# Remote Monitoring of Psoriasis: Comparing Care Models and Evaluating Quality of Life Outcomes – a mixed methods study

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Jana Arsenjeva[1*] BSc; Priit Kruus[1, 2*] MSc; Riina Hallik[1] MSc, MMS; Secil Matasova[1] MSc, BSc; Laura Prett[3] MD; Katrin Kaarna[4] MD; Liisi Raam[5] MD, PhD; Oliver Taul[5] MD; Liis Ilves[5] MD; Kaisa Viljar[5] MD; Pille Konno[6] MD; Peeter Ross[1] MD, PhD; Külli Kingo[4] MD, PhD

[1] Tallinn University of Technology Tallinn EE
[2] Dermtest OÜ Tallinn EE
[3] Linnamõisa Family Medicine Centre Tallinn EE
[4] University of Tartu Tartu EE
[5] Tartu University Clinic, University of Tartu Tartu EE
[6] Confido Healthcare Centre Tallinn EE
[*]these authors contributed equally

**Corresponding Author:**
Jana Arsenjeva BSc

Tallinn University of Technology
Ehitajate tee 5
Tallinn
EE



## *Abstract*

**Background:** Remote monitoring is increasingly used for psoriasis care, with the International Psoriasis Council (IPC) endorsing teledermatology (TD) as a feasible alternative to in-person visits. While evidence supports dermatologist-led (specialist) remote monitoring, there is limited research on its effectiveness in primary care. A publicly reimbursed remote monitoring program was piloted at both primary and specialist care levels, allowing comparative analysis of quality of life (QoL) outcomes and insights into factors contributing to better management outcomes.

**Objective:** The aim of study was to evaluate the feasibility and effectiveness of remote psoriasis monitoring at both primary and specialist care levels, identifying factors that influence better outcomes at the primary care level.

**Methods:** Study employed a retrospective convergent parallel mixed-methods approach to analyze data from 110 patients initially recruited into a publicly reimbursed remote monitoring program between January 2022 and July 2023 at 7 family medicine centers and 1 outpatient dermatovenerology center. The study utilized data from a public insurance claims database and a TD platform, which included reports on the Dermatology Life Quality Index (DLQI) and additional metrics. The effectiveness of remote monitoring at both care levels was assessed via baseline-to-average DLQI comparisons. The minimal clinically important difference (MCID) was set at ? -3, and odds ratios (OR) between care levels were calculated, with specific cases analyzed via case series. Additionally, correlation analysis examined associations between DLQI changes and variables such as baseline Psoriasis Area Severity Index (PASI) scores, patient demographics, and collaborative care tools like e-consultation.

**Results:** The specialist care group (n=39) showed a significant mean reduction in DLQI of -1.33 (p = .011), whereas the primary care group (n=37) demonstrated a non-significant change of -0.34 (p = .359). Patients receiving specialist care were 3.91 times more likely to achieve a clinically significant improvement (MCID ? -3) compared to those in primary care (p = .042). Collaborative care between Primary Care Practitioners (PCPs) and specialists was linked to more favorable changes in DLQI scores (r = -.339, p = .040) at the primary care level. Case series analysis of patients achieving MCID in primary care revealed variability in management approaches, including PCP-led models incorporating collaborative care elements and nurse-led models without such collaboration.

**Conclusions:** This study is the first to compare remote psoriasis monitoring across specialist and primary care levels. While effective in specialist care, remote management at primary care shows less significant patient outcome improvements, mirroring findings from in-person PCP-led care. Using public claims data, the study highlights that integrating specialist support into PCP-

led care through standardized e-consultation may enhance outcomes. It underscores the need for further research and standardized collaborative care models between primary care providers and specialists in psoriasis remote management. Clinical Trial: The study received approval from the Research Ethics Committee of the University of Tartu, Estonia (ethical approval code: 350/T-14)

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patients achieving MCID in primary care revealed variability in management approaches, including PCP-led models incorporating collaborative care elements and nurse-led models without such collaboration.

**Conclusion:** This study is the first to compare remote psoriasis monitoring across specialist and primary care levels. While effective in specialist care, remote management at primary care shows less significant patient outcome improvements, mirroring findings from in-person PCP-led care. Using public claims data, the study highlights that integrating specialist support into PCP-led care through standardized e-consultation may enhance outcomes. It underscores the need for further research and standardized collaborative care models between primary care providers and specialists in psoriasis remote management.

**Trial Registration:** The study received approval from the Research Ethics Committee of the University of Tartu, Estonia (ethical approval code: 350/T-14)

**Keywords:** Psoriasis, remote management, primary care, specialist care, collaborative care, teledermatology

## Introduction

Psoriasis is a chronic inflammatory skin condition affecting approximately 2% of the global population [1-4]. The disease presents a significant burden, impacting physical, social, and psychological well-being, with severity closely linked to reduced quality of life (QoL) [3, 5-7]. Psoriasis is also associated with comorbidities such as psoriatic arthritis, cardiovascular disease, and depression, further increasing its burden [5, 7, 8]. QoL is widely recognized as an essential measure in psoriasis management, reflecting the disease's broad effects [3, 5]. There is a growing shift from traditional in-person specialist consultations to patient-centered remote care models, particularly for chronic dermatologic conditions like psoriasis [6, 9-11].

Teledermatology (TD) has emerged as a cost-effective [12, 13] and comparably effective [9] alternative to conventional care, improving accessibility and supporting early interventions [6, 7, 14]. TD encompasses several approaches, including synchronous (real-time video consultations) [1] and asynchronous store-and-forward systems, which allow patient data to be reviewed remotely by clinicians at a later time [9, 15]. Advanced TD models, such as Collaborative Connected Health (CCH), facilitate continuous monitoring through the integration of patient-reported outcomes, image uploads, and asynchronous communication, supporting proactive and timely intervention [8, 9]. Remote monitoring represents a key component of TD, enabling continuous assessment of disease severity and treatment response beyond traditional clinic visits [6, 11].

