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Patient-Reported Outcome Measures for Mohs Reconstruction: A Systematic Review

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Abstract

Objective. Mohs micrographic surgery (MMS) and subsequent reconstructive procedures for the treatment of facial nonmelanoma skin cancers (NMSCs) significantly impact quality of life (QoL). A validated patient-reported outcome measure (PROM) for patients who undergo Mohs reconstruction is not yet established. This study aims to systematically assess the quality of existing PROMs to determine their effectiveness in capturing the challenges faced after Mohs reconstruction for facial NMSC.

Data Sources. A systematic review following established Preferred Reporting Items for Systematic Reviews and Meta-analyses guidelines was performed. Medline, PubMed, Scopus, and Cochrane databases were searched using keywords relevant to MMS, NMSC, facial reconstruction, QoL, and PROMs.

Review Methods. Inclusion and exclusion criteria were used to compile eligible PROMs. Methodological quality and psychometric properties of PROMs were evaluated using COnsensus-based Standards for the Selection of Health Measurement Instruments (COSMIN) criteria.

Results. Of 2997 articles, 78 met the inclusion criteria. Of these, 45 studies utilized a PROM as an outcome measure, and 33 reported PROM development or validation. COSMIN assessment demonstrated that the FACE-Q Skin Cancer Module and Facial Skin Cancer Index have the strongest validation. The Mohs Reconstruction Questionnaire-12 (MRQ-12) was the only PROM specific to this population of interest; however, it has not undergone psychometric property assessment.

Conclusion. Various PROMs have been utilized to assess QoL for patients undergoing facial reconstructive surgery after MMS. A clinically validated PROM specific to this patient population is required to gain deeper insight into these emotional impacts. Further validation and psychometric testing of the MRQ-12 may be beneficial.

Keywords

facial reconstruction, Mohs micrographic surgery, patient-reported outcome measures, quality of life, systematic review

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Nonmelanoma skin cancer (NMSC), primarily consisting of basal cell carcinoma and squamous cell carcinoma, affects an estimated 3 million Americans annually and has the highest worldwide incidence of any cancer.[1-3] The rate of NMSC is anticipated to double in the next 30 years and affect a younger cohort of patients.[4] Mohs' micrographic surgery (MMS), a cutaneous cancer excision technique that allows for complete microscopic control, is the current mainstay curative treatment for high-risk NMSC.[5-7] While MMS is highly effective, adequate margins of up to 4 to 6 mm can be required to ensure successful tumor removal, leading to sizable defects necessitating subsequent reconstruction.[7,8]

Surgical reconstruction of facial defects following MMS can improve both functional and aesthetic outcomes.[9,10] Postoperatively, patient perception and satisfaction regarding the reconstructive outcome can also play a role in future morbidity.[11] Several studies have supported using patient-centered care and perioperative counseling with an emphasis on cosmetic outcomes is highly important to skin cancer patients.[12-14] Clinicians therefore require reliable, sensitive tools to assess quality of life (QoL) measures in addition to oncologic and surgical outcomes following reconstruction.[4]

Despite the high incidence of NMSC requiring MMS and subsequent reconstruction (Mohs reconstruction), there has not been a singular, validated patient-reported outcome

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measure (PROM) consistently used to evaluate QoL outcomes for this population across the literature. Instead, several generic dermatologic or skin cancer PROMs have been implemented in the past, including but not limited to the FACE-Q scales and the Derriford Appearance Scale (DAS59). Recently, a new PROM, the Mohs Reconstruction Questionnaire-12 (MRQ-12), was developed specifically to evaluate patients who undergo reconstruction following MMS.[15] This study aims to systematically review and evaluate the adequacy and validity of existing PROMs, with the objective of determining their effectiveness in accurately capturing QoL outcomes in patients with facial NMSC who undergo Mohs reconstruction.

