Telemedicine in dermatology: Evaluation of secondary and tertiary teledermatology
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A pilot study on tertiary teledermatology: feasibility and acceptance of telecommunication among dermatologists


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Abstract

**Background:** Tertiary teledermatology (TTD), where a general dermatologist consults a specialized dermatologist on difficult cases using communication technologies, is a relatively new service. We evaluated the value, feasibility and dermatologists' acceptance of tertiary teledermatology.

**Methods:** From February 2008 till April 2008, in the dermatology department of a Dutch university hospital, 13 general dermatologists used TTD to consult 11 specialized dermatologists and 2 residents at the university medical centre. We measured 1) avoided physical referrals to the university centre, 2) usability of the system (SUS score) and 3) user acceptance and satisfaction by using questionnaires.

**Results:** During the pilot, general dermatologists consulted via TTD 28 times. In 61% (n=17) of the consultations, the general dermatologists would have referred their patients to the university centre if no teledermatology were available. For 71% (n=12) of these 17 consultations, physical referral was not necessary after teledermatology. The mean SUS score of all the users was 80. All dermatologists were satisfied with TTD (mean satisfaction of 7.6 on a 1-point scale, and acceptance was high.

**Conclusions:** The baseline measurements showed that half of tertiary referrals were suitable for TTD. These results suggest that TTD substantially reduces unnecessary physical referrals. Furthermore, all users accepted TTD and were satisfied with it. A large-scale evaluation is necessary to confirm and generalize our conclusions.
**Introduction**

The use of teledermatology has become widely accepted, especially for communication between general practitioners and dermatologists. Besides making dermatologists services accessible in remote areas\textsuperscript{1,2}, it also makes the referral process more efficient, safer and more convenient for patients.\textsuperscript{3-5} Although most evaluation studies on teledermatology are small-scale pilots\textsuperscript{6}, reviews of teledermatology studies have shown teledermatology to be diagnostically accurate, reliable and in some cases cost efficient.\textsuperscript{4,5,7-9} Most studies report high physician satisfaction with teledermatology.\textsuperscript{7-9} Patient satisfaction and acceptance of teledermatology is also high.\textsuperscript{1,5,7-13}

Besides the above uses, dermatologists also use teledermatology to communicate with each other. This is called tertiary teledermatology (TTD, see Figure 3, Chapter 1). TTD offers a number of advantages and can help solve several problems.\textsuperscript{14} It is used seek advice on difficult cases that require specialized treatment or knowledge. This can help solve problems in the conventional referral process, where patients are sometimes referred to the wrong sub-specialty, or where patient data is sometimes missing or incomplete. These problems lead to longer consultation times and longer waiting lists. Teledermatology can reduce these problems by formalizing patient data entry and guiding better triage. Furthermore, in current practice without TTD, communication via unsecured email messages is increasing, including clinical photos and patient data for consultation.\textsuperscript{15} A secured TTD web application, which features adequate identification, authentication and authorization, could replace email traffic and make this process safer and more standardized. Few studies have been published on TTD\textsuperscript{14}, and its value in practice has never been investigated.
The aim of the present study was to evaluate the feasibility and acceptance of TTD in a three-month pilot in a dermatology department of a Dutch university hospital. We addressed the following research questions:

1. Does TTD reduce physical referrals between general and academic dermatologists?
2. Can we create a usable TTD system?
3. Do dermatologists accept this new technology?

**Methods**

The department of dermatology of the Academic Medical Center (AMC), a Dutch university hospital, diagnoses and treats patients referred by general practitioners (secondary care) and by dermatologists or other specialists (tertiary care). We distinguished three types of tertiary referrals: Inter-departmental Referrals, Second Opinion Referrals and Specialized Referrals. Inter-departmental Referrals are referrals by other specialists from within the hospital. Second Opinion Referrals are patient-initiated referrals after consultation with a dermatologist outside the hospital. The Specialized Referrals were divided into two subgroups: referrals from general dermatologists outside the hospital (Specialized Referrals A) and referrals from all other specialists outside the hospital (Specialized Referrals B). In 2007 the dermatology department received 1238 tertiary referrals, which amounts to 12% of all referrals they received. The baseline measurement encompassed all tertiary referrals. The pilot study focused on Specialized Referrals A.

