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Fee Comparisons of Treatments for Nonmelanoma Skin Cancer in a Private Practice Academic Setting

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Abstract

OBJECTIVE—To compare fees for biopsy, treatment procedure, repair, and 2-month follow-up for nonmelanoma skin cancer (NMSC) treatments: electrodesiccation and curettage (ED&C), excision, and Mohs micrographic surgery (MMS).

METHODS—A cost comparison of 936 primary NMSCs diagnosed in 1999/2000 at a University affiliated dermatology practice. Clinical data was from medical record review. 2007 Medicare Fee Schedule costs determined fees for surgical care. Pearson chi-square tests, t-tests and analysis of variance compared fee differences. Linear regression determined independent effects of tumor and treatment characteristics on fees.

RESULTS—Mean fees/lesion were \$463 for ED&C, \$1,222 for excision, and \$2,085 for MMS ($p < .001$). For all treatments, primary procedure costs were highest (38%, 45%, and 41%). Total repair fees were higher with MMS (\$735) vs excisions (\$197). Fees were higher for head and neck tumors ($p < .001$), H-zone tumors ($p < .001$), and tumors smaller than 10 mm in diameter ($p = .04$). Regression models predicted that the treatment fees would be \$2,109 for MMS and \$1,252 for excision ($p < .001$). Tumor size greater than 10 mm in diameter (added \$128), tumors on the head and neck (added \$966), and MMS (added \$857 vs excision) were independently related to higher fees ($p < .001$).

CONCLUSION—Even after adjusting for risk factors, MMS has higher fees than excision for primary NMSC. Repairs accounted for the majority of this difference. These fee comparisons provide a basis for comparative effectiveness studies of treatments for this common cancer.

Nonmelanoma skin cancer (NMSC), including cutaneous basal cell (BCC) or squamous cell carcinoma (SCC), is a major public health concern, accounting for more than 2 million cases in the United States annually and increasing.^{1,2} Typical tumor recurrence rates are low after all major therapies (tumor destruction with electrodesiccation and curettage (ED&C), excision, and Mohs micrographic surgery (MMS),³ although rates may not be directly comparable because treatment modalities may vary according to location, size, and other features that may predispose to recurrence. Some observational studies have demonstrated that MMS results in the highest cure rates for primary and recurrent skin cancers,⁴⁻⁷ but for many lower-risk tumors, evidence is lacking to favor one treatment over another. Recently, a randomized clinical trial found no difference in 5-year recurrence rates after excision and MMS for primary facial BCC,⁸ although these results are controversial.⁹⁻¹¹ Clinical guidelines permit selection of multiple treatments for most tumors,¹² but insufficient data exist on cost of NMSC treatment, and the majority of cost data follow old costing rules.³

Medicare, whose fee criteria recently have been updated to better reflect how MMS is performed, covers the treatment of most NMSC.¹³ Our objective was to compare total treatment fees of the three most common NMSC treatments in a university-affiliated dermatology practice in 2007 costs.

Methods

Sample

We studied 936 primary NMSCs diagnosed in 723 consecutive patients (1999/2000), treated with ED&C, excision, or MMS being followed as part of an ongoing prospective cohort study at a university-affiliated and Veterans Affairs dermatology practices. Our institutional review board-approved sample was limited to lesions at the private site because we did not have access to cost data from the VA. NMSCs were identified by daily review of pathology records and defined according to final histopathologic diagnosis of BCC or SCC. Clinical data were obtained from medical record review using structured data collection forms. The biopsying clinician made the treatment choice. ED&C typically consisted of three cycles. The vast majority of excisions were simple excisions followed immediately by closure (i.e. margins of excised specimens were examined histologically in fixed specimens after closure). MMS consisted of histographically guided serial excisions followed by repair once tumor-free sections were attained. Characteristics of the study sample and the clinical outcomes have been published.^{3,14,15}

Categories of Fees

We define fees as the 2007 Medicare-approved fee schedule (MFS) payment for each component of care. Two types of resource use were determined for calculation of fees: those related to biopsy and treatment (complete removal of tumor, repair, and any follow-up procedures) and related dermatology visits in the 2 months after primary treatment. Specific fee categories included diagnostic biopsy, pathology readings, primary procedure, repairs (simple, intermediate, complex, and skin flaps and grafts), any secondary procedures (included if a second medical appointment and procedure (ED&C, excision, or MMS) was necessary for treatment of remaining tumor after the primary procedure and was not already included in the fees of that procedure), medications given in the postoperative period (pain medication and antibiotics), and 2-month follow-up visits. Table 1 lists cost categories

according to Current Procedural Terminology (CPT) code and their associated fees, as calculated below. Total fee was the sum of fees for each treatment category.

