# Bundled payment for actinic keratosis management: Pilot evaluation of developed models

Joslyn S. Kirby, MD, MS, MEd,[a] Colleen F. Silva, MD,[b] Sara B. Ferguson, MD,[c]
David Shupp, MD,[c] James G. Marks, Jr, MD,[a] and Jeffrey J. Miller, MD, MBA[a]
*Hershey and State College, Pennsylvania; and Indianapolis, Indiana*

**Background:** There is an opportunity to explore alternate payment models in dermatology.

**Objective:** To pilot 2 bundled payment models for actinic keratosis (AK) management.

**Methods:** A prospective cohort study was conducted during September 2013-June 2016. Consecutive patients were recruited from clinics of 5 dermatologists. Patients had to be adults, have ≥1 year of care at the department, and have a history of AK. A bundled payment strategy was prospectively piloted for 1 year and compared with costs in the prior year.

**Results:** Overall, 400 participants were enrolled, and complete data was collected for 254 participants. During the year of bundled payments, actual total annual spending on claims was $70,557, whereas model 1 and model 2 bundled payment models would have totaled $67,310 and $74,422, respectively, for the patient cohort. Patient satisfaction surveys showed no difference in the quality of care.

**Limitations:** Single-center study and limited sample size. International Classification of Diseases 9 and 10 codes were used to identify claims and might be inaccurate. Costs were modeled rather than fully implemented.

**Conclusion:** Dermatologists should be aware of bundled payment models. More work is needed to elucidate the optimal formulation of a bundled payment for AK management, including the services covered, time delimitation, and risk stratification factors. ( J Am Acad Dermatol 2019;80:679-84.)

*Key words:* actinic keratosis; alternative payment; bundled payment; cost; health care; health economic.

Health care expenditures have accounted for upwards of 17% of the US gross domestic product and are projected to increase to 19.9% of the gross domestic product by 2025.[1] Concerned by this continued and unsustainable rate of growth, the Centers for Medicare and

> **Abbreviations used:**
>
> AK:   actinic keratosis
> ICD:  International Classification of Diseases
> SCC:  squamous cell carcinoma
> SD:   standard deviation

Medicaid Services introduced the Bundled Payment for Care Improvement Initiative in 2011 with the aim to evaluate payment strategies that could improve health care value, defined as the outcomes achieved for patients per dollar of cost.[2,3] Bundled payment or episode-based payment is reimbursement to health care providers for expected costs for defined episodes of care.[4] An episode of care is often focused on a specific condition and includes all the services needed to manage it, such as provider visits, laboratory testing, procedures, and medications.[5] For example, the bundled payment model for an episode of lower extremity joint (hip or knee) replacement includes inpatient hospital services, physician services, postacute care services, and any readmissions or other related services through 90 days after the initial hospital discharge.[6] If spending on services for the episode is below the budgeted amount, then the providers may share in savings; alternatively, if costs exceed the budgeted amount, then the providers may incur losses. Many bundled payment initiatives have focused on episodes that predominant inpatient care; however, there are initiatives that also include a large component of outpatient care.[7]

Bundled payments have been piloted for several surgical conditions and, more recently, were developed for chronic conditions, such as coronary artery disease, end-stage renal disease, and diabetes.[8] We previously developed 8 bundled payment models for the management of actinic keratosis (AK) and simulated the performance of the models in a large claims database.[9] The 8 bundled payments were based on the mean or a percentile threshold of historical claims, such as the median annual payment. The 8 bundled payments were developed on the basis of the annual total cost of AK care, which included office visits, AK-specific procedures (eg, cryotherapy), and AK-related medications (photodynamic therapy or prescription topical medications). Biopsy was considered a test related to AK care, so the cost for biopsy was included; pathology services were excluded. Costs were measured from the perspective of the health care system, which was taken as the sum of costs paid by the patient and the insurer for 1 year. Some of the modeled episode payments were case adjusted, meaning a dollar

---

## CAPSULE SUMMARY

- The bundled payment is an alternative payment model to the fee-for-service model used for health care reimbursement.

- One of the 2 bundled payment models piloted was sufficient to cover the total patient fee-for-service costs.

- More work is needed to develop and pilot bundled payment models for actinic keratosis management, which could vary by services covered, case adjustments, and other factors.

