

# Adherence to a novel home phototherapy system with integrated features

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## Abstract

**Objective:** To measure adherence using a novel home UVB phototherapy system designed to promote adherence.

**Study Design:** A retrospective, observational study conducted to evaluate patients' adherence to a prescribed three-times-per-week treatment protocol using a novel home phototherapy system with integrated features designed to improve adherence.

**Methods:** Data was collected from 18 psoriasis patients, 27 vitiligo patients, and three atopic dermatitis patients using a novel home phototherapy system under normal use conditions. Adherence was also calculated using two alternative methods to allow for comparison between published phototherapy adherence studies.

**Results:** The median patient adherence (N=48) to treatment with the home phototherapy system was 80%. There were no significant differences in adherence between different ages, genders, or diseases (P>0.05). Early adherence (N=48) to the home phototherapy system was 90% and dichotomous adherence (N=32) was 71%.

**Conclusions:** By implementing a smartphone application and web-based portal with the home phototherapy system, patients have multiple mechanisms in place to ensure adherence.

of the problem has led to a conclusion that increasing the effectiveness of adherence interventions may have a far greater impact on the health of the population than any improvement in specific medical treatments [1-3]. Chronic dermatological diseases suffer from the same adherence problem, with one systematic review of literature finding adherence rates for psoriasis treatment reported in the range of 21.6%-66.6% [4]. Although adherence to phototherapy treatment for dermatological diseases has not been widely studied, there is evidence that outcome improvement is correlated with adherence [5].

There is a wide range of methods to measure adherence and no standard has been adopted. Self-reported adherence measurement is the least preferred method as it has been widely reported to overestimate adherence when compared to indirect methods [4, 6]. Indirect measurement methods can include measuring medication weights, counting prescription refills, or monitoring opening and closing of medication bottles. Direct measurement of adherence, while not always possible, provides the most precise measure of adherence [6]. Within these categories are continuous and dichotomous measurement methods. Continuous methods measure adherence of patients on a graduated scale. Dichotomous methods categorize patients as either adherent or non-adherent based on set criteria.

For phototherapy treatment of dermatological conditions, it is possible to directly measure adherence. Treatment records can be used for determining adherence for in-office phototherapy.

*Keywords: adherence, phototherapy, psoriasis, vitiligo*

## Introduction

Adherence to treatment for chronic diseases is a global problem with adherence estimated at 50% by the World Health Organization (WHO), [1]. The extent

For home phototherapy, adherence can be measured by using an electronic monitoring system connected to the treatment device or by using a system that has integrated record keeping. Despite the potential ability to directly measure adherence to phototherapy treatment, it has not been widely studied [7-9].

Interventions can improve treatment adherence, which may lead to improved outcomes [10, 11]. Clinical studies in which patients are encouraged to complete treatments are expected to increase adherence [8, 9, 12]. A retrospective follow-up analysis of a study demonstrating 100% adherence, found that adherence dropped to 55% after completion of the prospective study [9]. It is also possible to increase adherence by using reminders [12, 13]. A study evaluating the effect of treatment reminders for topical treatment of psoriasis, found that adherence could be increased from 38% to 65% using an App that provided reminders [13]. Adherence is also linked to patient preferences and patient satisfaction, so adherence may be improved by creating a better user experience [14, 15]. Studies have found that two or more interventions are more likely to be more successful than a single intervention [12].

This study aims to measure adherence to a 3x/week treatment plan using a novel home UVB phototherapy system designed to resolve known issues with conventional phototherapy, including adherence. The system features three unique functions intended to improve adherence. First, the system has an integrated App with schedule management and reminders that reside on the patient's smartphone. Second, the system includes a patient support program whereby patients are trained, encouraged, and monitored to support proper treatment and adherence. Third, the system enables patients to administer treatment at home with a simplified process that includes guidance for dose changes and progress assessment.