**Baseline measurement**

During two months (December 2007–January 2008), the number and type of all tertiary referrals to the dermatology department of the AMC, resulting in a face-to-
face consultation, were collected by means of a checklist. The checklist included the following items:

1. The reason for the referral;
2. The time it took to perform the consultation;
3. Whether or not important patient information, which should be present at the time of the consult, was missing;
4. Whether the referral was correct (e.g. right sub-specialist, right urgency);
5. Whether the referral would have been suitable for teledermatology. The latter was based solely on the academic dermatologist’s prediction.

The checklist was completed anonymously for each Inter-departmental Referral, Second Opinion Referral and Specialized Referrals A and B. All the residents and dermatologists of the AMC dermatology department participated in the baseline measurements. No consequences existed for not filling out the checklist. To check if all referrals were reported during the baseline measurement, data in the hospital administration system from January 2007 to January 2008 were compared with the referrals reported in the checklists. In this comparison, Specialized Referrals A and B were merged, as the hospital administration system did not differentiate between Specialized Referral A and B.

**Tertiary teledermatology system**

The KSYOS Teledermatology Consultation System (KSYOS TeleMedical Centre, the Netherlands) was used for the TTD communication. This system is widely used for secondary teledermatology in The Netherlands and was adapted to fit the needs of TTD. Modifications of the system were based on interviews with four of the participating academic dermatologists. They specified which information they would require from the general dermatologists during a TTD consultation. The web-based KSYOS TTD Consultation System stored the patient data in a central database, making it accessible to the users via an Internet connection and a web-browser. Users accessed the system by logging in using either a
username/password combination or a healthcare provider identification card. The HTTPS secure Internet protocol protected data transfer. A maximum of 4 digital photographs, accompanied by structured textual data containing patient history and other information, could be sent. A teleconsultation consisted of two parts: one for the general dermatologist and one for the academic dermatologist. The general dermatologist’s part contained fields for:

1. General patient data (e.g. name, address, birth date);
2. Photographs;
3. Reason for referral;
4. Reports of any previous examinations;
5. Medical history;
6. Medication usage;
7. The patient’s history including sexually transmitted diseases, tropical dermatology and allergies;
8. A selection box to assign a subspecialty, such as psoriasis, pigmentation and paediatric dermatology.

The part for the academic dermatologist contained fields to describe findings, diagnosis, advice and remarks. For each subspecialty, at least one academic dermatologist with extensive knowledge in that area participated in the study.

Consultation process

General dermatologists initiated the teleconsultations and remained responsible for the treatment throughout the TTD process. Patient data and clinical photographs were first assessed and answered by a pre-assigned academic dermatology resident. The resident selected the most suitable academic dermatologist based on the indicated subspecialty or the description of the problem. The academic dermatologist checked the answers given by the resident and corrected them if needed. He or she then sent the response back to the general dermatologist. For educational purposes, the resident checked the answers given by the academic dermatologists. If the academic dermatologist
asked for additional information or the general dermatologists had a follow-up question, the above process could be repeated in a second round. After this, no more rounds were possible, and the general dermatologist closed the teleconsultation.

When a new teleconsultation or a response to a teleconsultation was available, automatic notification messages were sent by email to alert either the academic dermatology resident or the general dermatologist. To alert an academic dermatologist about a new or follow-up teleconsultation, the dermatology resident personally created a notification email.

**Pilot study**

Ten general dermatologists from 7 hospitals and 3 dermatologists from private practice were invited to send teleconsultations to the AMC for a period of 3 months (February 2008 - April 2008). A total of 11 academic dermatologists and 2 academic dermatology residents of the AMC were involved in answering the teleconsultations. A teleconsultation had to be answered by the academic dermatologists within 5 working days after the teleconsultation had been sent. Patients were asked for their informed consent for sending their information over the Internet. Dermatologists received no reimbursement. No ethics permission was required as all patients received both teledermatological and conventional face-to-face care.