---

amount was added depending on the characteristics and comorbidities of a particular patient.[10-12] Six of the 8 proposed models predicted cost savings compared with fee-for-service cost from the retrospective data sets. The objective of this study was to prospectively evaluate the performance of 2 of the bundled payment models for AK, namely the median-based indirect adjustment bundled payment (model 1) and the mean-based bundled payment (model 2) that were developed previously and tested only on retrospective claims data. The model 1 payment was based on the median annual cost for AK care with an additional adjustment (ie, payment) for additional time and effort possibly spent assisting patients, eg, conducting phone calls rather than clinical visits. The model 2 payment was based on the mean annual total paid for AK care without any adjustments for indirect services related to care management or patient factors.

## METHODS
### Study design

Consecutive patients were prospectively recruited from the clinic schedules of 5 dermatologists at Penn State Department of Dermatology. Patients had to be adults (≥18 years of age) with a history of AK, established patients in the department for ≥1 year, and English literate and consent to participate. The year prior to the study enrollment was considered year 1 of the study and served as a historical control. The year after study enrollment was considered year 2 and contributed to the bundled payment data (Fig 1). Patients were enrolled during September 2014-June 2015, resulting in all historical and prospective data for the study being in the date range September 12, 2013-June 22, 2016. During the study, no changes in billing, receivables, or incentive structure were made; rather, fee-for-service payments were billed and received by the Department during the study period. Before data collection, the dermatologists in the study met and were given cost estimates for office visits, destructive therapies (cryotherapies), topical therapies, and the amount of the episode-based payment. They did not receive an incentive for savings incurred nor were they penalized for costs above the episode-based payment. The dermatologists met monthly for the first
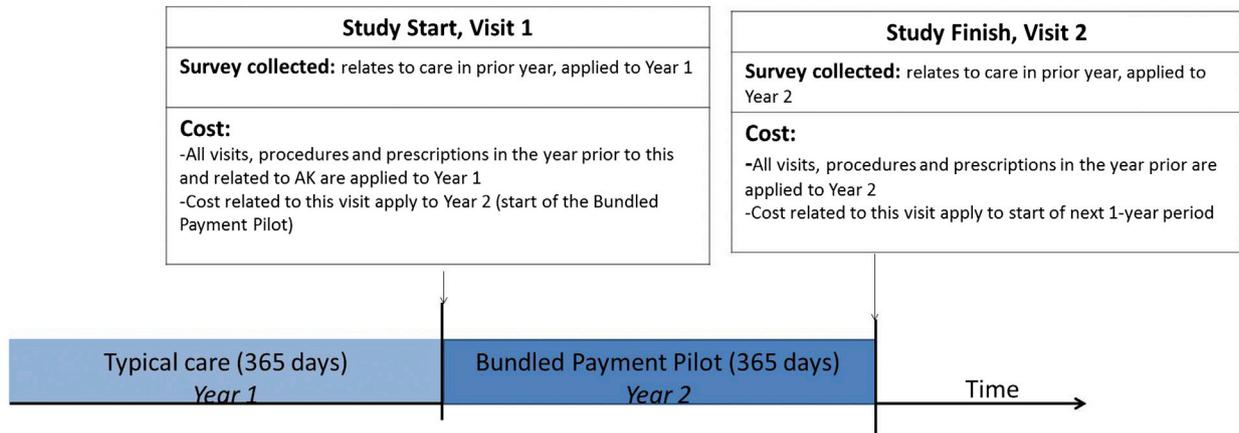
**Fig 1.** Organization of the study and data collection. Patients were enrolled into the study at visit 1, and the bundled payment period ended 1 year after study enrollment. At visit 1, patients completed a survey rating their satisfaction with their health care in the preceding year; thus, data collected at visit 1 applied to care before the bundled payment pilot, or during typical care. Survey data collected at visit 2 applied to care the patient received during the bundled payment pilot study. All costs for AK-related visits and prescriptions were totaled for the year prior to the Bundled payment. The costs related to visit 1 were applied to the bundled payment, as well as costs from any AK-related visit or prescription during the bundled pilot period. In contrast, the costs related to visit 2 were not applied to the pilot period as it constituted the start of a new 1-year period. *AK,* Actinic keratosis.

