Telemedicine in dermatology: Evaluation of secondary and tertiary teledermatology
van der Heijden, J.P.

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Evaluation of a tertiary teledermatology service between peripheral and academic dermatologists in the Netherlands

Job P van der Heijden MSc ¹;³, Nicolette F de Keizer PhD ², Leonard Witkamp MD PhD ³, Phyllis I Spuls MD PhD ¹

¹Department of Dermatology, Academic Medical Centre, University of Amsterdam, The Netherlands;
²Department of Medical informatics, Academic Medical Centre, University of Amsterdam, The Netherlands;
³KSYOS Health Management Research, Amstelveen, The Netherlands
Abstract

**Background:** Tertiary teledermatology (TTD, secondary care to tertiary care teleconsultation) is applied rarely compared to the frequently applied secondary teledermatology (primary to secondary care).

**Objective:** To determine the effect of TTD on referrals from peripheral dermatologists to the tertiary centre and to evaluate acceptance of TTD.

**Methods:** From May 2010 to May 2012, 39 dermatologists could send in teleconsultations to one of two tertiary centres. Prevented physical referrals to the tertiary centres by TTD were calculated based on questions before and after TTD. The acceptance of the TTD system was evaluated through questionnaires, a focus group meeting and personal interviews.

**Results:** 85 teleconsultations were sent by 13 peripheral dermatologists from 9 care institutions and answered by eight tertiary dermatologists. 62% (n=53) of the patients would have been referred physically to the tertiary centre if teledermatology were not available. In this group, teledermatology prevented 81% (n=43) physical referrals. Dermatologists indicated that TTD had important advantages such as fast response time, formalized records, data and privacy security. However, the current work process using telephone and email was preferred because of its ease of use and direct personal network. The following conditions that could lead to successful implementations were indicated: a) a national TTD system including all dermatologists indexed according their sub specialty, b) ability to send the TTD consultation to a dermatologist personally, c) ability to discuss a case with multiple dermatologists, d) connections to Electronic Health Records, e) change in policies of tertiary centres or health insurers, where they would stimulate the use of TTD consultation for all referrals and questions.

**Conclusions:** Although quantitative results indicate that TTD can be used to improve triage between secondary and tertiary centres and dermatologists perceived advantages of TTD, the motivation to use TTD in this setting was lacking as current work processes were easier to use.
Chapter 6 - Evaluation of a tertiary teledermatology service

Introduction

Email traffic and the use of other digital technologies to communicate have increased significantly in the last decade and will continue to do so.¹ This has also become apparent in the medical sector, in which physicians and patients alike send medical questions and data through email. This process can be regarded as a simple form of telemedicine, the delivery of healthcare by use of information and communication technology (ICT), enabling caregivers and caretakers to work together independently of place and time.² Drawbacks of this unstructured type of telemedicine are poorly documented cases that are flooding mailboxes; cases not linked to any patient record; and medical data stored and sent in an unsecured environment.³ Generally no reimbursement is arranged for this form of telemedicine. A frequently used solution for secondary teleconsultation (primary care to secondary care consultation via telemedicine) is a teleconsultation system, that is often web-based and can provide identification, authorization and authentication of the involved actors, secured transfer of medical data and formalized entry, storing and representation of information, as well as administration and billing.⁴

In dermatology, the field with the largest use of teleconsultation, considerable research has been performed on secondary teledermatology (TD).⁵,⁶ Over the years various modes of delivery (store-and-forward, real-time, hybrid), capturing technologies (digital (video-)camera, dermoscopic camera, mobile-phone camera), purposes (advice, triage, education, monitoring), actors (general practitioners, (tertiary) specialists, nurses, patients) have been subject of research in the field of TD.⁷,⁸ Results have shown that TD has high diagnostic accuracy and reliability in many implementations⁹,¹⁰ and showed 68% reduction in physical referrals and 18% cost reduction in a large scale implementation in The Netherlands.¹¹
Tertiary TD (TTD; secondary care to tertiary care teleconsultation) is applied less frequent in comparison to secondary TD.\textsuperscript{13} A TTD pilot study showed that electronic communication among dermatologists supported by a TD system was feasible and had the potential to structure communication between specialists.\textsuperscript{12} The primary aim of this study was to determine the effect of tertiary TD on referrals from peripheral dermatologists to the tertiary centre and to evaluate acceptance of TD in a tertiary setting.

