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Association of Hair Loss With Health Utility Measurements Before and After Hair Transplant Surgery in Men and Women

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Supplemental content

IMPORTANCE Androgenetic alopecia is a highly prevalent condition across both sexes and can be surgically corrected through hair transplant. Health utility scores, which represent quantitative estimates of individual preferences for a given state of health, are a measure of health-related quality of life. The health utility scores for sex-specific alopecia and the posttransplant state have not previously been quantified.

OBJECTIVE To obtain health utility measurements for the objective assessment of sex-specific alopecia and hair transplant surgery and to analyze layperson perception of alopecia compared with other chronic health conditions.

DESIGN, SETTING, AND PARTICIPANTS A prospective clinical study was conducted from August 1 to December 31, 2017, at the Harvard Decision Science Laboratory. Adult casual observers (n = 308) completed an internet-based health utility questionnaire. Health states were presented using still patient images and a description of 5 health states, including monocular blindness, binocular blindness, male alopecia, female alopecia, and male posttransplant state.

MAIN OUTCOMES AND MEASURES Health utility measures of sex-specific alopecia, posttransplant state, and monocular and binocular blindness were measured by visual analog scale (VAS), standard gamble (SG), and time trade-off (TTO) in quality-adjusted life-years (QALYs). Groups were analyzed with 1-way analysis of variance and post hoc Tukey pairwise comparison.

RESULTS The 308 participants included 157 (51.0%) women with a mean (SD) age of 30.8 (13.5) years. Mean (SD) health utility measures included 0.85 (0.18) QALYs for the VAS, 0.93 (0.17) QALYs for the SG, and 0.93 (0.17) QALYs for the TTO in male alopecia; 0.83 (0.19) QALYs for the VAS, 0.92 (0.17) QALYs for the SG, and 0.91 (0.18) QALYs for the TTO in female alopecia; and 0.93 (0.11) QALYs for the VAS, 0.95 (0.15) QALYs for the SG, and 0.95 (0.16) QALYs for the TTO in a man in the posttransplant state. The mean (SD) health utility of monocular blindness was 0.76 (0.17) QALYs for the VAS, 0.87 (0.21) QALYs for the SG, and 0.86 (0.20) QALYs for the TTO. The health utility score for the posttransplant state was significantly improved compared with the health utility score for alopecia in both sexes (female VAS: +0.10 [95% CI, 0.06-0.14; $P < .001$]; male VAS, +0.08 [95% CI, 0.04-0.12; $P < .001$]). Hair loss in women and men demonstrated significantly lower QALYs on the VAS compared with the posttransplant state (female: −0.10 [95% CI, −0.14 to −0.06; $P < .001$]; male: −0.08 [95% CI, −0.12 to −0.04; $P < .001$]).

CONCLUSIONS AND RELEVANCE Alopecia has a meaningful negative influence on health utility measures in both sexes. Hair transplant surgery significantly increases health utility measures compared with untreated alopecia in both sexes as rated among layperson observers.

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Androgenetic alopecia (AGA) affects more than 80% of white men and 40% of women, rendering it one of the most common medical conditions.[1] Androgenetic alopecia is typically considered by society and clinicians to be of little medical consequence[2,3]; however, the negative psychosocial effect of hair loss on an individual's self-esteem, social functioning, and identity over time is grossly underestimated.[4] Body dysmorphia and feelings of social disadvantage are common in individuals with AGA.[5,6] Even clinically imperceptible alopecia has been associated with decreased quality of life.[7]

Androgenetic alopecia can be treated medically or surgically, generating an annual global market revenue of $4 billion with a 1.8% growth rate.[8] The US Food and Drug Administration has approved medical treatments, including topical finasteride, a type 2 5α-reductase inhibitor, and oral minoxidil to slow and reverse hair loss.[1,9,10] These therapies have demonstrated significant improvement in hair count numbers and density in clinical trials.[9,10] Many patients do not achieve sufficient benefit from medical management and seek surgical options. Hair transplant has become a widely popular procedure; techniques include follicular unit transplant and follicular unit extraction.[10]

