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Use of video directly observed treatment for tuberculosis in Northern Norway

ORIGINAL ARTICLE

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BACKGROUND

In 2017, a total of 261 patients with tuberculosis were reported in Norway, whereof 90 % completed their therapy. Anti-tuberculosis drugs are administered as daily directly observed treatment (DOT) to all patients. We

investigated whether this could be done by video conference.

MATERIAL AND METHOD

We conducted a clinical observation study at the University Hospital of North Norway in the period 2016–2019, in which patients ≥ 16 years with tuberculosis after a minimum of two weeks of daily DOT during home visits continued their treatment through video conference (video DOT). The password-protected and encrypted video conference service provided by Norwegian Healthnet was used. The home care service contacted the patient by video conference in real time and observed the intake of drugs via a tablet computer, smartphone or PC.

RESULTS

20 out of 30 patients met the inclusion criteria, whereof 17 patients (15 foreign-born) with a median age of 32 (17–74) were included. The average observed drug intake per patient was 86.1 % in the period with home-based DOT and 75.9 % in the period with video DOT. The median daily time spent by the home care service was 17 (2–40) minutes for home visits and 3 (1–8) minutes for video conferences. Fourteen out of 17 patients and 14 out of 17 home nurses preferred video conferencing over home visits. Fifteen patients and all home care nurses would recommend video conferencing to others. Technical problems (8.9 %) were the most common reason for directly observed treatment *not* being undertaken during the period with video conferencing.

INTERPRETATION

Video DOT was feasible for the selected patients. Video conferencing was time-efficient for the home care service and was preferable to home visits.

Main findings

Video directly observed treatment for tuberculosis was feasible for the selected patients.

Video conferencing was time-efficient for the home care service and was preferred by the majority of the patients and home care nurses.

Of all infectious diseases, tuberculosis claims the highest number of lives globally (1), but its prevalence in Norway is declining and is among the world's lowest (2). In 2017, altogether 261 patients with tuberculosis were reported to the Norwegian Institute of Public Health, 89 % of whom were foreign-born (2). Their median age was 30 years. A total of 90 % of the patients completed their tuberculosis treatment (3), and Norway thereby achieved the World Health Organization's goal that 90 % or more should complete their course of treatment (4). The Regulations on Tuberculosis Control recommend that anti-tuberculosis drugs be administered as daily directly observed treatment (DOT) to all patients, although individual adaptations are made in line with the recommendations from the World Health Organization (1), (5–7).

Insufficient compliance with treatment can lead to therapeutic failure and development of antibiotic resistance (1). DOT is intended to ensure that the treatment is completed, by having health personnel observe the patient taking and swallowing all the doses of anti-tuberculosis drugs (6). The drugs are taken once daily for a minimum of six months (1). In Norway, the practical implementation of DOT is normally delegated to the home care service, which provides the drugs to the patient during visits to his/her home or at the home care service office. Tuberculosis coordinators, who are hospital employees, coordinate the follow-up and treatment of the patients in collaboration with a medical specialist and the primary health service (6).

The large geographical distances in Norway entail long travel times and challenging logistics, since the timing of the home-based DOT needs to be adapted to the daily schedules of both the patient and the home care nurse. Daily home visits may also be a threat to confidentiality, and some patients have described the home visits as stigmatising and humiliating (8–10).

The World Health Organization's guidelines from 2017 provide for DOT to be carried out via video (7). The vision of the national strategy for e-health 2017–2022 is to digitise Norwegian health and care services (11). Northern Norway Regional Health Authority aims to be at the forefront of the use of information technology in patient treatment in Norway with a view to improving accessibility and efficiency (12). Studies from the UK, USA and Australia show that video DOT is a reliable method that saves time and money, while fulfilling the patients' needs (9, 10, 13)(13–15). The video conferences can be undertaken in real time (10, 14), or the patient can film his or her own intake of drugs and send the video to health personnel for later viewing (9, 13, 15, 16).