4 months, then as needed, to review the study and costs and discuss literature related to evidence-based therapy for AK. The study was approved by the Penn State Institutional Review Board.

**Definition of cost variables**

Costs were measured from the perspective of the health care system and included payments from both insurers and patients. Total cost was calculated for year 1 and year 2 for each patient (Fig 1). Payments from office visits, biopsies, destructive procedures, and prescriptions for AK were included if the International Classification of Diseases (ICD) 9 or ICD-10 code for AK (702.0 or L57.0, respectively) was included on the claim. Inpatient claims were excluded because AK is rarely treated in this setting. Treatment data included the utilization and costs for destruction of AK (current procedural terminology codes 17000, 17003, or 17004) or topical prescription therapy. Prescription treatments were limited to fluorouracil, imiquimod, diclofenac, and ingenol and were identified by drug name and national drug code number. Prescription drug costs were not available from the health care system, so the mean cost for each medication was used from our prior work.[9] Biopsy procedures (11100, 11101) were also included. Services billed by the pathologist were excluded. Photodynamic therapy is not performed at our centers. The model 1 and model 2 bundled payment amounts used in this study were taken from

our prior work[9] and after adjustment for inflation were $265/year for model 1 and $293/year for model 2 in 2016 US dollars.

For the patient cohort, the payments for AK-related claims were totaled, and if the total amount for the year exceeded the total from the bundle amount, then theoretically the dermatologists would absorb the costs. Conversely, if the total of the bundle amount was higher than the amount from claims, then the dermatologists would keep the excess payment. Patients' costs in year 1 (year before the study) were used as a historical comparison.

**Definition of other variables**

Patient satisfaction with care was evaluated using the Consumer Assessment of Healthcare Providers and Systems survey. This is a validated measurement tool available from the Agency for Healthcare Research and Quality; it evaluates the patient's rating of care received in the year before completing the survey.[13]

**Statistical analysis**

All costs were adjusted for inflation and are reported in 2016 US dollars.[14] Analyses included descriptive statistics, paired *t* test or McNemar test, and logistic regression. R version 3.3.2 (Vienna, Austria) was used, statistical tests were 2-sided, and a *P* value <.05 was considered statistically significant.
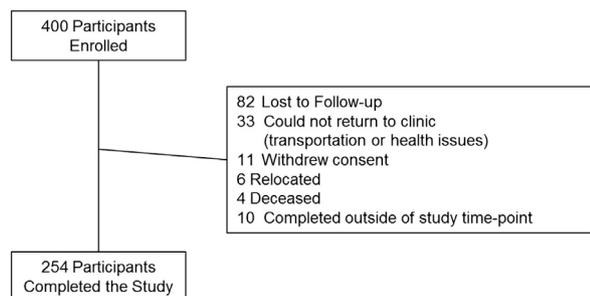
**Fig 2.** Patient cohort information. A prospective cohort study was conducted during September 12, 2013-June 22, 2016. The participants' costs in the year before the bundled payment pilot study (year 1) were used as a historical comparison for year 2, during which the bundled payment was piloted. Payments from office visits, biopsies, procedures, and prescriptions related to actinic keratosis management were included and totaled for each year.

**Table I.** Demographic characteristics of study sample

| Demographic | Value | |
|---|---|---|
| | **71.14 (8.62)** | |
| **Age, y, mean (SD)** | **n** | **%** |
| Sex | | |
| Male | 181 | 71.26 |
| Female | 68 | 26.77 |
| Not reported | 5 | 1.97 |
| History of skin cancer | | |
| Yes | 157 | 61.81 |
| No | 97 | 38.19 |
| Insurance type | | |
| Private | 138 | 54.33 |
| Medicaid | 0 | 0 |
| Medicare | 109 | 42.91 |
| VA | 6 | 2.36 |
| Other | 1 | 0.4 |

*SD*, Standard deviation; *VA*, Veterans Affairs.

