Modeling the Effect of Shared Care to Optimize Acne Referrals From Primary Care Clinicians to Dermatologists

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Modeling the Effect of Shared Care to Optimize Acne Referrals From Primary Care Clinicians to Dermatologists

Kristina J. Liu, MD; Rebecca I. Hartman, MD, MPH; Cara Joyce, PhD; Arash Mostaghimi, MD, MPA, MPH

IMPORTANCE Access to dermatologists remains a nationwide challenge. Optimizing referrals to a dermatologist may reduce patient wait times.

OBJECTIVE To model the effect of algorithm-based acne treatment by primary care clinicians on referral patterns and costs.

DESIGN, SETTING, AND PARTICIPANTS Overall, 253 referrals from primary care clinicians to dermatologists for acne from January 2014 through March 2015 were reviewed at Brigham and Women’s Hospital. No-show rate, diagnostic concordance between primary care clinicians and dermatologists, treatment at the time of referral, and treatment by a dermatologist were ascertained, and we modeled 2 treatment algorithms—initiation of topical treatments by primary care clinicians (algorithm A) and initiation of topical treatments and oral antibiotics by primary care clinicians (algorithm B)—to identify the most effective referral patterns and costs.

MAIN OUTCOMES AND MEASURES The primary outcome was the elimination of unnecessary appointments with a dermatologist. Secondary outcomes included reduction in delay to treatment, health care cost savings, and decrease in no-show rate.

RESULTS Overall, 150 of 253 referred patients were seen and treated by a dermatologist; 127 patients (50.2%) were not on prescription acne treatment at the time of dermatology referral. Model A reduced initial referrals in 72 of 150 cases (48.0%), eliminated referrals in 60 of 150 cases (40%), and reduced average delay-to-treatment by 28.6 days. This resulted in cost savings of $20.28 per patient, reduction of wait time by 5 days per patient, and decreased the no-show rate by 13%. Model B reduced initial referrals in 130 of 150 cases (86.7%), eliminated referrals in 108 of 150 cases (72%), and reduced average delay-to-treatment by 27.9 days. This resulted in cost savings of $35.68 per patient, shortened wait time by 9 days per patient, and decreased the no-show rate by 24%.

CONCLUSIONS AND RELEVANCE Algorithm-based treatment of acne by primary care clinicians may eliminate unnecessary appointments, reduce wait time for treatment, lower costs, and reduce patient no-shows.

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Skin disease accounts for one-eighth of visits to primary care clinicians in the United States. Patients referred to dermatologists often have difficulty making appointments in a timely fashion, with an average wait time of 33.9 days before the first available visit.

Addressing inefficiencies in the referral process may improve access to dermatologic care. Reallocation of appropriate aspects of skin care to primary care clinicians may reduce wait times for dermatology appointments, allowing quicker access to care for other patients seeking dermatologic evaluation. Improving coordination of care in an era of accountable care organizations (ACO) targets the triple aim of improving patient satisfaction and quality of care while reducing overall system costs.

In this study, we model the effect of algorithm-based acne treatment by primary care clinicians on referrals to a dermatologist. Despite the high diagnostic concordance of acne between patients, referring physicians, and dermatologists, acne remains a common indication for referral to a dermatologist. The effect of primary care clinician education and management algorithms in reducing referrals to specialty care have been demonstrated for other diseases. Stepwise treatment algorithms for acne that can be implemented by a primary care clinician have been proposed in both the primary care and dermatology literature.

We hypothesize that application of an acne treatment algorithm by primary care clinicians can propel acne into a shared care environment that may reduce patient wait times to appropriate treatment, streamline the referral process, and decrease the number of referred patients who never see a dermatologist (no-shows).

Methods

Data Source

We conducted a retrospective review of all electronic referrals (eReferrals) completed by primary care clinicians within the Brigham and Women’s Hospital network from January 2014 through March 2015. The eReferral system is the standard system for internal referrals between primary care clinicians and specialists at our institution. The database includes the referring location, name of primary care clinician, reason for referral, referral urgency, response time (date the patient was contacted to date of scheduled appointment), and the outcome of the eReferral (scheduled vs declined).

A search of referral reasons for the term “acne” was performed. Each identified chart was manually evaluated to assess all topical and systemic treatments prescribed by the primary care clinician, whether the patient was evaluated by a dermatologist, diagnostic agreement between the primary care clinician and dermatologist, and all topical and systemic treatments prescribed by the dermatologist at the initial visit and over 6 months of treatment. Patient demographic information, including age, sex, race and education level, was obtained from hospital registration systems.

