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SMARTWATCHES IN DERMATOLOGY - CURRENT APPLICATIONS AND ITS' POTENTIAL IN THE FUTURE

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ABSTRACT

Background: The rapid expansion of wearable technology led to the widespread adoption of smartwatches as tools for continuous health monitoring. These devices allow tracking of physiological and behavioral parameters such as heart rate, physical activity and sleep patterns. Although their clinical utility has been widely explored in many medical specializations, their potential role in dermatology remains relatively underinvestigated despite the high global prevalence of skin diseases.
Objective: This review aimed to evaluate current and potential applications of smartwatches in dermatology and to characterize selected smartwatch devices with regard to their health-related features with emphasis on parameters relevant to dermatology.
Methods: A narrative review of the literature was conducted focusing on studies investigating smartwatch use in dermatologic contexts. Additionally, two commercially available devices were characterized with regard to their health-monitoring capabilities and dermatologic relevance.
Results: Current evidence indicates several promising dermatologic applications of smartwatches. Motion sensors may enable objective monitoring of scratching behavior in patients with pruritic conditions like atopic dermatitis. Sleep monitoring functions provide insights into the relationship between sleep disturbances and skin health including changes in hydration, elasticity and overall skin quality. Furthermore, smartwatches capable of displaying ultraviolet radiation exposure may potentially support skin cancer prevention by encouraging sun-protective behaviors. Smartwatch-derived data may also complement teledermatology by providing continuous metrics that support remote monitoring and research.
Conclusions: Despite limited dermatology-specific functionalities, smartwatches show potential for symptom monitoring, lifestyle assessment and preventive dermatologic care. Their integration with teledermatology may enhance patient management through continuous objective data and improved remote monitoring.

KEYWORDS

Dermatology, Smartwatch, Wearable Device, Sleep Monitoring, Skin Cancer, Pruritus

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Introduction

In recent years, smartwatches have evolved from consumer-oriented electronic devices into widely used tools for health monitoring. The rapid development of wearable technology combined with growing interest in personalized and preventive healthcare has contributed to their increasing global adoption. Recent estimates suggest that more than 560 million people worldwide currently use smartwatches and this number is expected to continue increasing over the coming decade as wearable devices become more accessible and technologically advanced (Kumar, 2026). This rapid expansion reflects the growing integration of digital health technologies into everyday life and highlights a broader shift toward continuous and individualized health monitoring. Many smartwatch users rely on these devices to track essential physiological and behavioral parameters, including heart rate, physical activity and sleep patterns which can provide valuable insights into overall health and lifestyle. The advanced capabilities of modern smartwatches such as high-precision sensors, continuous biometric monitoring and algorithm-driven data analysis allow large volumes of health-related data to be collected in real time, creating new opportunities for their application in clinical practice and biomedical research.

While smartwatches have demonstrated usefulness in many areas of medicine, their clinical potential has been most thoroughly explored in cardiology. In particular, wearable devices have demonstrated considerable potential in the detection and monitoring of arrhythmias. Smartwatch technologies incorporating photoplethysmography and electrocardiographic sensors have been shown to aid in the identification of atrial fibrillation and other rhythm anomalies. A systematic analysis highlighted the diagnostic value of smartwatch-based monitoring for atrial fibrillation detection, suggesting that such devices may serve as helpful tools for early identification and long-term management of cardiovascular disorders (Elbey et al, 2021). These findings

illustrate the broader potential of wearable technologies to support disease screening, remote patient observation and preventive healthcare strategies.

In contrast, the application of smartwatches in dermatology remains relatively unexplored. This gap is particularly noteworthy considering the substantial global prevalence of skin diseases. Skin cancer represents one of the most frequently diagnosed malignancies worldwide, accounting for more than a million new cases each year (Bray et al, 2024). In addition, other dermatologic conditions affect a large part of the population. For example, acne vulgaris is estimated to affect approximately one in ten individuals globally, making it one of the most ubiquitous skin disorders (Alexis et al, 2024). Psoriasis, a chronic immune-mediated inflammatory disease, affects up to 2% of the global population and is associated with significant physical, psychological and socioeconomic burdens (Parisi et al, 2020). Given the high prevalence and often chronic nature of dermatologic conditions, there is an increasing interest in utilizing digital health technologies to support disease monitoring, patient self-management, and preventive care. Although modern smartwatches incorporate sensors capable of measuring physiological and environmental parameters, only a limited number of functionalities are currently tailored to dermatologic applications. Given the high incidence and often chronic nature of skin diseases, there is growing interest in applying digital health tools to facilitate disease monitoring, promote patient self-management and enable preventive interventions.