Methods

This systematic review was performed in adherence to the Preferred Reporting Items for Systematic Reviews and Meta-analyses guidelines (Supplemental File S1, available online).[16]

Search Strategy

A systematic search of the literature was performed to identify articles related to NMSC, MMS, soft tissue facial reconstruction for NMSC, QoL, and PROM. The search was conducted using PubMed (MEDLINE), Scopus, and Cochrane databases from inception of the databases to September 2023, and results were restricted to those written in the English language. Letters, abstracts, systematic reviews, editorials, and meta-analyses were excluded. Search string strategies can be found in Supplemental File S2, available online. Included articles' references were reviewed to identify any supplementary or missed articles.

Study Selection

Four reviewers (N.G., S.M., N.Q., J.T.) independently reviewed the studies and screened the abstracts for eligibility using inclusion and exclusion criteria, with each abstract screened by at least 2 reviewers. The inclusion criteria and exclusion criteria that were utilized to screen studies are recorded in **Table 1**. Abstracts that fell under the inclusion criteria were rescreened by 2 reviewers (N.G. and S.M.) in the full-text form to confirm eligibility for data extraction and quality assessment. Any conflict was resolved through discussion and consensus by these reviewers and resolved by other reviewers (N.Q. or J.T.), if required.

Data Extraction

When assessing full-text versions of the article, the following data were collected: PROM used, year of publication, target population, sample size, language and country of origin, available translations, and whether the PROM was used as an outcome measure or its development or validation was described.[17] PROM data such as a number of items, types of subscales, response options, score range, and scoring method were also collected. Articles that described development or validation were further evaluated by the COnsensus-based Standards for the Selection of Health Measurement Instruments (COSMIN) criteria.

Methodological Quality and Psychometric Property Assessment

Full-text articles regarding development were evaluated using the COSMIN guidelines developed by Terwee and colleagues.[18,19] This set of guidelines was developed to assess the PROM measurement properties including PROM development, content validity, structural validity, internal consistency, cross-cultural validity, reliability, measurement error, criterion validity, construct validity, and responsiveness further described in Supplemental File S3, available online. Each category is scored on a 5-point scale with grades "inadequate," "doubtful," "adequate," "very good," or "not applicable." This grading system follows that the lowest score in each subcategory is the overall rating for that respective measurement property, following the "the worst score counts" principle.[20] Results were pooled for articles that described the validation of PROMs across multiple studies and languages.

Good Measurement Property Analysis and Grading of Recommendations Assessment, Development, and Evaluation Analysis

The quality of psychometric properties for each PROM was assessed based on established Good Measurement

Table 1. Inclusion and Exclusion Criteria Utilized When Screening Studies

Inclusion criteria
• Study cohort which included patients with facial NMSC, patients who undergo MMS, or patients who undergo soft tissue facial reconstruction.
• Articles which demonstrated the development or psychometric validation of a PROM or utilized it as an HRQoL outcome measure
• English-only articles
• Articles which include patients ≥18 years of age
Exclusion criteria
• Articles which include patients <18 years of age
• Questionnaires not developed or validated in patients with facial NMSC, patients who undergo MMS, or patients who undergo soft tissue facial reconstruction.
• Patients with oropharyngeal, nasopharyngeal, laryngeal head and neck cancer.
• Mandibular or maxillary reconstruction
• Abstract-only papers, conference, editorials, articles without available full text, case reports, case series, systematic reviews, or meta-analyses

Abbreviations: HRQoL, health-related quality of life; MMS, Mohs micrographic surgery; NMSC, nonmelanoma skin cancer; PROM, patient-reported outcome measure.

Property analysis guidelines, assigning ratings of sufficient (+), insufficient (−), or indeterminate (?) to each property.[19] To evaluate the overall quality of evidence for pyschometric properties, each property was scored using the Grading of Recommendations Assessment, Development, and Evaluation (GRADE) guidelines for all PROMs. The GRADE approach considers factors like risk of bias, inconsistency, imprecision, and relevance to the study population of interest.[21] Based on these factors, the evidence was categorized as high, moderate, low, or very low quality. Measurement properties that were rated as indeterminate during Good Measurement Property analysis were not eligible for GRADE analysis. The results of the Good Measurement Property analysis and GRADE analysis were then used to determine the suitability of each PROM for our specific population—patients who undergo Mohs reconstruction for facial NMSC.