Additional primary care clinician demographic data, including type of provider (attending physician, resident physician, nurse practitioner, or physician’s assistant), years in practice, and medical specialty (of MD practitioners), were obtained from the Board of Registration in Medicine for the Commonwealth of Massachusetts. Partners Healthcare institutional review board approval was obtained for this study.

Statistical Analysis

Patient demographics and scheduling variables were compared between patients with a complaint of acne alone and patients with complaints of acne plus another dermatologic issue using χ² tests. Treatment prescribing patterns of the primary care clinicians were recorded as counts and percents. Similarly, counts and percents of treatments by primary care clinicians and by dermatologists were computed among patients who were referred by primary care clinician and ultimately evaluated by a dermatologist, and changes in treatment were assessed with the McNemar test.

We devised 2 acne treatment algorithms, one in which topical treatments were initiated by primary care clinicians instead of dermatologists (algorithm A) (Supplement), and a second in which topical treatments and systemic antibiotics were initiated by primary care clinicians instead of dermatologists (algorithm B) (Supplement). To estimate the effect of primary care clinician-initiated acne treatments, we applied each of these algorithms to the original eReferal acne data set and calculated ensuing reductions in dermatology appointments and delays to treatment.

We analyzed the treatments prescribed by a dermatologist for each patient over 6 months in the eReferal data set and then applied algorithms A and B to each patient. For example, if a patient’s acne was treated successfully with topical treatments alone, then applying algorithm A would obviate dermatology visits at all. If a patient required topical treatments initially and systemic antibiotics at later visits, then applying algorithm A would delay the initial dermatology visit, but a later dermatology visit would still be necessary to prescribe systemic antibiotics. Conversely, applying algorithm B...
Results

We identified 261 unique patient referrals that included “acne” within the reason for referral. We excluded 8 patients who were already being treated for acne by a dermatologist at the time of the referral (n = 3) or were not referred for acne (n = 5). Of 253 eligible patients, 170 were ultimately evaluated by a dermatologist; 151 were confirmed to have active acne and 150 were started on treatment. Of 253 eligible patients, 170 were ultimately evaluated by a dermatologist; 151 were confirmed to have active acne and 150 were started on treatment.

Hispanic white ethnicity. More than two-thirds (68.4%) of patients were referred for evaluation of acne alone, while the remainder were referred for acne and another dermatologic issue. No significant differences were identified between patients referred solely for acne or acne in addition to another dermatologic problem (Table 1).

Eighty-one percent of patients were referred from attending physicians, 11% from mid-level clinicians, and 8% from resident physicians. The median time between referral request and date of appointment was 19 days. No statistically significant difference was seen in scheduling time between the “acne” and “acne plus other” referral groups.

Treatment prescribing patterns by primary care clinicians showed that 127 patients (50.2%) received no topical or systemic treatment prior to referral to a dermatologist. In this setting, topical treatments included over-the-counter products, such as salicylic acid, that were specifically recommended by the primary care clinician. Among those who were treated, the most commonly used topical treatments were benzoyl peroxide (n = 59 [23.3%]), topical antibiotics (n = 49 [19.4%]), and topical retinoids (n = 33 [13.0%]). Overall, 30 patients (11.9%) were started on dual combination topical therapy, and 8 patients (3.2%) were started on triple combination topical therapy. Antibiotics were the most commonly prescribed systemic treatment (n = 42 [16.6%]) (Table 2).

We compared treatment patterns between primary care clinicians and dermatologists among patients who were evaluated by dermatology, confirmed to have acne, and started on treatment (n = 150) (Table 3). Nearly all (n = 150 of 151 [99.3%]) patients were initiated on either topical or systemic treatment after the initial dermatology visit (P < .001); 47 patients (31.3%) were started on triple combination topical therapy by a dermatologist compared with 7 patients (4.7%) by primary care clinicians (P < .001). Changes in prescribing patterns of all topical and systemic treatments were statistically significant except for the use of oral contraceptive pills (P = .74). Only 5 patients (3.3%) required escalation of treatment by dermatologists to isotretinoin.