Fee-Based Costing Procedure

We used 2007 Medicare billing rules to assign a specific fee to each tumor (Table 1). Medicare fees represent a paid amount and are often used as a proxy for costs, as we do here, because it represents the paid amount excluding mark-ups. The major change in the 2007 Medicare billing rules was the addition of tumor location to the MMS fees, made because the Centers for Medicare and Medicaid Services (CMS) determined the code descriptors for MMS procedures were unclear and subject to differing payer interpretations. Their goal was to make rules more consistent with the coding conventions for ED&C and excision (based on location and size).¹⁶ The 2008 CMS multiple procedure reduction rule further removed the exemption for disallowing additional charging when the same physician performs more than one procedural service on the same patient on the same day. Because our analysis was according to lesion rather than according to patient, this rule does not affect our total fee estimates significantly,¹⁷ although we also did regression analysis following the 2008 MFS where the most expensive procedure (the flap) is paid 100% and the Mohs procedure is paid at 50% to determine the effect on our fee comparisons.¹⁷

Medicare ED&C fees are assigned based on lesion size. Excision fees are based on tumor location and excised diameter. Because information on excised diameter was not available for tumors in this study, this information was estimated by adding lesion size and double the margin size, which were available. To estimate fees when lesion sizes were missing (3%), we imputed the cost for the smallest-diameter lesion for that location, according to Medicare rules for actual fee assignment for reimbursement when this information is missing. When margin size was missing (10%), we imputed by multiplying lesion size times an average ratio of margin size to lesion size for a particular location.¹⁸ For example, with 2-mm average margin and 8-mm average lesion, $2/8 = 0.25$ mm. Thus, for a 10-mm tumor with missing margin information, the calculated margin was $(0.25 \times 10 \text{ mm}) \times 2 = 5.0$ mm.

Medicare MMS fees were calculated based on tumor location and number of MMS stages. The CPT codes separate locations on the trunk or extremities from those on the head or neck, and the first stage and additional stages for each location, up to five tissue blocks per stage. We assumed no more than five tissue blocks at any MMS stage.¹⁹

For each primary procedure CPT code, total fees included the outpatient physician facility fee and the physician's Outpatient Prospective Payment System fee in 2007 dollars. Both of these components are considered part of the total procedure fee.

Any repairs after the primary procedure were coded separately, and fees were calculated using the 2007 Medicare Physician Fee schedule when appropriate. Simple repairs are already included in Mohs procedure fees. A simple closure repair (CPT codes 12020 and 12021) is included in excision procedure fees and so was not added again. Simple repair CPT codes vary depending on size and location of the repair; intermediate and complex layered closures and repairs vary depending on location. We also determined location- and size-dependent fees of flap and graft repairs. These procedures can be included if using modifier 58, which then covers related procedures done by the same physician during the 90-day postoperative period or Mohs on a different site.²⁰

Fee-Based Costing Algorithms per Tumor

To show patient, tumor, and care characteristics that probably affect choice of therapy and the components of total fees, we created a decision tree (Figure 1). Decision trees can be used as tools to compare different outcomes, including fees as we do here. We chose to use a

decision tree because it clearly lays out the options included in determining fees and provides a visual framework to quantify total fee values. Variables in the decision tree were selected based on National Comprehensive Cancer Network guidelines for care of NMSC,¹² as well as factors that affect fees in the 2007 Medicare Fee Schedule. The decision tree began with the three treatment types (ED&C, excision, and MMS procedures) and continued to include all of the main variables necessary for the fee-based formulas, including tumor diameter, location, MMS stage, and need for repairs, including flaps or grafts. Using the decision tree, conditional formulas were created to assign CPT-based 2007 Medicare Fee Schedule fees for primary treatments and repairs for each tumor in the data set and to assign fees according to specific tumor characteristics.

Fees for medications were determined from the 2007 Drug Topics Red Book, using the average wholesale price less 25% to better reflect the actual cost of drugs after contract pricing.²¹ To determine a typical number of follow-up visits after each type of treatment, we reviewed a sample of 115 medical records of these and other subjects treated at the same facility for NMSC and determined the average number of visits within 2 months of each type of treatment that were separately billed for (54 ED&C, 30 excision, and 31 MMS procedures were reviewed). Visits after 2 months were not included because it was difficult to determine accurately whether they were related to the original lesion. Not including the visits already included in the procedure itself, we found that, on average, there was one additional visit for ED&C, two for excision procedures, and three for MMS procedures. We also performed the analysis excluding these follow-up visits.

Severity of Tumor

To permit us to analyze fees according to risk categories and to compare fees after adjusting for severity of tumor, we used tumor features related to clinical severity, such as size and location. We also calculated a variable for each tumor based on aggressiveness of histologic features.¹²

Statistical Analysis

The tumor was the unit of analysis. The overall analytic strategy was as follows. First, for each treatment group, we calculated the mean total fees and fees of individual fee categories. We performed analysis of variance with Bonferroni correction on fee categories to determine whether there was a significant difference in fee categories for each treatment type. Next, we compared the mean fees in each treatment group for important clinical subgroups. Pearson chi-square tests and two-sided *t*-tests were used to determine whether there was a significant difference in the total treatment fees based on characteristics of the tumor or patient.

