ACCEPTANCE OF A MOBILE PATIENT-SUPPORT SYSTEM FOR THE HOME MONITORING OF HIGH-NEED PSORIASIS PATIENTS

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Abstract

A mobile patient-support system (MPS) appears effective for the home monitoring of high-need psoriasis patients receiving etanercept. For its successful implementation into routine practice, information on patient and dermatologist acceptance is crucial. A pilot study was performed to assess the quality of MPS by user acceptance and to examine the association between patient acceptance and perceived health-related quality of life. Psoriasis patients receiving etanercept performed mobile visits over 12 weeks transmitting clinical images and data to teledermatologists who provided treatment instructions. Ten Patients and two teledermatologists completed 20-item patient (weeks 6 and 12) and 10-item physician (at week 12) acceptance questionnaires. In addition, patients answered the Dermatology Life Quality Index (DLQI) at weeks 0, 6, and 12. Both patients and remote examiners were pleased with MPS with high acceptance rates. In addition, 80% of the patients considered MPS an alternative to in-person consultation and 90% felt they were in good hands but had achieved a more flexible and empowered lifestyle. No significant correlations were found between patient acceptance and DLQI. Both remote examiners found MPS a convenient and reliable tool for patient monitoring. Neither patients nor remote examiners thought further in-person consultations necessary. MPS is a feasible patient-driven home monitoring system for high-need patients with psoriasis that makes a meaningful difference in their lives. It is well accepted by both patients and involved physicians.

1. Introduction

Telemedicine has revolutionized some aspects of health care delivery by transforming relationships between patients and physicians[1] shifting the power of consultation so that patients may become more informed and assertive.[1] Even with a chronic illness such as psoriasis, effective communication addressing patients' needs and expectations seems mandatory to strengthen patient confidence and motivation to use their own skills and knowledge to take effective control over their life.

Teledermatology has great potential because the rapid advancement of mobile technologies has made close support and coaching in the home possible.

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However, a decreased acceptance by either patients or dermatologists may impede successful use in routine practice. Furthermore, it has been debated whether patients' perceived health-related quality of life might have an effect on their acceptance of teledermatologic tools.[2]

As part of a pilot-study that demonstrated the feasibility of MPS with high diagnostic and therapeutic concordance to a conventional in-person consulting process, we conducted acceptance assessments among participating patients and the two remote examiners. Furthermore, we examined the association between patient acceptance and perceived health-related quality of life.

2. Methods

2. 1. Setting and study population

The pilot study took place at the Psoriatic Unit of the Department of Dermatology, Medical University of Graz, Austria, between January 2006 and January 2007. 10 consecutive patients meeting the following criteria were enrolled in this pilot study: men or women aged 18 years or older with psoriasis who were eligible for etanercept treatment[3]. No distinction was made between different subtypes or duration of psoriasis. All patients provided written informed consent to participate in the study and approval of the local Ethics Committee was granted.

In detail, the study population consisted of 6 men and 4 women, with a median age of 40 years (range, 25 to 67 years). The majority of patients (8/10) had plaque psoriasis whereas two presented with localized pustular psoriasis on palms and soles. During the 12-week study period, all patients received etanercept (50mg, twice a week, subcutaneously) according to standard protocol.[3]

In addition to face-to-face visits at weeks 0, 1, 6 and 12, patients conducted "mobile visits" at weeks 0, 1, 2 and then every two weeks for the remaining study period.

Patients completed a 20-item patient acceptance questionnaire at weeks 6 and 12 and a Daily Quality Life Index (DLQI) at weeks 0, 6 and 12, while the remote examiners completed a 10-item physician acceptance questionnaire at week 12. In addition, the patients and physicians were asked to count the time effort required for each mobile consultation.

2. 2. Architecture of MPS

In order to perform the mobile visits, patients received a conventional mobile phone (Nokia 6630) equipped with a built-in 1.3 mega-pixel CMOS (Complementary Metal Oxide Semiconductor) -sensor, a 65,536 colors bright active matrix liquid crystal display, and an implemented C++ application, based on SymbianOS. The especially designed software integrated both a section for image capturing and one for the input of patients´ medical history via questionnaire. The captured pictures were stored and sent as JPEG (joint photographic experts group, a compression algorithm for digital images) files with a resolution of 1280 x 960 pixels, each compressed to approximately 100 kilobytes. The technology used to transmit data was a packet-based wireless data transfer via General Packet Radio Service (GPRS) or Universal Mobile Telecommunication System (UMTS) to a central web-server with mobile access to the internet. Additional software was developed for analysis of incoming patient data by the remote examiners (teledermatologists). For this purpose, Hypertext Preprocessor (PHP), a server-side scripting language, and a relational database engine using the scripting language Structured Query Language (SQL) were implemented on the web-server to cre-

ate a database driven webpage. PHP processed the page request and converted the data from the database into a web-interface with login-protected user access. The operating system was Microsoft Windows. In addition, a mobile phone-based feed back system was created, that converted email messages into short text messages (Email-to-SMS) to directly send treatment instructions from the remote examiner to the correspondent mobile phones of the patients.