### Table 1. Patient Demographics

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Overall (n = 253 [100%])</th>
<th>Acne (n = 173 [68.4%])</th>
<th>Acne + Other (n = 80 [31.6%])</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, No. (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18-24</td>
<td>59 (23.3)</td>
<td>43 (24.9)</td>
<td>16 (20.0)</td>
<td>.78</td>
</tr>
<tr>
<td>25-30</td>
<td>85 (33.6)</td>
<td>55 (31.8)</td>
<td>30 (37.5)</td>
<td></td>
</tr>
<tr>
<td>31-40</td>
<td>67 (26.5)</td>
<td>46 (26.6)</td>
<td>21 (26.3)</td>
<td></td>
</tr>
<tr>
<td>&gt;40</td>
<td>42 (16.6)</td>
<td>29 (16.8)</td>
<td>13 (16.3)</td>
<td></td>
</tr>
<tr>
<td>Sex, No. (%)</td>
<td></td>
<td></td>
<td></td>
<td>.59</td>
</tr>
<tr>
<td>Male</td>
<td>58 (22.9)</td>
<td>38 (22.0)</td>
<td>20 (25.0)</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>195 (77.1)</td>
<td>135 (78.0)</td>
<td>60 (75.0)</td>
<td></td>
</tr>
<tr>
<td>Race, No. (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-Hispanic white</td>
<td>114 (45.1)</td>
<td>75 (43.4)</td>
<td>39 (48.8)</td>
<td></td>
</tr>
<tr>
<td>Black</td>
<td>41 (16.2)</td>
<td>32 (18.5)</td>
<td>9 (11.3)</td>
<td>.38</td>
</tr>
<tr>
<td>Hispanic</td>
<td>67 (26.5)</td>
<td>45 (26.0)</td>
<td>22 (27.5)</td>
<td></td>
</tr>
<tr>
<td>Asian</td>
<td>16 (6.3)</td>
<td>9 (5.2)</td>
<td>7 (8.8)</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>15 (5.9)</td>
<td>12 (6.9)</td>
<td>3 (3.8)</td>
<td></td>
</tr>
</tbody>
</table>
Applying algorithm A (primary care clinicians initiate topical treatments) to our eReferral acne data set would reduce initial referrals by 48.0% (n = 72 patients) and eliminate referrals altogether for 60 patients (40.0%) (Table 4). The mean (SD) delay-to-treatment would be reduced by 28.6 (24.9) days. Applying algorithm B (primary care clinicians initiate both topical treatments and systemic antibiotics) would reduce initial referrals by 86.7% (n = 130 patients) and eliminate referrals for 108 patients (72.0%) (Table 4). Algorithm B would reduce the mean (SD) delay-to-treatment by 27.9 (27.6) days.

Assuming a new dermatology visit cost of $75.46 and a median wait time of 19 days, the original 253 identified eligible patients in our acne eReferral data set experienced a total of 170 dermatology appointments with 83 no-shows. These 170 visits would incur a cost of $12,828 with 3230 days of total wait time. The net cost per patient would be $50.70 with 13 days of wait time per patient and a 33% no-show rate.

If primary care clinicians adopted algorithm A and initiated topical treatments prior to referral, 40% of referrals would be eliminated, resulting in 102 dermatology appointments at a cost of $7697. This would provide a savings of $5131 compared with the current referral strategy. Patients would save an additional $2924 in opportunity costs associated with unnecessary visits. The total wait time would be decreased by 1292 days with 33 fewer no-shows. The net health care cost per patient would be $30.42 ($20.28 savings per patient) and per-patient wait time would be 8 days with a no-show rate of 20%.

Adoption of algorithm B would eliminate 72% of all referrals, resulting in a total of 48 dermatology appointments at a cost of $3622 and a savings of $9206 compared with the current referral strategy. Total wait time would be reduced by 2318 days with 60 fewer no-shows; patients would save $5246 in opportunity costs. The net health care cost per person would be $14.32 ($35.68 savings per patient) and per-person wait time would be 4 days with a no-show rate of 9%.

Discussion

In this study, we assessed prescribing patterns of primary care clinicians and dermatologists within our cohort and identified significant differences in the types and combinations of treatments prescribed. Overall, 127 of 253 patients (50.2%) were not on any prescription treatments, and 158 patients (62.5%) were not on any topical treatments prior to referral to a dermatologist. In comparison, 141 patients (94.0%) were placed on at least one prescription treatment (Table 3). Patients in the current referral strategy were more likely to be prescribed systemic treatments, particularly antibiotics, compared with patients in the shared-care strategy. Patients in the shared-care strategy were more likely to be prescribed topical treatments, particularly benzoyl peroxide, compared with patients in the current referral strategy.