Next, to examine the independent association between patient, tumor, and care characteristics and total fees, we performed linear regression models. We used robust regression to iteratively reweight ordinary least squares to control for deviant cases.²² The dependent variable was total fees; independent variables were patient sex, tumor type, tumor location (head or neck vs trunk or extremities and H-zone or not), tumor size, histologic recurrence risk variable, type of treatment, and performance of repairs (including flaps and grafts). We used the natural log of fees to reduce the inherent skew of fee data. The resulting regression coefficients were smeared to avoid retransformation bias and to bring log fees back to the original scale so that useful conclusions can be drawn about treatment fees.²³

Finally, to test robustness of our findings and as a further control for selection bias, we estimated fees for tumors treated using MMS as if they were treated with excision instead. Although not suggesting that these tumors could or should be treated with excision, we

wanted to directly compare fees of the two treatments on the same tumors. Types of repairs, flaps, and grafts and margin size were assumed to be the same for determination of total fees for both procedures. Other researchers have used a similar approach to estimate from one sample and one treatment what the characteristics of the sample and resulting fees would be for the alternative treatment.^{24,25}

Results

Treatment Patterns

Of the 936 tumors, 80% (748) were BCC and 20% (188) were SCC, similar to literature estimates of typical NMSC (Table 2).^{3,26-29} Overall, ED&C was used for 27% of lesions, excision for 29%, and MMS for 44%. There was no significant difference in treatment choice between tumor types ($p = .25$), but significantly more tumors of both types were treated using MMS (BCC 44%, $p = .001$ and SCC 42%, $p = .03$) than with the other two treatments. Differences in tumor diameter between treatment types approached significance ($p = .06$). Of patients with small tumors (≤ 10 mm, 71% of the sample), 52% underwent MMS, 28% excision, and 20% ED&C, whereas for large tumors (>10 mm), the distribution was more equal, although MMS was still used more often. MMS was much more likely to be used in head and neck and H-zone tumors. Treatments use was further described in a previous article.³

As expected, most of the tumors were on the head and neck and other nontrunk and extremity locations (60%). Sixty-nine percent of head neck tumors were treated using MMS, compared with only 8% using ED&C. Similarly, 80% of H-zone tumors were treated using MMS. Fifty-six percent of trunk and extremity lesions were treated using ED&C and only 5.1% using MMS. Using the histologic recurrence risk variable described earlier, we found a significant difference in treatment selection ($p < .001$), with more high-risk tumors treated using MMS (58%) and an equal distribution of treatment types between the low risk tumors, although somewhat fewer excisions (28%) than the other two treatments. Finally, there were significantly different treatment selections between the sexes ($p = .03$). There were more men (59%) than women (41%) with tumors, but 48% of treatments were MMS for women and 41% for men. It appears that more men underwent ED&C, whereas more women underwent MMS, which may be related to sex differences in tumor location and risk characteristics and possible sex-based preferences.

Total Fees and Fees According to Category

For all tumors, average total unadjusted fees per lesion were \$463 for tumors treated using ED&C, \$1,222 for excision, and \$2,085 for MMS ($p = .001$; Table 3, Figure 2). The primary procedure fees were the highest single fee category (ED&C, \$177; excision, \$550; MMS, \$855), accounting for approximately 40% of total fees. Pathology fees were highest for excision. (For MMS, histopathologic examinations performed during the procedure are not charged separately.) MMS had the highest average fees for repairs. When total repairs and secondary procedure fees were added together, the fees were highest for MMS (\$735), followed by excision (\$222), and were infrequent and therefore low (\$5) for ED&C. Tumors treated using ED&C had no repairs, but two tumors needed a secondary procedure: one excision and one MMS. For MMS, revisions, repairs, and secondary procedures together were the second highest fee category after the primary procedure itself. Only one tumor treated using MMS required a secondary procedure, but one required a split-thickness skin graft, whereas 13 tumors treated using excision required a secondary procedure (Table 3).

Fees for Each Treatment Type According to Tumor Characteristics

We compared mean total fees for each type of treatment in important clinical subgroups (Table 4). For all three treatments, fees were significantly higher for large tumors and for H-zone locations than for others. Fees were significantly higher for head and neck tumors than for trunk and extremity tumors for excision and MMS. For excision treatment alone, fees were significantly higher for SCC than BCC.

Predictors of Total Fees

In multivariable regression log models, independent predictors of higher total fees were head or neck location, diameter larger than 10 mm, and repair with flap or graft (Table 5). We found that a head or neck lesion cost \$966 more than one on the trunk or extremities, a lesion larger than 10 mm in diameter had a fee of \$128 more than a lesion with a diameter of 10 mm or less, and having a flap or graft had a fee of \$1,767 more than none.

Excision and MMS were independent predictors of higher fees than with ED&C ($p < .001$). Furthermore, MMS was an independent predictor of higher fees than excision (\$857 higher). Using this model, the predicted fees for MMS treatment of a tumor on the head or neck with a flap or graft and a diameter larger than 10 mm (a more-difficult tumor to treat) was \$2,109, whereas a lesion of this same description treated using excision was predicted to have a fee of \$1,252, approximately \$857 less ($p < .001$). Excluding drug fees from total fees did not change the value or significance of the coefficients. We also performed our regression excluding the 2-month follow-up rules and found that MMS accounted for 28% of the total fees rather than 32% and did not change our overall conclusions that MMS has significantly ($p < .001$) higher fees than excision and ED&C. Using the 2008 billing rule for reductions in reimbursement for secondary procedures lowered the total fees of MMS compared to excision by \$155 in our regression. The MMS procedure still accounted for 32% of overall fees, but skin flaps and grafts contributed \$500 (27%) less to this fee (from 78% to 51% of total fees). Using the new 2008 rule, MMS continues to have significantly higher fees than excision, and for primary procedure fees, the pattern of results was similar except that location in the H-zone was now a positive predictor ($p = .046$).