CCH models can empower PCPs to play a role in the treatment of psoriasis. Digital platforms provide PCPs with tools to manage patients and submit data for specialist evaluation as needed. This enables specialists to monitor changes in psoriasis severity, adjust treatment plans in a timely manner, and reduce the need for in-person referrals [11]. E-consultations, a form of asynchronous TD, enable PCPs to obtain timely specialist input without requiring real-time interaction [15]. This approach has been shown to improve access to specialists, reduce unnecessary referrals, and streamline decision-making in primary care [16]. Furthermore, collaborative e-consultation models, when integrated with remote monitoring, can enhance continuity of care and optimize treatment adjustments [8, 11, 14].

The International Psoriasis Council (IPC) framework outlines the potential role of TD in psoriasis management, emphasizing its ability to improve accessibility, streamline workflows, and enhance treatment efficiency [17]. While TD provides a viable alternative to in-person visits, its successful integration into primary care remains a challenge, with key barriers including limited dermatology expertise, resource constraints, and the need for standardized implementation protocols [18-20]. Despite the growing adoption of TD, research on its impact at the primary care level remains limited [18]. PCPs often serve as the first point of contact for psoriasis patients, yet they face substantial challenges, including insufficient dermatological training [19, 21], multimorbidity complexities [22], and delayed access to specialists [20]. These challenges can lead to delays in diagnosis, suboptimal treatment decisions, and insufficient consideration of QoL outcomes [18, 19]. Remote monitoring offers a potential solution by bridging the gap between primary and specialist care, facilitating continuous disease assessment, and supporting early intervention. However, its impact on primary care workflows and patient outcomes remains underexplored. This study aims to evaluate the feasibility and effectiveness of remote psoriasis monitoring in both specialist-led and primary care settings, identifying factors influencing better outcomes at the primary care level, and examining how collaborative digital tools, including e-consultations and continuous monitoring systems, impact QoL.

## Methods

## Study Design

This retrospective convergent parallel mixed-methods study utilized data from a publicly reimbursed remote monitoring pilot program which was part of a quasi-experimental multi-site trial conducted in

Estonia from January 2022 to July 2023 at 7 family medicine centers and 1 outpatient dermatovenerology center [23]. The design enabled simultaneous collection and analysis of quantitative and qualitative data to provide a comprehensive understanding of the program's impact. Data sources included a country-wide public insurance claims database covering all publicly reimbursed patient interactions, visits, and medications during the study period and a secure TD platform database, where Dermatology Life Quality Index (DLQI) and other remote monitoring measures were reported. Additionally, qualitative data were collected via patient feedback, system usability questionnaires, and semi-structured interviews with participating healthcare providers.

## Outcome Measures

The primary outcome of this paper was the effectiveness of remote psoriasis management, measured by changes in the DLQI across primary and specialist care levels [24, 25]. The DLQI, a validated 10-question tool, assesses psoriasis's impact on QoL. Scores range from 0 to 30, with higher scores indicating a greater effect [26, 27]. This tool is widely used in dermatological studies, facilitating comparisons and insights into factors influencing outcomes [5, 27, 28].

Effectiveness was analyzed first for the entire intervention group, then compared between primary and specialist care, and evaluated separately for detailed insights. The Psoriasis Area and Severity Index (PASI) was used at baseline to categorize psoriasis severity (mild: 1-4, moderate: 5-10, severe: >10) [29], providing a clinical context for examining relationships between disease severity and QoL outcomes.

Correlation analysis explored clinical factors associated with DLQI changes in primary care. The odds ratio (OR) for achieving meaningful DLQI improvement in minimal clinically important difference (MCID ≤ -3) was calculated, informed by prior studies on MCID ranges in dermatological conditions [30, 31]. Specific cases achieving the MCID in psoriasis management at the primary care level were selected for case series analysis, incorporating qualitative and quantitative data such as patient feedback questionnaires, interviews with healthcare personnel, claims data [32, 33], and medication prescriptions.

## Study Population

This study employed the data from 110 patients participating in the remote monitoring group at both care levels of the real-life reimbursed remote monitoring pilot trial [23]. There were 55 men and 55 women initially recruited, with 74% (56) aged 50 or below and 26% (20) aged above 50. The inclusion criteria for remote monitoring included: (1) a diagnosis of plaque psoriasis, (2) age between 18 and 75 years, (3) access to a smartphone or computer, and (4) willingness to provide

informed consent and commit time to the study. Exclusion criteria included (1) a non-plaque psoriasis diagnosis, (2) a history of alcohol or drug abuse within six months preceding the study, (3) an inability to fulfill study requirements, and (4) any other reasons deemed by the investigator or sponsor that rendered the patient ineligible.

## Quantitative Data Collection and Exclusion

Data were collected at both specialist and primary care levels. Initially, patient eligibility was confirmed and informed consent obtained, followed by the first completion of Patient-Reported Outcome Measures [34] and PASI, which were securely stored in a specialized TD database built for the use case by a TD company. The study protocol required patients to regularly complete online questionnaires like DLQI, Psoriasis Symptoms and Signs Diary [35] and Early Arthritis for Psoriatic Patients [36], facilitated through a web-based platform with 2-factor authentication login. DLQI questionnaires were scheduled to be sent to patients monthly every 15th date of the month, allowing completion at home. Email reminders were sent, including follow-up reminders. Doctors were also encouraged to actively engage with patients. The platform enabled real-time transmission of patient-generated data, allowing physicians to securely and conveniently access and review the results. PCPs or specialist-dermatologists could review this information asynchronously to provide recommendations to patients, initiate treatment adjustments, or refer patients to other specialists as needed.

The System Usability Scale (SUS) was used to assess system usability using a 10-item questionnaire. Participants rated each item on a 5-point Likert scale, ranging from 0 (Strongly Disagree) to 4 (Strongly Agree). Scores ranging from 0 to 100, where higher scores reflect better usability, were derived by converting individual responses and scaling the total by a factor of 2.5 [37]. SUS scores were obtained directly from the pilot study [23] without adjustments and analyzed as part of the case series outcomes for this study.

Additionally, e-consultations were facilitated through the Health Information System. PCP submitted detailed referrals to a chosen specialist, including information about the patient's condition, test results, clinical observations, and secure access to previous remote monitoring data conducted at the primary care level. Specialists reviewed the referral information and provided recommendations or requested in-person visits, responding within four working days. The PCP and the patient had access to the consultation records, fostering transparency and efficient communication [38].