Health-state utility analysis is relatively new to the medical literature.[11-13] Health-state utility analysis is used to capture quantitative, health-related quality of life scores representing individual preference for a given health state. Utility scores are typically quantified using the visual analog scale (VAS), time trade-off (TTO), and standard gamble (SG) measures.[11]

Hair transplant for patients with alopecia significantly improves their psychosocial health and naive observer-rated appearance and perception of success and approachability.[4] The utility measures of sex-specific alopecia and posttransplant health states have not been investigated, to our knowledge. Herein, the health utility measures of sex-specific AGA, including postsurgical intervention with hair transplant, were assessed among layperson observers using 5 randomized health states.

Key Points

Question What is the health utility score for sex-specific alopecia and the posttransplant state?

Findings In this prospective questionnaire study of 308 adult patients, the health utility score after hair transplant significantly improved compared with the health utility score of alopecia in both sexes. Participants were willing to undergo a 7% to 8% risk of death and trade off 7% to 9% of healthy life-years for a complete cure of their hair loss.

Meaning Hair transplant surgery significantly increases health utility measures compared with untreated alopecia in both sexes as rated among layperson observers.

Methods

Participants

In a prospective fashion, a pool of adult casual observers (n = 308) enrolled at the Harvard Decision Science Laboratory, Harvard University, Cambridge, Massachusetts, rated the utility of 5 randomized health states, consisting of monocular blindness, binocular blindness, male alopecia, female alopecia, and a male posttranplant state. The study was conducted from August 1 to December 31, 2017. Health states were presented to observers using still patient images and health state descriptions. As depicted in eFigures 1 through 3 in the Supplement, images of 1 man with monocular blindness, 1 man with binocular blindness, 1 man with alopecia, 1 woman with alopecia, and 1 man after hair transplant were shown. The images of monocular blindness and binocular blindness are stock illustrations that have been previously used in the Harvard Decision Science Laboratory for similar health utility studies. The photographs of patients with alopecia were actual patients who had undergone evaluation at Massachusetts Eye and Ear, Boston, for hair loss but had not had any prior procedures performed for hair loss. The photograph of the man after hair transplant was from a patient who had undergone a hair transplant at Massachusetts Eye and Ear. Patients were chosen to represent hair loss that was not at the extremes of the Norwood or Ludwig classification scales,[14] and the angle of the photographs was chosen to demonstrate hair loss in a deidentified manner. All data were collected in a deidentified manner using REDCap (Research Electronic Data Capture), a secure, web-based platform designed for development and distribution of electronic data capture tools. The institutional review board of the Massachusetts Eye and Ear approved the study, which did not require informed consent for the use of deidentified records.

Heath Utility Questionnaire

Health utility scores were measured using VAS, SG, and TTO measures.[15] The VAS is a continuous sliding scale with the worst health state (death) and the best health state (perfect health) at opposite ends of the scale, corresponding to health utility values of 0 and 100, respectively.[15] Participants slide a marker on the scale to rank the health state on the continuum from death to perfect health. For example, if monocular blindness was placed at 0.8 on the VAS rating scale, we could assert that 1 year with monocular blindness is approximately equivalent to the value of 80% of a year in perfect health. This would be displayed as 0.8 quality-adjusted life-years (QALYs), providing a language for comparing health states among different diseases and the cost utility of different treatments.

The goal of the SG is to find a maximum risk of death a participant would accept to avoid having a specific health condition.[15] Participants are presented with a specific risk of death starting at 1%. The percentage is subsequently adjusted using the ping-pong method to find the maximum risk that the participant is willing to accept to be completely cured of the disease. For example, a 15% chance of death would be displayed as 0.85 QALYs. eFigure 4 in the Supplement demonstrates how the ping-pong method was used during our SG measure.