All general dermatologists were given a digital camera (Easy Share C713, Kodak) so they could take the required photographs. All participants received a user’s manual for the teleconsultation system. On request, they were also given an on-site demonstration by one of the researchers to show them how to take clinical photographs. The photographs were taken at a resolution of 1.2 megapixels.
Statistics

User statistics were recorded. Response time was calculated based on working days from 08:30-17:30, not counting weekends. One researcher analysed the teleconsultations to determine if the advice given in a teleconsultation was of a therapeutic or diagnostic nature. Two academic dermatologists classified all the teleconsultations into a subspecialty for comparison with the subspecialties indicated by the general dermatologists.

Avoided physical referrals

During every teleconsultation, the system asked evaluation questions. At the start of each teleconsultation the general dermatologist was asked: would he/she have referred the patient to the academic centre if teledermatology were not available? After each teleconsultation, the general dermatologist was asked: would he/she still refer the patient to the academic centre? A referral was tagged as ‘avoided’ when the answer to the first question was ‘Yes’ and the answer to the second questions was ‘No’. The general dermatologist was also asked: (1) was the answer of the academic dermatologists useful? and (2) did they learn from the teleconsultation? Academic dermatologists were asked about their confidence level in their diagnosis and if they wanted to see the patient for a physical consultation.

User acceptance and satisfaction

After the study was finished, a questionnaire was sent to all participating general and academic dermatologists and residents. The questionnaire contained a generic part, a user-specific part and a part to determine system usability. The first part contained the same questions for all participants: (1) Did you experience any problems experienced while using the system? (2) Which data entry fields were useful? (3) Do you believe TTD could have a role in continuing
medical education? (4) Were four photographs sufficient for a teleconsultation? They were also asked to rate their satisfaction (on a 10-point scale, where 10 was the highest level of satisfaction) regarding the TTD system, the conduct of the study and TTD as a concept.

The second part was user-specific and was aimed at general, academic or resident dermatologists. For each user group, a set of propositions was created, with which the respondent either agreed or disagreed. General dermatologists were asked about the time spent on performing a teleconsultation and again whether they felt they had learned from using TTD. Academic dermatologists were asked about time spent and how they felt about the interaction with the residents. The residents were asked if they had learned from TTD and about the interaction with the academic dermatologists.

The third part of the questionnaire contained the System Usability Scale (SUS), a validated scale to determine the usability of the system.\(^\text{17}\) The SUS results in a score between 0 and 100, where acceptable systems score above 70, better products score in the range from 77 to 89 and superior systems score 90 or higher.\(^\text{18}\)

**Results**

**Baseline measurement**

During the two-month baseline measurement period, 181 tertiary referrals were recorded by checklist (Table 1). Of the 181 referrals measured, 78 (43%) were indicated as Specialized Referrals (A and B). The hospital administration system recorded 149 Specialized Referrals (A and B) to the dermatology department during the baseline measurement period. This indicates that no checklist results were received for 71 (48%) of the consultations that were conducted during the baseline measurement period.
### Table 1: Baseline results of tertiary referrals to the academic hospital