**Methods**

The dermatology department of the Dutch university hospital Academic Medical Centre (AMC) and the tertiary centre for pigmented skin disorders (SNIP) were designated as receiving tertiary centres. All peripheral dermatologists who frequently had sent emails with patient related questions and photo’s to specialized dermatologists in the AMC and SNIP or with a high referring rate to the AMC and SNIP were invited to use a tertiary TD system, instead of email or telephone.

All participants received a personal on-site training session of 1 hour in the use of the teledermatology system. In addition, all peripheral dermatologists received training in clinical photography.

Directions were given that tertiary teledermatology consultations (TTDCs) concerning pigmented skin lesions were to be sent to the SNIP and that TTDC should not be used for urgent cases. No specific directions were given to peripheral dermatologists as to what other diagnostic types would or would not be suitable for tertiary teledermatology. The peripheral dermatologists selected patients for a TTDC from new or existing patients in their practice a) with a skin condition that was in their opinion suitable for teledermatology and b) they considered calling about, emailing about or referring to a tertiary centre.
The Tertiary Teledermatology Consultation Process

Peripheral dermatologists initiated the TTDC and remained responsible for the treatment throughout the tertiary TD process. Patient data, clinical photographs and sometimes histopathology photos were added to the TTDC system by the peripheral dermatologist. They selected a subspecialty and one of the two receiving tertiary centres (AMC or SNIP) as part of the TTDC. Subspecialties available were allergic dermatology, eczema, phlebology, laser, oncology, paediatric dermatology, pigmentology, proctology, psoriasis, sexual transmitted disease and tropics.

Six pre-assigned academic dermatology residents (each for 4 months) first assessed and answered the TTDC. Reason for this setup were two-fold: 1) an education track to introduce TD to the resident, and 2) efficient triage, as the peripheral dermatologist could not select a specific tertiary dermatologist, the resident selected the best-suited tertiary dermatologist based on the indicated subspecialty and the medical problem. For each subspecialty, at least one academic dermatologist with extensive knowledge in that field participated in the study.

The tertiary dermatologist checked the answers given by the resident, corrected them if needed and, as was agreed beforehand, tried to sent response back within 5 working days to the peripheral dermatologist. If necessary, a second TTDC round could be initiated in case the tertiary dermatologist needed more information or the peripheral dermatologist needed clarification. After one or two rounds the peripheral dermatologist closed the TTDC. As part of the TD education track, the resident had the opportunity to view the TTDC after the input of the tertiary dermatologist.

All actors were notified of new, answered or second round TTDCs by means of a notification-email in their regular email inbox, which included a direct hyperlink to the TTDC system. No patient data was included in these emails.
Tertiary Teledermatology System

The KSYOS Tertiary Teledermatology Consultation System (TTDCS) (KSYOS TeleMedical Centre, Amstelveen, The Netherlands) was used for all TTD communication. The TTDCS was web-based and had a store-and-forward modality. The KODAK EasyShare C813 digital photo camera was used for photo acquisition (camera setting: no flash, auto-focus, 2 megapixels, resolution 2048x1536, 72 DPI, JPEG compression: best). Up to a maximum of 4 photos could be added to a single TTDC. All TTDC records were stored in a secured database. Timestamps for new and answered first and second round TTDCs were automatically recorded. Further specifications of this system can be found in the methods section of the pilot study.  