The final method, TTO, asks participants to choose a specific amount of time in a lesser health state that they would trade off for an immediate and complete cure of their health condition. The participant gives the amount of time in perfect health they deem equivalent to living with a poorer health state.[15] Based on the median age of patients with AGA and estimated life expectancy (approximately 80 years), 36 years was chosen as the maximum amount of time that one can choose to live without trading off years. Participants were then asked to choose between living for 36 years with alopecia or living for a lesser amount of time without alopecia.

Statistical Analysis

Survey responses in which a respondent graded binocular blindness as having a higher utility than monocular blindness (using the VAS, SG, or TTO) or provided identical responses across each scenario were excluded from the data analysis. Forty-one individual surveys were excluded from analysis based on failure to meet the aforementioned criteria. Means and SDs of utility scores were calculated and normalized to a continuous 0 to 1 scale. Data were assessed for normality using the Shapiro-Wilk test. One-way analysis of variance with post hoc Tukey pairwise comparison was used to detect whether any significant differences existed among VAS, SG, and TTO scores between each health state. Pairwise significance was adjusted using the Bonferroni correction to reduce the chance of type I error for multiple comparisons. Results were considered significant if $P < .05$ was observed. Statistical analyses were completed with Stata/MP software (version 14.1; StataCorp).

Results

Three hundred eight participants completed the questionnaire. The mean (SD) participant age was 30.8 (13.5) years with a similar composition of men (147 [47.7%]) and women (157 [51.0%]; unknown in 4 [1.3%]). Race/ethnicity, educational level, and income were well distributed and heterogeneous among participants. More participants were single (179 [58.1%]). Participant demographics can be found in **Table 1**.

Mean health utility scores are reported in **Table 2**. Binocular blindness received the lowest mean (SD) health utility score of 0.53 (0.24) QALYs on the VAS, 0.72 (0.27) QALYs on the SG, and 0.69 (0.25) QALYs on the TTO scales. Hair loss for women had slightly lower mean (SD) scores when compared with men (VAS: 0.83 [0.19] vs 0.85 [0.18] QALYs; SG: 0.92 [0.17] vs 0.93 [0.17] QALYs; and TTO: 0.91 [0.18] vs 0.93 [0.17] QALYs). Monocular blindness had higher health utility scores than binocular blindness, and slightly lower scores than hair loss. The posttransplant state had the highest mean (SD) health utility score at 0.93 (0.11) QALYs on the VAS, 0.95 (0.15) QALYs on the SG, and 0.95 (0.16) QALYs on the TTO scales.

Health states were then analyzed in comparison with alopecia for women (**Table 3**) and men (**Table 4**). Alopecia for men compared with women was deemed as similar (mean difference on the VAS, +0.02 [95% CI, −0.02 to 0.06]; and mean difference on the SG, +0.01 [95% CI, −0.04 to 0.06]; mean difference on the TTO, +0.02 [95% CI, −0.02 to 0.06]). Significant improvement occurred on the VAS when comparing the posttransplant state with female alopecia (mean difference, +0.10; 95% CI, 0.06-0.14; $P < .001$). Men in the posttransplant state also experienced similar increases in VAS scores (mean difference, +0.08; 95% CI, 0.04-0.12; $P < .001$).