Total Fees of Same Sample Given Each Treatment

As described above, we further controlled for selection bias by estimating fees for the sample of tumors that were treated using MMS as if they had received excision instead. With this exercise, the average fees of the primary procedure changed from \$855 to \$605 if the tumors had been treated with excision ($p < .001$). Thus, for the same tumors, MMS still had with higher fees than the excision procedure, but the fee differences between the two procedures (\$250) was lower than the actual unadjusted procedure fee differences (\$305). When including all fee categories and calculating MMS fees as if the procedure had been an excision, estimated average total fees decreased from \$2,085 to \$1,778, ($p < .001$), indicating that treatment selection might affect fee differences between MMS and excision. When controlling for selection bias using this exercise, differences in total fees between excision and MMS were only \$356, whereas the difference was \$863 in uncontrolled comparisons and \$857 when predicted from our regression models. The fact that the difference in total fees decreased so much with the exercise of substituting the primary procedure fees indicates that the repair fees strongly affect these differences (in fact, flaps and grafts add 84% to total fees). MMS had significantly higher fees than excision even when factors of selection bias were controlled for.

Discussion

Diagnosis, treatment, and 2-month follow-up of primary NMSC has high total Medicare-based fees: on average \$463 if treated using ED&C, \$1,222 using excision, and \$2,085 using MMS. Moreover, this public health burden will increase as the incidence rises.¹ This is the first study that compares surgical treatment fees using the 2007 Medicare CPT MMS billing rules, which permit higher payments for greater complexity of lesion location. This change will probably result in a larger difference in fees between MMS and other therapies than that estimated using previous rules.^{25,30}

We found that MMS had the highest total fees overall and for the majority of fee categories, even when controlling for many factors of treatment selection bias. In adjusted models, MMS had total fees that were \$857 greater than for excision. This difference is largely attributed to the fact that MMS tends to be performed in areas that require a complex closure for repair. These types of costly complex closures are not generally performed with excisions because, without knowledge of clear margins, a complicated repair is compromised or must be repeated if the margins are positive.

Miller found that 1992 U.S. MMS fee-based costs ranged from \$884 to \$2,576 for treatment of a 2-cm lesion on the nose at three different treatment sites,³¹ but few studies have compared fees between treatments for NMSC. A review article of economic evaluations of NMSC found only eight studies from 1965 to 2003 and indicated that the majority had serious shortcomings.³² Only two studies compared excision and MMS.^{25,30} Cook and Zitelli found that MMS treatment and 5-year follow-up fee-based costs were \$1,243, whereas traditional surgical excision treatments ranged from \$1,167 to \$1,973, depending on location of procedure and type of margin control. In this study, MMS was 7% more expensive than excisions with permanent sections but 11% cheaper than excisions with frozen sections.²⁵ Their study did not include tumors that were actually treated using excision but relied on expert opinion to estimate resource use for excision treatments from an MMS-treated sample. Four recent articles compared costs of treatments for head and neck BCC only, and these are difficult to compare fairly with our results because of their differing costing techniques and factors included in costs.^{6,24,33-35} Bentkover and colleagues found that MMS costs from \$400 to \$600 more than excision depending on number of stages or frozen sections done.³⁵ Bialy and colleagues found that cost differences were sensitive to type of repair chosen and number of frozen sections and positive margins.²⁴ For our study, we had tumor-specific data on use of frozen sections for each tumor treated using excision and consistently found that MMS had higher fees than excision even when accounting for these factors.

Smeets and colleagues, in a randomized clinical trial in the Netherlands, found that the surgical costs alone of MMS were almost twice those of excision (Euro 406 vs Euro 217)^{6,34} using data from the finance department at the hospital. Lear found that the costs of MMS alone in Canada were only C\$871 including estimates for recurrence.³³

After adjustment to U.S. 2007 dollars, we found the fees for excision and MMS to be 1.6 to –2.3 times as high as those found in a Dutch study by Essers and colleagues, who used micro-costing techniques rather than Medicare billing rules to estimate costs.³⁶ Cost estimates for NMSC care in different countries cannot be substituted for one another, making it even more important to have an updated estimate of fees in the United States with which to inform treatment decisions in this country.

Our study has several limitations. First, because the sample was from a tertiary medical center, it may not be generalizable to a general practice. Because a true cost study is difficult to do, we are comparing fees in this study that are largely outside of the physician's control.