2. 3. Mobile visit

At the basic face-to-face visit (week 0) patients also received a structured training session on the appropriate use of the mobile devices, the implemented application, and fundamental imaging skills for lighting, focus and composition. Patients then submitted images and text data via mobile phones from their homes on the predefined dates during the study period. They were asked to take pictures of the most severely affected area of the skin in the various body regions according to Psoriasis Area and Severity Index (PASI) and Palmoplantar PASI (PPPASI) scores for plaque psoriasis and localized pustular psoriasis on palm and soles, respectively. If new locations and/or psoriasis lesions had occurred in the meantime, they were instructed to choose the appropriate location via drop-down menu in order to add it to the user profile and to further photograph the new lesions. Printouts of the lesions identified at each face-to-face visit where provided to the patients to help insure that same locations were photographed at every visit. In cases of very widespread psoriasis, patients were asked to have someone else take the photographs. Patients were requested to take the pictures against a white background and without digital zooming to avoid the moiré effect (a phenomenon similar to stroboscopy) and to optimize the white balance of the camera sensor, and after the affected skin area had been fully displayed on the phone screen and a minimum distance of approximately 10cm had been maintained. All images were taken without flashlights to avoid interfering back-scattering of the flash-light, and in darkened rooms with bright illumination of the lesions using a conventional bulb (between 2500 and 3000 Kelvin) to standardize the color temperature of the captured pictures and to reduce the image noise. In a second step, patients were prompted to answer a short questionnaire providing historical information, including current body weight, planned medical interventions (e.g., vaccinations, operations), and occurrence of undesirable side effects.

Treatment instructions, including dosage changes, stopping etanercept or requesting a patient visit were send to the patients´ phones within 24 hours.

2. 4. Measures

Patient acceptance and perceived health-related quality of life: The patient acceptance questionnaire consisted of 20 items, which were rated on a five-point scale, ranging from ‘not applicable’ to ‘very applicable’. In addition, the 20-items were grouped into three acceptance subscales ‘interaction’, ‘impact on daily life’ and ‘usability’ based in the content of items (*Figure 1*).

The Dermatology Life Quality Index (DLQI) is a compact self-reported questionnaire to measure health-related quality of life over the previous week in patients with skin diseases. It has been validated in patients with psoriasis[4,5] and it consists of 10 items covering symptoms and feelings, daily activities , leisure, work and school, personal relationships and treatment. For interpretation of the health-related quality responses, the commonly used set of bands of DLQI scores[6] was applied as follows: DLQI scores 0-1, no effect at all on patient life; DLQI scores 2-5, small effect; DLQI scores 6-10, moderate effect; DLQI scores 11-20, very large effect on patient’s life; and

DLQI scores 21-30, extremely large effect on patient life.

Physician acceptance: The physician acceptance questionnaire consisted of 10 items, which were rated on a five-point scale, ranging from 'not applicable' to 'very applicable'. The 10 items were further grouped into two major acceptance subscales, 'diagnostic reliability' and 'usability of mobile consultation' (*Figure 2*).

2. 5. Analysis methods

For patient acceptance, a numerical value from 0 to 4 points was assigned to each of the 20 items, with 4 points indicating the highest level of acceptance. Thus, the total patient acceptance scored from 0-80, the subscale 'interaction' from 0-16 (4 items), 'impact on daily life' from 0-20 (5 items), and 'usability' from 0-44 (11 items). In addition the five-point response scale was collapsed into two categories: 0 ('not'), 1 ('barely'), and 2 ('less appropriate') into 'not appropriate', and 3 ('appropriate') and 4 ('very appropriate') into 'appropriate'. The health-related quality of life (DLQI) responses were then correlated with each of the three composite acceptance variables.

The 10 items of the DLQI were summed to produce scores with a minimum of 0 and a maximum of 30. Each item was scored on a four-point scale ranging from 0 to 3, with higher scores indicating greater impairment in health-related quality of life.

Measures of internal consistency reliability were performed on both patient-reported measures using Cronbach´s alpha coefficient.

Physician acceptance responses were put to the same analysis procedure as described above for the patient acceptance questionnaire. Overall physician acceptance scores ranged from 0-40 (10 items), the subscales 'diagnostic reliability' (7 items) from 0-28 and 'usability of mobile consultation' (3 items) from 0-12, with higher scores indicating higher acceptance levels.