The aim of this review was to analyze the current and emerging applications of smartwatches in dermatology and to evaluate selected smartwatch devices with respect to their health-related functionalities, particularly those relevant to dermatological parameters.

Methodology

For the purpose of this review, the two leading smartwatch brands on the global market were identified and their most recent models were selected for a detailed analysis of health-related features. Information regarding device specifications, sensor capabilities and available functionalities was collected from the official websites of the respective manufacturers. Particular attention was paid to parameters with potential relevance for dermatologic monitoring including sensors for physiological metrics, activity tracking, sleep assessment and environmental exposure.

Subsequently, a comprehensive literature search was conducted using the PubMed database to evaluate the current and emerging applications of smartwatches in dermatology. The search strategy included a combination of the following keywords: “smartwatch”, “wearable device”, “dermatology”, “dermatologist”, “skin disease” and “skin condition”. A total of 42 articles were initially retrieved. Following a thorough screening process, studies that did not focus on dermatologic applications or were outside the scope of wearable health technology were excluded. Only several articles directly addressing the current and prospective use of smartwatches in dermatology were retained for detailed analysis. These studies provided insights into practical applications such as monitoring pruritus or sleep-related skin changes, highlighting both the current state of evidence and opportunities for future research.

Results

Data regarding the global smartwatch market share was obtained from Counterpoint Research. According to the third-quarter 2025 data, Apple and Huawei were identified as the two leading smartwatch vendors, holding the top positions in terms of global shipments (Kumar, 2026). Apple maintained its position as the market leader, accounting for 23% of the worldwide smartwatch shipment share, while Huawei held the second position with 17%. To provide a representative analysis of the health-related features offered by the leading brands, one of the most recent models from each company, Apple Watch Series 11 and Huawei Watch 5, were selected for detailed examination. Information regarding device specifications, notification capabilities and health measurement functionalities was systematically extracted from the official websites of both manufacturers. The analysis focused on features with potential clinical or wellness applications, particularly those relevant to monitoring physiological parameters and lifestyle factors. The evaluated parameters included: health sensors, continuous monitoring, blood pressure, heart rate, electrocardiogram (ECG), arterial stiffness, sleep tracking, sleep apnea, fitness tracking, steps, health summary feature and menstrual cycle tracking. By thorough interpretation of these functionalities, the analysis aimed to provide a comprehensive overview of the current capabilities of leading smartwatch devices in supporting health assessment and potential relevance to the field of dermatology.

Apple Watch Series 11

The smartwatch is equipped with a range of advanced sensors and algorithms that enable continuous monitoring of major health indicators. Key functionalities include heart rate tracking, wrist temperature measurement and motion detection, which together allow for ongoing assessment of vital physiological parameters. The device's Vitals app integrates these data into an overview of daily health, displaying metrics such as heart rate, respiratory rate, wrist temperature and sleep duration which enables users to track trends over time and identify deviations from their typical patterns. In addition, the smartwatch provides real-time alerts when multiple metrics fall outside normal ranges, facilitating early recognition of potential health problems.

One of the device's key innovations appears to be a hypertension detection algorithm which may identify signs of persistent high blood pressure and issue notifications of possible hypertension. This feature is particularly relevant in the context of global health. Approximately 1.4 billion individuals aged 30–79 were affected by hypertension in 2024, representing one-third of the global population within this age group (WHO, 2025). The smartwatch's ECG app enables the detection of atrial fibrillation, a potentially life-threatening cardiac arrhythmia, while the Heart Rate app provides alerts for tachycardia, bradycardia or irregular heart rhythms, thereby supporting timely medical evaluation.

Sleep monitoring is also integrated into the system. The sleep score serves as an objective indicator for evaluating and optimizing sleep quality by analyzing factors such as sleep duration, bedtime regularity and frequency of awakenings enabling comparison across consecutive nights. In addition, the device tracks respiratory patterns, generating alerts that may indicate sleep apnea or other sleep-related respiratory disturbances.