Table 1. Participant Demographics

Characteristic	Patient Data (n = 308)
Age, mean (SD), y	30.8 (13.5)
Sex, No. (%)	
Female	157 (51.0)
Male	147 (47.7)
Unknown	4 (1.3)
Race/ethnicity, No. (%)	
White (non-Hispanic)	143 (46.4)
Asian/Pacific Islander	49 (15.9)
African American (non-Hispanic)	38 (12.3)
Mixed race	20 (6.5)
Latino or Hispanic	18 (5.8)
Arab	4 (1.3)
Bangladeshi, Pakistani, or Indian	18 (5.8)
Native American, Aleut, or Aboriginal	0
Other	9 (2.9)
Declined to answer	9 (2.9)
Educational level, No. (%)	
Some high school	2 (0.6)
High school diploma or GED	26 (8.4)
Some college	75 (24.4)
Associate's degree	7 (2.3)
Bachelor's degree	79 (25.6)
Some graduate school	35 (11.4)
Graduate or professional degree	78 (25.3)
Professional certification and/or license	5 (1.6)
Declined to answer	1 (0.3)
Annual household income, $, No. (%)	
<15 000	33 (10.7)
15 001-25 000	29 (9.4)
25 001-35 000	15 (4.9)
35 001-50 000	33 (10.7)
50 001-75 000	50 (16.2)
75 001-100 000	24 (7.8)
>100 000	71 (23.1)
Declined to answer	53 (17.2)
Marital status, No. (%)	
Single	179 (58.1)
Committed relationship	58 (18.8)
Married	49 (15.9)
Separated	2 (0.6)
Divorced	11 (3.6)
Declined to answer	9 (2.9)

Abbreviation: GED, General Education Development.

Table 2. Hair Loss Health Utility Scores

Method	Health Utility Scores, Mean (SD)					
			Hair Loss			
	Monocular Blindness	Binocular Blindness	Female	Male	Posttransplant State	*P* Value[a]
VAS (n = 284)	0.76 (0.17)	0.53 (0.24)	0.83 (0.19)	0.85 (0.18)	0.93 (0.11)	<.001
SG (n = 291)	0.87 (0.21)	0.72 (0.27)	0.92 (0.17)	0.93 (0.17)	0.95 (0.15)	<.001
TTO (n = 299)	0.86 (0.20)	0.69 (0.25)	0.91 (0.18)	0.93 (0.17)	0.95 (0.16)	<.001

Abbreviations: SG, standard gamble; TTO, time trade-off; VAS, visual analog scale.

[a] Calculated using 1-way analysis of variance.

Table 3. Post Hoc Utility Comparisons vs Female Hair Loss

Comparison Health State by Method	Mean Difference (95% CI)	*P* Value[a]
Monocular blindness		
VAS	−0.07 (−0.11 to −0.03)	<.001[b]
SG	−0.05 (−0.10 to −0.01)	.02[b]
TTO	−0.05 (−0.09 to −0.01)	.02[b]
Binocular blindness		
VAS	−0.30 (−0.34 to −0.26)	<.001[b]
SG	−0.20 (−0.25 to −0.16)	<.001[b]
TTO	−0.22 (−0.26 to −0.18)	<.001[b]
Male hair loss		
VAS	+0.02 (−0.02 to 0.06)	.69
SG	+0.01 (−0.04 to 0.06)	.97
TTO	+0.02 (−0.02 to 0.06)	.72
Posttransplant state		
VAS	+0.10 (0.06 to 0.14)	<.001[b]
SG	+0.03 (−0.02 to 0.08)	.36
TTO	+0.04 (−0.00 to 0.08)	.09

Abbreviations: SG, standard gamble; TTO, time trade-off; VAS, visual analog scale.

[a] Calculated using 1-way analysis of variance with post hoc Tukey pairwise comparison.

[b] Significant at α = .05.

Table 4. Post Hoc Utility Comparisons vs Male Hair Loss

Comparison Health State by Method	Mean Difference (95% CI)	*P* Value[a]
Monocular blindness		
VAS	−0.09 (−0.13 to −0.05)	<.001[b]
SG	−0.06 (−0.11 to −0.02)	<.001[b]
TTO	−0.07 (−0.11 to −0.03)	<.001[b]
Binocular blindness		
VAS	−0.32 (−0.36 to −0.28)	<.001[b]
SG	−0.21 (−0.26 to −0.17)	<.001[b]
TTO	−0.24 (−0.28 to −0.20)	<.001[b]
Female hair loss		
VAS	−0.02 (−0.06 to 0.02)	.69
SG	−0.01 (−0.06 to 0.04)	.97
TTO	−0.02 (−0.06 to 0.02)	.72
Posttransplant state		
VAS	+0.08 (0.04 to 0.12)	<.001[b]
SG	+0.02 (−0.03 to 0.07)	.74
TTO	+0.02 (−0.02 to 0.06)	.72

Abbreviations: SG, standard gamble; TTO, time trade-off; VAS, visual analog scale.