The intervention was financed through a public reimbursement model implemented as part of a nationwide remote care pilot project by the Estonian Health Insurance Fund, the sole public payor of the solidary health care system. This ensured that TD services were accessible to the population

without additional costs to the patient [39]. The intervention payment model included value-based payment model elements, including an outcome-based payment to participating healthcare providers at the end of the 1-year remote monitoring period.

Participants were enrolled in the study at different times throughout the study period. To address this, the first DLQI entry within 45 days of enrollment in the study was considered the baseline score. In cases where the QoL questionnaire was completed twice during the initial or any follow-up month of observation, the average of the two scores was taken. Participants were excluded from the study if they had more than six months of inactivity or if they did not complete a baseline DLQI questionnaire within 45 days of enrollment. Additionally, those who met both exclusion criteria were not included in the final analysis.

## Qualitative data collection

Patient satisfaction was measured using a feedback form from adapted Estonian Society of Family Physicians' standard questionnaire with detailed information provided in Multimedia Appendix 1, which was administered to the intervention group during the pilot's final quarter.

To build on these findings, semi-structured interviews were conducted with 10 healthcare professionals, including dermatovenereologists, PCPs, and nurses, who were involved in the pilot study [23]. These interviews examined the feasibility of the remote monitoring model and validated patient-specific case data [23]. The interviews explored the feasibility of the remote monitoring model and corroborated patient-specific case data.

## Statistical Analysis

## Quantitative data analysis

### *Descriptive and Comparative Analyses*

For both groups, descriptive statistics were used to summarize demographic characteristics and baseline clinical features, including DLQI and PASI scores. The average DLQI change was calculated for each participant using all available follow-up data to account for variability in follow-up completion and differing study start times. This approach ensured the inclusion of participants with incomplete follow-ups while providing a comprehensive measure of QoL improvement. The DLQI change was determined by subtracting the baseline score from the average follow-up score over 11 months.

An independent sample t-test [40] compared the mean DLQI change scores between specialist and primary care groups, with Levene's test [41] assessing variance equality. The Wilcoxon signed-rank test evaluated treatment effectiveness within the combined care group [42]. Due to the non-normal

distribution, the Wilcoxon test was applied to the primary care group, while a one-sample t-test [43] assessed effectiveness in the specialist care group. Data normality was verified using the Shapiro-Wilk test [44].

### *Odds Ratios and Correlations*

OR analysis [45] was conducted to compare the likelihood of achieving MCID (DLQI ≤ -3) in specialist versus primary care. Additional comparative analyses, including independent sample t-tests and chi-square tests [46], examined differences between patients who achieved MCID and those who did not. Within the primary care group, Pearson's correlation analysis [47] explored associations between DLQI changes and clinical factors, such as baseline PASI score, age, sex, disease duration, and e-consultation.

All results achieving p-values less than 0.05 were considered statistically significant. Calculations were performed with JAMOVI software version 2.3.28.

## Qualitative case series analysis

A case series analysis [48] was conducted on PCP patients with an MCID of ≤ -3 to explore factors influencing treatment effectiveness at the primary care level. Data sources included reimbursement claims (e.g., visits, collaborative care, lab tests, diagnoses, and prescriptions), SUS scores, patient feedback, and treating physician interview data. Although case series analysis carries a higher risk of bias, it is valuable for identifying patterns and building medical knowledge [49]. Subjects were selected based on exposure (remote monitoring at PCP level) and outcome (MCID ≤ -3), ensuring straightforward and replicable criteria. Given the multifactorial influence on QoL—such as treatment type, medication, and collaborative care—remote monitoring has been linked to patient security [50] and may also relate to anxiety factors [51]. These insights were incorporated to identify patterns of DLQI improvement and guide future research.

The study received approval from the Research Ethics Committee of the University of Tartu, Estonia (ethical approval code: 350/T-14)

# Results

## Participant Demographics and Baseline Characteristics

The final study population comprised 76 participants, with a balanced distribution of males (48.7%, n = 37) and females (51.3%, n = 39). The mean age of the participants was 43.46 years (SD = 10.86), with a range encompassing early to middle adulthood. The mean PASI score at baseline was 3.94 (SD = 4.46), indicating that, on average, participants had mild to moderate psoriasis. Participants' baseline DLQI score had a mean of 5.28 (SD = 4.90), reflecting a moderate impact of the condition

on their QoL. Additionally, 36% of the participants (n=27) reported having associated diseases, like hypertension (31%, n=8), dyslipidemias (19%, n=5), and enteropathic arthropathies (16%, n=4), among other conditions. The mean duration of the condition (years since onset) was 11.70 years (SD = 6.12), suggesting that many participants had lived with psoriasis for a significant portion of their lives. All results are shown in Table 1.

**Table 1. Baseline demographics (n=76)**

| Characteristics | Combined group (n=76) | Specialist Care (n=39) | Primary Care (n=37) |
|---|---|---|---|
| **Gender** | | | |
| Sex (Male), n (%) | 37 (48.7%) | 23 (62.2%) | 14 (37.8%) |
| Sex (Female), n (%) | 39 (51.3%) | 16 (41.0%) | 23 (59.0%) |
| Age (years), mean (SD) | 43.46 (10.86) | 44.33 (12.40) | 42.54 (9.04) |
| PASI, mean (SD) | 3.94 (4.46) | 3.45 (4.22) | 4.47 (4.71) |
| DLQI Baseline, mean (SD) | 5.28 (4.90) | 6.21 (5.16) | 4.31 (4.49) |
| Associated diseases (%) | 27 (36%) | 13 (48.1%) | 14 (51.9%) |
| Years Since Onset, mean (SD) | 11.70 (6.12) | 11.85 (6.60) | 11.54 (5.65) |

## DLQI Changes and Effectiveness Across Care Settings

In the remote monitoring group, DLQI scores decreased, with an average change of -0.85 (SD = 2.89), indicating a general improvement in QoL in the combined care group. Wilcoxon Signed-Rank test results show that the mean change in DLQI scores within the combined group is statistically significant (mean difference: -0.85, 95% CI -1.48 to -0.23, $t$ = 823, $p$ = .009).