In terms of physical activity assessment, the Apple Watch Series 11 offers comprehensive fitness and activity tracking. It contains a wide range of workouts, continuously records exercise metrics, and presents progress visually through the Activity Rings system. Data is synchronized with the iPhone's Fitness app, facilitating long-term trend analysis, goal setting and personalized feedback. Real-time workout tracking is equipped with audio guidance and motivational cues enabling users to optimize performance, maintain engagement and enhance training outcomes. Collectively, these features position the Apple Watch as a comprehensive tool for continuous health monitoring, lifestyle management, and preventive care.

Huawei Watch 5

The Huawei Watch 5 features an advanced health monitoring system built around the multi-sensor X-TAP module which integrates ECG, photoplethysmography (PPG) and pressure-sensing technologies to provide rapid and accurate physiological measurements. Users can obtain key health indicators quickly by placing a finger on the X-TAP sensor, enabling efficient and on-demand assessments of vital signs. In addition to these measurements, the device provides continuous real-time monitoring of essential physiological parameters including heart rate, blood oxygen saturation (SpO2), respiratory indicators, skin temperature and stress levels. By combining on-demand readings with continuous biometric tracking, the Huawei Watch 5 allows for a comprehensive view of the user's health status throughout the day and night.

The device uses its X-TAP module and TruSleep technology to track total sleep duration, sleep stages and nighttime awakenings. It generates a sleep score summarizing overall sleep quality and monitors respiratory patterns, helping identify sleep breathing disturbances. However, it does not generate a notification of sleep apnea. Sleep data is visualized in the Huawei Health app enabling trend analysis and personalized feedback.

Health data is presented through the Health Insights and Health Glance features which provide structured summaries and visualizations that help users monitor trends and detect deviations from individual baseline values. The smartwatch also tracks Heart Rate Variability (HRV), a parameter that reflects fluctuations in the intervals between heartbeats. HRV is increasingly recognized as an indicator of cardiovascular risk, condition of autonomic nervous system, recovery status and stress levels, making it especially valuable for both clinical monitoring and lifestyle management (Tiwari, Kumar, Malik, Raj & Kumar, 2021).

In terms of fitness and activity tracking, the Huawei Watch 5 records daily activity levels, supports multiple workout modes and captures detailed training metrics enabling users to analyze performance trends and progress over time. The device synchronizes data with Huawei's Health app, allowing long-term tracking, goal setting and personalized feedback. Together, these features position the Huawei Watch 5 as a useful wearable for continuous health monitoring, lifestyle management and preventive care.

The summary and comparison of health-centered features of both smartwatches is displayed in Table 1.

Table 1. Health-focused features of Apple Watch Series 11 and Huawei Watch 5

Features	Apple Watch Series 11	Huawei Watch 5
Health sensors	Heart-rate sensor, ECG, wrist temperature sensor	X-TAP multi-sensor (ECG, PPG, pressure), heart-rate, SpO2, stress, temperature
Continuous Monitoring	Heart rate, SpO2, respiratory rate, temperature, sleep metrics	Heart rate, SpO2, stress, respiratory indicators, temperature
Blood pressure	Yes (with notifications)	No
Heart rate	Yes (with notifications)	Yes (with HRV)
ECG	Yes (with notifications)	Yes (with notifications)
Arterial stiffness	No	Yes
Sleep tracking	Yes	Yes
Sleep apnea	Yes (with notifications)	Yes
Fitness Tracking	Activity tracking, real-time workout tracking, personalized audio motivation	Activity tracking; performance analysis over time
Steps	Yes	Yes
Health summary	Vitals App (overnight overview)	Health Insights and Health Glance
Menstrual cycle	Yes	Yes

Dermatology-related health features

In Table 2 a comparison of dermatology-oriented features of the smartwatches is presented. Sunrise/sunset times and air quality are available on both devices while UV index is only accessible on Apple Watch.