The true cost of performing MMS may be lower because one physician provides clinical, oncologic, surgery, pathology, anesthesia, and reconstructive services. It is preferable to have actual cost data for each patient, but our fee-based costing method using the specific characteristics of the tumor is accurate and better estimates costs than do patient bills that represent charges. Some data were missing for lesion size (3%), margin size (10%), and number of blocks, requiring us to impute these measurements from others in the sample. Although the need for imputation is a limitation of this study, it is preferable to dropping cases when more than 5% of cases are affected.¹⁸ Each additional block allows additional billing of CPT code 17315 for \$74, so this addition would not change the conclusions drawn from our analysis that MMS has higher fees than excision.

Our study did not include fees related to recurrence, and it may be that lower recurrence rates with MMS will make this procedure cost-effective or cost-saving, but in a recent study from the Netherlands, recurrence outcomes were found to be similar after MMS and excision for primary facial BCC,⁸ although the validity and generalizability of these results have been questioned.⁹ Nevertheless, the costs of treating recurrent lesions initially treated with ED&C or excision may cost more to manage than those initially treated using MMS, because significant surgical intervention is often required to remove the recurrent tumor and its associated scar. Additionally, using 3-year recurrence data from the Dutch study, Essers and colleagues conducted a cost-effectiveness study in 2001 Euro comparing MMS with surgical excision for BCC of the face.³⁶ They concluded that MMS is not more cost-effective for primary facial BCC than standard excision, with an incremental cost-effectiveness ratio of 29,231 Euro per recurrence prevented, but because a maximum national willingness to pay for the cost-effectiveness outcome in their study (recurrence prevented) has not been determined as it has for the criterion standard outcome (quality adjusted life years), it is difficult to conclude that MMS is not cost-effective. In a later study, Essers estimated that individuals are willing to pay 462 Euro to avoid a 1% increase in recurrence, which will be helpful to include in future cost-effectiveness studies.^{37,38}

A strength of our study is that we modeled the important risk parameters for fees using a decision analytic framework that can be built upon in further comparative effectiveness and economic studies comparing NMSC treatments. In addition, ours is one of the few studies that captured information on actual tumor characteristics that could be used to estimate fees for all treatments. Ours is also one of the first to use the new 2007 billing rules that significantly changed the method of fee determination for MMS. In 2008, after completing our study, an additional change was made to the billing rules by implementing a 50% reduction in payment for performance of multiple procedures on the same day by the same physician after 100% payment for the most expensive procedure. Because our analysis is according to tumor, rather than patient, this change does not affect our analysis greatly, but we included this new rule change and reran the regression analyses and found that MMS contributed \$702 instead of \$857 over having an excision now (\$155 less). Nevertheless, our conclusion that MMS has significantly higher fees than excision did not change.

Conclusion

The major finding from our study is that MMS has significantly higher fees than excision, even when adjusting for many tumor, patient, and care characteristics. We found that tumor size and H-zone location had significant effects on total fees, although MMS remained significantly costlier than excision even when controlling for these factors. The fee difference is largely attributed to the fact that MMS tends to be performed in areas that require complex and costly closures for repair, those not generally performed with excisions. This study compares fees only, and treatment choice should be based on treatment guidelines and not fees. Treatment using a less-expensive option may also be less curative,

resulting in a greater potential for procedure-related morbidity, as well as the possibility of requiring flap or graft repair instead of a straightforward layered closure. Overall, these data will be important for future comparative effectiveness studies and for those planning for the appropriate diffusion of this technology within medical care systems and nationally.

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Figure 1.
Tree showing components of calculation of fees using Medicare payment rules.

Figure 2.
Fees (US\$) according to treatment type and fee category.

TABLE 1
Common Procedural Terminology (CPT) Codes and Fees According to Category of Fee

<i>Fee Category</i>	<i>CPT Code</i>	<i>Average Fee Across range of CPT Codes</i> *
Diagnostic biopsy of skin including simple closure Pathology	11100	\$106.26
Surgical pathology (for initial biopsy or to determine whether treatment is complete)	88305	\$69.93
Pathology with frozen section(s), single specimen ** Primary procedure	88331	\$92.29
ED&C		
Tumor diameter >10mm, head or neck, H-zone	17282-4, -6	\$294.85
Tumor diameter >10mm, head or neck, non-H-zone	17272-4, -6	\$273.29
Tumor diameter 10mm, head or neck, H-zone	17280-1	\$190.41
Tumor diameter 10mm, head or neck, non-H-zone	17270-1	\$171.78
Tumor diameter >10mm, trunk or extremity	17262-4, -6	\$230.15
Tumor diameter 10mm, trunk or extremity	17260-1	\$167.86
Excision †		
Tumor diameter >10mm, head or neck, H-zone	11642-4, -6	\$994.30
Tumor diameter >10mm, head or neck, non-H-zone	11622-4, -6	\$1,072.77
Tumor diameter 10mm, head or neck, H-zone	11640-1	\$539.00
Tumor diameter 10mm, head or neck, non-H-zone	11620-1	\$444.91
Tumor diameter >10mm, trunk or extremity	11602-4, -6	\$683.36
Tumor diameter 10mm, trunk or extremity	11600-1	\$361.04
MMS ‡		
Any diameter, head or neck, first stage	17311	\$569.55
Each additional stage, head, or neck	17312	\$410.30
First stage, trunk, or extremity	17313	\$534.30
Each additional stage, trunk, or extremity	17314	\$396.74
Repairs		
Closure or simple repair §		
Simple repair scalp, neck, axillae, external genitalia, trunk, extremities, 25 mm	12001	\$184.47
Simple repair scalp, neck, axillae, external genitalia, trunk, extremities, 26-75 mm	12002	\$195.46
Simple repair face, ears, eyelids, nose, lips, mucous membranes, 25 mm	12011	\$187.50
Simple repair face, ears, eyelids, nose, lips, mucous membranes, 26-50 mm	12013	\$201.52
Simple repair face, ears, eyelids, nose, lips, mucous membranes, 51-75 mm	12014	\$223.88
Treatment of superficial wound dehiscence; simple closure	12020	\$264.05
Treatment of superficial wound dehiscence; simple closure with packing	12021	\$216.30
Layer closure intermediate or complex repair		