Two independent reviewers (N.G. and S.M.) completed the data extraction, COSMIN evaluation, and GRADE analysis. Any discrepancies were resolved through discussion and consensus of the reviewers. Percentage agreement was calculated for each item by dividing the number of ratings with agreement by the total number of ratings for each measurement property. Percentage agreement >80% was considered sufficient for the purpose of this study.

Results

Supplemental File S4, available online details the number of articles retrieved. Database search yielded 3359 articles. After the removal of duplicate articles, 2998 titles, and abstracts were screened for eligibility using inclusion and exclusion criteria. Of those, 99 full-text articles were reviewed for eligibility, and 78 were included in the systematic review. Forty-five articles utilized relevant PROMs as an outcome measure (Supplemental File S5, available online), and 33 articles described relevant PROM development and/or validation. The FACE-Q Skin Cancer Module was most frequently used (n = 17) as an outcome measure. **Table 2** provides a content overview of each PROM for which development or validation studies were performed, and **Table 3** summarizes all existing development and/or validation studies for each PROM.

Methodological Quality and Psychometric Property Assessment

Quality assessment and psychometric property assessment were performed by 2 reviewers (NG and SM). **Table 4** presents an assessment of the quality and psychometric properties of each PROM. PROM development, including PROM design and concept elicitation (CI), was "adequate" for the FACE-Q Skin Cancer Module, Facial Skin Cancer Index (SCI), Basal and Squamous Cell Carcinoma Quality of Life, and MRQ-12, but less than "adequate" for all other PROMs. In terms of content validity, the Facial SCI and Skindex-16 performed best with an overall "adequate" score. Cross-cultural validity could only be assessed for the FACE-Q Skin Cancer Module. Criterion validity was not reported for any studies as there is no gold-standard PROM for the population of interest for comparison. The MRQ-12 was the only PROM specific to patients who undergo Mohs reconstruction for facial NMSC; however, it has not undergone psychometric property assessment.

Good Measurement Property Analysis and Grading of Recommendations Assessment, Development, and Evaluation Analysis

Good measurement property analysis is displayed in **Table 5**. The Facial SCI, FACE-Q Skin Cancer Module, and Skin Cancer Quality of Life Impact Tool had the largest number of positive ratings demonstrating the highest quality of PROMs studied. Furthermore, GRADE analysis (**Table 6**) was used to pool results of the quality of evidence (**Table 3**) and quality of PROMs (**Table 4**) to provide an overall recommendation for the use of each PROM. The FACE-Q and Facial SCI had high-quality evidence for all psychometric properties that could be assessed. All other PROMs' quality of evidence were downgraded for risk of bias, inconsistency, imprecision, indirect results, or inadequate studies. The percentage agreement for the 2 independent reviewers (N.G. and S.M.) who completed the data extraction and COSMIN analysis was 97.5%.

Discussion

In this systematic review, we identified 9 existing PROMs previously used as outcome measures for patients with NMSC, those undergoing facial MMS, or those undergoing facial soft tissue reconstruction. These PROMs vary in focus, ranging from general health-related QoL to specific concerns related to facial appearance and function. Despite the variety of tools, there is no PROM currently recognized as the accepted measure for our population of interest—patients who undergo Mohs reconstruction. Previous studies have often relied on generic PROMs developed for broader dermatological or skin cancer evaluations when assessing QoL in patients who underwent Mohs reconstruction for facial NMSC.[53-55] However, these PROMs have not been validated for patients who undergo Mohs reconstruction, often because the process is time-consuming and expensive. Additionally, generic PROMs may fail to incorporate factors that are important in the evaluation of patients who undergo both MMS and reconstruction of facial defects.

Our review aimed to address this gap by systematically analyzing these PROMs to determine their effectiveness in capturing the unique challenges faced by this patient population. Thus, we assessed studies that described the development and validity of PROMs to provide recommendations for a comprehensive QoL measure for patients undergoing Mohs reconstruction for NMSC.

