic […] sometimes when you have to repeat things many times […] then it created a slightly different atmosphere, perhaps, than it would have been if it had been in person.”

Despite these smaller issues, students did not perceive technology as a barrier to providing clear clinical information.

Theme 3: Patient-related advantages: comfort, preparedness, and accessibility

Students consistently highlighted advantages for patients. They observed that video consultations reduced the need for travel, were convenient for follow-up conversations, and allowed patients to participate from familiar surroundings. One student noted:

“They were sitting at home in familiar surroundings, and they were relaxed in a different way, I think, than if they had been sitting in some white office.”

They also emphasized that video could be particularly appropriate for patients who were already well informed about their condition:

“It made really good sense for her […] not having to come into the department, because she had already looked into many of the things beforehand.”

For some patients, especially those living far from the hospital, students saw video as a meaningful way to ensure access to timely genetic counselling without requiring long travel.

Theme 4: Competencies required for conducting effective video consultations

Students described effective video consultations as requiring both technical familiarity and heightened communicative awareness. Several emphasized that clinicians must pay closer attention to emotional cues, since physical reassurance is not possible:

“You need to be much better at noticing if people become emotional […] because you can’t go over and put a hand on their shoulder.”

Technical competence was also seen as necessary to avoid disruptions that might hinder the flow of the consultation:

“I do think you need to have control of the technical side, but otherwise it’s a communication skill, I would say.”

Students viewed the combination of these skills as essential for maintaining clarity, trust, and patient engagement during video-based encounters.

Theme 5: Digitalization and the future medical work life

Students reflected on how video consultations may influence their future work lives as doctors. They recognized potential for flexibility and increased accessibility yet also expressed concerns about becoming too distanced from patients.

One student worried about the impact of excessive digitalization:

“The fear might be that you end up never meeting any people in real life, because you’re just sitting behind a screen.”

Another student shared the same concern:

“I would also find it annoying if I had a work life where I had to look into a screen, that’s probably what I’m looking forward to the least.”

Although they valued the flexibility video consultations could provide, students emphasized the need to preserve in-person interactions, especially in emotionally sensitive or complex situations.

# DISCUSSION

The present study explored medical students’ attitudes towards video consultations in clinical genetics and whether these attitudes changed following participation in a video consultation. Overall, students reported positive experiences and expressed generally favorable attitudes towards video consultations. Only minor changes were observed between pre- and post-intervention responses to attitude questionnaires, suggesting that participation in a single video consultation did not substantially change students’ overall views on telehealth. However, the qualitative analyses disclosed that students experienced technical obstacles as less than expected and increased their appreciation of patient benefits of telehealth. In a small pilot study of 12 medical students, Särchen et al found that interest in video consultations increased for many students following a four-week teaching intervention. In contrast to our study, the students actively conducted video consultations themselves under supervision (12).

Thus, more active participation over a longer period might have led to a more significant change in attitudes in our study.

The COVID19 pandemic led to rise in the use of telemedicine across specialties, fewer in-patient consultation and consequently affected medical students' clinical rotations. Analyzing a questionnaire study of 46 medical students, which was aimed at medical students' learning experiences rather than attitudes towards video/telephone consultations, some similarities to our study can be observed. They found that face-to-face consultations were preferred, while both video and telephone consultations were still perceived as a valuable learning experience (7). The students reported IT malfunctions (a few or many) that impaired the consultation in approximately 40% of the video consultations, despite the use of an NHS-approved software (Nearme/Attend Anywhere), which could be a contributory factor to the lesser learning outcome. Although the studies assessed different outcomes, a similar pattern was observed, with students generally viewing video consultations positively while still valuing in-person consultations. In our study, participants generally evaluated video consultations positively but remained neutral regarding a preference for video consultations over in-person encounters.

A French national pre-COVID19 questionnaire study (from 2018-19) including 3,312 medical students and residents found that although telemedicine education and training (ET) had been integrated in the medical curriculum since 2009, only 14.5% of respondents stated that they had received telemedicine ET, and 97.9% stated they were not sufficiently trained (13). The same applied to a study from the US from 2020, including 156 internal medicine interns at the start of their residency; the majority (74%) had received no training in video/telephone consultations during medical school, and for those who had, the training lasted less than 2 hours for the vast majority (14). This contrasts with the statement of most of the interns (75%) who found telehealth training during medical school important.