## Methods

This was a retrospective, observational study conducted to evaluate patients' adherence to a

prescribed three-times-per-week treatment protocol using a novel home phototherapy system with integrated features designed to improve adherence. Records for all patients that started treatment with the Clarify Medical Home Light Therapy System were collected on May 16, 2018. A total of 60 patients were reviewed. Only patients with 10 or more treatment sessions were included in the study, which resulted in 48 patients, 27 with vitiligo, 18 with psoriasis, and three with eczema. Ages ranged from 10 to 71 years old with patients under 18 having a parent or guardian responsible for their treatment.

Adherence was calculated for each patient by dividing the number of treatments the patient administered by the number of treatment opportunities they had. Treatment opportunities are defined as the number of times the patient was scheduled to use the device for treatment using the prescribed three-times-per-week treatment plan.

Adherence was also calculated using two alternative methods to allow for comparison between published phototherapy adherence studies. Early adherence was calculated by determining the percentage of patients that completed at least 7 treatments. Dichotomous adherence was calculated by determining the percentage of patients that completed at least two thirds of their scheduled treatments after 20 treatments.

## Results

Females made up 50% of subjects and 50% were male. Disease types included vitiligo (N=27),

**Table 1.** Median continuous adherence by patient group.

Group	Median Continuous Adherence
<b>Gender</b>	
Male (n=24)	79.3%
Female (n=24)	82.0%
<b>Age</b>	
Less than 30 (n=8)	86.6%
30 to 50 (n=27)	76.7%
50 and above (n=13)	91.7%
<b>Disease</b>	
Psoriasis (n=18)	81.5%
Vitiligo (n=27)	80.8%
Eczema (n=3)	76.9%
<b>Total (n=48)</b>	<b>80.4%</b>

psoriasis (N=18), and eczema (N=3). Patient ages ranged from 10-71. There were no significant differences between adherence for age, gender, or disease ( $P>0.05$ ), (**Table 1**). The median patient adherence to treatment using continuous methodology was 80% (N=48).

Using the early adherence methodology, adherence to treatment was 90%, with 43 of the 48 patients completing at least 7 treatments.

For the dichotomous method, 37 patients completed at least two thirds of their planned treatments, but only 22 of them had completed 20 treatments at the time of assessment. The other 15 were excluded from this calculation since they had not progressed far enough through their treatment course to be included. Less than two thirds of planned treatments were completed by 11 patients, but only 9 of them had enough treatment opportunities to determine that they would not meet the adherence criteria (**Figure 1**). The other two were excluded from this calculation. Of the 31 patients that met the inclusion criteria, 22 were adherent, resulting in a dichotomous adherence of 71%.

## Discussion

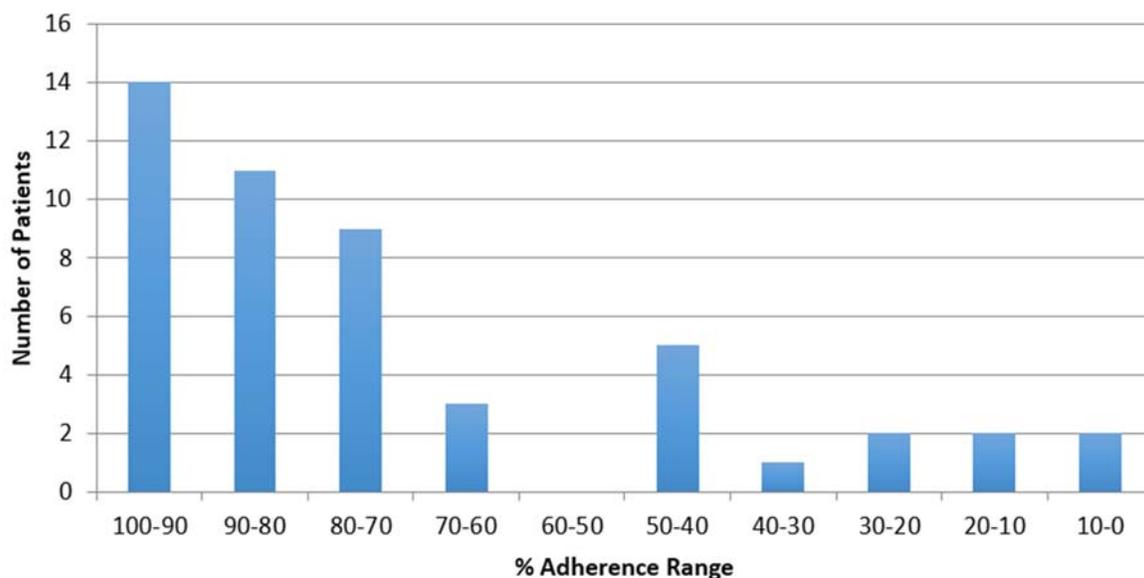
Adherence to phototherapy treatment for chronic skin conditions has not been widely studied [7-9]. A