In this study we have investigated the feasibility, the proportion of observed drug intake and degree of compliance, the home care nurses' time use, and the patients' and the home care services' assessments of video DOT in municipalities in Northern Norway.

Material and method

This is a clinical observation study of patients receiving treatment for tuberculosis at the University Hospital of North Norway, Tromsø, undertaken in collaboration between the hospital and the community primary health service in ten municipalities. The inclusion period lasted from 1 September 2016 to 15 September 2018. The study period lasted until 14 March 2019. The absolute inclusion criteria were age ≥ 16 years, ≥ 2 months left of the treatment period and peroral treatment. In an interview with the patient, one of the two tuberculosis coordinators assessed whether the patient had sufficient understanding of the disease and motivation to undertake DOT via video conferencing.

Implementation

The video conferencing was undertaken using Acano/Cisco Meeting, a password-protected and encrypted video conferencing system supplied through Norwegian Healthnet, of which all Norwegian local authorities and hospitals are members (17). The solution is approved for use in the health and care sector and complies with EU/EEA requirements for communication security (18–21). Norwegian Healthnet has solutions only for communication in real time. The hospital's quality and development centre provided technical assistance.

The patients and the home care nurses were trained by the tuberculosis coordinator in how to undertake video DOT. The patients used their own smartphone, tablet computer or PC, or were loaned a tablet computer by the study. The home care services were loaned tablet computers with a SIM card by the study. Prior to starting with video conferencing, the patients should have undergone well-functioning home-based DOT over a minimum of two weeks.

The home care nurse started the video conference with the patient at the agreed time every day. In order to establish contact, both parties needed to be logged in. The patient introduced him-/herself by name and date of birth and placed their face in front of the camera so that it was clearly visible. The patient swallowed the pills with some water from a transparent glass and filmed his/her empty oral cavity after taking the drugs. If the patient failed to answer the video call-up, the nurse would call the patient by telephone and/or undertake a home visit. If technical problems prevented the video conference, an agreement was made for either self-administration of the drugs or a home visit. If the technical problems persisted, contact was made with the tuberculosis coordinator primarily or with the hospital's quality and development centre.

Compliance with drug intake according to the agreement included observed drug intake or agreed self-administration. In case of poor compliance with the video DOT, a joint decision was made by the tuberculosis coordinator and the home care service on whether home-based DOT should be resumed. During the period with video conferencing, the patient received pill dispensers for 2–4 weeks from the home care services, alternatively the patient would keep all drugs at home.

Data collection

Each day, the home care nurse registered the following information on a paper form with a colour photo of the patient and the drugs (for identification): completed home-based or video DOT, causes of non-performance and alternative follow-up, if any, and time use in minutes for the home visit (including transport back and forth and the duration of the patient contact) or for the video conference (time from log-in to the end of the video conference). The tuberculosis coordinator undertook quality assurance of the data collected. If the drug intake had not been documented in writing by the home care service, the tuberculosis coordinator collected monthly confirmation of the drug intake observed during home visits or video conferences by telephone from the home care service. In the study, this was registered as 'drug intake not documented in writing'. If contact could not be established with the patient in the period with video conferencing, the patient confirmed his/her drug intake in the subsequent contact with the home care service (registered as 'the patient

did not respond when contacted'). In both these types of events, the responsible specialist and the tuberculosis coordinator considered the drugs as having been taken, and no patients in the study had their tuberculosis treatment extended as a result of them.

Upon completion of the therapy, the tuberculosis coordinator conducted a structured interview (a questionnaire with pre-defined response categories and some free text) with each patient, in the hospital or by telephone. The tuberculosis coordinator also conducted interviews with one employee from each home care district (similar, adapted questionnaire).

Data analysis

The data are presented in a purely descriptive form. We first calculated a) the proportion of observed drug intake (%), b) compliance with drug intake according to the agreement (%) and the home care service's average time use per day (minutes) for each patient. Then we calculated the averages of a) and b) for all patients (N = 17) and the median value of the average of the time used by the home care service. We present a) and b) as averages (%) with standard deviations, and the home care services' time use as a median value within a range. We used SPSS version 25.