<i>Fee Category</i>	<i>CPT Code</i>	<i>Average Fee Across range of CPT Codes</i> *
Trunk or extremities, layer closure or intermediate repair	12031–7	\$332.86
Neck, hands, feet, genitalia, layer closure, or intermediate repair	12041–7	\$340.62
H-zone, layer closure or intermediate repair	12051–7	\$354.75
Layer closure or complex repair	13100	\$529.06
Skin transfer or rearrangement, skin flap repair [¶]		
Scalp, arms, legs 31.6 mm diameter (advancement flap or rotation flap on scalp)	14020	\$1,399.69
Scalp, arms, legs, 31.6–54.8 mm diameter	14021	\$1,593.34
Forehead, cheeks, chin, mouth, neck, axillae, genitalia, hands, feet 31.6 mm diameter	14040	\$1,445.54
Forehead, cheeks, chin, mouth, neck, axillae, genitalia, hands, feet, 31.6–54.8 mm diameter	14041	\$1,658.91
Eyelids, nose, ears, lips, 31.6 mm diameter	14060	\$1,477.76
Eyelids, nose, ears, lips, 31.6–54.8 mm diameter	14061	\$1,725.61
>54.8mm, any area	14300	\$2,165.04
Distant pedicle flap—assume location or size not a factor	15650	\$1,651.53
Skin grafts		
Split-thickness graft: face, scalp, eyelids, mouth, neck, ears, orbits, genitalia, hands, feet, or multiple digits; first 100 cm ²	15120	\$2,027.09
Full-thickness graft: scalp, arms, legs	15220	\$1,419.02
Full-thickness graft: forehead, cheeks, chin, mouth, neck, axillae, genitalia, hands, or feet	15240	\$1,554.31
Full-thickness graft: nose, ears, eyelids, or lips	15260	\$1,610.02
Medications (only as prescribed)		
Tyco#3 (1–2 tabs 4×/d as needed for 7 days)	\$13.46	
Vicodin (1–2 tabs every 4hours as needed for 7 days)	\$3.50	
Keflex (500mg every 4hours for 14 days)	\$15.29	
Postoperative follow-up visit, normally included in the surgical package, to indicate that an evaluation and management service was performed during a postoperative period for a reason(s) related to the original procedure	99024	\$0.00
Follow-up visit up to 2 months after the procedure (including doctor and facility fee)/visit	99213	\$102.07
Secondary procedures (ED&C, excision, or MMS) ^{‡‡}	\$178, \$508, or \$855	

Tyco#3, acetamenophen plus Codiene#3.

We specifically checked the Medicare fees for procedures 11642–4, –6, and 11622 because we thought that they should be reversed, and our verbal and e-mailed response was that they were correct as is.

* Total fees include physician and facility fees.

[¶]Excision includes simple closure: code selection is determined by measuring the greatest clinical diameter of the apparent lesion plus that margin required for complete excision (lesion diameter plus the most narrow margin required equals the excised diameter). The measurement is made before closure.

[‡]We assumed that all patients had only five tissue blocks for each stage.

[§]Simple repair is not added on for excision patients because it is included in treatment fees.

[¶] Skin flaps (rotation flap or advancement flap) = adjacent tissue transfer or rearrangement divided by location and size in cm².

^{**}

Six excision patients had frozen sections.

^{††}

Secondary procedures were performed when a physician indicated that a second medical appointment and procedure (ED&C, Excision, or MMS) was necessary for treatment of a remaining tumor after the primary procedure.