Evaluation

The TTDC system asked the following evaluation questions for every TTDC performed:

The peripheral dermatologist was asked when starting a TTDC:

• Would you have referred this patient to a tertiary specialist when teledermatology was not available? (Yes or No)

The peripheral dermatologist was asked when closing a TTDC

• Are you referring this patient to a tertiary centre? (Yes or No)
• Did you learn from the tertiary specialist’s response? (Not at all, Slightly, Substantially, or A lot)
• Did the response from the tertiary specialist help you(r patient)? (Not at all, Slightly, Substantially, or A lot)
The tertiary dermatologist was asked when sending the answer (both rounds) in a TTDC:

- Given your current knowledge of the case, do you find it necessary to see the patient live? (Yes, No or Not applicable)
- Is your advice diagnostic or therapeutical in nature? (Diagnostic, Therapeutic, Both or Other)

**Potential prevented referrals**

Prevented physical referrals were measured by means of evaluation questions posed for every TTDC. A referral was defined as ‘prevented’ when the answer to question “Would you have referred this patient to a tertiary specialist if teledermatology was not available?” was positive and to question “Are you referring this patient to a tertiary centre?” was negative.

**Acceptance**

A two-hour focus group session with the participating tertiary dermatologists and personal 30 minutes structured interviews with 6 peripheral dermatologists were held at the end of the study period to evaluate the acceptance of the system and to determine the reasons for success or failure of tertiary teledermatology in this setting. The following topics were discussed:

- Moment the TTDC was filled out and time it took to answer the TTDC.
- Usability of the system
- Quality of the TTDCs
- Reimbursement
- Reasons for failure
- Reasons for success / success scenarios
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Results

Thirty-nine of 60 peripheral dermatologists from 15 care institutions that were invited to take part in the study confirmed their participation. From May 2010 until May 2012 a total of 85 TTDCs were sent by 13 peripheral dermatologists (9 care institutions, Figure 1) and answered by eight tertiary dermatologists (5 AMC, 3 SNIP). These TTDCs concerned 48% male patients (n=41) and an average age of 32.5 years (median: 33, range: 8 months – 86 years). In 65% of all TTDCs (n =55) a second round was performed. These contained a follow-up question by the peripheral dermatologist in 16% (n=9) of the second rounds, feedback about patient management to the tertiary dermatologist in 56% (n=31) and in 15 cases the second round was used for a general thank you or social conversation between the dermatologists. Response time of the tertiary dermatologists was 5 working days on average (median 3 days, min 1 hour, max 25 days).

Figure 1 - Tertiary teleconsultations per care institution
The advice given by the tertiary dermatologists was in 48% (n=41) of diagnostic nature, in 15% (n=13) of therapeutic nature, in 37% (n=31) both diagnostic and therapeutic. In more than half of the TTDCs the peripheral dermatologist stated the TTDC was useful and they learned from the answers provided (Figure 2).

![Figure 2 - Evaluation question response](image)

**Potential prevented referrals**

The peripheral dermatologists would have physically referred 62% (n=53/85) of the patients selected for TTDC to the tertiary centre if teledermatology were not available (Figure 1). In this group, teledermatology prevented 81% of physical referrals (n=43/53).

A TTDC was performed as second opinion in 38% of the cases (n=32), as the peripheral dermatologist did not intend to refer the patient physically without TTD. From this group, 19% (n=6) were yet referred to the tertiary centre after the TTDC was performed. (Table 1)
The tertiary dermatologist thought it necessary to see the patient in vivo in 19 cases (22%) after the first round. After the second round 9 out of the 19 (47%) were still thought necessary to be seen in vivo. Of these 9 patients 4 were actually referred. Of the 66 cases that were not deemed necessary to be seen in vivo after the first round the tertiary dermatologist wanted to see 8 patients in vivo after the second round of which 8 patients were actually referred. From the remaining 58 patients 6 were referred while the tertiary dermatologist did not think it was necessary. (Table 2)

**Table 1 - Referrals according to peripheral dermatologist**

<table>
<thead>
<tr>
<th>Q1: Would you have referred without TTD?</th>
<th>Q2: Are you referring after TTD?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Yes</td>
<td>10</td>
</tr>
<tr>
<td>No</td>
<td>6</td>
</tr>
<tr>
<td>Total</td>
<td>16</td>
</tr>
</tbody>
</table>

**Table 2 - Referrals according to tertiary dermatologist**

<table>
<thead>
<tr>
<th>Referral necessary according to tertiary DL</th>
<th>1st round</th>
<th>2nd round</th>
<th>2nd round not performed</th>
<th>Referred according to peripheral DL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>19</td>
<td>66</td>
<td>5</td>
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<td>10</td>
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<td>6</td>
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<td>2</td>
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</tbody>
</table>
Perception of peripheral dermatologists

Six peripheral dermatologists were interviewed who performed 26, 13, 5, 4, 3 and 0 TTDCs respectively. Results are summarized per topic.