Table 2. Treatments Prescribed by Primary Care Clinicians

<table>
<thead>
<tr>
<th>Topical treatment</th>
<th>Patients, No. (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benzoyl peroxide</td>
<td>59 (23.3)</td>
</tr>
<tr>
<td>Antibiotics</td>
<td>49 (19.4)</td>
</tr>
<tr>
<td>Retinoids</td>
<td>33 (13.0)</td>
</tr>
<tr>
<td>Other/OTC</td>
<td>39 (15.4)</td>
</tr>
<tr>
<td>No. of topical treatments</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>158 (62.5)</td>
</tr>
<tr>
<td>1</td>
<td>57 (22.5)</td>
</tr>
<tr>
<td>2</td>
<td>30 (11.9)</td>
</tr>
<tr>
<td>3</td>
<td>8 (3.2)</td>
</tr>
<tr>
<td>Systemic treatments</td>
<td></td>
</tr>
<tr>
<td>Antibiotics</td>
<td>42 (16.6)</td>
</tr>
<tr>
<td>OCP</td>
<td>8 (3.2)</td>
</tr>
<tr>
<td>Spironolactone</td>
<td>4 (1.6)</td>
</tr>
<tr>
<td>Isotretinoin</td>
<td>0</td>
</tr>
<tr>
<td>Overall treatment</td>
<td>127 (50.2)</td>
</tr>
<tr>
<td>Treatments only</td>
<td>12 (4.7)</td>
</tr>
<tr>
<td>Prescription topical</td>
<td>62 (24.5)</td>
</tr>
<tr>
<td>Systemic treatments</td>
<td>13 (5.1)</td>
</tr>
<tr>
<td>Topical + systemic treatment</td>
<td>39 (15.4)</td>
</tr>
</tbody>
</table>

Table 3. Treatments Prescribed for Patients Seen by Dermatology With Confirmed Acne

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Treatment by Primary Care Clinian</th>
<th>Initial Dermatology Treatment</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Topical</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>benzoyl peroxide</td>
<td>42 (27.8)</td>
<td>100 (66.2)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Antibiotics</td>
<td>39 (25.8)</td>
<td>90 (59.6)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Retinoids</td>
<td>29 (19.2)</td>
<td>97 (64.2)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Other/OTC</td>
<td>32 (21.2)</td>
<td>15 (9.9)</td>
<td>.004</td>
</tr>
<tr>
<td>No. of topical treatments</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>77 (51.0)</td>
<td>10 (6.6)</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>45 (29.8)</td>
<td>42 (27.8)</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>22 (14.6)</td>
<td>52 (34.4)</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>7 (4.6)</td>
<td>47 (31.1)</td>
<td></td>
</tr>
<tr>
<td>Systemic</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Antibiotics</td>
<td>32 (21.2)</td>
<td>57 (37.7)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>OCP</td>
<td>6 (4.0)</td>
<td>7 (4.8)</td>
<td>.74</td>
</tr>
<tr>
<td>Spironolactone</td>
<td>3 (2.0)</td>
<td>11 (7.3)</td>
<td>.02</td>
</tr>
<tr>
<td>Isotretinoin</td>
<td>0 (0.0)</td>
<td>5 (3.3)</td>
<td></td>
</tr>
<tr>
<td>Overall</td>
<td></td>
<td>52 (34.4)</td>
<td>1 (0.7)</td>
</tr>
<tr>
<td>Treatments only</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other/OTC</td>
<td>11 (7.3)</td>
<td>2 (1.3)</td>
<td></td>
</tr>
<tr>
<td>Prescription</td>
<td>48 (31.8)</td>
<td>70 (46.4)</td>
<td></td>
</tr>
<tr>
<td>Systemic</td>
<td>9 (6.0)</td>
<td>7 (4.6)</td>
<td></td>
</tr>
<tr>
<td>Topical + systemic treatment</td>
<td>31 (20.5)</td>
<td>71 (47.0)</td>
<td></td>
</tr>
</tbody>
</table>

Abbreviations: OCP, oral contraceptive pill; OTC, over the counter.
* Clindamycin, erythromycin, dapson, metronidazole.
* Salicylic acid, Proactiv, tea tree oil, azaleic acid, hexachlorophene.
* Does not include other/OTC.
* Doxycycline, minocycline, clindamycin, amoxicillin, trimethoprim-sulfamethoxazole, erythromycin, cephalexin, cefadroxil, azithromycin.
I prescription topical treatment at their initial dermatology visits. Application of either algorithm A or algorithm B by primary care clinicians would result in substantial reduction of referrals, yielding decreased health care costs, treatment delays, no-shows, and opportunity costs for patients.

These findings are consistent with prior reports that have demonstrated the effect of guideline interventions on referral patterns.\(^8\)\(^-\)\(^13\) In a Cochrane review\(^3\) of interventions employed to improve outpatient referrals, “dissemination of guidelines with structured referral sheets” was one of only two strategies shown to affect referral rates.