<table>
<thead>
<tr>
<th></th>
<th>Inter-departmental referral**</th>
<th>Second opinion referral***</th>
<th>Specialized referral A****</th>
<th>Specialized referral B*****</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>No.</td>
<td>91</td>
<td>12</td>
<td>24</td>
<td>54</td>
<td>181</td>
</tr>
<tr>
<td>Patient information missing</td>
<td>23 (3 NA*)</td>
<td>7</td>
<td>6</td>
<td>10</td>
<td>46</td>
</tr>
<tr>
<td>Suitable for teledermatology</td>
<td>40 (2 NA*)</td>
<td>5</td>
<td>11</td>
<td>15 (1 NA*)</td>
<td>71</td>
</tr>
<tr>
<td><strong>Referrals</strong></td>
<td>**</td>
<td>**</td>
<td>**</td>
<td>**</td>
<td>**</td>
</tr>
<tr>
<td><strong>Patient initiated referrals after they have seen a different dermatologist</strong></td>
<td>**</td>
<td>**</td>
<td>**</td>
<td>**</td>
<td>**</td>
</tr>
<tr>
<td>Incorrect referral</td>
<td>8 (3 NA*)</td>
<td>1</td>
<td>4</td>
<td>2</td>
<td>15</td>
</tr>
<tr>
<td>Time to perform consultation (min)</td>
<td>&lt;5 (17)</td>
<td>&lt;5 (1)</td>
<td>&lt;5 (0)</td>
<td>&lt;5 (0)</td>
<td>&lt;5 (18)</td>
</tr>
<tr>
<td></td>
<td>5 - 10 (33)</td>
<td>5 - 10 (4)</td>
<td>5 - 10 (4)</td>
<td>5 - 10 (14)</td>
<td>5 - 10 (55)</td>
</tr>
<tr>
<td></td>
<td>&gt;20 (17)</td>
<td>&gt;20 (1)</td>
<td>&gt;20 (7)</td>
<td>&gt;20 (5)</td>
<td>&gt;20 (30)</td>
</tr>
</tbody>
</table>

* Not Available: no answer was provided.

** Referrals by other departments within a hospital

*** Patient initiated referrals after they have seen a different dermatologist

**** Referrals by dermatologists from other hospitals or private practice

***** Referrals by all specialists other than dermatologist from other hospitals or private practice

Of the 181 tertiary referrals, 24 (13%) were referrals from general dermatologists (Specialized Referrals A). About half (n=11) of these were considered suitable for teledermatology. The main reason given for the referral was diagnostic advice (n=18); the reason for the remaining 6 referrals was starting new treatment. In 13 (54%), the consultation lasted 10-20 min and in four (17%) it took 5-10 min. In total, six of the consultations (25%) missed some patient data. The reasons given for the 4 incorrect referrals were: “not the right specialist” (n=2), “not the right sub-specialist” (n=1); and not specified (n=1).
Pilot study

During the pilot study, a total of 28 teleconsultations were performed; 9 general dermatologists and 11 academic dermatologists sent and answered one or more teleconsultations. There were 8 male and 20 female patients. The mean age of the patients was 39 years.

Statistics

The mean response time—the mean time between the teleconsultation sent by the general dermatologist and the response sent back by the academic dermatologist—was 2.2 days for the first round. In 36% of the cases (n=10), the general dermatologists initiated a second round. The mean response time for the second round was also 2.2 days. The mean response time from the start of the teleconsultation by the general dermatologist to the final response by the academic dermatologist was 3.0 days. The usage of the data entry fields in a teleconsultation is summarised in Table 2.

The reason for the teleconsultations was diagnostic advice in 61% (n=17) of the cases, therapeutic advice in 18% (n=5) and both diagnostic and therapeutic in 21% (n=6). The general dermatologists indicated a specialism in 39% (n=11) of the teleconsultations. Paediatric dermatology and pigmentology (the subfield of dermatology concerning pigment disorders, such as pigmented tumors, hypopigmentation and hyperpigmentation) were the most frequently selected specialisms.

Avoided physical referrals

In 17 of the 28 teleconsultations (61%), the general dermatologist indicated that the patient would have been physically referred to the academic centre if TTD were not available. In this group, 5 patients (29%) were physically referred after teleconsultation, while 71% (n=12) of the physical referrals to the academic centre were avoided. In addition, one of the teleconsultations resulted in an
additional physical referral. This means that without TTD the general dermatologist would not have referred the patient to an academic centre, but after the teleconsultation the patient was referred at the academic dermatologist’s request.