Table 2. Dermatology-related features on Apple Watch Series 11 and Huawei Watch 5

Feature	Apple Watch Series 11	Huawei Watch 5
UV index	Yes	No
Sunrise/sunset time	Yes	Yes
Air quality	Yes	Yes

Discussion

The Smartwatch Market was valued at USD 35.29 billion in 2025 and it is projected to reach USD 91.96 billion by 2035 with steady growth in the upcoming decade. Ascending health awareness has played a major role in this development. Smartwatches are undergoing a transition from basic fitness tracking devices to comprehensive health monitoring systems. The continuous surveillance of major health parameters like heart rate, blood pressure, SpO2 or sleep quality provides real-time insights that support preventive care and informed health decisions (MetaTech Insights, 2025). Many of the physiological metrics tracked by smartwatches are clinically useful, especially in cardiology, including cardiovascular risk assessment, arrhythmia detection and monitoring during telerehabilitation (Bayoumy et al, 2021). This demonstrates the

potential for similar integration of dermatology-focused metrics, which could transform skin health monitoring in consumer wearables.

Pruritus

Pruritus is a common and often distressing symptom associated with numerous dermatologic conditions significantly impairing patients' quality of life. Persistent itching can lead to discomfort, sleep disturbances and psychological stress, making it an important clinical problem in dermatology. Dermatologic disorders frequently accompanied by pruritus include contact dermatitis, eczema, urticaria and neurodermatitis. However, pruritus is not only limited to primary skin diseases but may also occur as a symptom of systemic conditions including inflammatory and metabolic disorders, infections, neurological and endocrine diseases, psychiatric conditions and certain malignancies. In addition, dermatological diseases themselves may contribute to for instance sleep disturbances as symptoms such as nocturnal pruritus or pain can disrupt normal sleep patterns and reduce overall sleep quality (Song, Xian, Yang, Xiong, Lai & Zhong, 2018). Scratching, a behavioral response to itching, can further aggravate skin inflammation and worsen the underlying condition creating a vicious cycle of itch and skin damage.

Importantly, subjective patient-reported itch severity does not always correspond to actual scratching behavior. This discrepancy highlights the need for objective tools capable of monitoring scratching activity and providing more reliable data for clinical assessment. Accordingly, wearable technologies, including smartwatches, have recently been investigated as potential tools for the objective monitoring of pruritus. In one study, two pediatric patients with atopic dermatitis were monitored using an Apple Watch equipped with an accelerometer and a dedicated application, the Itch Tracker, designed to detect scratching activity (Sugiyama, Matsuzaki, Motomura, Hiramoto & Nakahara, 2025). The device recorded nocturnal wrist movements associated with scratching, enabling visualization and quantification of scratching episodes during sleep. The results revealed noticeable discrepancies between subjective reports of itch intensity and objectively measured scratching behavior. By visualizing these patterns, clinicians were able to evaluate changes in scratching activity before and after treatment thereby supporting more precise therapeutic decision-making. This study expanded upon the authors' earlier research which explored the relationship between nighttime scratching and sleep quality in children with atopic dermatitis (Sugiyama et al, 2023). The research revealed a positive correlation between the frequency of nocturnal scratching episodes and the severity of the disease. Moreover, increased scratching activity was associated with poorer sleep quality indicating that pruritus can significantly interfere with restorative sleep in affected individuals. In earlier evaluations, the scratching detection application demonstrated high sensitivity and positive predictive values supporting its potential usefulness as a reliable monitoring tool (Ikoma et al, 2019).

Although the available studies are limited by small sample sizes and short observation periods, the findings suggest that wearable devices such as smartwatches may become a practical and objective tool in everyday practice. Motion sensors and accelerometers enable detection of scratching episodes generating quantitative data that can complement subjective patient-reported symptoms. This could assist clinicians in evaluating disease activity and treatment response. Continuous monitoring may also allow the identification of patterns and potential triggers of pruritus in real-world settings. Furthermore, integration with mobile health applications and teledermatology platforms could facilitate remote patient monitoring and long-term symptom assessment. With further technological development and clinical validation, smartwatches may become valuable accessory tools in the management of pruritic dermatologic conditions.