It is important to note that a dermatologist’s role in the treatment of acne must still be maintained. Experience from other similar efforts to transfer care from specialists to primary care clinicians has shown the effectiveness of reassigning clinical tasks to other team members to improve access to specialty care.\(^19\) Our model suggests that empowering primary care clinicians to manage mild to moderate acne will reduce inefficiencies in the referral process so patients can benefit from expedited access to dermatologists when needed, resulting in more timely diagnosis and treatment of dermatologic diseases.

These data must be interpreted in the context of our study design. Primary care is a limited resource, similar to dermatology. Our findings are extracted from and applicable to patients who already have access to primary care clinicians. While patients can be efficiently treated by presenting directly to a dermatologist, in many health plans, a referral from primary care is a requisite step that precludes this possibility. Furthermore, 235 patients (92.9%) in our cohort were being managed by their primary care clinicians for other health conditions in addition to acne. Given these other health concerns, the patients in our study would likely access their primary care clinician regardless of the problem of acne. Thus, the judicious use of primary care resources to manage acne as part of the holistic care of the patient can prove to be a time- and cost-saving strategy.

This is a single-center study, which may reflect only a subset of national referral and prescribing patterns. It will be important to replicate these results at other institutions. Additionally, this study does not include patients with acne who were managed by primary care clinicians without referrals to dermatology. These patients may possess differences in clinical presentation or management.

Another limitation of our study is the lack of reflection of patient preference in the referral decision-making process. It should be noted that 80 (31.6%) of the referrals in our study were for acne plus another dermatologic issue, and such patients likely require dermatologic evaluation regardless of primary care clinician-driven acne management.

Future research should aim to evaluate the acceptability and adoption of structured referral guidelines by primary care clinicians, including the amount of training required for implementing these systems, and the sustainability of any changes in practice. Primary care clinicians’ treatment decisions should be evaluated to ensure that patient safety and outcomes are not compromised. It remains to be seen whether expansion of this treatment model to more complicated acne cases (i.e., patients who are pregnant or require hormonal therapy) or other skin conditions is feasible and beneficial.

**Conclusions**

Our results indicate that algorithm-based treatment of mild to moderate acne by primary care clinicians could potentially alter referral patterns, streamlining patient care by reducing wait time for treatment and lowering overall costs. Future research is needed to validate these proposed guidelines as a prospective, quality-improvement intervention.

**Table 4. Application of Treatment Algorithm**

<table>
<thead>
<tr>
<th>Treatment Algorithm</th>
<th>Patients, No. (%)</th>
<th>Reduction of Delay in Receiving Treatment, Mean (SD), d</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patients, No. (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Initial Appointment Unnecessary</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No Appointment Necessary</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Topical treatments only</td>
<td>72 (48.0)</td>
<td>21.6 (24.9)</td>
</tr>
<tr>
<td>Topical + systemic antibiotics</td>
<td>130 (86.7)</td>
<td>27.9 (27.6)</td>
</tr>
</tbody>
</table>

**Abbreviation:** SD, standard deviation.

**References**

Sugaring—Modern Revival of an Ancient Egyptian Technique for Hair Removal

Victoria Lim, BS; Brian J. Simmons, BS; Eric L. Maranda, BS; Ladan Affifi, BS; Penelope J. Kallis, BS; Joaquin Jimenez, MD

The practice of hair removal dates as far back as 30,000 years. Over the centuries, hair removal technology has improved from the use of crude tools to advanced laser techniques. There are 2 main methods of hair removal: epilation and epilation. Epilation removes hair from the root and permits a longer period before hair regrowth, and the skin can be conveniently cleaned with water alone.2,3

In recent years, societal norms have shifted to prize the use of more natural ingredients, and this ancient Egyptian technique aligns well with these values. Consequently, sugaring has experienced a modern revival. More salons are offering the service to clients, and a variety of ready-made products are commercially available for use at home. Nonetheless, the beauty of sugaring lies in its simplicity, and the cost-effective ingredients further sweeten the deal.

Sugaring is a safe technique that has been practiced for centuries, can be done at home, and is ideal for most candidates limited by other hair removal methods.

Therefore, dermatologists should know about this simple technique to be able to inform their patients about an alternative hair removal option.

Author Affiliations: University of Miami, Miller School of Medicine, Department of Dermatology and Cutaneous Surgery, Miami, Florida.

Corresponding Author: Eric L. Maranda, BS, Department of Dermatology and Cutaneous Surgery, University of Miami, Miller School of Medicine, 1475 NW 12th Ave, Miami, FL 33136 (emaranda@med.miami.edu).