In the specialist care group, the mean DLQI change was -1.33 (SD = 3.12), indicating significant improvement (mean difference: -1.33, 95% CI -2.34 to -0.32, $t$ = -2.66, $p$ = .011). The primary care group's mean DLQI change was -0.34 (SD = 2.57) and not statistically significant (mean difference: -0.34, 95% CI -1.00 to 0.42, $t$ = 259, $p$ = .359). Results are shown in Tables 2 and 3.

**Table 2: Descriptive Statistics and Shapiro-Wilk Test Results**

| Group | Mean DLQI Change | Standard Deviation (SD) | Shapiro-Wilk *p*-value | Normality |
|---|---|---|---|---|
| Remote Monitoring Group | -0.85 | 2.89 | .013 | Not normal |
| Specialist Care Group | -1.33 | 3.12 | .056 | Normal |
| Primary Care Group | -0.34 | 2.57 | .004 | Not normal |

**Table 3. Statistical Test Results**

| Group | Test Performed | Mean Difference | 95% Confidence Interval (CI) | Test Statistic (*W* or *t*) | *p*-value | Statistical Significance |
|---|---|---|---|---|---|---|
| Remote | Wilcoxon | -0.85 | -1.48 to -0.23 | $W$ = 823 | .009 | Yes |

| | | | | | | |
|---|---|---|---|---|---|---|
| Monitoring Group | Signed-Rank Test | | | | | |
| Specialist Care Group | One-sample t-test | -1.33 | -2.34 to -0.32 | $t$ = -2.66 | .011 | Yes |
| Primary Care Group | Wilcoxon Signed-Rank Test | -0.34 | -1.00 to 0.42 | $W$ = 259 | .359 | No |

## Comparison Between Care Types

An independent sample t-test was employed to compare the mean DLQI change scores between patients receiving care in specialist settings and those in primary care. The results were not statistically significant (mean difference: 0.99, 95% CI 0.32 to 2.30, $t$ = 1.51, $p$ = .136). The detailed results are presented in Table 4.

**Table 4. Independent Samples t-Test and Levene's Test for Equality of Variances (Primary Care vs. Specialist Care)**

| **Performed** | **Mean DLQI Difference** | **Levene's Test Statistic** | **Levene's Test *p*-value** | ***t*-value** | **95% Confidence Interval (CI)** | ***p*-value** | **Statistical Significance** |
|---|---|---|---|---|---|---|---|
| Independent Samples t-Test | 0.99 | 2.12 | .149 | 1.51 | (0.32 to 2.30) | .136 | No |

## Odds Ratio & MCID Achievement

Analysis was conducted on patients receiving specialist care (n=39) and primary care (n=37). An MCID in DLQI, defined as a change of ≤ -3, was achieved by 10 patients in the specialist care group and 3 in the primary care group.

Statistical tests showed a significant difference in MCID achievement between care types ($\chi^2$ = 4.12, $p$ = .042). Patients in specialist care were approximately 3.91 times more likely to achieve a clinically meaningful improvement in DLQI than those in primary care (Table 5).

**Table 5: MCID and OR Results**

| **Metric** | **Specialist Care Group (n=39)** | **Primary Care Group (n=37)** | **Combined (n=76)** |
|---|---|---|---|
| Total Participants | 39 | 37 | 76 |
| Achieved MCID (DLQI ≤ -3), n (%) | 10 (25.6%) | 3 (8.1%) | 13 (17.1%) |
| Chi-square Test (Independence) | $\chi^2$ = 4.12, $p$ = .042 | | |
| Odds Ratio (95% CI) | OR=3.91 (0.98 to | | |

| | | | |
|---|---|---|---|
| | 15.57) | | |

## Correlation Analysis in Primary Care Group

The analysis of the primary care group revealed no significant correlation between PASI scores and DLQI change ($r$ = 0.15, $p$ = .384). However, a moderate negative correlation was observed between the number of e-consultations (defined in this paper as the presence of collaborative care) between PCP and specialist and DLQI change ($r$ = -0.34, $p$ = .040), suggesting that more e-consultations were associated with a greater decrease in DLQI change score. These key findings are summarized in Table 6.

**Table 6: Correlation Analysis (Pearson's r and two-tailed P value) among Primary Care Group**

| Variable | DLQI change | PASI | Sex | Age | Associated Diseases | E -consultation | Years since onset |
|---|---|---|---|---|---|---|---|
| DLQI change | — | | | | | | |
| *r* | — | | | | | | |
| *P* value | — | | | | | | |
| PASI | 0.147 | — | | | | | |
| *r* | 35 | — | | | | | |
| *P* value | .384 | — | | | | | |
| Sex | 0.207 | 0.061 | — | | | | |
| *r* | 35 | 35 | — | | | | |
| *P* value | .22 | .722 | — | | | | |
| Age | -0.235 | 0.039 | -0.128 | — | | | |
| *r* | 35 | 35 | 35 | — | | | |
| *P* value | 0.161 | 0.817 | 0.452 | — | | | |
| Associated Diseases | 0.033 | 0.046 | -0.136 | -0.006 | — | | |
| *r* | 35 | 35 | 35 | 35 | — | | |
| *P* value | .845 | .787 | .423 | .971 | — | | |
| E-consultation | -0.339 | -0.198 | -0.184 | -0.034 | -0.104 | — | |
| *r* | 35 | 35 | 35 | 35 | 35 | — | |
| *P* value | **.04** | .24 | .275 | .841 | .538 | — | |
| Years since onset | -0.009 | 0.115 | 0.036 | -0.263 | 0.171 | 0.297 | — |
| *r* | 35 | 35 | 35 | 35 | 35 | 35 | — |
| *P* value | .958 | .5 | .834 | .116 | .313 | .074 | — |

## Case series analysis at the primary care level

Three cases were included in further case series analysis to reveal potential patterns and understandings of patient remote management at the primary care level.

### *Case 1*

A woman in her sixties with mild (PASI 0.6) psoriasis and a baseline DLQI score of 16.0 points was enrolled in remote monitoring during the summer period and had been living for two years with the

disease on set.

The patient's DLQI score decreased by -6.5 during the remote monitoring period. Treatment was managed by a large 10-PCP office with a nurse-led approach. The patient reported overall satisfaction with the remote monitoring service and its user experience (SUS score = 85), mentioned a sense of security, and suggested that she would rather continue with remote monitoring. The patient also suggested that remote monitoring did not reduce the need to visit a healthcare provider in person.