### Table 2. Text fields available in the TD system, usage and usefulness

<table>
<thead>
<tr>
<th>Text field</th>
<th>Text field used (n=28 TTD** consults)</th>
<th>Text field thought as useful by users (n=18)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Question to dermatologist</td>
<td>100%</td>
<td>Not Available</td>
</tr>
<tr>
<td>Dermatological examination</td>
<td>100%</td>
<td>Not Available</td>
</tr>
<tr>
<td>Medical history</td>
<td>68%</td>
<td>94%</td>
</tr>
<tr>
<td>Diagnostic test II*</td>
<td>50%</td>
<td>Not Available</td>
</tr>
<tr>
<td>Patient history</td>
<td>36%</td>
<td>89%</td>
</tr>
<tr>
<td>Atopy</td>
<td>29%</td>
<td>72%</td>
</tr>
<tr>
<td>Other medication</td>
<td>29%</td>
<td>78%</td>
</tr>
<tr>
<td>Familial history</td>
<td>25%</td>
<td>78%</td>
</tr>
<tr>
<td>Work environment</td>
<td>25%</td>
<td>67%</td>
</tr>
<tr>
<td>Travelling behaviour</td>
<td>14%</td>
<td>56%</td>
</tr>
<tr>
<td>Allergies</td>
<td>11%</td>
<td>72%</td>
</tr>
<tr>
<td>Diagnostic test I*</td>
<td>11%</td>
<td>Not Available</td>
</tr>
<tr>
<td>Sexually transmitted diseases</td>
<td>7%</td>
<td>61%</td>
</tr>
</tbody>
</table>

* Diagnostic test I and II were text fields in which results of diagnostic test could be entered (e.g. dermatoscopy, pathology, lab report)

** Tertiary Teledermatology

The general dermatologists indicated that the answer of the academic dermatologist was useful in 82% (n=23) of the teleconsultations, and that they had learned from the teleconsultation in 86% (n=24) of the teleconsultations.

The overall confidence in the diagnosis was moderate: very sure (n=1), sure (n=2), fairly sure (n=4), somewhat unsure (n=6) and unsure (n=2). For the remaining 13 teleconsultations the academic dermatologist indicated that no diagnosis was made through teleconsultation.
User acceptance and satisfaction

The response rate of the usability and satisfaction questionnaire was 82%. This amounted to 8 out of 11 for the academic dermatologists, 2 out of 2 for the residents, and 8 out of 9 for the general dermatologists.

In the generic part, 22% reported that they experienced some problems in using the system. These included not being able to log in from home, small text fields leading to extensive scrolling, not having the log-in codes at hand, not being able to use the system on mobile devices and not getting a notification when a new consultation was received. A comparison between the actual usage of the information entry fields and the percentage of respondents who felt the field was useful is shown in Table 2.

Regarding the other questions, 83% (n=15) reported that 4 photographs were sufficient for a teleconsultation; and 72% (n=13) felt that the TTD could be used for continuing medical education. On average, the respondents were satisfied about all three matters; the TTD system, the conduct of the pilot study and TTD as a concept all scored 7.6 out of 10.

An overview of the propositions in the second part of the questionnaire and the answers given is shown in Tables 3-5. General dermatologists indicated that they spent 5-10 min entering all information per teleconsultation, 75% (n=6) indicated it took less than five minutes to take pictures of the patient and 88% (n=7) believed they had learned from participating in TTD. All the academic dermatologists said they could complete a teleconsultation in 5-10 min and thought the process, where the resident acted as the first station for the teleconsultations, was very effective. The two residents were also positive about the set up; they both indicated that they learned from the interaction with the academic dermatologist and that a teleconsultation often resulted in additional communication with an academic dermatologist to discuss or clarify the case.
Table 3: Results evaluation questionnaire Tertiary Teledermatology (TTD)

