POSB358

Health State Utilities Associated With Weight Loss in Type 2 Diabetes and Obesity

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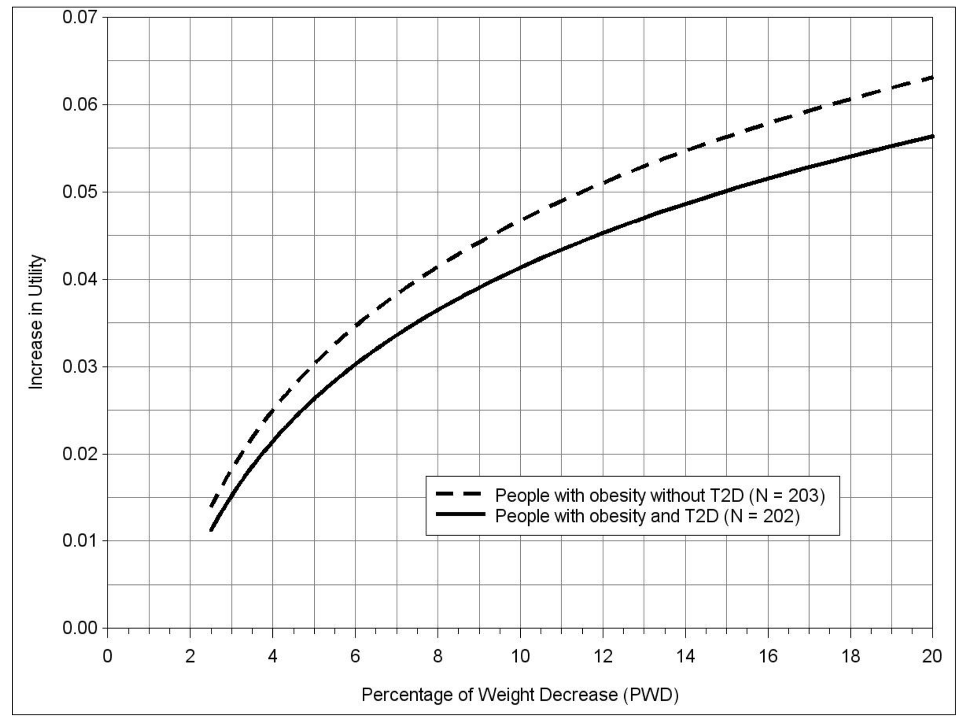
BACKGROUND AND OBJECTIVES

- Health state utilities associated with weight change are needed as inputs for cost-utility models examining the value of treatments for obesity and type 2 diabetes (T2D).
- For individuals with body mass index (BMI) in the normal to obese range, lower BMI or body weight is generally associated with greater utility.[1-5]
- However, the available data have some limitations. For example, studies estimating the utility impact of changes in body weight have focused on relatively small changes in weight such as a 3% to 7% increase or decrease.[6-10]
- Several newer treatments, like tirzepatide, are associated with greater amounts of weight loss.[11-14]
- **The purpose of this study was to estimate health state utilities associated with body weight decreases up to 20% based on preferences of individuals with obesity, with and without T2D.**

KEY RESULTS

Figure 1. Change in Utility as a Function of Percentage Change in Weight[1,2,3]



[1]These are plots of the two regression models from Table 3 that do not include covariates. Both models are log-linear regressions of change in utility as a function of the natural log of the weight change represented in the health states.

[2]Model for participants with diabetes: $y = -0.00861 + 0.0217*\log(x)$

[3]Model for participants without diabetes: $y = -0.00782 + 0.0237*\log(x)$

Table 2. Health State Utilities

	Health State Utility[1]		Utility Increases[2] Compared to Current Weight	
	Mean	SD	Mean Utility Increase	SD
Obesity with T2D (N = 202)				
A. Current weight	0.797	0.184	-	-
B. 2.5% less weight	0.808	0.176	0.011	0.029
C. 5% less weight	0.820	0.171	0.023	0.050
D. 10% less weight	0.839	0.167	0.042	0.068
E. 15% less weight	0.850	0.158	0.053	0.087
F. 20% less weight	0.857	0.155	0.060	0.093
Obesity without T2D (N = 203)				
A. Current weight	0.817	0.191	-	-
B. 2.5% less weight	0.832	0.180	0.015	0.041
C. 5% less weight	0.846	0.173	0.029	0.055
D. 10% less weight	0.866	0.164	0.048	0.077
E. 15% less weight	0.884	0.159	0.067	0.095
F. 20% less weight	0.894	0.153	0.077	0.108

[1]TTO scores are on a scale anchored with 0 representing dead and 1 representing full health.