The patient reported that no one actively contacted her during the remote monitoring period, corroborated by an interview with the leading care provider at the PCP clinic. No known psoriasis comorbidities were detected during the study period. Additionally, no medications for psoriasis were prescribed during or before the study period, and no collaborative care episodes, such as e-consultations with specialists-dermatologists, were conducted during the study period by the PCP office for this patient. However, 21 days before the start of remote monitoring, the patient was prescribed methylprednisolone and bilastine for allergic reactions.

### *Case 2*

A man in his forties with mild (PASI 0.2) psoriasis and a baseline DLQI score of 11.0 points. Patient was enrolled in remote monitoring during the spring period and had been living 16 years with the disease on set.

During the remote monitoring period, his DLQI score decreased by -8.3 points. The patient was treated by a medium-sized 5-PCP office with a PCP-led approach. The patient reported overall satisfaction with the remote monitoring service and its user experience (SUS score = 70). The patient mentioned that he would like to continue with the remote care model structure and monitoring. He also suggested that remote monitoring reduced the need to visit a healthcare provider in person and helped him better manage his psoriasis.

The patient also reported that he was actively contacted during the remote monitoring period, corroborated by an interview with the leading care provider of that PCP clinic. No known psoriasis comorbidities were detected during the study period. Eight prescriptions for psoriasis medication were prescribed by the doctor and retrieved by the patient, including Calcipotriol + Betamethasone and Mometasone in the first months of the monitoring period and Methotrexate 4 months after the remote monitoring start and after the conclusion of the e-consultations with specialists-dermatologists. Four collaborative care episodes, such as e-consultations with specialists, were done during the study period by the PCP office for this patient.

### *Case 3*

A woman in her forties with mild (PASI 0.5) psoriasis and a baseline DLQI of 8.0 points. Patient was enrolled in remote monitoring during the summer period and had been living for four years with the disease on set.

During the remote monitoring period, there was a reduction of -3.3 points in her DLQI score. Patient treatment was managed by a large 10-PCP office with a nurse-led approach. Patient reported overall satisfaction with the remote monitoring service and its user experience (SUS score = 72.5). Patient found the explanations from the healthcare providers clear and sufficient, felt well-informed about how to seek help, and appreciated the ability to express opinions or ask questions about her treatment. The patient was satisfied with the speed of in-person and remote appointments and noted that the remote monitoring helped manage psoriasis better, reducing the need for in-person visits. She expressed a desire to continue with remote monitoring after the pilot period.

The PCP office did not conduct collaborative care episodes, such as e-consultations with specialist-dermatologists, during the study period for that patient.

## Discussion

## Summary of Key Findings

This study employed a mixed-methods approach to explore the feasibility and effectiveness of remote monitoring for psoriasis across primary and specialist care settings and to identify factors contributing to better QoL outcomes at the primary care level.

### *Comparative effectiveness of remote psoriasis management*

A comparative analysis measured the effectiveness of remote psoriasis management at both primary and secondary care levels. Consistent with previous studies [1, 23], the findings suggest that remote monitoring improves QoL in specialist care settings. However, improvements in primary care remain limited [20], reflecting systemic challenges such as insufficient training, limited confidence, inadequate resources, and inconsistent guideline adherence among PCPs [18, 19, 52].

This study extended prior insights from in-person care to remote management, finding that patients in specialist care were 3.91 times more likely to achieve clinically meaningful DLQI improvements than those in primary care. These disparities align with earlier findings [19, 20, 50], showing that PCPs are less likely to deliver consistent, guideline-based care due to gaps in knowledge and training [18-20]. Addressing these gaps through standardized guidelines could help ensure consistent care quality across primary and specialist settings, as supported by previous research [53].

### *Collaborative care impacts outcomes at the primary care level*

Current study also explored factors influencing QoL outcomes at the primary care level. Previous research demonstrates that tools like e-consultations enhance PCP capacity to manage psoriasis [6, 10, 23]. Structured referral protocols with frequent e-consultations have been shown to improve PCP confidence and patient QoL [10], while digital workflows reduce delays and improve outcomes [54].

In this study, PCPs could use e-consultations to collaborate with specialists. A correlation analysis found a moderate negative relationship between e-consultation frequency and DLQI change ($r = -0.339$, $p = 0.040$), supporting the role of frequent specialist involvement in improving outcomes [55, 56]. Similarly, the lack of significant correlation between PASI and DLQI change ($r$ =0 .142, $p$ = .384) in the primary care group aligns with previous research [3, 57] suggesting that QoL improvements may depend more on psychosocial support and treatment adherence than on clinical severity. This underscores the need to incorporate patient-centered care models alongside traditional severity metrics. A case-series example illustrated a patient achieving clinically meaningful DLQI improvement (MCID ≤-3) through multiple collaborative care interventions. The lack of standardized collaborative care protocols in the pilot study may have limited the consistency of these benefits.

### *Variability in remote care management practices at the primary care level*

The case series analysis highlighted variability in remote care management among PCPs, which aligns with prior studies showing inconsistent practices in primary care psoriasis management [19, 20]. Some patients were managed solely by PCPs, while others were monitored by nurses, reflecting disparities in care approaches. However, the analysis did not identify consistent patterns linking management practices to QoL improvements. These findings reinforce the need for clear, protocol-driven collaborative care models to standardize remote monitoring practices and improve outcomes.

## Limitations

As a mixed-methods study, it had to balance quantitative and qualitative data and integrate several complementary research methods, which introduced complexities in design and execution and increased the risk of bias [58].

The relatively small sample size (n=76) reduces the generalizability of the findings on [5] comparative effectiveness analysis and correlation analysis. A larger sample can provide more robust data and enable more definitive conclusions about differences in QoL outcomes between specialist and primary care settings [1]. Thus, it lacks control for confounding factors, such as variations in psoriasis severity and treatment adherence [5, 7], which could be better addressed through

randomization in future research.

The study included a case series analysis to detect factors and patterns. The case-series analysis did not reveal a common pattern that could contribute to QoL improvement at primary care level psoriasis remote monitoring patients. It also did not disprove the potential factors shown in the existing literature and our correlation analysis. The remote monitoring pilot had not prescribed clear protocols of collaborative care or referral practices. Thus, these factors were researched based on quantitative public claims data and by employing less rigorous explorative methods.