<table>
<thead>
<tr>
<th>Propositions to general dermatologist (n=8) *</th>
<th>Agree (%)</th>
<th>Disagree (%)</th>
<th>NA (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specialized teledermatology has prevented physical referrals to the academic centre</td>
<td>62.5</td>
<td>37.5</td>
<td>0</td>
</tr>
<tr>
<td>I am satisfied with the average response time of the academic dermatologists</td>
<td>87.5</td>
<td>0</td>
<td>12.5</td>
</tr>
<tr>
<td>For the option to ask a follow-up question, one single time is enough</td>
<td>75</td>
<td>12.5</td>
<td>12.5</td>
</tr>
<tr>
<td>The patients are helped faster because I used teledermatology</td>
<td>75</td>
<td>25</td>
<td>0</td>
</tr>
<tr>
<td>Triage has improved by the use of specialized teledermatology</td>
<td>62.5</td>
<td>37.5</td>
<td>0</td>
</tr>
<tr>
<td>I find specialized teledermatology a positive addition to the care I can provide to my patients</td>
<td>87.5</td>
<td>12.5</td>
<td>0</td>
</tr>
<tr>
<td>I will continue to use the TTD system in the future</td>
<td>75</td>
<td>25</td>
<td>0</td>
</tr>
<tr>
<td>My knowledge has extended because of the input from an academic dermatologist</td>
<td>87.5</td>
<td>12.5</td>
<td>0</td>
</tr>
</tbody>
</table>

* Original questions were in Dutch

Table 4. Results evaluation questionnaire Tertiary Teledermatology (TTD)

<table>
<thead>
<tr>
<th>Propositions to academic dermatologist (n=8) *</th>
<th>Agree (%)</th>
<th>Disagree (%)</th>
<th>NA (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I always answer a TTD consult within 5 working days</td>
<td>75</td>
<td>25</td>
<td>0</td>
</tr>
<tr>
<td>Answering a TTD consult can be done faster than within 5 working days</td>
<td>75</td>
<td>25</td>
<td>0</td>
</tr>
<tr>
<td>For the option to ask the general dermatologist a question, one single time is enough</td>
<td>100</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>I miss the histological images in the pathology reports</td>
<td>37.5</td>
<td>62.5</td>
<td>0</td>
</tr>
<tr>
<td>Triage has improved by the use of specialized teledermatology</td>
<td>62.5</td>
<td>25</td>
<td>12.5</td>
</tr>
<tr>
<td>When a patient is referred to the AMC after a TTD consult has been done, I can help the patient faster</td>
<td>12.5</td>
<td>87.5</td>
<td>0</td>
</tr>
<tr>
<td>The design where the dermatology-resident first handles a TTD consult and then sends it to me is an effective way of working</td>
<td>100</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>I change a lot of the text filled in by the resident</td>
<td>62.5</td>
<td>37.5</td>
<td>0</td>
</tr>
</tbody>
</table>

* Original questions were in Dutch
Table 5. Results evaluation questionnaire Tertiary Teledermatology (TTD)

<table>
<thead>
<tr>
<th>Propositions to resident (n=2) *</th>
<th>Agree (%)</th>
<th>Disagree (%)</th>
<th>NA (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I always answer a TTD consult within 2 working days</td>
<td>0</td>
<td>100</td>
<td>0</td>
</tr>
<tr>
<td>Answering a TTD consult can be done faster than within 2 working days</td>
<td>0</td>
<td>100</td>
<td>0</td>
</tr>
<tr>
<td>For the option to ask the general dermatologist a question, one single time is enough</td>
<td>100</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>I miss the histological images in the pathology reports</td>
<td>100</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>I experience a substantial learning effect</td>
<td>100</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>My answers are often adapted by the academic dermatologist</td>
<td>0</td>
<td>100</td>
<td>0</td>
</tr>
<tr>
<td>I often have some oral communication about a TTD consult with the academic dermatologist</td>
<td>100</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

* Original questions were in Dutch

System usability

The mean SUS score of the general dermatologists was 78. The mean SUS score of the academic dermatologists was 81. The mean SUS score of the resident dermatologists was 86. The overall mean SUS score was 80.

Discussion

The results of our pilot study demonstrate that: (1) a tertiary teledermatology system has the potential to reduce physical referrals between general and academic dermatologists; (2) the TTD system we created is feasible and usable; and (3) general as well as specialist dermatologists accept such a system. Our results support these conclusions as follows.