Score points and time are reported as median with range (minimum - maximum) in parentheses, the percentages of maximum possible score points are given in mean with standard deviation (SD). Patient's responses are displayed as frequencies with percentages. Associations between item-scales were assessed with the Spearman rank correlation coefficient and internal consistency of item-scales with Cronbach's alpha. All computations were done using the statistical package SPSS for Windows version 14.0.1®. A p-value of < 0.05 was considered significant

3. Results

Patient acceptance and perceived health-related quality of life: The responses to the patient acceptance items are shown in *Figure 1*.

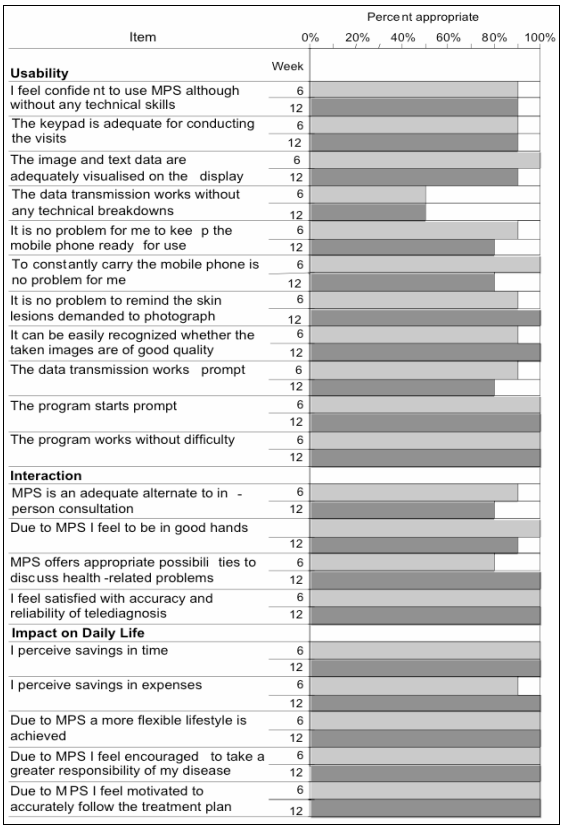

Figure 1: Patient responses (in percentages) to the 20-item acceptance questionnaire at weeks 6 and 12, grouped by the three composite variables 'usability', 'interaction', and 'impact on daily life'

The patients assigned MPS a high mean overall acceptance of 81.0% (SD: 6.53) at week 6 and 82.9% (SD: 9.15) at week 12. Acceptance in all subscales was comparably high with slightly higher values at week 12 than at week 6. At week 12, for the 'interaction' variable (4 items), scores as a percentage of the maximum possible score ranged from 62.5 to 100.0 (mean ± SD 78.1 ± 9.88, median 75.0). Scores for the 'impact on daily life' (5 items) variable ranged from 75.0 to 100.0 (mean ± SD 89.5 ± 7.62, median 90.0) and for the 'usability' variable (11 items) from 65.9 to 100.0 (mean ± SD 81.6 ± 10.58, median 79.5). The total sum score of the patient acceptance questionnaire including the three composite items showed scores ranging from 68.8 to 98.8 (mean ± SD 82.9 ± 9.15, median 81.3) at week 12.

There was no statistically significant correlation between patient acceptance and perceived health-related quality of life.

The DLQI scores noticeably decreased over the 12-week period indicating better patient quality of life at the end of the study. At week 0, patients assigned their disease a very large effect on their life with a median score of 15.5 (range 4-28), at week 6, they perceived a moderate effect with a median score of 8.5 (range: 0-17), and at week 12, they noticed only a small effect with a median score of 5.0 (range: 0-30). A test for the internal consistency of the 20-item acceptance questionnaire showed a good α reliability of 0.77 and 0.90 at weeks 6 and 12 respectively, and an excellent α reliability for the DLQI, ranging from 0.91 at week 0 and 0.90 at week 6, to 0.97 at week 12.

The median time effort for the patients required for conducting the mobile visits was 8.0 min (range: 6-12).

Physician acceptance: The responses to the physician acceptance items are presented in *Figure 2*.