Variability in remote care management approaches among PCPs, combined with the absence of clear collaborative care protocols, may have limited the consistency and rigor of outcomes observed in this study.

Based on this, one can clearly conclude that any remote monitoring study conducted across different care levels (primary and specialist care) should rigorously consider the effect on QoL of the healthcare system's referral practices, e.g., are there any general referral, e-consultation, or collaborative care elements already a part of the healthcare system. This should be considered, and the protocol for using such referral practices should be clearly outlined for such study participants.

This is the first study of its kind to compare publicly reimbursed remote psoriasis monitoring at both specialist and primary care levels while also evaluating collaborative care tools such as e-consultations and standardized referral protocols for improving patient outcomes. Its limitations provide a foundation for future research, which should address these limitations through well-powered randomized controlled trials that account for this study's factors and learning points.

## Suggestions for Future Research

Future studies should prioritize the development of structured collaborative care models, such as standardized e-consultations, to enhance PCP-led psoriasis management. Another promising avenue for research is leveraging public claims data to analyze care processes and identify patterns in referral and treatment behaviors. As noted in prior studies, investigating the psychological effects of remote monitoring could provide insights into how these interventions impact patient security and reassurance.

Moreover, future research should explore variations in care design and compare the effectiveness of nurse-led, PCP-led, and collaborative approaches. Randomized controlled trials with more extensive and diverse populations are essential to validate findings and deepen our understanding of how remote monitoring can improve QoL outcomes, particularly in primary care settings.

## Conclusion

With limited specialist access, PCPs play an important role in managing psoriasis, highlighting the importance of providing them with appropriate tools and support. Collaborative practices, such as e-consultations and standardized referral protocols, can enhance care coordination and complement specialist expertise. Supporting PCPs through improved resources and guidance can contribute to better patient outcomes, particularly in resource-constrained settings.

This study offers unique insights by directly comparing remote monitoring outcomes between specialist and primary care settings. It shows how primary care, when supported by structured resources, can approach specialist-level effectiveness. However, primary care remote management yields less significant improvements, reflecting systemic challenges seen in in-person PCP-led care.

These findings highlight the potential of integrating specialist involvement into PCP-led care through standardized e-consultation practices. Leveraging public claims data in a mixed-methods approach underscores the need for collaborative care models to ensure consistent quality. Further research should refine and implement these models to optimize remote psoriasis management in primary care.

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## Conflicts of interest

Priit Kruus, Riina Hallik, Külli Kingo, and Peeter Ross hold stocks or stock options in the company responsible for providing the remote monitoring software. Some authors (Liisi Raam, Oliver Taul, Liis Ilves, Kaisa Viljar, and Pille Kanno) received financial support for providing the service and participating in the study.

## Abbreviations

CCH: Collaborative Connected Health

CI: Confidence Interval

DLQI: Dermatology Life Quality Index

IPC: International Psoriasis Council

MCID: Minimal clinically important difference

OR: Odds Ratio

PASI: Psoriasis Area Severity Index

PCPs: Primary Care Providers

QoL: Quality of Life

SD: Standard Deviation

SUS: System Usability Scale

TD: Teledermatology

## References

1. Ford AR, Gibbons CM, Torres J, et al. Access to dermatological care with an innovative online model for psoriasis management: Results from a randomized controlled trial. Telemed J E Health. 2019;25(7):619-27. PMID:30222518. DOI:10.1089/tmj.2018.0160.
2. Zhu B, Wang Y, Zhou X, et al. A controlled study of the feasibility and efficacy of a cloud-based interactive management program between patients with psoriasis and physicians. Med Sci Monit. 2019;25:970-6. PMID:30713334. DOI:10.12659/msm.913304.
3. Bhosle MJ, Kulkarni A, Feldman SR, Balkrishnan R. Quality of life in patients with psoriasis. Health Qual Life Outcomes. 2006;4:35. PMID:16756666. DOI:10.1186/1477-7525-4-35.
4. Young PM, Chen AY, Ford AR, Cheng MY, Lane CJ, Armstrong AW. Effects of online care on functional and psychological outcomes in patients with psoriasis: A randomized controlled trial. J Am Acad Dermatol. 2023;88(2):364-70. PMID:31175908. DOI:10.1016/j.jaad.2019.05.089.
5. Mazzotti E, Picardi A, Sampogna F, et al. Sensitivity of the dermatology life quality index to clinical change in patients with psoriasis. Br J Dermatol. 2003;149(2):318-22. DOI:10.1046/j.1365-2133.2003.05378.x.
6. Havelin A, Hampton P. Telemedicine and e-health in the management of psoriasis: Improving patient outcomes - a narrative review. Psoriasis (Auckl). 2022;12:15-24. PMID:35320971. DOI:10.2147/ptt.S323471.
7. Strober BE, van der Walt JM, Armstrong AW, et al. Clinical goals and barriers to effective psoriasis care. Dermatol Ther (Heidelb). 2019;9(1):5-18. PMID:30578464. DOI:10.1007/s13555-018-0279-5.
8. Roca S, Almenara M, Gilaberte Y, et al. When virtual assistants meet teledermatology: Validation of a virtual assistant to improve the quality of life of psoriatic patients. Int J Environ Res Public Health. 2022;19(21):14527. PMID:PMC9655501. DOI:10.3390/ijerph192114527.
9. Armstrong AW, Chambers CJ, Maverakis E, et al. Effectiveness of online vs in-person care for adults with psoriasis: A randomized clinical trial. JAMA Network Open. 2018;1(6):e183062-e. DOI:10.1001/jamanetworkopen.2018.3062.
10. Chambers CJ, Parsi KK, Schupp C, Armstrong AW. Patient-centered online management of psoriasis: A randomized controlled equivalency trial. J Am Acad Dermatol. 2012;66(6):948-53. PMID:21890236. DOI:10.1016/j.jaad.2011.05.047.
11. Armstrong AW, Ford AR, Chambers CJ, et al. Online care versus in-person care for improving quality of life in psoriasis: A randomized controlled equivalency trial. J Invest Dermatol. 2019;139(5):1037-44. PMID:30481495. DOI:10.1016/j.jid.2018.09.039.
12. Parsi K, Chambers CJ, Armstrong AW. Cost-effectiveness analysis of a patient-centered care model for management of psoriasis. J Am Acad Dermatol. 2012;66(4):563-70. DOI:10.1016/j.jaad.2011.02.022.
13. Armstrong AW, Dorer DJ, Lugn NE, Kvedar JC. Economic evaluation of interactive teledermatology compared with conventional care. Telemedicine and e-Health. 2007;13(2):91-9. DOI:10.1089/tmj.2006.0035.
14. Weinberg V, van Haren E, Gombert-Handoko KB. Improving patient access to hospital pharmacists using econsults: Retrospective descriptive study. JMIR Form Res. 2023;7:e38518. PMID:36705957. DOI:10.2196/38518.