At baseline, almost half of the referrals from general dermatologists to specialized dermatologists (Specialized Referrals A) were suitable for TTD. Using TTD resulted
in a 71% reduction of physical referrals to the academic hospital in the patient group selected by the general dermatologists. Based on the system and user evaluation, the acceptance of TTD was high; all users reported a high level of satisfaction with TTD.

TTD can be used for different purposes, such as prevention of referrals, second opinions, continuing medical education and international expert groups; it can be a valuable addition to healthcare systems. The system and the way it is used might vary according to the purpose, but in the present pilot trial we demonstrated that it is relatively simple to use and effective for several of these purposes. TTD was used to improve access to the expert opinions of specialized dermatologists. This resulted in a more efficient tertiary referral process, with 71% avoided referrals. Secondary uses of TTD in the pilot trial were education and acquiring advice from a colleague, without the intention to refer. The general dermatologists sent 11 teleconsultations without any intention to refer the patient physically. Nevertheless, at the academic dermatologist’s request, one of these teleconsultations did result in a physical referral of the patient. This represents an improvement in the quality of care: the patient was treated by a physician better suited for the ailment, which would not have happened without TTD, or at least not so quickly.

The general dermatologists and the residents both indicated that they learned from using TTD. The general dermatologists indicated a learning effect in 86% of the cases, both during system evaluation and afterwards in the questionnaire. This educational benefit of TTD is a form of continuing medical education. Both residents indicated that they experienced a learning effect, along with the fact they learned to work with teledermatology at an early stage, which will benefit the use of teledermatology in the future.

We found similar results for TTD in this study compared to results found for secondary teledermatology on preventable referrals, acceptance and
satisfaction.\(^{5,7-9}\) Only a few studies on TTD concerning preventable referrals have been published, and none of them have reported quantitative data.\(^{20-22}\) One publication reported on physician acceptance, which was high.\(^{23}\) Several publications reported using TTD for continuing medical education, which seems to be one of the main purposes for which these systems are used.\(^{14}\)

The main reason for a tertiary referral was diagnostic advice, both for the baseline measurement (72% of the cases) and the pilot study (82% of the teleconsultations). In 82% of the teleconsultations, the general dermatologists indicated that the teleconsultation was useful, but no information was available about the reason for the remaining 18%. In 13 teleconsultations the academic dermatologists indicated that they made no diagnosis; 11 of these teleconsultations were therapeutic, and hence there was no request for a diagnosis since it had already been made. The confidence of the academic dermatologists in their diagnosis through TTD was moderate. However the advice given in these teleconsultations was enough for the general dermatologists to decide whether or not to refer a patient. The academic dermatologists often made a differential diagnosis, which reduces confidence in a single diagnosis.

The comparison of the number of checklists received in the baseline measurement with the hospital administration indicated that we only obtained the data for half of the consultations. This could have been caused by time restrictions or forgetfulness of the dermatologists, or even faulty registration in the hospital information system.

Based on the data we collected with the checklist, it is clear that TTD has potential. No major technical problems were reported in the evaluation. The reported problems concerned human error and were resolved quickly. It was not possible to implement automatic notification email messages to the academic dermatologists, but having the residents send notification messages by email solved this problem. Although the small scale of this pilot study prevents us from
making firm conclusions, the results certainly indicate that TTD can be useful for improving the communication between dermatologists. One possible defect in this pilot study was selection bias. The participating dermatologists were highly motivated and monitored. Consequently it was unlikely that they would not accept TTD. Second, no follow-up data was available on whether or not patients were seen live by an academic dermatologist after TTD. Finally, patient acceptance and satisfaction was not measured in this pilot. More research on a larger scale is needed to evaluate if and how tertiary teledermatology improves the tertiary referral process. Because confidence in diagnosis was moderate, future research could focus on the diagnostic reliability of TTD. Finally, TTD should be validated in different settings to generalize any conclusions.
Reference List


