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Teledermatology in Belgium: a pilot study

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ABSTRACT
Background: Teledermatology, the application of telemedicine in the field of dermatology, can be a valuable tool to improve the efficiency of care in general practice.
Objectives: In this pilot study, we implemented a teledermatology programme in Belgian context to assess the effect on referral rate and to evaluate the acceptability of teledermatology by clinicians and patients.
Material and methods: A store-and-forward teledermatology service between 12 general practitioners (GPs) and 3 academic dermatologists was evaluated for a period of 3–6 months. Clinicians and patients were questioned about satisfaction, benefits and barriers.
Results: In total, 54 teledermatologic consultations were performed. The referral rate was reduced. Thirty-one teleconsultations were performed instead of physical referral, of which nine patients were actually referred. In 23 cases, performed for a second opinion, two more patients were referred on the dermatologist’s advice.
Conclusion: Teledermatology proved to be a feasible and acceptable tool for both clinicians and patients. It also shows to be a valuable for triage and reducing unnecessary referrals. Considering the emergent pressure on health care in the next decades, teledermatology following GP selection could be useful for the Belgian health care system and deserves further elaboration in the search for effective tools to strengthen first line health care and streamline referral to secondary care.

Introduction

Telemedicine is the use of communication technologies in health care for the exchange of medical information over a distance. The visual character of dermatology makes it well-suited for telemedicine. Teledermatology has been the subject of research since 1995 and is one of the most evolved telemedicine services [1].

Teledermatology has two established modalities: store-and-forward teledermatology (SAFT) and live interaction teledermatology (LI). In the SAFT modality, digital images and associated patient data are sent to a distant site clinician who reviews the data hours or days later. The LI modality involves real-time video interaction between the consulting party and the teledermatologist. Store-and-forward modality is the main technology of choice because of its technological flexibility and lower cost of service delivery [2,3]. Teledermatology can be used either between another physician and a teledermatologist for triage/consultation, or directly between patient and dermatologist (direct-to-consumer teledermatology) (Figure 1).

The diagnostic reliability of teledermatology for non-pigmented lesions has been shown to be comparable with conventional face-to-face consultations [1,2,4–7]. In order for teledermatology to be considered reliable, the diagnosis must be reproducible by physicians using different modalities. Therefore, it is important to compare dermatologist-in-person consultations and teledermatology for diagnostic agreement. Systematic reviews by Levin and Warshaw (2009) and Whited et al. (2015) reported that good diagnostic agreement is the conclusion, when comparing a teledermatology diagnosis and in-person dermatologic diagnosis or histopathology with traditional face-to-face consultations [1,7]. However, several factors may directly impact the reliability of teledermatology including proper imaging, comprehensive history, and skills of the teledermatologists and referring physicians. Therefore, it is imperative to create good conditions and provide support and education to referring general practitioners (GPs) [4,7].

Currently, teledermatology is applied throughout all kinds of medical settings, e.g. in hospital and primary care, nursing homes, home care settings. Although it was initially developed for underserved and remote areas, the evidence for its cost-effectiveness in more densely populated settings is growing [2,6,8]. Teledermatology is...
Teledermatology can be of interest for different partners in the Belgian health care system. It can provide a triage system, that could be valuable in a context of emergent pressure on health care as our ageing population will entail an increased demand for care, which will not be followed by an equal increase in health care workers [12]. As teledermatology can reduce the number of face-to-face visits, it could lead to shorter waiting lists by triage and better access to dermatologic advice. Therefore, teledermatology could provide a valuable tool to keep health care accessible and sustainable.

In the field of telemedicine, however, Belgium is falling behind in comparison to other countries. Agoria, the Belgian federation of technology industry, stated in its position paper on e-Health that the development of telemedicine is slowed down by the lack of objective stimulating measures, resulting from a lack of confidence, caused by insufficient knowledge of the evidence and the small scale of experimental projects in Belgium [12].

In this study, we aim to explore the benefits and barriers of teledermatology in a Belgian pilot study, which can provide a basis for larger scale projects.