TABLE 2
Tumor Characteristics According to Treatment Type

<i>Tumor Characteristic</i>	<i>Electrodesiccation and Curettage</i>	<i>Excision</i>	<i>Mohs Micrographic Surgery</i>	<i>Total</i>	<i>p-Value for Pearson Chi-Square Test Across the Three Treatments</i>
Histologic type, <i>n</i>	253	274	409	936	
Basal cell carcinoma, <i>n</i> (%)	208 (27.8%) (82.2%)	210 (28.1%) (76.6%)	330 (44.1%) (80.7%)	748 (100%) (79.9%)	.25
Squamous cell carcinoma, <i>n</i> (%)	45 (23.9%) (17.8%)	64 (34.0%) (23.4%)	79 (42.0%) (19.3%)	188 (100%) (20.1%)	
Tumor diameter, <i>n</i>	174	248	407	829	
10 mm (small), <i>n</i> (%)	121 (20.5%) (69.5%)	165 (27.9%) (66.5%)	305 (51.6%) (74.9%)	591 (100%) (71.3%)	.06
>10 mm (large), <i>n</i> (%)	53 (22.3%) (30.5%)	83 (34.9%) (33.5%)	102 (42.9%) (25.1%)	238 (100%) (28.7%)	
Tumor location, <i>n</i>	253	274	409	936	
Trunk or extremities, <i>n</i> (%)	210 (56.3%) (83.0%)	144 (38.6%) (52.6%)	19 (5.1%) (4.6%)	373 (100%) (39.9%)	<.001
Head or neck, <i>n</i> (%)	43 (7.6%) (17.0%)	130 (23.1%) (47.4%)	390 (69.3%) (95.4%)	563 (100%) (60.1%)	
Head and Neck location, <i>n</i>, (row%), (column%), <i>n</i>	253	274	409	936	
Tumor not in H-zone, <i>n</i> (%)	236 (36.8%) (93.3%)	232 (36.2%) (84.7%)	173 (27.0%) (42.3%)	641 (100%) (68.5%)	<.001
Tumor in H-zone, <i>n</i> (%)	17 (5.8%) (6.7%)	42 (14.2%) (15.3%)	236 (80.0%) (57.7%)	295 (100%) (31.5%)	
Histologic recurrence risk, * <i>n</i>	253	274	409	936	
Low, <i>n</i> (%)	227 (35.4%) (89.7%)	178 (27.7%) (65.0%)	237 (36.9%) (57.9%)	642 (100%) (68.6%)	<.001
High, <i>n</i> (%)	26 (8.8%) (10.3%)	96 (32.7%) (35.0%)	172 (58.5%) (42.1%)	294 (100%) (31.4%)	
Sex, <i>n</i>	253	274	409	936	
Female, <i>n</i> (%)	86 (22.6%) (34.0%)	113 (29.7%) (41.2%)	181 (47.6%) (44.3%)	380 (100%) (40.6%)	.03
Male, <i>n</i> (%)	167 (30.0%) (66.0%)	161 (29.0%) (58.8%)	228 (41.0%) (55.7%)	556 (100%) (59.4%)	

* Presence or absence of the following histologic features associated with tumor recurrence: perineural or vascular involvement; moderate or poor differentiation; and presence of adenoid, acantholytic, adenosquamous, or desmoplastic features.

TABLE 3
Differences in Unadjusted Total Fees and Fee Categories According to Type of Treatment

<i>Procedure</i>	<i>Electrodesiccation and Curettage (1; n = 253)</i>	<i>Excision (2; n = 274)</i>	<i>Mohs Micrographic Surgery (3; n = 409)</i>	<i>Analysis of Variance, p-Value (Bonferroni Corrected)</i>
Mean fee per lesion ± standard deviation				
Primary procedure	\$177.44 ± 21.98 n = 253	\$550.11 ± 225.13 n = 274	\$855.35 ± 334.18 n = 409	<.001 (1,2,3), F= 566.22
Simple, intermediate, complex repairs	\$0 n = 0	\$191.63 ± 122.22 n = 204	\$263.32 ± 254.66 n = 231	<.001 (1,2,3), F= 168.05
Flaps and grafts	\$0 n = 0	\$5.18 ± 85.73 n = 1	\$471.26 ± 720.89 n = 125	>.99 (1,2), <.001 (2,3 & 1,3), F= 110.20
Secondary procedures *	\$5.39 ± 62.42 n = 2	\$25.50 ± 123.21 n = 13	\$0.44 ± 8.81 n = 1	= .006 (1,2), <.001 (2,3), (1,3) , F= 9.76
Biopsies	\$106.26 n = 253	\$106.26 n = 274	\$106.26 n = 409	>.99 (1,2,3), F= 0.00
Pathology	\$70.76 ± 7.58 n = 253	\$137.03 ± 22.79 n = 274	\$71.81 ± 11.33 n = 409	>.99 (1,3), <.001 (1,2 & 2,3), F= 1866.07
Drugs	\$0.92 ± 3.38 n = 18	\$1.69 ± 4.37 n = 40	\$9.94 ± 6.02 n = 335	= .23 (1,2), <.001 (1,3 & 2,3), F= 350.41
Follow-up visits	\$102.47 n = 253	\$204.51 n = 274	\$305.71 n = 409	<.001 (1,2,3), F= -8.8e+15
Total fees	\$462.84 ± 71.32	\$1,221.54 ± 308.38	\$2,084.60 ± 749.18	<.001 (1,2,3), F= 769.33

* Secondary procedures were performed when a physician indicated a second medical appointment and procedure (ED&C, Excision, or MMS) was necessary for treatment of a remaining tumor after the primary procedure.