## RESULTS

Overall, 400 participants were enrolled and complete data was collected for 254 participants (Fig 2). Table I describes the demographic characteristics of the group. Of note, most of the participants were male (71.26%, 181/254) and had a history of skin cancer (61.81%, 157/254); the mean (standard deviation [SD]) age was 71.14 (8.62) years. Table II shows the utilization and costs for AK-related care of the patient sample. In year 1, total AK-related annual spending was $53,510. Median annual spending was $179/patient and mean (SD) annual spending was $236.80 ($170.87)/patient. In year 2, median annual spending was $223.30/patient, an increase of $44.30 over the prior year (*P* = .0002),

and mean (SD) annual spending was $277.78 ($193.34)/patient, an increase of $40.98 over the prior year (*P* < .0001).

In year 2, the bundled payment was piloted with 5 dermatologists and 254 patients. Overall the mean number of visits, biopsies, cryotherapy, and topical treatment prescriptions were higher in year 2. When the bundled payments were calculated for this patient cohort, model 1 would have paid $67,310 and model 2 would have paid $74,422. The actual costs under the fee-for-service system totaled $70,557. Thus, the model 1 bundled payment would have resulted in a shortfall for the clinicians, and the model 2 bundled payment would have resulted in a surplus of $3865 for the year.

In year 2 of model 1, 42.52% (n = 108) of patients had fee-for-service costs that exceeded the bundled payment. In year 2 of model 2, 37.40% (n = 95) of patients had fee-for-service costs that exceeded the bundled payment. The difference between the models was significant (*P* < .0001). Patient age, sex, insurance type, and clinician identity were not significantly associated with the odds that year-2 fee-for-service costs would exceed the bundled payment. Although the proportion of patients with costs exceeding the bundled payment in year 2 did not significantly vary by clinician (*P* = .23), the proportion varied 0%-63.63% for the 5 providers.

Satisfaction surveys showed a mean (SD) satisfaction score of 9.78 (0.51) in year 1 and 9.75 (0.50) in year 2 (*P* = .46). In both years, 100% of responses indicated a high satisfaction score (score 8-10).

## DISCUSSION

The Bundled Payment for Care Improvement Initiative aimed to reduce costs, preserve outcomes, and encourage value by providing 1 payment for a single patient in a time period.[3,15] This study shows that model 2, the payment developed from the mean payments in our prior work,[9] was sufficient to cover the total patient fee-for-service, costs and the excess money would have been an incentive for the clinicians to participate. Importantly, model 1 would have resulted in a shortfall, where total fee-for-service costs exceeded the bundled payment. This version of bundled payment most closely resembles a retrospective bundled payment, where fee-for-service claims are paid, then at the end of the episode the cost is compared with the bundle payment amount and savings are shared or a portion of the excess cost is paid. In a prospective bundle, the fixed price of the bundle is paid to the provider(s) for the condition or episode. Data from the Integrated Healthcare Association on hundreds of bundled

**Table II.** Utilization and costs related to AK care during year 1 and year 2 of study

| Category | Year 1, typical payment | | | Year 2, bundled payment | | |
|---|---|---|---|---|---|---|
| | N | Cost, $, mean (SD) | Total cost, $ | N | Cost, $, mean (SD) | Total cost, $ |
| Patients | 226* | | | 254* | | |
| Office visits | 335 | 72.71 | 24,357.26 | 443 | 72.05 | 31,919.94 |
| Biopsies | 71 | | 3431.25 | 104 | | 5331.97 |
| One biopsy | 48 | 50.19 (32.98) | | 79 | 50.48 (33) | |
| Additional biopsies | 19 | 41.91 (18.02) | | 20 | 54.70 (39.75) | |
| Lip biopsy | 4 | 56.44 (30.66) | | 5 | 50.01 (29.90) | |
| Cryotherapy | 410 | | 21,219.56 | 505 | | 22,169.55 |
| Single AK | 229 | 69.83 (25.38) | | 286 | 62.94 (24.34) | |
| 2-15 AK | 178 | 26.81 (22.80) | | 213 | 15.89 (14.36) | |
| >15 AK | 3 | 152.21 (57.11) | | 6 | 130.69 (32.99) | |
| Topical therapy | 13 | | 4502 | 32 | | 11,136 |
| Fluorouracil | 12 | 348 | | 32 | 348 | |
| Imiquimod | 1 | 326 | | 0 | 0 | |
| Diclofenac | 0 | 0 | | 0 | 0 | |
| Ingenol | 0 | 0 | | 0 | 0 | |
| Annual spending | | 236.80 (170.87)[†] | 53,510 | | 277.78 (193.34)[†] | 70,557 |
| | | | | | Model 1, total from bundled payment[‡] | 67,310 |
| | | | | | Model 2, total from bundled payment[‡] | 74,422 |

*AK*, Actinic keratosis; *SD*, standard deviation.