Table 2. Characteristics and Scoring of Each PROM

PROM	Target population	# Items	Subscales	Response options	Range of scores	Scoring method
BaSQoL	Patients with BCC and SCC	16	Behavior, diagnosis and treatment, worries, appearance, and other people	4-point scale	0-48	Higher score = poorer QoL
FACE-Q Skin Cancer Module	Patients with facial SCC, BCC, or melanoma who underwent MMS	41	Appearance satisfaction, quality of life, patient experience	4-point scale	0-100	Higher score = better QoL
Facial SCI	Patients with facial NMSC	15	Emotion, social, appearance	5-point scale	0-100	Higher score = better QoL
MRQ-12	Patients undergoing MMS reconstruction	12	Emotion, social, appearance	5-point scale	12-60	Higher score = worse QoL
BIQ	Patients with HNSC	10	Appearance, cognitive, behavioral, social	5-point scale	15-75	Higher score = poorer body image
SCQOLIT	Patients with NMSC or MM	10	Psychosocial, physical	4-point scale	0-30	Higher score = worse QoL
Skindex-16	Patients with skin disease	16	Symptoms, emotion, physical/social functioning	7-point scale	0-100	Higher score = worse QoL
DLQI	Patients with skin disease	10	Symptoms/feelings, daily activities, leisure, work/school, personal relationships, treatment	4-point scale	0-30	Higher score = worse QoL
POS-H&N	Patients undergoing surgery for skin lesions	15	Psychosocial, functioning, cosmetic appearance, satisfaction	3-5 point scale	0-100	Higher score = worse QoL

Abbreviations: BaSQoL, Basal and Squamous Cell Carcinoma Quality of Life Questionnaire; BCC, basal cell carcinoma; BIQ, Body Image Questionnaire; DLQI, Dermatology Life Quality Index; HNSC, head and neck skin cancer; MM, malignant melanoma; MMS, Mohs Micrographic Surgery; NMSC, nonmelanoma skin cancer; POS-H&N, Patient Outcomes of Surgery-Head/Neck; PROM, patient-reported outcome measure; Qol, quality of life; SCC, squamous cell carcinoma; SCI, Skin Cancer Index; SCQOLIT, Skin Cancer Quality of Life Impact Tool.

Table 3. Summary of PROM Development and/or Validation Studies

PROM	Articles	Developer	n	Country of origin	Original language	Translations
BaSQol	Waalboer-Spuij et al, 2018[22] Yu et al, 2020[23]	Waalboer-Spuij et al	908	The Netherlands	Dutch	English
FACE-Q Skin Cancer Module	Lee et al, 2016[24] Lee et al, 2018[25] Dobbs et al, 2017[26] Dobbs et al, 2021[27] Ottenhoff et al, 2019[28]	Lee et al	603	United States	English	UK English, Dutch
Facial SCI	Rhee et al, 2005[29] Rhee et al, 2006[30] Rhee et al, 2007[31] Matthews et al, 2006[32] Samela et al, 2022[33] de Troya-Martin et al, 2015[34]	Rhee et al	1377	United States	English	Spanish, Italian
MRQ-12	Kavanagh et al, 2020[15]	Kavanagh et al	25	United States	English	None
BIQ	Beal et al, 2018[35]	Beal et al	239	United States	English	None
SCQOLIT	Burdon-Jones et al, 2010[36] Burdon-Jones et al, 2013[37] Karakok et al, 2023[38]	Burdon-Jones et al	336	United Kingdom	English	Turkish
Skindex-16	Chren et al, 1996[39] Chren et al, 2001[40] Chren et al 2012[41] Higaki et al, 2002[42] AlGhamdi et al, 2007[43] Chernyshov et al, 2009[44], 2011[45] El Fakir et al, 2014[46] He et al, 2014[47] Essa et al, 2018[48] Cárcano et al, 2018[49]	Chren et al	3791	United States	English	Japanese, Arabic, Ukranian, Runyakore, Moroccan Arabic, Chinese, Egyptian Arabic, Brazilian Portuguese
DLQI[a]	Finlay et al, 1994[50] Blackford et al, 1996[51]	Finlay et al	>50,000	United Kingdom	English	>80 languages
POS-Head/Neck	Cano et al, 2006[52]	Cano et al	485	United Kingdom	English	None