The data protection officer at the University Hospital of North Norway approved the study as a quality assessment study (0658/20012017). The patients, contact persons in the home care service and the Chief Municipal Medical Officer provided written consent to participate.

Results

30 patients ≥ 16 years were treated for tuberculosis during the inclusion period, ten of whom did not meet the inclusion criteria (Figure 1). Of the 20 who were asked, 17 consented to participate. Their median age was 32 (17–74) years, and nine were women (Table 1). Fifteen patients were foreign-born and two of them spoke little Norwegian or English. Twelve patients were in permanent employment or were students.

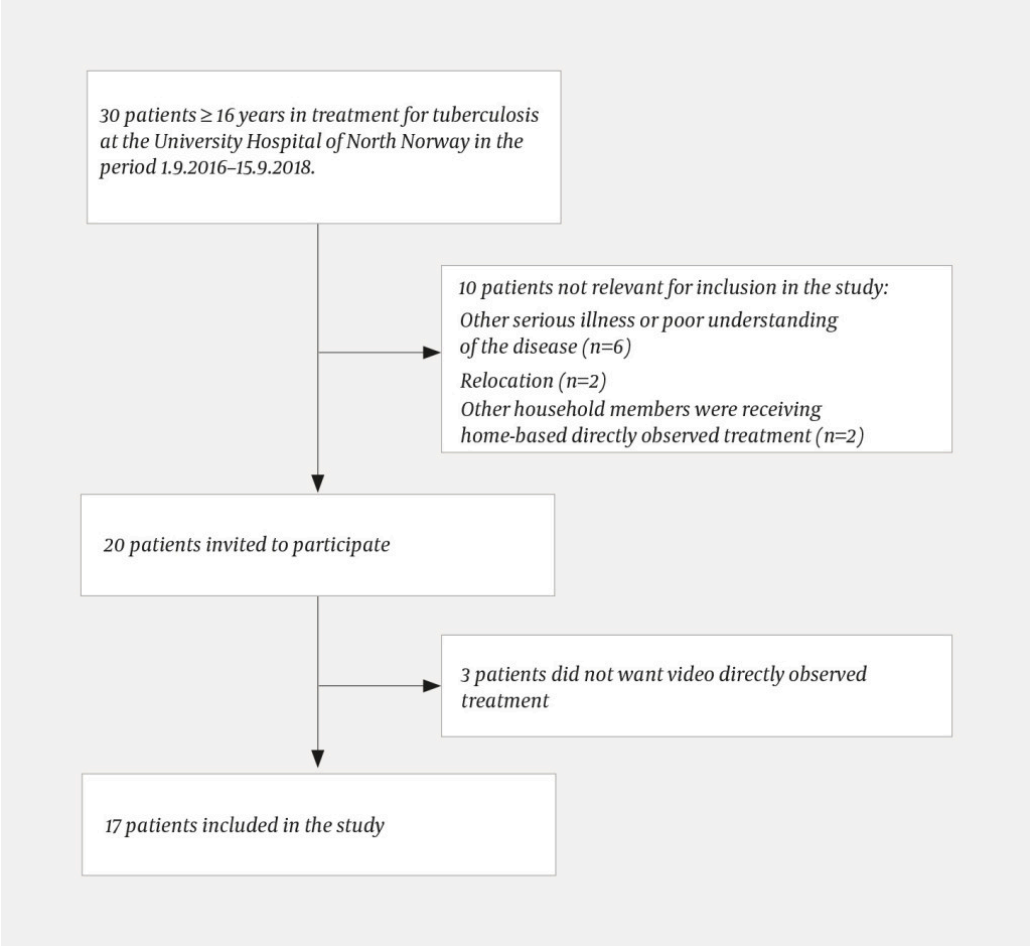

Figure 1 Study population for a clinical observation study that investigated directly observed treatment by video conference for patients ≥ 16 years with tuberculosis.