Materials and methods

Setting

The teledermatology service was implemented during the period from mid-July 2016 until the end of January 2017. The setting for the study was a neighbourhood health centre in Ghent and a group practice in Merelbeke. The teleconsults were answered by three dermatologists of Ghent University Hospital.

Inclusion and exclusion

Inclusion criteria for patients were: ≥18 years, capable of giving informed consent. Naevi and/or brown pigmented skin lesions that could be a naevus or dysplastic naevus or melanoma were excluded by the GPs. The teledermatology service was provided by KSYOS TeleMedical Centre, a Dutch health care institution specialising in telemedicine. All GPs received on-site training in clinical photography and the use of the teledermatology system before starting teledermatology. The GPs selected patients with skin conditions that were in their opinion suitable for a teleconsult. The database of KSYOS TeleMedical Centre used for this study held records on all teleconsults performed from mid-July 2016 till the end of January 2017. To create and close a teleconsult, GPs had to answer mandatory questions on outcome parameters.

The teledermatology consultation process

GPs sent teleconsults to the dermatologists with the use of the SAF-based KSYOS TeleDermatology Consultation System. A teleconsult consisted of two parts. The first part contained basic patient data, clinical photographs, the patient’s history and the GP’s questions to the dermatologist. The second part was optional and contained more detailed information on patient history and condition, partly based on semistructured questions. If necessary, a second teleconsultation round could be included, when the dermatologist needed more information about the case or when the GP needed clarification of the dermatologist’s advice. After one or two rounds, the teleconsult was actively closed by the GPs. Clinicians were notified of new, answered or second-round teleconsults by means of an anonymous notification e-mail in their regular e-mail inbox. Dermatologists were asked to answer a teleconsult within two working days.

GPs made pictures with the camera on their smartphone or the Nikon Coolpix digital photo camera provided by KSYOS (resolution of 16,1 Megapixels). There was no cost for the patient, nor remuneration for the clinicians. The study was covered by the research liability insurance of UZ Ghent.

Study design

The study primarily focused on two domains: efficiency and user satisfaction. Informed consent was
obtained from all individual clinicians and patients included in the study. The procedures performed in the study were in accordance with the ethical standards of the institutional research committee (UZ Ghent, EC 2016/0528).

In this study, efficiency of teledermatology was measured by the number of physical referrals prevented. A referral was defined as ‘prevented’ when the answer to the standard question ‘Would you have referred this patient if teledermatology was not available?’ was ‘YES’ and the answer to the second question, ‘Are you still referring this patient to the dermatologist?’, was ‘NO’. The first question was asked when a GP created a new teleconsult and the second question was asked when the teleconsult was closed by the GP. User satisfaction of GPs and dermatologists was evaluated by a short questionnaire per teleconsult and a larger questionnaire before and after the project. Patient satisfaction was questioned by the GP at the moment he or she informed the patient about the results. Excel was used for data analysis.

Results
Characteristics of use

During the period from mid-July 2016 until the end of January 2017, 12 GPs of two general practices participated in the project, with a varying participation time of 3–6.5 months. Two GPs opted not to participate in the study. One GP felt no need to receive dermatologic advice, the second GP experienced smartphone problems. The average age of the GPs was 36 years (median 33, range 27–64 years), with a male female distribution of 5–7. The teleconsults were answered by three female academic dermatologists, with an average age of 47 years (range 43–50).

In total, 54 teleconsults were performed, with a mean of 1.2 teleconsults per GP per month. All invited patients agreed and gave their informed consent. 41 patients (76%) completed the questionnaires. The median response time of the dermatologist in the first round of the teleconsult was 17 h. In seven cases, a second round was performed. The median time spent per teleconsultation by dermatologists was less than 10 min.

Diagnostic groups

In 47 teleconsults, a diagnosis could be made. These diagnoses can be categorized in seven main diagnostic groups: eczema, infectious diseases, benign tumours, (pre)malignant tumours, erythematousquamous diseases and acneiform conditions (Figure 2). Most teleconsults were performed for advice on diagnosis or therapy.