Abbreviations: BaSQoL, Basal and Squamous Cell Carcinoma Quality of Life Questionnaire; BIQ, Body Image Questionnaire; DLQI, Dermatology Life Quality Index; MRQ-12, Mohs Reconstruction Questionnaire-12; n, total population size; POS-Head/Neck, Patient Outcomes of Surgery-Head/Neck; PROM, patient-reported outcome measure; SCI, Skin Cancer Index; SCQOLIT, Skin Cancer Quality of Life Impact Tool.

[a]Over 200 studies exist regarding the psychometric properties and validation of the DLQI in English or other translations. For the purpose of this paper, only studies that described the original development and validation of the DLQI were reviewed.

COSMIN, good measurement properties, and GRADE analyses revealed that while the FACE-Q and Facial SCI demonstrated some high-quality evidence for psychometric properties that could be assessed, no PROMs met all COSMIN standards for high-quality development. Notably, more than half of the PROM development studies assessed had significant shortcomings in cognitive interviewing and CI, critical components of PROM development and their successful use.[56-58] Cross-cultural validity of a majority of PROMs could not be assessed despite widespread PROM translation. This is due to the lack of validation of those translations, limiting their global applicability. Lastly, because responsiveness was sporadically reported, the ability to differentiate a disease-specific PROM from a generic PROM was limited.[59]

Previous reviews have investigated the validity and quality of PROMs used in patients with NMSC or those who have undergone soft tissue reconstruction. Bates et al found that the Facial SCI is the most appropriate PROM in patients with facial NMSC due to low variability between items and low test-retest correlations.[4] While not specific to facial NMSC, another review evaluated PROMs that have been utilized for patients with facial skin cancer. It was reported that although various questionnaires demonstrate high validity, none thoroughly address post-skin cancer facial reconstruction.[60] Lastly, 1 review found that although the FACE-Q, SCI, POS-H/N, and DAS 59/24 had adequate evidence for QoL assessment in patients who undergo soft-tissue reconstruction, there was variability in the validation processes of these instruments, thus requiring further

Table 4. Assessment of PROM Development and Validity Based on the COSMIN Checklist

	PROM development										Construct validity		Responsiveness			
PROM	PROM design	CI Study	Total PROM development	Content validity	Structural validity	Internal consis-tency	Cross-cultural validity	Reliability	Measurement error	Criterion validity	Convergent validity	Known groups validity	Comparison with gold standard	Comparison with other instruments	Comparison between subgroups	Comparison before and after intervention
BaSQoL	A	A	A	D	V	V	-	A	A	-	V	-	-	V	-	A
FACE-Q Skin Cancer	V	A	A	-	V	V	I	A	-	-	A	-	-	-	-	V
Facial SCI	A	A	A	A	V	V	-	A	-	-	A	-	-	A	-	V
MRQ-12	A	A	A	-	-	-	-	-	-	-	-	-	-	-	-	-
BIQ	D	I	I	-	V	I	-	-	-	-	A	-	-	A	-	-
SCQOLIT	D	I	I	I	V	V	-	A	I	-	D	D	-	D	D	-
Skindex-16	D	I	I	A	A	V	-	I	-	-	A	D	-	A	D	-
DLQI[a]	I	D	I	-	D	D	-	D	-	-	-	V	-	-	-	-
POS-H&N	D	I	I	D	A	V	-	A	-	-	A	-	-	A	-	V

Abbreviations: A, adequate; BaSQoL, Basal and Squamous Cell Carcinoma Quality of Life Questionnaire; BIQ, Body Image Questionnaire; CI, cognitive interview; D, doubtful; DLQI, Dermatology Life Quality Index; I, inadequate; MRQ-12, Mohs Reconstruction Questionnaire-12; POS-Head/Neck, Patient Outcomes of Surgery-Head/Neck; PROM, patient-reported outcome measure; SCI, Skin Cancer Index; SCQOLIT, Skin Cancer Quality of Life Impact Tool; V, very good; -, no information was presented to address this property.