Abraham et al studied 15 medical students' attitudes towards telehealth and found that, similar to our results, the students found that "Doctors can provide quality care to their patients via telehealth" (93% strongly or somewhat agree), and all students found that it is a valuable service to offer to patients (15). Furthermore, 80% found that it would be an important part of their future career, albeit only 14% somewhat agreed with being familiar with the concept of telehealth, whereas the remainder were neutral or disagreed. Finally, Walker et al developed a program to help students gain confidence with telemedicine, consisting of three modules, a video and a simulation session (16). A survey of 93 students pre- and post-training showed that the students' attitudes towards using telemedicine as well as the importance of telemedicine changed in a positive direction. A recent UK mixed-methods study found that previous exposure to teleconsultations in clinical placements was positively associated with medical students' attitudes towards including teleconsultation in undergraduate medical education. Unlike our study, however, the study was cross-sectional and did not examine changes following an intervention (17).

The present study, together with prior research, suggests that medical students and doctors generally recognize the importance of telemedicine and view it as an integral part of their future careers. However,

formal training in telemedicine remains scarce in medical school curricula, despite being perceived positively when offered. While we did not encounter major technical issues in this study, ensuring a safe and efficient telemedicine setup remains essential for successful implementation.

Given that it is agreed that training of telehealth is important and at present sparse, the low participation rate in the course offered are surprising. We have not had the possibility to investigate the reason for this, but speculate that it may stem from two key factors: the condensed timeline of the clinical genetics course, which leaves students with limited time as they simultaneously prepare for exams; and insufficient prior exposure to clinical genetics as a medical specialty, which may reduce students' motivation to engage further with the field.

Limitations

A significant limitation of the study is the low participation rate, resulting in a small sample size and a very selected cohort. As we have only studied medical students who voluntarily participated in a telemedicine course, limited generalizability of the findings must be assumed.

Another limitation is the methodological inconsistency during data collection. As the study progressed, changes were made to the data collection procedure due to participant dropout. Consequently, only some participants contributed qualitative data, while others completed questionnaires only. This resulted in an uneven contribution of qualitative and quantitative data across participants, which may have limited the integration and the extent to which qualitative findings reflect the experiences of the full study sample.

# CONCLUSIONS

In conclusion, we found that medical students generally hold positive attitudes towards video consultations, with participation in a single session doing little to shift overall views, though it did ease concerns about technical barriers and deepen appreciation for patient benefits. These results echo wider evidence that students and young doctors see telemedicine as valuable and relevant to their future careers, yet formal training remains scarce across medical curricula. The low uptake of the course offered here underscores this gap between perceived importance and actual engagement. We believe that further research should focus om how more sustained training may better shape attitudes and competence.

# Declarations

Ethics approval and consent to participate

The Danish Committee Act (Komitéloven), (Lov om videnskabsetisk behandling af sundhedsvidenskabelige forskningsprojekter) and the current consolidated version (LBK nr. 1268 of 28/11/2024) state in § 14, stk. 2 that health science questionnaire studies and health science register

research projects only have to be notified to the research ethics committee system if the project includes human biological material. Thus, questionnaire and interview studies as the current are exempt from notification to the research ethics committee system. This study was conducted in accordance with relevant ethical guidelines and regulations, including the principles of the Declaration of Helsinki. All participants provided informed oral consent to participate in the study prior to completing the questionnaires and/or participating in the interviews.

Consent for publication

No individual details of people are included in the manuscript

Availability of data and materials

The data are not publicly available due to the small number of participants and the need to protect participants' privacy and confidentiality.

Competing interests

The authors declare that they have no competing interests

Funding

The study was supported by an educational quality grant from The Department of Clinical Medicine at the Faculty for Health Sciences at the University of Copenhagen.

Authors' contributions

EO and BD designed the study. AA recruited participants and collected questionnaires. All authors conducted the interviews. AA analyzed the data and drafted the manuscript. All authors read and approved the final manuscript

Acknowledgements

We thank all medical students, doctors and patients who participated in the study.

# References

1. Vrečar I, Hristovski D, Peterlin B. Telegenetics: an Update on Availability and Use of Telemedicine in Clinical Genetics Service. J Med Syst. 2017 Feb;41(2):21.
2. Kidholm K, Svendsen IW, Yderstræde K, Ølholm AM, Rayce K, Kjølhede T. The hospital telemedicine TELEMED database: Providing information on evidence-based telemedicine services to hospital managers and healthcare professionals. J Telemed Telecare. 2021 Jun;27(5):280–7.
3. Sundhedsdata-Styrelsen [Internet]. [cited 2025 Dec 25]. Available from: https://sundhedsdata.iterm.dk/