[a] Calculated using 1-way analysis of variance with post hoc Tukey pairwise comparison.

[b] Significant at α = .05.

Health states were than analyzed in comparison with the posttransplant state (**Table 5**). Significantly lower QALYs for monocular blindness and binocular blindness on the VAS (mean difference, −0.17 [95% CI, −0.21 to −0.13] and −0.40 [95% CI, −0.44 to -0.36], respectively), SG (mean difference, −0.08 [95% CI, −0.13 to -0.04] and −0.23 [95% CI, −0.28 to −0.19], respectively), and TTO (mean difference, −0.09 [95% CI, −0.13 to -0.05] and −0.26 [95% CI, −0.30 to -0.22], respectively) ($P < .001$ for all comparisons). Hair loss in women and men demonstrated significantly lower QALYs on the VAS for hair loss in women (mean difference, −0.10; 95% CI, −0.14 to −0.06; $P < .001$) and men (mean difference, −0.08; 95% CI, −0.12 to −0.04; $P < .001$).

Discussion

To our knowledge, this study is the first to objectively quantify the health utility of sex-specific alopecia and the posttransplant state. Participants perceived individuals who had undergone hair transplant as healthier than those with hair loss, as indicated by the significant amounts of QALYs they would trade to go from living with hair loss to a posttransplant state. Participants exhibited risk-taking behavior to correct alopecia through transplant similar to the risk-taking used to correct monocular blindness.

The mean SG and TTO for alopecia compared with monocular and binocular blindness were revealing. Binocular blindness was unsurprisingly the lowest ranked health state through all 3 scoring domains, with participants willing to trade in as much as one-third of their remaining life for complete cure. Alopecia was demonstrated to be a particularly distressing state, with women and men willing to trade in 9% and 7% of their remaining life to permanently cure their hair loss. These values are similar to those of other health states, including scoliosis,[16] craniosynostosis,[17] and body contouring after massive weight loss.[18] Interestingly, the health utility score for female hair loss was not found to be significantly different than that for male hair loss.

Measuring health utility has become important in the age of declining revenues and amplified emphasis on patient-perceived outcomes, such as the value of a specific health state (eg, shortness of breath), rather than a purely clinical output (eg, measurement of forced expiratory volume in the first second of expiration).[11,13,19] Policy makers prefer preference-based measures such as health state utilities, which are generated with continuous rating scales (eg, VAS, SG, and TTO).[11] Obtaining the general population's perception of health utility has been shown to be one of the most important but elusive measures.[20]

Health utility assessment has been limited in the facial plastic surgery literature. Using House-Brackmann grading, facial reanimation surgery demonstrated VAS values of 0.92 for low-grade facial paralysis, 0.76 for medium-grade facial paralysis, and 0.43 for high-grade facial paralysis.[21] The SG and TTO values were 0.98 and 0.98, respectively, for low-grade facial paralysis; 0.93 and 0.92, respectively, for medium-grade facial paralysis; and 0.77 and 0.74, respectively, for high-grade facial paralysis. In microtia with unilateral deafness, a VAS value of 0.80, an SG value of 0.91, and a TTO value of 0.88 were obtained.[22] Functional septorhinoplasty for nasal obstruction demonstrated a preoperative mean VAS of 0.72 that increased to 0.825 after surgery.[23] The aging neck after massive weight loss exhibited a VAS value of 0.89, SG value of 0.94, and TTO value of 0.95.[24] Thus, hair loss in men and women was perceived as comparable to medium-grade facial paralysis and unilateral deafness with microtia, slightly better than nasal obstruction, and worse than the aging neck after weight loss.