[a]Over 200 studies exist regarding the psychometric properties and validation of the DLQI in English or other translations. For the purpose of this paper, only studies that described the original development and validation of the DLQI were reviewed.

Table 5. Good Measurement Property Analysis for the Quality of PROMs

PROM	Structural validity	Internal consistency	Reliability	Measurement error	Hypothesis testing for construct validity	Cross-cultural validity	Criterion validity	Responsiveness
BaSQoL	+	+	+	?	+	?	?	?
FACE-Q	+	+	+	?	+	?	?	+
Facial SCI	+	+	+	?	+	?	?	+
MRQ-12	?	?	?	?	?	?	?	?
BIQ	?	+	?	?	?	?	?	?
SCQOLIT	+	+	+	?	+	?	?	+
Skindex-16	+	+	?	?	+	?	?	?
DLQI[a]	?	?	?	?	?	?	?	?
POS-Head/Neck	?	+	+	?	+	?	?	+

Abbreviations: BaSQoL, Basal and Squamous Cell Carcinoma Quality of Life Questionnaire; BIQ, Body Image Questionnaire; CI, cognitive interview; DLQI, Dermatology Life Quality Index; MRQ-12, Mohs Reconstruction Questionnaire-12; POS-Head/Neck, Patient Outcomes of Surgery-Head/Neck; PROM, patient-reported outcome measure; SCI, Skin Cancer Index; SCQOLIT, Skin Cancer Quality of Life Impact Tool; +, sufficient; −, insufficient;? indeterminate.
[a]Over 200 studies exist regarding the psychometric properties and validation of the DLQI in English or other translations. For the purpose of this paper, only studies that described the original development and validation of the DLQI were reviewed.

Table 6. GRADE Overall Quality of Evidence Analysis

PROM	Structural validity	Internal consistency	Reliability	Measurement error	Hypothesis testing for construct validity	Cross-cultural validity	Criterion validity	Responsiveness
BaSQoL	Moderate	Moderate	Moderate	N/A	Moderate	N/A	N/A	N/A
FACE-Q	High	High	High	N/A	High	N/A	N/A	High
Facial SCI	High	High	High	N/A	High	N/A	N/A	N/A
MRQ-12	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
BIQ	N/A	Very Low	N/A	N/A	N/A	N/A	N/A	N/A
SCQOLIT	Low	Low	Low	N/A	Low	N/A	N/A	Low
Skindex-16	Low	Low	N/A	N/A	Low	N/A	N/A	N/A
DLQI[a]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
POS-Head/Neck	N/A	Moderate	Moderate	N/A	Moderate	N/A	N/A	Moderate

Abbreviations: BaSQoL, Basal and Squamous Cell Carcinoma Quality of Life Questionnaire; BIQ, Body Image Questionnaire; CI, cognitive interview; DLQI, Dermatology Life Quality Index; MRQ-12, Mohs Reconstruction Questionnaire-12; N/A, not applicable; POS-Head/Neck, Patient Outcomes of Surgery-Head/Neck; PROM, patient-reported outcome measure; SCI, Skin Cancer Index; SCQOLIT, Skin Cancer Quality of Life Impact Tool.
[a]Over 200 studies exist regarding the psychometric properties and validation of the DLQI in English or other translations. For the purpose of this paper, only studies that described the original development and validation of the DLQI were reviewed.

study.[61] While these studies individually identified and assessed the validity of existing PROMs that have been used in patients with skin cancer who undergo MMS or those who undergo soft tissue reconstruction, our study evaluated existing PROMs to determine those that are most suitable for patients who undergo both procedures, MMS and facial reconstruction.