Sleep monitoring and skin health

Sleep deprivation is a well-established risk factor for numerous adverse health outcomes. It has been strongly linked to the development of cardiovascular diseases, including hypertension, coronary heart disease and stroke. In addition, inadequate sleep is associated with a higher risk of metabolic disorders such as obesity or type 2 diabetes and it may increase vulnerability to psychological disturbances like heightened stress levels, anxiety and depressive symptoms (Shah et al, 2025). Beyond these systemic consequences, insufficient sleep can also negatively affect skin health. It has been associated with worsening of inflammatory skin conditions, impaired skin barrier function, decreased skin hydration and increased transepidermal water loss (TEWL). Chronic sleep deprivation may also accelerate visible signs of skin aging by disrupting normal processes of skin regeneration and repair. Importantly, the relationship between sleep and dermatological health is bidirectional. Many skin diseases themselves contribute to sleep disturbances as symptoms such as persistent pruritus, pain or discomfort can interfere with the ability to fall asleep and maintain normal sleep patterns (Afzal & Ali, 2023).

In a study by Jang et al. (2020), researchers investigated the effects of prolonged sleep restriction on skin characteristics in middle-aged women, employing Xiaomi smartwatches to objectively monitor sleep duration. Participants' sleep was reduced from 8 to 4 hours per night over six consecutive nights and the resulting changes in skin quality were evaluated. Skin hydration decreased markedly after a single night of sleep restriction and continued to decline over the six night period. Other parameters including skin gloss, texture, transparency, elasticity and wrinkle formation also deteriorated significantly with elasticity exhibiting one of the most pronounced reductions during researched sleep limitation. Certain characteristics, such as skin texture showed delayed impairment, becoming notably affected only after several days of restricted sleep. Similarly, another article by Jang et al. (2022) examined how sleep disruption caused by smartphone use before bedtime affects skin health in young women. Observed changes included reduced skin moisture, elevated sebum secretion, more pronounced flaking and a decline in shine, translucency and elasticity. Researchers utilized a smartwatch to track essential sleep metrics such as bedtime, wake-up time, overall sleep duration and the proportion of light sleep allowing for precise, real-time monitoring.

Together, these findings highlight the growing potential of smartwatches in dermatology by enabling continuous monitoring of sleep patterns, such as bedtime, wake-up time, proportion of light sleep and total sleep duration. In both studies, wearable devices provided reliable data allowing researchers to accurately capture behavioral and environmental factors that influence skin physiology and link them to measurable changes in skin hydration, elasticity, texture and overall quality. As wearable technology advances, these devices are increasingly valuable for studying lifestyle impacts on skin health and evaluating dermatological interventions.

Skin cancer

Data from Global Cancer Observatory (GLOBOCAN 2022) demonstrates that skin cancer was the 4th most commonly diagnosed cancer worldwide combining non-melanoma and melanoma cases. Nearly 130.000 people died from this disease. Nonmelanoma skin cancer, with basal cell carcinoma excluded, constitutes the most commonly diagnosed cancer in men and women in Australia and New Zealand and is also the leading malignancy among men in the United States (Bray et al, 2024). Ultraviolet radiation exposure is a dominant modifiable risk factor for skin cancer causing DNA damage that may initiate carcinogenesis. Both short-term, intense UV exposure (e.g. recreational sunbathing) and long-term, continuous exposure contribute to an increased risk of the cancer mentioned. Early-life sunburns and indoor tanning in young adulthood further amplify the vulnerability. Additionally, environmental conditions like latitude, altitude and cloud cover influence UV intensity with higher levels observed closer to the Equator, at greater elevations and under a clear sky. These factors underline the importance of sun protection and minimizing artificial UV exposure for prevention (Watson, Holman & Maguire-Eisen, 2016). Furthermore, UV radiation causes inflammation, premature skin aging, formation of wrinkles and pigmentary changes (D'Orazio, Jarrett, Amaro-Ortiz & Scott, 2013).

Recent research suggests that wearable UV sensors and potentially smartwatches could play a role in mitigating these risks by providing real-time UV exposure data and promoting protective behaviors. Longitudinal research has shown that using personal UV sensors can provoke sun-protective behaviors, such as reduced outdoor time and increased sunscreen use (Parsons et al, 2021). Although a randomized controlled trial in melanoma survivors found that wrist-worn UV sensors alone did not significantly transform patients' behavior (Vogel et al, 2023), a questionnaire study confirmed that wearable UV devices can be practical and acceptable for both adults and children, simultaneously raising awareness of UV risk (Nagelhout et al, 2020).