Societal implications of hair loss are real and a perceived quality-of-life stressor,[4] similar to those associated with the aging face.[4,25] The Hair Specific Skindex-29 demonstrated decreased quality of life if alopecia was severe or of longer duration, if the age at onset of alopecia was young, or if any hospital treatment was required for alopecia.[2] A randomized controlled survey demonstrated that individuals with hair loss were rated as more attractive, more successful, younger, and more approachable after hair transplant.[4] Our study adds to this literature as a first step in valuing the quality of life for hair loss and helps quantify improvement after surgical repair. In addition, our study serves as a benchmark for cost-utility analyses, which use quality-of-life valuation in their determination.

Table 5. Post Hoc Utility Comparisons vs Posttransplant State

Comparison Health State by Method	Mean Difference (95% CI)	*P* Value[a]
Monocular blindness		
VAS	−0.17 (−0.21 to −0.13)	<.001[b]
SG	−0.08 (−0.13 to −0.04)	<.001[b]
TTO	−0.09 (−0.13 to −0.05)	<.001[b]
Binocular blindness		
VAS	−0.40 (−0.44 to −0.36)	<.001[b]
SG	−0.23 (−0.28 to −0.19)	<.001[b]
TTO	−0.26 (−0.30 to −0.22)	<.001[b]
Female hair loss		
VAS	−0.10 (−0.14 to −0.06)	<.001[b]
SG	−0.03 (−0.08 to 0.02)	.36
TTO	−0.04 (−0.08 to 0.00)	.09
Male hair loss		
VAS	−0.08 (−0.12 to −0.04)	<.001[b]
SG	−0.02 (−0.07 to 0.03)	.74
TTO	−0.02 (−0.06 to 0.02)	.72

Abbreviations: SG, standard gamble; TTO, time trade-off; VAS, visual analog scale.

[a] Calculated using 1-way analysis of variance with post hoc Tukey pairwise comparison.

[b] Significant at α = 0.05.

Limitations

An important consideration when evaluating health utility is the population performing the evaluation.[11] This study focuses on the layperson's assessment of the significance of hair loss when viewed in others. These results are important because they help describe the social effect of AGA as viewed by society as a whole. However, a person who does not have the condition may have a different view than a patient who is living with the condition. For example, patients with monocular blindness or hair loss may believe the condition is worse than the layperson thinks or may actually believe that the condition is not as bad as it seems to a layperson. This perception was demonstrated in facial paralysis, where casual observers and surgical experts perceived patients with facial paralysis more negatively than the patients viewed themselves.[26] For comparison, future research within our clinic will repeat the health utility measurements in men and women with AGA. Another limitation is that, with the rating scales used, participants tended to rate health states worse on the VAS compared with the SG or TTO measures; therefore, all 3 scales were studied and reported.[13] After consideration of these limitations, these data are the first to examine the health utility of sex-specific hair loss and after hair transplant and are robust in quantity of participants and diversity of queried individuals. A third limitation is with the sample size of the clinical vignettes. Although we attempted to minimize confounders through selection of a common race and avoidance of extremes of age or hair loss, care must be taken in extrapolation of the results herein, because we did not explicitly account for factors such as race/ethnicity, sex, and age. In a future study, use of multiple examples of varying degrees of hair loss across a wider spectrum could be used with mixed-effects regression model analysis. Photographs of the sample vignettes used have been made available to the reader to assess the suitability of applying our findings to their own population.

Conclusions

The health utility scores for alopecia were significantly reduced in both sexes, approaching those of monocular blindness. Participants were willing to undergo a 7% to 8% risk of death and to trade off 7% to 9% healthy life-years for a complete cure of their hair loss. Hair transplant surgery significantly increased health utility as rated by casual observers.

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Concept and design: Abt, Heiser, Jowett, Tessler, Lee.
Acquisition, analysis, or interpretation of data: Abt, Quatela, Heiser, Jowett, Lee.
Drafting of the manuscript: Abt, Quatela, Jowett, Lee.
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