major failing in the study of adherence is the lack of analysis under normal use conditions. This study evaluated adherence using a phototherapy system with integrated patient support, monitoring, and automatic collection of treatment records, so adherence could be assessed without any interventions that might influence the outcome.

The median patient adherence to the three-times-per-week treatment plan using the home phototherapy system was calculated using a continuous methodology at 80%. This was the primary method of measurement since continuous measurement is generally favored over dichotomous measurement [6]. Median adherence was used as an indicator instead of the mean as the distribution was not normal.

Early adherence is a measure of patient motivation to continue a treatment plan once started. In a retrospective study that measured early adherence at Brigham Women's Hospital Phototherapy Center, early adherence was defined as completing at least seven phototherapy sessions at the clinic [16]. Of the 479 patients included in the Brigham study analysis, 68% were adherent compared to 90% early adherence in this study using the same measurement process.

Dichotomous adherence measures the percentage of patients that are generally compliant over the



**Figure 1.** Patient adherence distribution. More than half the patients were more than 80% adherent.

course of the treatment plan [6]. This study used the same criteria for dichotomous adherence calculation as a retrospective study that measured psoriasis adherence at the Photomedicine Center in Vancouver. Adherence was defined as completing two of three treatments per week for 20 treatment sessions. Of the 851 psoriasis patients in the Vancouver study, 47% were adherent to the treatment plan as compared to 71% dichotomous adherence in this study using the same measurement process. The Vancouver study also assessed vitiligo adherence over a 60-week session, but the Clarify data could not be compared since patients had not yet been on the treatment for that period [7].

This study assessed patient adherence using a home phototherapy system with three integrated adherence control features. It is not clear what contribution resulted from each of the adherence control features. It also could not be determined if there were other features, such as the ability to administer treatment at home, that contributed towards the adherence result.

A limitation of the study was the variable number of treatment opportunities for patients. Treatment opportunities varied from 10 to 45 with an average of 28. Another limitation is that the sample size was not large enough to determine adherence differences for age, gender, and disease.

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## Conclusion

An at-home phototherapy system can reduce the obstacles of time, expense, and travel. It can provide the satisfaction of in office phototherapy. By implementing a smartphone application and web-based portal with the phototherapy system, patients have multiple mechanisms in place to ensure adherence.

## Potential conflicts of interest

SR Feldman has received research, speaking and/or consulting support from a variety of companies including Galderma, GSK/Stiefel, Almirall, Leo Pharma, Baxter, Boeringer Ingelheim, Mylan, Celgene, Pfizer, Ortho Dermatology, Taro, Abbvie, Cosmederm, Anacor, Astellas, Janssen, Lilly, Merck, Merz, Novartis, Regeneron, Sanofi, Novan, Parion, Qurient, National Biological Corporation, Caremark, Advance Medical, Sun Pharma, Suncare Research, Informa, UpToDate and National Psoriasis Foundation. He is founder and majority owner of [www.DrScore.com](http://www.DrScore.com) and founder and part owner of Causa Research, a company dedicated to enhancing patients' adherence to treatment. Emily Unrue, Alexandra Collins, and Abigail Cline have no conflicts to disclose.

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