*In total, 254 people were recruited and contributed to year 2; 28 of these participants had visits just longer than the 1-year date range set for the study, so they did not have costs that contributed to year 1, resulting in 226 participants with year 1 data.

[†]*P* value <.0001 for comparison.

[‡]Theoretical amount collected by clinicians to care for all patients in the cohort.

payments suggests that bundled payments start as a retrospective model, then move toward a prospective bundled payment.[16]

Overall, the number of visits, biopsies, cryotherapy, and topical therapy prescriptions increased from historical care in year 1 to the bundled payment pilot in year 2. The bundled payment was evaluated after a single year of experience, and a longer study could address questions that arose during this pilot study. First, the increase in visits, biopsies, cryotherapy, and topical therapy might have been related to necessary care but might also have been due to bias, considering the clinicians knew their practice was being evaluated. A longer study would help to elucidate this point. A longer study would also facilitate measurement of squamous cell carcinoma (SCC) in this group and to evaluate the impact of the bundled payment on this important outcome. Patient satisfaction with care during the episode did not differ from satisfaction in the year prior; however, disease-related outcomes, such as AK counts, were not performed because they have poor reliability.[17]

In addition, topical therapy has a high cost, which could impede its use, but topical therapy could reduce long-term costs of AK-related care.[18] Thus, a change to the AK bundled payments developed earlier[9] and evaluated here, could be to extend the duration of the analysis of the bundled payment up to 3 years. The evaluation of expenditures over a longer time frame could support spending more for topical AK therapies and encourage clinicians to think about long-term outcomes. The cost of medical therapy has been included in inpatient and outpatient bundled payments for other conditions or episodes, so this cost was also included in these bundled payments. Although clinicians do not set the cost of medications, they can evaluate the cost-effectiveness among treatments.

Several limitations of the study warrant discussion. Claims were included based on the ICD-9 and ICD-10 codes for AK; variability in coding by clinicians might have caused errors. Prescription costs were not available in claims data and were therefore extrapolated from a previous study. Patients were limited to 1 center and geographic region, so results cannot be generalized. Also, no changes in the medical record or billing system were made, and there were no changes in billing or receivables.

From these limitations also comes opportunities for further study of the bundled payment option, such as the impact of a longer episode. Other bundled payment versions might expand the focus of the episode. For example, clinicians might treat AK not only to decrease the impact of AK but also

because of concern for SCC development; thus, the bundle could include management of AK and SCC. Of note, the bundle already incorporated the cost for biopsies to monitor for SCC, but there is an opportunity to include other dermatopathologists' contributions to the overall management of AK. In addition, all clinicians who treat AK need to be aligned with practice guidelines, as a service provided would go toward the episode and the bundled payment. From clinician to clinician, there was variability in the proportion of patients treated who had costs that exceeded the bundled payment amount in year 2. This discrepancy highlights the importance of clinicians aligning treatment strategies before and during implementation of the bundled payment. Variability in clinicians' approach to AK has been previously highlighted.[19] Clinician alignment with clinical practice guidelines could reduce waste; however, there are some challenges and limitations to AK guidelines.[20]

Alternative payment models are being explored in an effort to reduce waste. Bundled payments are just 1 model being piloted. This study shows that the process to develop a bundled or episode-based payment system will require iterative cycles or development and pilot testing to determine included services and metrics. Implementation will need to address challenges related to clinician variation, utility of clinical practice guidelines, costs of therapy, and restructuring systems and processes to support management of the many clinicians and departments that contribute to an episode.[16,21] Dermatologists should be aware of bundled payment models and contribute to this research to ensure the product is valuable for all stakeholders.