4. Gorrie A, Gold J, Cameron C, Krause M, Kincaid H. Benefits and limitations of telegenetics: A literature review. J Genet Couns. 2021 Aug;30(4):924–37.
5. Primholdt Christensen N, Skou KE, Boe Danbjørg D. Health Care Professionals' Experiences With the Use of Video Consultation: Qualitative Study. JMIR Form Res. 2021 Jul 21;5(7):e27094.
6. Møller OM, Vange SS, Borsch AS, Dam TN, Jensen AM, Jervelund SS. Medical specialists' use and opinion of video consultation in Denmark: a survey study. BMC Health Serv Res. 2024 Apr 24;24(1):516.
7. Patterson C, Collins K, Hunter I. Comparing medical student experience of face-to-face and remote access consultations during the coronavirus pandemic. J Telemed Telecare. 2024 Jun 1;30(5):851–9.
8. Ayatollahi H, Sarabi FZP, Langarizadeh M. Clinicians' Knowledge and Perception of Telemedicine Technology. Perspect Health Inf Manag. 2015 Nov 1;12(Fall):1c.
9. Vidal-Alaball J, Flores Mateo G, Garcia Domingo JL, Marín Gomez X, Sauch Valmaña G, Ruiz-Comellas A, et al. Validation of a Short Questionnaire to Assess Healthcare Professionals' Perceptions of Asynchronous Telemedicine Services: The Catalan Version of the Health Optimum Telemedicine Acceptance Questionnaire. Int J Environ Res Public Health. 2020 Mar 25;17(7):2202.
10. Parker K, Chia M. Patient and clinician satisfaction with video consultations in dentistry - part two: clinician satisfaction. Br Dent J. 2021 May 27;1–5.
11. Malterud K. Systematic text condensation: a strategy for qualitative analysis. Scand J Public Health. 2012 Dec;40(8):795–805.
12. Särchen F, Springborn S, Mortsiefer A, Ehlers J. Patient Care via Video Consultations: Piloting and S.W.O.T. Analysis of a Family Medicine Digitally Synchronous Seminar for Medical Students. Int J Environ Res Public Health. 2022 Jul 22;19(15):8922.
13. Yaghobian S, Ohannessian R, Iampetro T, Riom I, Salles N, de Bustos EM, et al. Knowledge, attitudes and practices of telemedicine education and training of French medical students and residents. J Telemed Telecare. 2022 May;28(4):248–57.
14. Wong CJ, Nath JB, Pincavage AT, Bird A, Oyler JL, Gill K, et al. Telehealth Attitudes, Training, and Preparedness Among First-Year Internal Medicine Residents in the COVID-19 Era. Telemed J E-Health Off J Am Telemed Assoc. 2022 Feb;28(2):240–7.
15. Abraham HN, Opara IN, Dwaihy RL, Acuff C, Brauer B, Nabaty R, et al. Engaging Third-Year Medical Students on Their Internal Medicine Clerkship in Telehealth During COVID-19. Cureus. 2020 Jun 24;12(6):e8791.
16. Walker C, Echternacht H, Brophy PD. Model for Medical Student Introductory Telemedicine Education. Telemed J E-Health Off J Am Telemed Assoc. 2019 Aug;25(8):717–23.
17. Wetzlmair-Kephart LC, O'Malley A, O'Carroll V. Medical students' and educators' opinions of teleconsultation in practice and undergraduate education: A UK-based mixed-methods study. PloS One. 2025;20(3):e0302088.