Moment the TTDC was filled out and time it took to fill.

All indicated that TTDCs were filled out after office hours, at the end of the day or during breaks, never during the time the patient was present.

Usability

Five out of 6 found the system user friendly, specifically because they were already used to the very similar system for secondary teledermatology. One reported having issues with uploading photo’s due to file size restrictions in the system and losing username/password.

Quality of the TTDCs

The answers provided were very detailed and resulted in effective management of the patients. More experienced dermatologists (> 15 years of practice) found the answers provided “modest” to “no added knowledge”. The response time in some cases took more than 5 days.

Reimbursement

All thought that reimbursement for the peripheral dermatologist was not needed and not justifiable. Reimbursement of tertiary dermatologist was a possibility, but should reflect the amount of work that is performed per TTDC.

Reasons for failure

The main reason for failure was that asking a question through telephone, email, and other mobile communication (e.g. chat services) remained easier, faster and
more user friendly than using any TTDC system. Especially because the professional regional networks of dermatologists were already established and thus personal contact information (e.g. email address and mobile phone number) was known to most of the participating dermatologists, eliminating the need for the TTDC system.

It was preferred to directly contact a specific dermatologist on personal title instead of a tertiary centre where internal processes decided who provided the answer.

Some felt there was no need to contact tertiary centres, as they managed all cases within their own centres via weekly case discussions, or had sufficient knowledge to decide when a patient needed a physical referral to a tertiary centre.

Safety and privacy issues concerning patient data in email traffic on its own were not a strong motivator.

Reasons for success / success scenarios

The structured characteristics of TTDCs were preferred above the unstructured information in email and telephone. A motivator would be the possibility to exchange information between Electronic Health Records (EHR) in the different hospitals.

The TTDC system provided the peripheral dermatologists a lower threshold to ask a question compared to using the telephone, as they did not feel that they were disturbing the tertiary dermatologist at an inconvenient time.

A TTDC system with a national index of all dermatologists with tertiary knowledge specified per sub specialism would increase the value of the system.

Lastly, tertiary centres could make it mandatory to use a TTDC system for all referrals and questions, instead of referral letters, email and telephone for reasons such as security and privacy of data and continuity of care.
Perception of tertiary dermatologists

Six tertiary dermatologists (4 AMC, 2 SNIP) were present at the focus group meeting. Results are summarized per topic.

Moment the TTDC was filled and time it took to fill.

TTDCs were answered in between work, during breaks and at the end of the day. Usually it took 5 to 10 minutes to answer a TTDC, exceptions were some cases when further research was needed due to a difficult nature of the case.

Usability of the system

The system was usable but had several shortcomings. It was difficult to remember log in credentials, as the usage of the system over time was low. Due to relative small text fields scrolling was needed to read all information. Information was sometimes overlooked as it was presented on two separate pages. Email notification was helpful; improvement would be a possibility to decline a TTDC so a colleague could answer it.

Quality of the TTDCs

The quality of the photos was in some cases very poor. The cases presented were valid and interaction with the peripheral dermatologists led to interesting discussions. Some cases were too difficult to assess and not suitable for teledermatology. The second round was useful, but the finality of two rounds was good as it prevented endless online discussion.

Reimbursement

Two participants felt inter collegial consultation between specialists should be free of charge, as email and telephone are also not reimbursed; others felt the specialists providing the answers should be reimbursed for the work they deliver.
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Reasons for failure

In their experience, the benefit of the TTDC system over email was modest. Email is more user-friendly, easier and faster. Issues with safety and privacy of patient data when using email were of too little concern to counter the ease of use of email and thus did not motivate the use of the TTDC system.