Although our results revealed that the FACE-Q Skin Cancer Module and the Facial SCI demonstrated adequate psychometric properties, their applicability to patients who undergo Mohs reconstruction for facial NMSC has its limitations. The items of the FACE-Q Skin Cancer Module focus on satisfaction with scar appearance after skin cancer treatment, worry about skin cancer diagnosis, and satisfaction with facial appearance. The questionnaire fails to incorporate the impact that surgical reconstruction may have on functional outcomes, such as facial disfigurement or mobility, as well as the broader psychosocial effects of undergoing reconstructive surgery. Similarly, the Facial SCI evaluates patients' worry or frustration about their skin cancer diagnosis and worry about its social consequences, again lacking a comprehensive assessment of the functional and emotional impacts related to soft tissue reconstruction after surgical excision.

Consequently, Kavanagh and Christophel developed the MRQ-12 due to the lack of PROMs available specific to the unique challenges faced by patients undergoing Mohs reconstruction with questions relevant to its functional, emotional, and psychosocial effects on QoL.[15] Although specific to our population of interest, the MRQ-12 development study focused on thorough CI and cognitive interviewing processes, rather than assessment of psychometric properties. To establish questionnaire domains, an analysis of available plastic surgery, dermatology, and otolaryngology instruments was conducted. CI interviews were guided using open-ended questions to identify factors that were significant to patients. Cognitive interviews subsequently revealed the relevance, appropriateness, and readability of the preliminary questionnaire. Despite the lack of psychometric validation, the initial methodology of PROM development was paramount, and the MRQ-12 provides the first sensitive and specific questionnaire developed for our population of interest.

Most PROMs included fell short regarding questions relevant to the social, emotional, and appearance-related aspects of reconstruction of post-MMS defects. This study highlights the need for a PROM specific to patients with facial NMSC who undergo Mohs reconstruction to evaluate QoL and disease experience. As emphasized by previous investigations, reconstruction of Mohs defects can significantly impact patients' well-being and psychosocial distress leading to cancer worry.[55] Thus, it is imperative to utilize a disease-specific PROM such as the MRQ-12, rather than generic PROMs, to adequately capture QoL impact on not only patients but also caregivers and providers. This would optimize patient care, counseling, and support.

This study should be interpreted in the context of its limitations. First, COSMIN criteria are dependent on the subjective rating of the reviewers, thus, subject to variation and bias. We attempted to control for variation by maintaining a percentage agreement above 80%. Additionally, while reviewing the included studies, we noted that studies were not consistent in their methods of psychometric validation, complicating their comparison and development of a concrete conclusion. Variations in the methodology of validation may be due to a year of publication and changes in the COSMIN checklist with time. Future studies, that involve psychometric property measurement of the MRQ-12, should be performed for the use of the MRQ-12 as a validated PROM for patients who undergo Mohs reconstruction.

Conclusion

Various PROMs have been utilized to assess QoL for patients undergoing facial reconstruction after MMS. As the incidence of facial NMSC continues to grow, a clinically validated PROM specific to this patient population is required to gain deeper insight into these emotional impacts in order to guide perioperative patient counseling and support. While the FACE-Q Skin Cancer Module and Facial SCI adequately assess QoL in patients who undergo MMS and subsequent reconstruction, further validation and psychometric testing of the MRQ-12 would be beneficial in the establishment of a sensitive and specific PROM for this population.

Author Contributions

Neha Garg, developed methodology, performed a formal investigation, and analysis, and wrote the manuscript; **Shreya Mandloi**, performed a formal investigation, and analysis, and wrote the manuscript; **Natalia Queenan**, performed a formal investigation and wrote the manuscript; **Jay Trivedi**, performed a formal investigation, and wrote a manuscript; **Adam McCann**, performed idea conceptualization and reviewed the manuscript; **Vivian Xu**, reviewed the manuscript; **Dev Amin**, reviewed the manuscript; **Howard Krein**, edited and reviewed the manuscript; **Ryan Heffelfinger**, provided project supervision and edited and reviewed the manuscript.

Disclosures

Competing interest

The author(s) declare that there is no conflict of interest.

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Supplemental Material

Additional supporting information is available in the online version of the article.

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