Efficiency

In 31 cases (57%), GPs initiated a teleconsult instead of physically referring the patient. This means that the GP would have referred the patient to the dermatologist if she did not dispose of teledermatology. After the teledermatology process, only nine of these patients were actually referred. The referral rate was reduced with 71%.

In addition, GPs initiated 23 teleconsults (43%) for a second opinion. In these cases, the GP would not have asked a dermatologist’s advice if teledermatology was not available. After the teledermatology consultation, two of these patients were yet referred to the dermatologist on the dermatologist’s advice (Figure 3).

The dermatologists gave the following reasons to advise referral: need for clinical evaluation, need for a technical act (biopsy, surgery) or need for dermatoscopic evaluation. In two cases, insufficient quality of the pictures was a reason for the dermatologist to ask for referral.

Motivating factors and barriers

All clinicians wanted to continue working with teledermatology in the future. They all believed that teledermatology is a safe way to evaluate dermatologic pathologies, with enough options in case of uncertainty (extra questions, advice to refer). They
perceived the programme as user friendly. The GPs were satisfied with the response time of the dermatologist.

When asked for personal motivating factors, GPs especially withheld the learning effect. Secondly, they appreciated the ability to deliver better care. Thirdly, they valued an improved collaboration with the dermatologists. When asked for potential barriers for future use, five GPs reported difficulties in taking good pictures. This corresponds with the dermatologists’ report of poor picture quality in eight teleconsults. GPs pointed out several reasons for this: (i) insufficient resolution of the pictures taken with camera’s provided by KSYOS or with their smartphone camera, (ii) difficulty of focussing on skin lesions on hairy surfaces, (iii) poor technical skills (lighting, background, focussing). Furthermore, four GPs named the increased workload as a potential barrier (Table 1).

The strongest motivating factor for dermatologists was the promise of an increased efficiency of care organisation and better triage. The second most important benefit was the availability of a safe frame for the already existing flow of telecommunication, and the possibility of remuneration for this work. Thirdly, they appreciated the better cooperation with GPs. Potential barriers were time investment, the inability to use their hands to make the diagnosis, and the lack of feedback about the eventual outcome (Table 2).

**Ideas for future implementation**

All doctors believed that the GP should be liable for the teledermatology service. Eight GPs thought that the liability should be shared with the dermatologist. All doctors agreed that there should be a remuneration for the dermatologist, whereas the opinions on the

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<th>Potential barriers</th>
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<td>1. Learning effect</td>
<td>1. Difficulties to make good pictures</td>
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<td>2. Better care for patient</td>
<td>2. Increased workload</td>
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<td>3. Improved collaboration with dermatologist</td>
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necessity of a remuneration for the GP differed. For all clinicians, integration of the data into the existing health record system would be a great advantage.

**Patient satisfaction**

Forty-one patients filled out the questionnaire. Thirty-eight patients did not prefer a physical referral over a teleconsult. In 34 cases, patients felt they were helped well. Thirty-five patients agreed that the availability of teledermatology would stimulate them to go to the GP earlier with a dermatological problem.

**Discussion**

We aimed to assess the benefits and barriers of teledermatology in a Belgian general practice setting.

**Efficiency**

A first important finding in this pilot study is that teledermatology reduced the number of referrals to the dermatologist. The total reduction rate of 71% is comparable to the results of previous studies in other countries. A recent study in the Netherlands with the same design, including 1820 GPs and 166 dermatologists showed a 74% reduction of the referral rate [8]. In other studies with different designs, the percentage of prevented face-to-face appointments varies between 13% and 81% [5,6].