Table 1

Characteristics of the 17 patients who received video directly observed treatment in ten municipalities in Northern Norway in the period 1 September 2016–14 March 2019

Characteristics	Number
Age in years, median (range)	32 (17–74)
Sex	
Female	9
Male	8
Continent of birth	
Europe	4
Africa	8
Asia	5
Years lived in Norway for those born abroad (n = 15), median (range)	7 (2–16)
Language	
Good Norwegian/English skills	15
Limited Norwegian/English skills	2

Characteristics	Number
Occupation	
Employed	6
Studying	6
Other	5
Co-morbidity	
Only tuberculosis	11
Tuberculosis and other long-term illness	6
Type of tuberculosis	
Pulmonary[1]	6
Extrapulmonary	11

[1]Includes patients with only pulmonary tuberculosis or pulmonary tuberculosis with accompanying affection of another organ

Daily follow-up of drug intake

Even though two weeks of home-based DOT had been scheduled before the start of the video conferencing sessions, three patients started their video conferences after only 0–5 days of home visits.

The median follow-up time was 3 (0–16) weeks for home visits and 24 (9–53) weeks for video conferencing (Table 2). In the period with home visits, the drug intake was observed in the office of the home care service for 2 out of 17 patients, while the others were visited in their own homes. Eight patients tended to undertake the video conference mostly from their home, while nine undertook the video conference at home, at work, outdoors or while travelling. The average observed drug intake per patient amounted to 86.1 % in the period with home visits and 75.9 % in the period with video conferencing (Table 2). Compliance with the agreed intake in accordance with the agreement amounted to 95.4 % in the period with home visits and 89.8 % in the period with video conferencing. There were major variations between patients in how the drug intake was carried out in the video conferencing period (Figure 2).

Table 2

Follow-up time, observed drug intake, compliance with drug intake according to the agreement and the home care service's time use for home-based and video directly observed treatment for 17 patients in ten municipalities in Northern Norway in the period 1.9.2016–14.3.2019.

	Home visit	Video conference
Total number of days in the study period	608	3 023
Follow-up time, median number of weeks (range)	3 (0–16)	24 (9–53)

	Home visit	Video conference
Observed drug intake, average (SD)	86.1 % (26.0)	75.9 % (19.1)
Compliance with drug intake acc. to the agreement[1], average (SD)	95.4 % (8.3)	89.8 % (11.3)
Time use by the home care service, median no. of minutes (range)[2]	17 (2–40)	3 (1–8)

[1]Compliance with drug intake according to the agreement included observed drug intake and agreed self-administration.

[2]Missing data for time use amounted to 48.4 % (294 of 608 days) for the period with home-based directly observed treatment and 4.2 % (127 of 3023 days) for the video conferences.