# Figures

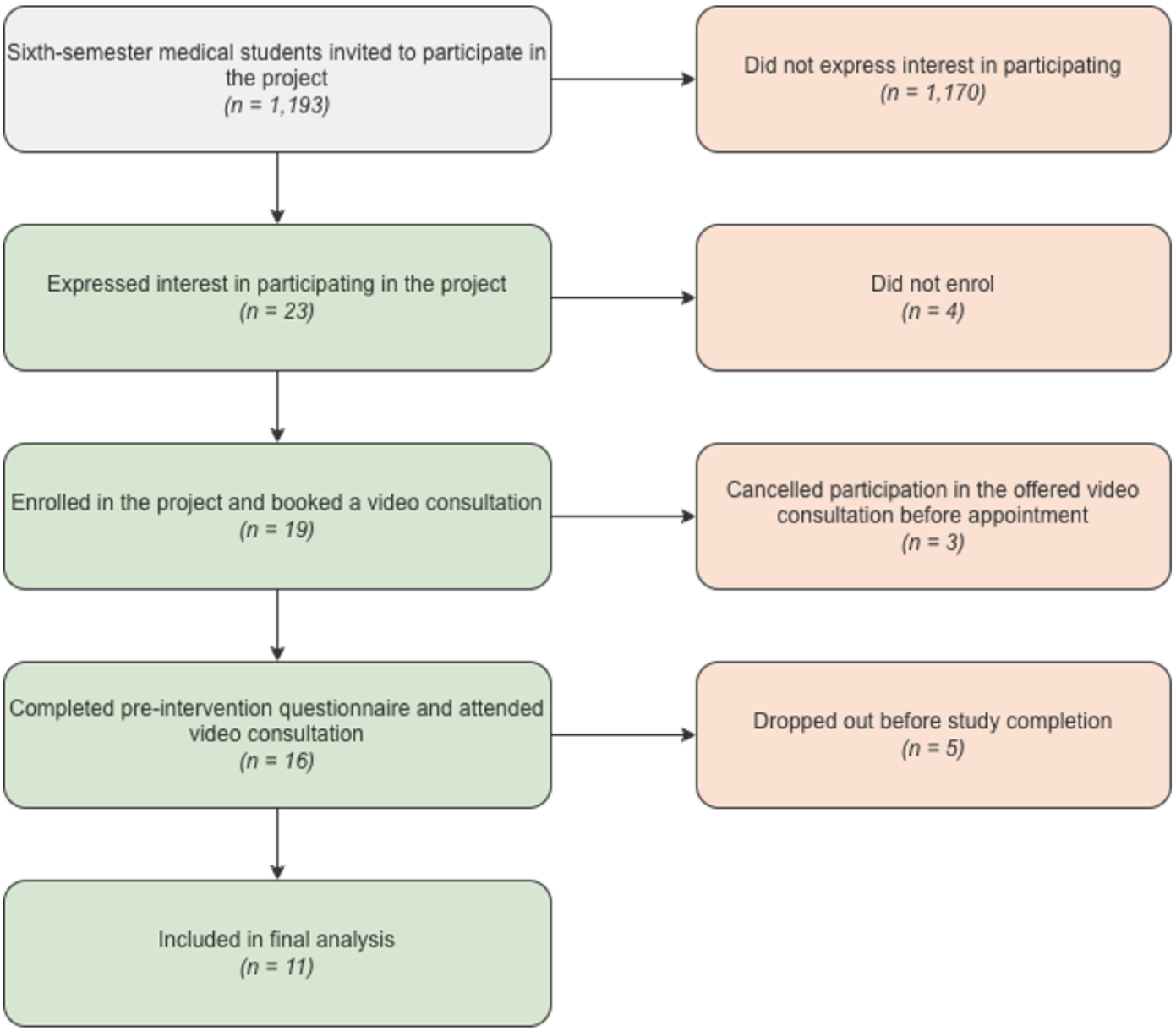



**Figure 1**

Flow diagram showing participant recruitment, enrolment, attrition, and inclusion in the final analysis.

**Figure 2. Individual pre–post changes for overlapping questionnaire items (n = 11)**

| Question (pre; post) | Participant 1 | Participant 2 | Participant 3 | Participant 4 | Participant 5 | Participant 6 | Participant 7 | Participant 8 | Participant 9 | Participant 10 | Participant 11 | Participated in interview |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| What is your general attitude toward video consultations? (Q6; Q8) | 5;4 | 3;3 | 4;5 | 2;4 | 3;4 | 3;4 | 5;4 | 3;3 | 4;4 | 4;4 | 3;2 | Yes (P1–7), No (P8–11) |
| Video consultations are an effective way to communicate with patients (Q7; Q9) | 5;3 | 3;3 | 3;4 | 2;4 | 4;4 | 3;4 | 4;4 | 3;4 | 3;3 | 4;4 | 3;3 | |
| Video consultation is less satisfying for the doctor (Q8; Q10) | NA* | 3;3 | 3;2 | 4;5 | 3;3 | 3;2 | 3;3 | 3;3 | 4;4 | 3;2 | 3;4 | |
| Video consultations are convenient to use compared to in-person visits (Q9; Q11) | 3;3 | 3;3 | 4;5 | 4;5 | 3;3 | 5;3 | 5;5 | 4;4 | 4;4 | 4;4 | 3;3 | |
| Video consultations can partially replace in-person consultations (Q10; Q12) | NA* | 4;3 | 4;4 | 3;4 | 4;4 | 4;4 | 4;5 | 2;3 | 4;5 | 3;3 | 3;2 | |
| In some cases, video consultation is the best solution for the patient (Q11; Q13) | 5;5 | 5;3 | 4;4 | 4;4 | 4;4 | 4;4 | 5;5 | 4;4 | 4;5 | 5;5 | 4;4 | |
| If video consultations become widespread, how do you think it will affect your future work life as a doctor? (Q12; Q14) | 3;4 | 3;3 | 3;4 | 3;2 | 3;4 | 3;3 | 4;5 | 2;4 | 3;3 | 3;4 | 2;2 | |

** NA indicates missing post-intervention responses due to exclusion of invalid duplicate questionnaire entries.*

**Figure 2**

Individual pre–post changes for overlapping questionnaire items (n = 11). Heatmap colours indicate the direction of pre–post changes, with darker shading indicating larger changes. NA indicates missing post-intervention data.

# Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- Supplementaryfile1.docx
- Supplementaryfile2.docx