A remarkable finding in our pilot study was that the distribution of indications for teleconsults was similar to larger scale international studies with a similar design [8]. This suggests that our study can be considered as a valuable sample, despite the small scale [8,9,11]. Studies on a larger scale and with a longer follow-up will

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*Figure 3. Effect of teledermatology on referral rate.*

*Table 1. Personal motivators and potential barriers for GPs.*

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*Table 2. Personal motivators and potential barriers for dermatologists.*

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<th>Personal motivators</th>
<th>Potential barriers</th>
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<tr>
<td>1. Increased efficiency of care organisation, triage</td>
<td>1. Time investment</td>
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<td>2. Safe frame and reimbursement for existing telecommunication</td>
<td>2. Lack of third dimension (palpation)</td>
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<td>3. Better cooperation with GP</td>
<td>3. No feedback about outcome</td>
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be needed to support these findings. The reduction of the referral rate is an important outcome parameter in literature, and can correlate with a higher effective health care system and shortening of waiting lists [5,6]. This study does not provide direct data on the time the dermatologist eventually could save, as compared to conventional care, One can even suppose that teledermatology may create more work, as there are many consults initiated for second opinion. However, we recorded that the dermatologist spent a short time spent per teleconsult (less than 10 min) and eventual referrals were more specifically oriented (specific consultation, surgery, …). In addition, the substantial learning effect for the GP is highly likely to reduce the number of teleconsults on the long term. The study of Van der Heijden et al. (2011) described a decrease of the number of teleconsults per GP in the first year after starting teledermatology, with a stabilisation of the number after the first year [8].

There is growing evidence that a teledermatology service can be cost-effective even in densely populated regions [2,5,6,8,13]. When evaluating teledermatology cost-effectiveness, it is important to consider societal costs in addition to health care system costs that are associated with conventional care. By averting the need for dermatological consultations, teledermatology not only decreases appointment waiting times and the amount of time needed for a consultation, but also decreases travel costs and loss of productivity. A cost-evaluation in the Netherlands, with a fully implemented teledermatology service, estimated teledermatology to be cost-effective when the prevention of physical referrals is over 37% [8].

The impact of teledermatology on efficiency and costs, however, is context-dependent. In Belgium, the waiting times for in-person dermatologic consultations are high, but not as high as in the Netherlands. Benders and Rouppe van der Voort found a mean waiting time of 6 weeks for a general dermatologic consultation in 2008 [14]. According to Lambert and Deprez, the waiting time for a polyclinic consultation in UZ Ghent was 17 weeks in 2015 [15]. Furthermore, it is foreseen that the demand will only increase, as the Belgian population is greying. The IMF predicts that by 2050 the percentage of Belgian population over the age of 65 will increase from 16% to 25%.

In conclusion, teledermatology may provide better access to dermatological advice in a more efficient and even cost-saving manner, but more research in Belgian context is necessary to support that hypothesis.

Physician satisfaction, facilitators, barriers

In this study, GPs and dermatologists all perceived teledermatology as a user-friendly technology with an added value for their practice, and want to continue working with teledermatology in the future. Importantly, the dermatologists perceive teledermatology as a safe and effective way of evaluating dermatologic pathologies. The learning effect for the GP has earlier been described as a key motivating factor for implementation of teledermatology [11,16]. In addition, the dermatologist’s interest in the triage effect also accords with earlier evidence. Interestingly, dermatologists expressed the hope that the already existing flow of questions by e-mail could in this way be poured into a safe format, with the possibility of remuneration for this work.

Important facilitators for GPs and dermatologists were a user-friendly programme, an achievable time investment, training and technical support and a remuneration for the dermatologist. This is in line with earlier research [11,13,16]. Barriers for future implementation were the difficulty to take good pictures and the impossibility to integrate teleconsultations into the existing electronic health record. The acquisition of qualitative pictures also proved to be a challenge in earlier research. The main problem is often not the resolution, but the technique of taking pictures (lighting, background, camera position,….) [11]. Several countries, such as the United States, have developed standards for good practice, including technological requirements and practical guidelines [17], but there are no international standards yet.

Difficulties in interfacing the teledermatology application with an existing electronic medical record have been described as a barrier in many countries [11]. In the future, the development of practical guidelines and the design of an application for teledermatology on the eHealth platform could encourage the broader application of teledermatology.

We conclude that the participating physicians are enthusiastic to work with teledermatology, provided that there is a good infrastructural and organisational context.