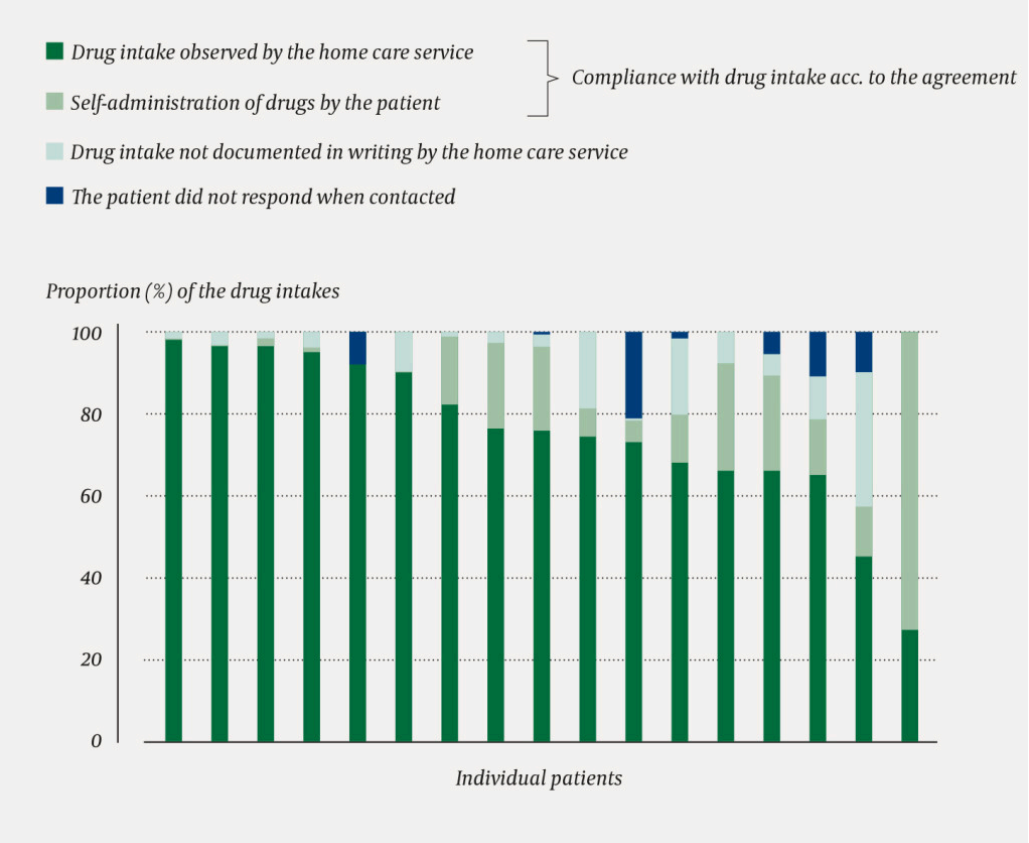

Figure 2 Implementation of drug intake in the period with directly observed treatment by video conference for each patient.

At the close of the study, 16 of the 17 patients had completed their tuberculosis treatment. The remaining patient completed the course of treatment after the study had ended.

Time use

The home care service's median time use for DOT amounted to 17 (2–40) minutes for home visits and 3 (1–8) minutes for the video conference (Table 2).

Eleven patients reported using less time for the video conferences than for the home visits, while two patients reported that the video conference took longer, because they had to wait for the home care service to make contact after logging in.

Practical and technical problems

All of the patients were able to cope with the digital technology. Two patients reverted to home visits during the last weeks of their treatment because practical and/or technical problems had arisen (Box 1). Five home care nurses reported frequent practical problems when undertaking video DOT, seven reported few problems and five reported no problems. Lack of punctuality, among both the patients and the nurses, caused a number of practical problems.

Box 1 Practical and technical problems in undertaking video directly observed treatment for patients in ten municipalities in Northern Norway in the period 1.9.2016–14.3.2019.

PRACTICAL PROBLEMS

The patient did not respond when contacted

The patient or the home care nurse had forgotten what time to call

The home care nurse could not find the tablet computer or the registration form

The tablet computer's battery was flat

The filming of the drug intake was unsatisfactory

The home care nurse had failed to record the drug intake in writing

TECHNICAL PROBLEMS

The audio and/or video connection failed

The picture was blurred/unstable

The video conference service was disrupted or out of action

Poor Wi-Fi coverage

No mobile network

Technical problems (89 %, 268 out of 3023 days in the period with video conferencing) was the single most common reason why video DOT was not undertaken.

Home visits vs. video conferences

Eleven patients felt that confidentiality could best be upheld by video conferencing, while six answered 'don't know'. The patients provided supplementary statements such as: 'It was very obvious when uniformed nurses came to my house. There are no old people in this neighbourhood' and 'It was an advantage to have DOT by video conference. I felt I had more freedom,

because I could take the drugs anywhere, and I could travel'. Fourteen out of 17 patients preferred video conferencing to home visits, and 15 would recommend video conferencing to others.

Fourteen out of 17 home care nurses preferred video conferencing to home visits, and they all expressed a wish for the video conferencing to be continued for new patients. One home care nurse elaborated on her response: 'The home care service did not have to drive all the way to the patient and this saved a lot of time. The patients had more freedom to live their lives, and this was a really positive thing'.