They missed the possibility to have multiple specialists discuss about a patient, limiting its usefulness.

Finally, as there was a declining trend in patients coming to the outpatient clinic, referral prevention (e.g. teledermatology) received less motivation due to financial reasons.

Reasons for success / Success scenarios

The TTDC system should be as user-friendly as email (e.g. by EHR integration). Specialized centres that operate on a national level could benefit from the geographical distance that their patients have to travel for the specialized care. A prerequisite would be a national index of all dermatologists with specialized knowledge embedded in the system.

When demand for care is higher than the supply, the need for better triage to the tertiary centre would arise. TTDC could provide a triage tool for all tertiary referred patients. However, it could be a threshold for referral, leading to less referred patients and possibly lower standard of care.

Discussion

Studies on teledermatology in a secondary care setting show several successful implementations.11;14-16 Our study shows that, although the TTDC system was effective in preventing referrals and dermatologist perceived some advantages of
the system, its acceptance was low amongst both the peripheral and the tertiary dermatologists.

Use of tertiary TD can prevent physical referrals to a tertiary centre by 81% when applied to patients who would have been referred without TD (n=53). When a TTDC was performed as second opinion (n=32), 19% (n=6) were referred to the tertiary centre after the TTDC was performed demonstrating improved care as these patients were identified for fast referral to a tertiary specialist. In addition, the referral advice given by the tertiary dermatologist was followed in 85% of all the cases (n=72). The 5 working days maximum response time was met in almost all cases.

Despite the relatively positive signals shown in the pilot study\textsuperscript{12} and in the results on triage found in this study, the number of peripheral dermatologist actively participating was poor. Only 33% of the dermatologists that confirmed participation sent one or more TTDCs. In addition, the teleconsultations sent during the study period was low, despite active monitoring by the authors (reminders by telephone and email). On average, a peripheral dermatologist sent in three TTDCs per year, compared to nine TDCs a GP sent in per year in secondary teledermatology.\textsuperscript{11} Moreover, the actual numbers show that one care institution (and one dermatologist in particular) was accountable for almost half of the TTDCs, putting the average number of TTDCs per dermatologist per year at 2.

The main reason was that there was no need to use the TTDC system, as current systems (telephone/email) were already available and easier to use. Despite favourable circumstances (fast response time, high quality answers, good system usability), the familiarity of using telephone and email was stronger than other motivators to use TTDC (formalized records, secure communication, privacy protection). The major difference with secondary teledermatology was the strong network amongst dermatologists. Unlike GPs, dermatologists possess email addresses and direct telephone numbers of their colleagues in tertiary centres,
enabling fast access and discarding the need for a system that provides these communication lines.

Reimbursement, although welcomed when proper tariffs and regulations would be implemented, was not a factor influencing the use of the system. Currently, answering clinical email and telephone are not reimbursed and some feel intercollegial advice is part of working in a tertiary centre and does not apply for reimbursement.

The low inclusion of TTDCs during this two-year study as well as the fact that three peripheral dermatologists were responsible for 60% of the TTDCs is a limitation of the results on referral prevention and therefore the generalizability of our results should be interpreted with caution.

Both peripheral and tertiary dermatologists have provided several conditions that could lead to a successful implementation of TTDC. 1) Improvements to the TTDC system such as: a) a national system including all Dutch dermatologist indexed according to sub specialty knowledge, b) being able to send the TTDC to a dermatologist directly instead to a centre, c) being able to discuss a case with multiple dermatologists irrespective of the institutions, d) connections to EHRs. 2) Change in policies of tertiary centres, where they would stimulate the use of TTDC for all referrals and questions. 3) Government or health insurance regulations demanding the use of telemedicine.

**Conclusion**

Although quantitative results indicate that tertiary teledermatology has potential to improve triage between secondary and tertiary centres, under current conditions the motivation in peripheral dermatologists to use tertiary teledermatology in this setting was low.
Acknowledgements

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