TABLE 4
Unadjusted Mean Fees of the Three Treatment Groups According to Important Clinical Subgroup

<i>Tumor Characteristic</i>	<i>Electrodesiccation and Curettage</i>	<i>Excision</i>	<i>Mohs Micrographic Surgery</i>	<i>Overall Average Fees</i>
Histologic type				
Basal cell carcinoma	\$460	\$1,196.74	\$2,082.55	\$1,382.74
Squamous cell carcinoma	\$475	\$1,302.92	\$2,093.14	\$1,436.77
Total <i>n</i>	253	274	409	936
Fee <i>t</i> -test <i>p</i> -value	.28	.02	.91	.42
Tumor diameter				
10 mm (small)	\$465	\$1,158.96	\$2,008.39	\$1,455.31
> 10 mm (large)	\$486	\$1,409.11	\$2,332.99	\$1,599.48
Total <i>n</i>	174	248	407	829
Fee <i>t</i> -test <i>p</i> -value	.03	<.001	<.001	.04
Tumor location				
Trunk or extremities	\$458	\$1,187.50	\$1,787.10	\$807.43
Head or neck	\$486	\$1,259.25	\$2,099.09	\$1,781.93
Total <i>n</i>	253	274	409	936
Fee <i>t</i> -test <i>p</i> -value	.07	.05	.02	<.001
Tumor location in H-zone				
Not in H-Zone	\$462	\$1,200.84	\$1,879.64	\$1,111.95
In H-Zone	\$477	\$1,335.86	\$2,234.84	\$2,005.55
Total <i>n</i>	253	274	409	936
Fee <i>t</i> -test <i>p</i> -value	.05	.01	<.001	<.001
Histologic recurrence risk (as defined in Table 2)				
Low	\$460	\$1,203.08	\$1,998.42	\$1,234.09
High	\$484	\$1,255.76	\$2,203.34	\$1,741.89
Total <i>n</i>	253	274	409	936
Fee <i>t</i> -test <i>p</i> -value	.28	.21	.01	<.001
Sex				
Female	\$454	\$1,193.32	\$2,077.45	\$1,447.22
Male	\$467	\$1,241.36	\$2,090.28	\$1,356.93
Total <i>n</i>	253	274	409	936
Fee <i>t</i> -test <i>p</i> -value	.07	.19	.86	.11

TABLE 5

Robust Regression of Log Normal Total Fees

<i>Independent Variable or Risk Factor Prob > F Significant at 0.0000, n = 792, F(6,785) = 2977, R² of Regfit = 0.684[‡] (1)</i>	<i>Log Coefficient (Standard Error; 2)</i>	<i>T-Statistic (3)</i>	<i>95% Confidence Interval (4)</i>	<i>Percentage of Fees Accounted for Using [(1-e^x) × 100]] X = coefficient, from Having Risk Factor or Other Predictor (5)</i>	<i>Predicted Fees for Having the Risk Factor or Other Predictor (n; 6)</i>	<i>Predicted Fees[†] for Not Having the Risk Factor or Other Predictor (n; 7)</i>	<i>Additional Fee of Having the Risk Factor or Other Predictor (Column 6-Column 7) (8)[*]</i>
Head or neck site	0.0825 (0.0120)	6.85 [§]	0.0589–0.1062	8.6	\$1,851.09 (511)	\$885.48 (281)	\$965.61
Size > 10 mm	0.0687 (0.0094)	7.30 [§]	0.0502–0.0871	7.1	\$1602.836 (230)	\$1474.45 (562)	\$128.38
Had skin flap or graft	0.5778 (0.0125)	46.24 [§]	0.5533–0.6024	78.2	\$2989.27 (128)	\$1222.27 (664)	\$1,767.00
Histologic high-risk tumor (excluding site and size)	0.0063 (0.0091)	0.69	–0.0116 0.0183–0.0242	0.6	\$1824.89 (262)	\$1360.36 (530)	\$464.53
Had excision versus ED&C	0.9222 (0.0123)	66.70 [§]	0.8980–0.9465	151	\$1251.92 (223)	\$472 (172)	\$779.92
Had MMS versus ED&C [§]	1.2014 (0.0146)	74.69 [§]	1.1727–1.2301	232	\$2109.03 (397)	\$472 (172)	\$1637.03
Had MMS versus excision	0.27912 (0.0121)	23.12 [§]	0.2555–0.3029	32.2	\$2109.03 (397)	\$1251.92 (223)	\$857.11
Constant	6.0986 (0.0098)	620.91 [§]	6.0793–6.1179	444.23	NA	NA	NA

Robust regression costs are geometric mean fees closest to the desired median fee. ED&C, electrodesiccation and curettage; MMS, Mohs micrographic surgery.

* Differences in the fees of columns 6 and 7 result in the difference in total fees between these two tumor treatments shown in column 8.

[†] All fees were predicted using the treatment subgroup specific smearing factor.

[‡] R² values reported with robust regression are not appropriate and should not be used. Instead a regfit R² is calculated and reported in this table http://www.ats.ucla.edu/stat/Stata/faq/reg_r2.htm.

[§] p < .001.