Discussion

Our study showed that video DOT was feasible for selected patients and time-efficient in municipalities in Northern Norway. The proportion of observed drug intake and the compliance with drug intake according to the agreement were high both in the period with home visits and during the period with video conference. The majority of the patients and home care nurses preferred video conferencing to home visits.

Our study presumed that the drug intake was recorded in writing by the home care service in order to be registered as observed. In cases where home visits and video conferences had not been documented in writing, the home care service confirmed in a subsequent phone call from the tuberculosis coordinator that the drug intake in all likelihood had been observed. The real proportion of observation of drug intake is therefore likely to be higher than what is reported here. Completion of the study's paper form was an addition to the home care services' recording of their own documentation. Time constraints and the large number of staff involved may explain the missing registrations.

The high proportion of observed drug intake and compliance in accordance with the agreement in the initial period of home visits can be explained by the fact that this was at an early stage of the treatment, the period was short and the patients were motivated to change to video conferencing. In line with other research, we found that video conferencing is a feasible method for observing the intake of anti-tuberculosis drugs (13–15), (22). The proportion of observed drug intake and compliance in video conferencing concurs with or exceeds that found in international studies (15, 22). One reason could be that in our study, we offered video conferencing to all patients who, according to Norwegian guidelines, would otherwise have received a daily home visit. In many countries, for example the UK, DOT is reserved for risk groups with poor compliance of drug intake because of mental illness, homelessness, addiction etc. (15). In such selected groups, compliance with video conferencing could be correspondingly low.

Technical problems prevented video DOT from being carried out in 8.9 % of the period, compared to 4.4 % in a study from the USA (23). We observed that technical problems reduced the patients' and home care nurses' motivation for video conferencing, and this was part of the reason why two of our 17 patients reverted to home visits for the later part of their treatment. In other studies, 4–

13 % of patients reverted to home visits because of technical problems, low compliance and/or a preference for home visits over video conferencing (9, 13, 16).

Video conferencing requires the patient to participate more actively in the treatment (23). This can be appropriate during parts of the treatment period, but not necessarily for its entire duration (7).

Home visits cannot always be fitted into the patient's life (8, 24). In our study, video conferencing enabled observation of drug intake in patients who were travelling or who wanted to avoid the neighbours' attention. The majority of the patients were working or studying, and more than half undertook video conferences both at home and elsewhere. Other studies have shown that the increased confidentiality and flexibility provided by video conferencing can reduce the number of days of previously agreed self-administration and thus mean that more patients complete their tuberculosis treatment (9, 10, 14, 16).

Video DOT has been shown to be cost-effective, and many studies have found a time use of approximately five minutes per video conference (10, 22, 23). In our study, the time used was even shorter.

In line with other studies, most patients reported that confidentiality was better protected in the video conference than in the home visits (13, 14, 16). We found that the majority of the patients and home care nurses preferred video conferencing to home visits (10, 13, 16). We found that those patients who preferred home visits also needed other home care services in addition to the tuberculosis treatment.

Strengths and limitations

As far as we know, this is the first study of video DOT in the Nordic countries. In our study, the video sessions were undertaken seven days per week, while some studies from the USA had undertaken video sessions only five days per week (9, 16). The study is limited in terms of its small number of participants, absence of a control group and the fact that the video conference service could not log completed sessions and time use. The home care service's paper-based registration form entailed varying data quality and some missing data.

Conclusion

Video DOT was feasible for the selected patients, yielded a high proportion of observed drug intake and was time-efficient for the home care services. The majority of the patients and home care nurses preferred video conferencing to home visits and would recommend it to others. Video conferencing functioned best when both the patient and the home care nurse were punctual. Based on results from the study, we have extended the practice of video DOT for patients with tuberculosis at the University Hospital of North Norway in Tromsø.

Further development of video conferencing technology will reduce the number of technical and practical problems and improve user-friendliness. The study provided video conferencing as an option to patients ≥ 16 years with

tuberculosis. Future studies should investigate the use of video conferencing among younger patients.

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The article has been peer reviewed.

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