15. Armstrong AW, Johnson MA, Lin S, Maverakis E, Fazel N, Liu F-T. Patient-centered, direct-access online care for management of atopic dermatitis: A randomized clinical trial. JAMA Dermatology. 2015;151(2):154-60. DOI:10.1001/jamadermatol.2014.2299.
16. Liddy C, Moroz I, Mihan A, Nawar N, Keely E. A systematic review of asynchronous, provider-to-provider, electronic consultation services to improve access to specialty care available worldwide. Telemedicine and e-Health. 2018;25(3):184-98. DOI:10.1089/tmj.2018.0005.
17. El Komy MHM, Chiricozzi A, van de Kerkhof P, et al. Telemedicine and psoriasis: A review based on statements of the telemedicine working group of the international psoriasis council. JEADV Clin Pract. 2023;2(1):19-31. DOI:10.1002/jvc2.93.
18. Kumar S, Flood K, Golbari NM, Charrow AP, Porter ML, Kimball AB. Psoriasis: Knowledge, attitudes and perceptions among primary care providers. J Am Acad Dermatol. 2021;84(5):1421-3. DOI:10.1016/j.jaad.2020.05.151.
19. Wade AG, Crawford GM, Young D, Leman J, Pumford N. Severity and management of psoriasis within primary care. BMC Fam Pract. 2016;17(1):145. DOI:10.1186/s12875-016-0544-6.
20. Kim WB, Jerome D, Yeung J. Diagnosis and management of psoriasis. Can Fam Physician. 2017;63(4):278-85. PMID:28404701.
21. Nawaz S, Tapley A, Davey AR, et al. Management of a chronic skin disease in primary care: An analysis of early-career general practitioners' consultations involving psoriasis. Dermatol Pract Concept. 2021;11(3):e2021055. PMID:34123559. DOI:10.5826/dpc.1103a55.
22. Déruaz-Luyet A, N'Goran AA, Pasquier J, et al. Multimorbidity: Can general practitioners identify the health conditions most important to their patients? Results from a national cross-sectional study in switzerland. BMC Fam Pract. 2018;19(1):66. DOI:10.1186/s12875-018-0757-y.
23. (Tervisekassa) HIF. Health insurance fund pilot project final report: Remote monitoring of psoriasis using dermtest image viewer software (version 1.1). 2023.
24. Bashyam AM, Feldman SR. Dermatology life quality index: Does improving the instrument make it better? Br J Dermatol. 2020;182(5):1082-3. DOI:10.1111/bjd.18598.
25. FINLAY AY, KHAN GK. Dermatology life quality index (dlqi)—a simple practical measure for routine clinical use. Clin Exp Dermatol. 1994;19(3):210-6. DOI:10.1111/j.1365-2230.1994.tb01167.x.
26. Van Voorhees AS, Stein Gold L, Lebwohl M, et al. Efficacy and safety of apremilast in patients with moderate to severe plaque psoriasis of the scalp: Results of a phase 3b, multicenter, randomized, placebo-controlled, double-blind study. J Am Acad Dermatol. 2020;83(1):96-103. DOI:10.1016/j.jaad.2020.01.072.
27. Mazzotti E, Barbaranelli C, Picardi A, Abeni D, Pasquini P. Psychometric properties of the dermatology life quality index (dlqi) in 900 italian patients with psoriasis. Acta Derm Venereol. 2005;85(5):409-13. DOI:10.1080/00015550510032832.
28. Whited JD. Teledermatology research review. Int J Dermatol. 2006;45(3):220-9. PMID:16533219. DOI:10.1111/j.1365-4632.2004.02427.x.
29. Carlin CS, Feldman SR, Krueger JG, Menter A, Krueger GG. A 50% reduction in the psoriasis area and severity index (pasi 50) is a clinically significant endpoint in the assessment of psoriasis. J Am Acad Dermatol. 2004;50(6):859-66. DOI:10.1016/j.jaad.2003.09.014.
30. Shikiar R, Harding G, Leahy M, Lennox RD. Minimal important difference (mid) of the dermatology life quality index (dlqi): Results from patients with chronic idiopathic urticaria. Health Qual Life Outcomes. 2005;3:36. PMID:15907211. DOI:10.1186/1477-7525-3-36.
31. Basra MK, Salek MS, Camilleri L, Sturkey R, Finlay AY. Determining the minimal clinically important difference and responsiveness of the dermatology life quality index (dlqi): Further data. Dermatology. 2015;230(1):27-33. PMID:25613671. DOI:10.1159/000365390.
32. Ma Q, Chung H, Shambhu S, et al. Administrative claims data to support pragmatic clinical trial outcome ascertainment on cardiovascular health. Clinical Trials. 2019;16(4):419-30. PMID:31081367. DOI:10.1177/1740774519846853.

