

## Is Teledermoscopy Improving General Practitioner Skin Cancer Care?

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### Abstract

Skin cancer incidences have tripled in the Netherlands for the last twenty years and are expected to increase even more in the coming years. Teledermoscopy (TDsc) is implemented in Dutch practice to support and enhance early skin cancer detection by general practitioners (GPs) through remote consultation with dermatologists. This study assesses the effect of TDsc consultation on the quality and efficiency of skin cancer care in the primary setting by analyzing 10,184 TDsc consultations.

### Keywords:

Telemedicine, Dermatology, Skin Cancer

### Introduction

Incidences of the most common skin cancer types have tripled in the Netherlands for the last twenty years [1]. Skin cancer accounts for 15% of all newly diagnosed cancers. Specifically, melanoma incidences are the highest in the Netherlands compared to other European countries, thereby likely increasing the burden on the general practice [1; 2].

Teledermoscopy (TDsc) has been suggested as a method to enhance the quality of care by supporting patient treatment and/or referral decisions. TDsc is defined as the provision of a consultation with a remote dermatologist based on digitally available dermatoscopic images [3]. As a result, TDsc could support GPs in primary dermatology healthcare in early diagnosis and referral of patients with skin problems, thereby augmenting their expertise in melanoma detection. Also, it can improve the efficiency of primary dermatologic care by preventing unnecessary referrals to secondary care, as well as accelerate the time to diagnosis.

Store-and-forward TDsc has been reimbursed and integrated into the Dutch healthcare system as a regular health service since 2009 by Ksyos Telemedical Center. Earlier studies in the Netherlands mainly focused on regular teledermatology [4; 5]. The aim of this study was to assess how TDsc affects the quality and efficiency of Dutch general practitioner dermatology care.

### Methods

TDsc consultations data performed between February 2009 and March 2017 from routine clinical practice sent between GPs and dermatologists in the Netherlands using Ksyos Teledermoscopy services (Ksyos, Amstelveen, the Netherlands) was analyzed descriptively. The TDsc flow can be seen in Figure 1.

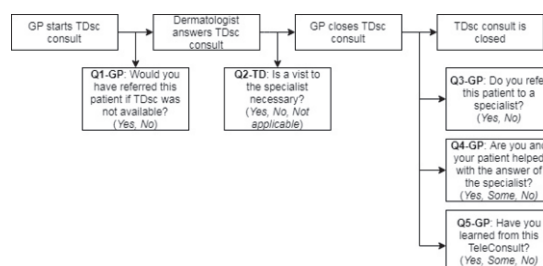


Figure 1. Overview of the five evaluation questions in the TDsc service. Q = Question, TD = teledermatologist.

Patients gave oral informed consent for a TDsc consultation. A TDsc consultation included among others, a maximum of four (dermatoscopic) pictures, an anamnesis, differential diagnosis by ICD-10 classification, and medical history. Questions to the dermatologist were asked in a free text field. As a result, the teledermatologist provided the diagnosis by providing an ICD-10 code and advice on diagnostic management by free text.

Five mandatory evaluation questions implemented in the Ksyos teledermoscopy service were asked to the GP and dermatologist (Figure 1). Answers to these evaluation questions were translated to indicators to assess the quality and efficiency of TDsc. Several of these indicators have also been used in a prospective study on the quality of general teledermatology [5]. In this study, dermatologists' response time was seen as an efficiency of care indicator related to the efficiency in the 'time to diagnose' process. The following indicators were subject in this study:

### Quality of Care

1. Extra dermatologic advice requests: when Q1 = No.
2. Additional required referrals: when Q1 = No AND Q3 = Yes.
3. GP valuation of TDsc: when Q4 = Yes, Some. And when Q5 = Yes, Some.

### Efficiency of Care

1. Prevented physical referrals: when Q1 = Yes AND Q3 = No.
2. Overall percentage of prevented physical referrals:  $1 - (\text{numerator is } Q3 = \text{Yes and the denominator is } Q1 = \text{Yes}) * 100\%$ .
3. Median dermatologists' response time: this was measured based on working days (8.30 am to 5.30 pm) from a 5-day working week.