**REFERENCES**

1. Keehan SP, Stone DA, Poisal JA, et al. National health expenditure projections, 2016-25: price increases, aging push sector to 20 percent of economy. *Health Aff (Project Hope)*. 2017;36(3):553-563.
2. Porter ME. What is value in health care? *New Engl J Med*. 2010; 363(26):2477-2481.
3. Centers for Medicare and Medicad Services. Bundled Payments for Care Improvement Initiative fact sheet. 2014. Available from: http://www.cms.gov/Newsroom/MediaRelease Database/Fact-Sheets/2014-Fact-sheets-items/2014-01-30-2.html. Accessed April 3, 2014.
4. Whitcomb WF, Lagu T, Krushell RJ, et al. Experience with designing and implementing a bundled payment program for total hip replacement. *Jt Comm J Qual Patient Saf*. 2015;41(9): 406-413.
5. Tsai TC, Joynt KE, Wild RC, Orav EJ, Jha AK. Medicare's Bundled Payment Initiative: most hospitals are focused on a few high-volume conditions. *Health Aff (Project Hope)*. 2015;34(3):371-380.
6. Centers for Medicare and Medicaid Services. Comprehensive care for joint replacement model. Available from: https://innovation.cms.gov/initiatives/cjr. Accessed May 21, 2018.
7. Centers for Medicare and Medicaid Services. CMS announces new payment model to improve quality, coordination, and cost-effectiveness for both inpatient and outpatient care. Available from: https://www.cms.gov/Newsroom/MediaRelease Database/Press-releases/2018-Press-releases-items/2018-01-09. html. Accessed May 21, 2018.
8. O'Byrne TJ, Shah ND, Wood D, et al. Episode-based payment: evaluating the impact on chronic conditions. *Medicare Medicaid Res Rev*. 2013;3(3).
9. Kirby JS, Delikat A, Leslie D, Miller JJ. Bundled payment models for actinic keratosis management. *JAMA Dermatol*. 2016; 152(7):789-797.
10. Cutler DM, Ghosh K. The potential for cost savings through bundled episode payments. *N Engl J Med*. 2012;366(12):1075-1077.
11. Ash AS, Ellis RP. Risk-adjusted payment and performance assessment for primary care. *Med Care*. 2012;50(8):643-653.
12. Housman TS, Williford PM, Feldman SR, et al. Nonmelanoma skin cancer: an episode of care management approach. *Dermatol Surg*. 2003;29(7):700-711.
13. Hargraves JL, Hays RD, Cleary PD. Psychometric properties of the Consumer Assessment of Health Plans Study (CAHPS) 2.0 adult core survey. *Health Serv Res*. 2003;38(6 Pt 1):1509-1527.
14. Bureau of Labor and Statistics. Databases, tables, and calculators by subject. Available from: https://data.bls.gov/cgi-bin/surveymost. Accessed May 22, 2017.
15. Slotkin JR, Casale AS, Steele GD Jr, Toms SA. Reengineering acute episodic and chronic care delivery: the Geisinger Health System experience. *Neurosurg Focus*. 2012;33(1):E16.
16. Williams T, Yegian J. Bundled payment: learning from our failures. In: Blog HA, ed. *Health Affairs Blog: Health Affairs*. 2014.
17. Weinstock MA, Bingham SF, Cole GW, et al. Reliability of counting actinic keratoses before and after brief consensus discussion: the VA topical tretinoin chemoprevention (VATTC) trial. *Arch Dermatol*. 2001;137(8):1055-1058.
18. Tolley K, Argenziano G, Calzavara-Pinton PG, Larsson T, Ryttig L. Pharmacoeconomic evaluations in the treatment of actinic keratoses. *Int J Immunopathol Pharmacol*. 2017;30(2):178-181.
19. Kirby JS, Gregory T, Liu G, Leslie DL, Miller JJ. Variation in the cost of managing actinic keratosis. *JAMA Dermatol*. 2017; 153(4):264-269.
20. Kirby JS, Scharnitz T, Seiverling EV, Ahrns H, Ferguson S. Actinic keratosis clinical practice guidelines: an appraisal of quality. *Dermatol Res Pract*. 2015;2015:456071.
21. Hussey PS, Ridgely MS, Rosenthal MB. The PROMETHEUS bundled payment experiment: slow start shows problems in implementing new payment models. *Health Aff (Millwood)*. 2011;30(11):2116-2124.