33. Birnbaum HG, Cremieux PY, Greenberg PE, LeLorier J, Ostrander JA, Venditti L. Using healthcare claims data for outcomes research and pharmacoeconomic analyses. Pharmacoeconomics. 1999;16(1):1-8. PMID:10539118. DOI:10.2165/00019053-199916010-00001.
34. Snyder AM, Chen SC, Chren MM, et al. Patient-reported outcome measures and their clinical applications in dermatology. Am J Clin Dermatol. 2023;24(4):499-511. PMID:36723756. DOI:10.1007/s40257-023-00758-8.
35. Papp KA, Blauvelt A, Kimball AB, et al. Patient-reported symptoms and signs of moderate-to-severe psoriasis treated with guselkumab or adalimumab: Results from the randomized voyage 1 trial. J Eur Acad Dermatol Venereol. 2018;32(9):1515-22. PMID:29512196. DOI:10.1111/jdv.14910.
36. Tinazzi I, Adami S, Zanolin EM, et al. The early psoriatic arthritis screening questionnaire: A simple and fast method for the identification of arthritis in patients with psoriasis. Rheumatology (Oxford). 2012;51(11):2058-63. PMID:22879464. DOI:10.1093/rheumatology/kes187.
37. Brooke J. Sus -- a quick and dirty usability scale. 1996. p. 189-94.
38. (Tervisekassa) HIF. Primary health care. Estonia: Estonia: Health Insurance Fund (Tervisekassa); [cited 2024 Sep 4]; Available from: https://www.tervisekassa.ee.
39. Koop C, Kruus P, Hallik R, et al. A country-wide teledermatoscopy service in estonia shows results comparable to those in experimental settings in management plan development and diagnostic accuracy: A retrospective database study. JAAD Int. 2023;12:81-9. PMID:37288150. DOI:10.1016/j.jdin.2023.02.019.
40. Kim HY. Statistical notes for clinical researchers: The independent samples t-test. Restor Dent Endod. 2019;44(3):e26. PMID:31485422. DOI:10.5395/rde.2019.44.e26.
41. Zhou Y, Zhu Y, Wong WK. Statistical tests for homogeneity of variance for clinical trials and recommendations. Contemp Clin Trials Commun. 2023;33:101119. PMID:37143826. DOI:10.1016/j.conctc.2023.101119.
42. Rosner B, Glynn RJ, Lee ML. The wilcoxon signed rank test for paired comparisons of clustered data. Biometrics. 2006;62(1):185-92. PMID:16542245. DOI:10.1111/j.1541-0420.2005.00389.x.
43. Mishra P, Singh U, Pandey CM, Mishra P, Pandey G. Application of student's t-test, analysis of variance, and covariance. Ann Card Anaesth. 2019;22(4):407-11. PMID:31621677. DOI:10.4103/aca.ACA_94_19.
44. Mishra P, Pandey CM, Singh U, Gupta A, Sahu C, Keshri A. Descriptive statistics and normality tests for statistical data. Ann Card Anaesth. 2019;22(1):67-72. PMID:30648682. DOI:10.4103/aca.ACA_157_18.
45. Szumilas M. Explaining odds ratios. J Can Acad Child Adolesc Psychiatry. 2010;19(3):227-9. PMID:20842279.
46. McHugh ML. The chi-square test of independence. Biochem Med (Zagreb). 2013;23(2):143-9. PMID:23894860. DOI:10.11613/bm.2013.018.
47. Miot HA. Correlation analysis in clinical and experimental studies. J Vasc Bras. 2018;17(4):275-9. PMID:30787944. DOI:10.1590/1677-5449.174118.
48. Murad MH, Sultan S, Haffar S, Bazerbachi F. Methodological quality and synthesis of case series and case reports. BMJ Evid Based Med. 2018;23(2):60-3. PMID:29420178. DOI:10.1136/bmjebm-2017-110853.
49. Kempen JH. Appropriate use and reporting of uncontrolled case series in the medical literature. Am J Ophthalmol. 2011;151(1):7-10.e1. PMID:21163373. DOI:10.1016/j.ajo.2010.08.047.
50. Ekstedt M, Nordheim ES, Hellström A, Strandberg S, Hagerman H. Patient safety and sense of security when telemonitoring chronic conditions at home: The views of patients and healthcare professionals - a qualitative study. BMC Health Serv Res. 2023;23(1):581. PMID:37340472. DOI:10.1186/s12913-023-09428-1.
51. Walker RC, Tong A, Howard K, Palmer SC. Patient expectations and experiences of remote monitoring for chronic diseases: Systematic review and thematic synthesis of qualitative studies. Int

J Med Inform. 2019;124:78-85. DOI:10.1016/j.ijmedinf.2019.01.013.
52. Nelson PA, Barker Z, Griffiths CE, Cordingley L, Chew-Graham CA. 'On the surface': A qualitative study of gps' and patients' perspectives on psoriasis. BMC Fam Pract. 2013;14:158. PMID:24138455. DOI:10.1186/1471-2296-14-158.
53. Young M, Aldredge L, Parker P. Psoriasis for the primary care practitioner. J Am Assoc Nurse Pract. 2017;29(3):157-78. DOI:10.1002/2327-6924.12443.
54. Kornmehl H, Singh S, Johnson MA, Armstrong AW. Direct-access online care for the management of atopic dermatitis: A randomized clinical trial examining patient quality of life. Telemedicine and e-Health. 2017;23(9):726-32. DOI:10.1089/tmj.2016.0249.
55. Katherine L, Saffan Q. Managing high frequency users of an electronic consultation system in primary care: A quality improvement project. BMJ Open Quality. 2021;10(2):e001310. DOI:10.1136/bmjoq-2020-001310.
56. Olayiwola JN, Potapov A, Gordon A, et al. Electronic consultation impact from the primary care clinician perspective: Outcomes from a national sample. J Telemed Telecare. 2019;25(8):493-8. PMID:29991315. DOI:10.1177/1357633x18784416.
57. Khoury LR, Skov L, Møller T. Facing the dilemma of patient-centred psoriasis care: A qualitative study identifying patient needs in dermatological outpatient clinics. Br J Dermatol. 2017;177(2):436-44. DOI:10.1111/bjd.15292.
58. Almalki S. Integrating quantitative and qualitative data in mixed methods research—challenges and benefits. Journal of Education and Learning. 2016;5:288. DOI:10.5539/jel.v5n3p288.

# Supplementary Files

# Multimedia Appendixes

Patient satisfaction questionnaire adapted from the Estonian Society of Family Physicians' standard questionnaire.
URL: http://asset.jmir.pub/assets/c19bc1fff95b631a6a787baca90d72d1.docx

CONSORT-EHEALTH checklist used for evaluating the completeness of reporting in the study.
URL: http://asset.jmir.pub/assets/a8bc57f7fa292797d6b7f3e6b2aead07.pdf