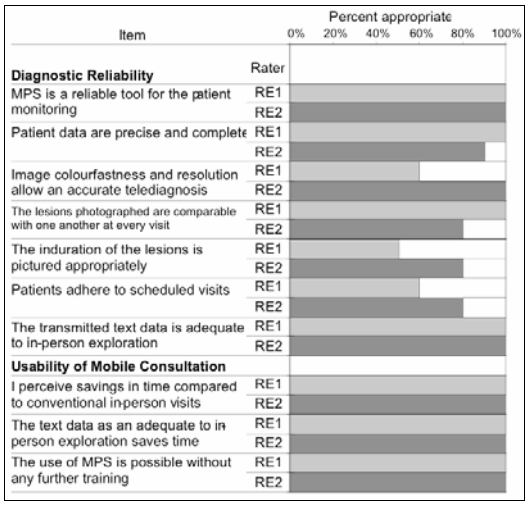

Figure 2: Remote examiner (RE1, RE2) responses to the 10-item acceptance questionnaire at week 12, grouped by the two subscales 'diagnostic reliability' and 'usability of consultation'

Scoring of both remote examiners' responses revealed comparably high levels of acceptance among the teledermatologists with a mean overall acceptance of 74.0% (SD: 3.48). The subscale 'diagnostic reliability' (7 items) was assigned a mean score of 73.2 (SD: 4.71), and 'usability of mobile consultation' (3 items) a mean score of 75.8 (SD: 2.56).

Both physicians measured a median time effort of 5.0 minutes (range: 5-8) per visit. Neither patients nor remote examiners thought further in-person consultations necessary.

4. Discussion

Validated instruments to assess patient and physician satisfaction with or acceptance of store-and-forward teledermatology do not currently exist.[7] Particular emphasis should be put on the understanding how patients and physicians perceive the interaction resulting from this new mode of care. Delayed or absent follow-up had been identified as a significant barrier to the acceptance of store-and-forward teledermatology[8], and moreover, patients have been found to be concerned about never having been evaluated directly by a dermatologist.[9] With MPS a collaborative model of care was developed which empowered the patients to contribute in their treatment process on a partnership basis. No referring clinician was required to relay information to the patient. Instead, medical advice was received directly from a teledermatologist within 24 hours.

Our patients reported a high level of mean overall acceptance of 81% at week 6, and 82.9% at week 12, which confirms previous research.[10,11] We could also demonstrate that all patients were satisfied with the remote treatment instructions, and the possibility offered to discuss their health-related problems. In addition, at week 12, 80% of the patients believed MPS to be an adequate alternative to in-person consultation, and 90% felt to be in good hands. As expected, MPS exerted great influence on patient daily life. All patients perceived savings of time and expenses, and moreover, they believed to have gained a more flexible and empowered lifestyle (*Figure 1*).
Mean DLQI scores noticeably decreased from 15.5 at baseline to 5.0 at week 12. Compared to previous research that reported a decline of mean scores of 11.7 and 12.2 at baseline to 7.1 and 6.7 at week 12 for psoriasis under conventional care with biologic therapy[12], the DLQI improvement in

our study seems excellent. Contrary to a recent report that found patient acceptance and satisfaction with telemedicine services to be complicated by patients' perceived health status[2], we observed no significant correlations. The present care model has greatly diminished the flaws of store-and-forward teledermatology, including insufficient privacy[2,9,13], embarrassment being photographed[2,13], limitations to expression of problems and concerns[2], completeness of information transmitted[11,14], anxiety about the unfamiliar technology[11], and frustration with technical problems[11]. We provided secure data access, and patients performed the visits in the home by themselves using conventional mobile phones. Additional text information helped them to adequately express health-related problems.

Even, elder patients and/or those suffering from more widespread disease were able to conduct the mobile visits within a maximum of 12 minutes. Thus, patients´ time expenditure for consultation was considerably lower than with conventional outpatient visits.

There is little information available regarding consultant dermatologists' satisfaction with and acceptance of store-and-forward teledermatology[8], but dermatologists have reported greater confidence when making the diagnosis by in-person examinations.[8] Our remote examiners assigned MPS a good overall acceptance of 74.0%. Both believed the text information to be adequate in comparison to a directly obtained history, and the remote consultation service to be a reliable tool for the patient-driven home monitoring in all of the cases. Some concerns were expressed with colorfastness and resolution of the images, comparability of photographed lesions and inability to appreciate dermal swelling and induration. In one case, RE2 considered patient data to be somewhat imprecise and incomplete, whereas RE1 was satisfied in all cases (*Figure 2*). Both remote examiners were able to perform consultations within a maximum of 6 minutes, a time effort that may have been never achieved by conventional visits. Moreover, they felt confident using MPS also without any previous training.

We have demonstrated that the integration of patient-driven home monitoring systems into the management of psoriasis is well accepted by both patients and dermatologists. A limitation of the study, however, is the lack of a control group, and a careful comparison of remote and outpatient care quality is needed before introducing MPS into clinical routine. Nevertheless, we believe that MPS is a valuable tool to promote partnerships between patients and dermatologists, facilitate self-management, improve compliance and medication management, and reduce the readmission rate for those with long-term conditions such as psoriasis.

5. References

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