Although these studies did not directly assess smartwatches, many contemporary devices are equipped with environmental sensors capable of estimating UV exposure and providing real-time alerts. By displaying the UV index, these devices offer users valuable information about ultraviolet radiation levels, thereby supporting protective behaviors. Expanding on this functionality, future smartwatches could track cumulative UV exposure over days, weeks or months and integrate these data with other health metrics collected by wearable devices such as physical activity, sleep and heart rate. This would enable the delivery of personalized notifications and recommendations including reminders to reapply sunscreen, wear protective clothing or limit outdoor activity during periods of elevated UV risk. By combining continuous monitoring with individualized guidance, such systems could facilitate more proactive and preventive behaviors, ultimately enhancing skin health and reducing the long-term risk of skin cancer.

Remote dermatologic monitoring

Telemedicine, the delivery of healthcare services through digital communication technologies, has become an increasingly important approach in dermatology, offering new opportunities to improve access, efficiency and quality of care. Dermatologic evaluation relies heavily on visual assessment making the specialty particularly well-suited for remote consultation. Teledermatology has been shown to achieve diagnostic accuracy comparable to in-person visits in many clinical scenarios. Systematic reviews indicate that teledermatology can enhance access to specialist care, reduce waiting times, and lower healthcare costs. Additionally, it facilitates timely interventions, especially for patients in remote regions where access to dermatologic expertise may be limited (Chow et al, 2024). These benefits have been documented across a variety of settings, including primary care referrals, chronic skin conditions and post-treatment follow-ups, demonstrating that teledermatology is not only feasible but effective in routine clinical practice. Beyond video consultations and image-based assessments, wearable devices such as smartwatches are emerging as valuable tools to complement remote dermatologic care by capturing continuous, objective physiological and behavioral data. By integrating such data into teledermatology workflows, clinicians and researchers can gain a more comprehensive understanding of disease dynamics outside the clinic enabling more personalized and proactive management.

The SkinTracker system provides a clear example of how smartwatches can be incorporated into remote dermatology research (Jin et al, 2023). Developed for individuals with atopic dermatitis, the platform links a mobile application for patients with a web-based portal for researchers allowing participants to submit standardized symptom questionnaires and photographs without attending clinic visits. At the same time, the platform connects with an Apple Watch to continuously gather data on physical activity including steps taken, exercise duration, standing time and sleep patterns. This setup enables researchers to objectively track lifestyle behaviors that may influence disease activity and to examine how these factors relate to symptom severity and clinician-evaluated skin outcomes. By integrating wearable-derived metrics with patient-reported data and clinical assessments, SkinTracker provides a continuous, longitudinal view of dermatologic conditions.

Smartwatches support the early identification of symptom aggravation, facilitate objective monitoring of treatment effectiveness and help detect modifiable behavioral triggers. The automated, real-time data collection offered by these devices represents a notable improvement over traditional teledermatology methods, supporting more proactive and individualized care.

Conclusions

Smartwatches have firmly established themselves as comprehensive and increasingly sophisticated health-monitoring tools. They are capable of continuously tracking a wide range of physiological parameters with growing precision and reliability. Their successful application across multiple medical fields highlights the potential of wearable devices to support preventive care, early intervention and real-time health management. Moreover, they provide clinicians and patients with objective data that can complement traditional clinical assessments.

In dermatology, smartwatches present a still poorly researched but particularly promising opportunity. They can provide objective monitoring of symptoms such as pruritus, track sleep patterns that influence skin health and even estimate UV exposure to support strategies for skin cancer prevention. By capturing continuous, real-world data, these devices generate personalized insights that bridge the gap between subjective symptom reports and measurable behavioral and physiological patterns. This capability not only supports more informed treatment decisions but also facilitates longitudinal monitoring of disease activity, identification of triggers and evaluation of therapeutic interventions outside the clinic setting. As wearable technology continues to advance, future devices may incorporate more sophisticated sensors, predictive algorithms and personalized feedback mechanisms, further enhancing early detection, individualized treatment planning and patient engagement. Realizing the full potential of smartwatches in dermatology will require continued technological innovation, rigorous clinical research and validation of wearable-derived metrics against established dermatologic outcomes.

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