## Results

A total of 10,184 TDsc consultations performed between 26<sup>th</sup> February 2009 and 27<sup>th</sup> March 2017 was analyzed. Those were sent by 730 GPs from 555 practices and answered by 95 dermatologists. TDsc consultations with missing responses were excluded from the analysis (N = 2,345). Table 1 represents the interpretation of those outcomes concerning the indicators described below.

Table 1. The TDsc quality and efficiency indicator outcomes.

TDsc quality of care indicators	
<b>Of the TDsc consultations:</b>	
1.	30.3% were performed by GP due to the availability of TDsc, to gain extra dermatological advice.
2.	17.3% led to physical referrals of patients otherwise not referred by the GP, these included pre-diagnosed skin cancer cases.
3.	97.4% was reported as helpful by the GP and 95.3% were considered educational/instructive.
TDsc efficiency of care indicators	
<b>Of the TDsc consultations:</b>	
1.	69.6% prevented a physical referral, decreasing the number of patients needed to be seen face-to-face by the dermatologists.
2.	Overall 62.1% physical referrals were prevented.
3.	2.23 hours was the median dermatologist response time increasing efficiency of the diagnostic process (mean; 6.58h, standard deviation; 26.8h).

### Quality of Care

Regarding the first indicator, 7,839 of 10,184 of the TDsc consultations were included and had responses on both Q1 and Q3. Of the included consultations, 2,379 (30.3%) were requested by the GP to gain supplementary dermatological advice (Table 1).

Concerning the second indicator, 411 patients (17.3%) who would otherwise not have been referred were physically referred after a TDsc consultation to the dermatologist (Q1 = No and Q3 = Yes). Teledermatologists provided an ICD-10 code for 149 of those consultations, including skin cancer diagnosis. In 7,637 TDsc consultations (97.4%) GPs reported that they and their patients were helped by the dermatologist's response (Q4 = Yes, Some). Assessment of the reported learning effect by GPs showed that 7,474 consultations (95.3%) were considered instructive (Q5 = Yes, Some).

### Efficiency of Care

Of the included consultations 5,460 (69.7%) were intended to prevent a physical referral (Q1 = Yes). Of these, 3,800 (69.6%) were actually prevented (Q1 = Yes and Q3 = No). Without TDsc 5,460 patients would have been referred to the dermatologists. After TDsc 2,071 patients were referred, resulting in 62.1% of prevented physical referrals overall.

Timestamps have been stored since July 2011. Hundred-eighteen consultations were excluded due to missing timestamps. The median response time of the dermatologist was 2.23h (Figure 2).

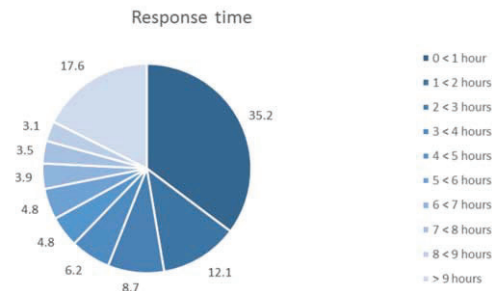


Figure 2. The distribution (%) of response times of TDsc consultations (N=10,066)

## Conclusions

The results from this study give a strong indication that TDsc is improving Dutch dermatologic general practitioner health care regarding its quality and efficiency. TDsc availability is valued by GPs in gaining additional and helpful dermatologic advice and prevented a high percentage of physical referrals. Moreover, TDsc resulted in the detection of potential skin cancer cases of patients who would not have been referred if TDsc had not been available. TDsc also improves the efficiency of GP dermatology healthcare by obtaining dermatological advice within one working day.

### Conflicts of Interests

E.T., F.v.S, and J.P.v.d.H. are employed (part-time) by Ksyos, and L.W. is the director of Ksyos. The remaining authors state no conflicts of interest.

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