Patient satisfaction

A final important outcome of this study is the high patient satisfaction. Teledermatology increased patient satisfaction by providing faster access to consultation as opposed to in-person visits. Other studies present similar results [11,18]. Interestingly, almost all patients indicated that the availability of teledermatology would stimulate them to go to the GP with a dermatological problem. This outcome can be very relevant for the Belgian context, as patients with common dermatologic problems too often consult second- and third-line health care without visiting the general practitioner first. According to data from the department of Dermatology at UZ Ghent (third-line), 73% of patients consult a dermatologist on their own initiative [19]. As teledermatology can leave management of common dermatologic care in the hands of the referring primary care provider, it can be a valuable tool to organise health care more efficiently.
Limitations

The present study had some limitations. First, the study has a small sample size, which limits the generalisability of the results. A second shortcoming of this study is the absence of any follow-up data on clinical and management outcome. However, large reviews showed no evidence that clinical outcomes of teledermatology were any different compared to conventional care [1,4,7]. But future research in Belgium should also include long-term follow-up data. Thirdly, the results can be biased by the specific setting of the study (neighbourhood health centre, academic hospital). As the use and reliability of teledermatology is highly dependent on motivation and skills of the teledermatologists and referring physicians, our results warrant a broader exploration of the use of teledermatology in different settings.

Furthermore, naevi and/or brown pigmented skin lesions that could be a naevus or dysplastic naevus or melanoma were excluded by the GPs, as previous studies have demonstrated that SAF teledermatology cannot be reliably used to rule out melanoma [20–23]. In this study, the identification of ‘pigmented lesions’ was based on the GP’s judgment. However, as a broad spectrum of pigmented lesions and disorders exists, future studies should use more specified inclusion and exclusion criteria concerning pigmented skin lesions. In the future, the addition of dermoscopic images (teledermatoscopy) may tackle this problem, as recent evidence reveals that addition of dermoscopic images to the teleconsult can render sensitivity and specificity high enough (>90%) to assist the dermatologist in making referral decisions [23].

And finally, we excluded patients not capable of giving informed consent (e.g. demented people) and children younger than 18. These patients account for a reasonable part of the dermatologic pathologies and are often restricted in mobility. They should be included in future studies, as teledermatology could be especially useful for these populations.

Future perspectives

In Belgium, telemedicine providers have not succeeded in continuing telemedical projects after the pilot phase yet, in spite of convincing outcomes. A major reason for that, is the absence of financial support by the social security, which makes business models unequilibrated [12,24]. Although teledermatology has been proven to be cost-effective in many settings, remuneration remains the main obstacle for the implementation of telemedicine into the national health care system in many countries [18].

Agoria formulated different goals to further develop telemedicine in Belgium in the future: (i) structural agreement between different authorities, (ii) more research on financial and economic impact of telemedical solutions, (iii) more investment in network infrastructure and (iv) a legal and deontologic frame [12].

Further studies should be conducted on a larger scale, with longer follow-up, and in different settings. Especially peripheral locations and nursing homes would be interesting locations to evaluate the pros and cons of teledermatology. Patients outside the GP practice can be interrogated about their health-seeking behaviour (e.g. in the waiting room for the dermatologist). Patient outcomes should be studied more extensively. The impact of teledermatology on the quality of life would be an interesting topic for additional research. Furthermore, cost-effectiveness of teledermatology in Belgium should be evaluated; a legal frame and good guidelines should be developed.

And finally, the field of application can be extended with teledermatoscopy, as used for the screening and detection of skin cancer [23].

Conclusion

This study indicates that teledermatology can provide patient access to dermatologic care in an efficient and convenient manner in a Belgian a daily practice setting. Important facilitators are a good infrastructural and organisational context.

Teledermatology following GP selection could be an effective tool to strengthen first line health care and streamline referral to secondary care. This could be very useful, considering the emergent pressure on health care in the next decades. However, further research is needed to evaluate the cost-effectiveness, to develop a legal frame, to investigate perceptions and receptiveness of Belgian clinicians in different settings, and to explore the effect of teledermatology on the health-seeking behaviour of Belgian patients more thoroughly. With the rapid advancements in technology, developing a practical and affordable platform for telemedical applications will be an essential component for efficient and cost-effective care in the future.

Disclosure statement

No potential conflict of interest was reported by the authors.

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