[2]Calculated by subtracting the utility of health state A from the utility of each other health state.

CONCLUSIONS

- Health states representing weight reduction of 2.5% to 20% were associated with increases in health state utility based on preferences of individuals with obesity with and without T2D. Greater amounts of weight decrease were associated with larger gains in utility.
- The mean utility increases in Table 2 may be used in CUAs to represent utility change associated with the specific percentage decreases in body weight represented in the health states (i.e., 2.5%, 5%, 10%, 15%, and 20%). Utilities associated with other amounts of weight loss (e.g., 7%) can be estimated using one of the equations in Table 3.
- Previous studies have proposed similar equations that can be used to estimate utility based on BMI or body weight.[2,16-21] Most of these previous equations modeled utility based on weight,[2,18,19,21] rather than modeling utility change based on weight change. In addition, previously published equations assumed a linear relationship between weight and utilities.[2,16-21] Current results suggest the relationship between weight change and utility change is logarithmic (Figure 1).

METHODS

Study Design

- Utilities were estimated in a vignette-based time trade-off (TTO) utility elicitation in the UK. Vignette-based TTO utility interviews were conducted with a sample of patients with obesity with and without T2D. Interviews were conducted both face-to-face and virtually (using videoconferencing software) due to the COVID-19 pandemic.

Participants

- All were required to be between 18 and 75 years old, have a BMI of ≥30 at time of enrollment, and reside in the UK. Participants in the subgroup with T2D were also required to have been diagnosed with T2D by a medical doctor and provide proof of T2D (e.g., prescription or medication packaging).

Health State Vignettes and Pilot Study

- For participants with obesity and T2D, health states began with a description of T2D (adapted from previous research[15]), followed by body weight: Either current weight or weight decrease of 2.5%, 5%, 10%, 15%, and 20%. For participants with obesity without T2D, the health states omitted the initial description of T2D, but had the same language describing body weight.
- Draft health states and utility assessment methods were tested in a pilot study with 31 participants (58.1% male; mean [SD] age 54.0 [11.0] years; n=17 with T2D). All participants reported that the health states were clear and understandable.

Procedures

- Participants completed an introductory ranking task before valuing the health states in a TTO task with a 20-year time horizon. In the TTO for each health state, participants were offered a choice between spending a 20-year period in the health state being rated versus spending varying amounts of time in full health. Choices were presented in one-year increments, alternating between longer periods of time and shorter periods of time (i.e., 20 years, 0 years [dead], 19 years, 1 year, 18 years, 2 years…).
- Utilities and utility difference scores were summarized as means and standard deviations.
- For future economic modeling, it may be necessary to estimate the utility increase associated with a specific amounts of weight loss between those in the health states (i.e., 2.5%, 5%, 10%, 15%, and 20%). To derive equations that could be used to provide these estimates, a series of regression models accounting for repeated measures from participants were run to determine the optimal functional form (e.g., linear vs. logarithmic) for predicting utility change associated with any percentage of weight decrease between 2.5% and 20%.

RESULTS

Sample Description

- Demographic and clinical information is presented in Table 1.

Health State Utilities

- Mean (SD) health state utilities and the utility increases associated with weight decreases are presented in Table 2.

Table 1. Sample Characteristics

Characteristics	Participants with T2D (N=202)	Participants without T2D (N=203)
Age (mean, SD) (yrs)	58.4 (10.7)	52.3 (12.0)
Gender (n, %)		
Male	104 (51.5%)	100 (49.3%)
Female	98 (48.5%)	103 (50.7%)
Ethnicity (n, %)		
White/Caucasian	162 (80.2%)	170 (83.7%)
African, Caribbean, or Black	19 (9.4%)	7 (3.4%)
Asian	8 (4.0%)	11 (5.4%)
Mixed race	9 (4.5%)	5 (2.5%)
Other	4 (2.0%)	10 (4.9%)
Duration of diabetes diagnosis (yrs)		
Mean [SD]	9.5 (8.4)	n/a
Median [Range]	7.0 [0.1-50.0]	n/a
Current diabetes medication (n, %)		
No medication treatment	28 (13.9%)	n/a
Oral medication	123 (60.9%)	n/a
Non-insulin injectable medication	1 (0.5%)	n/a
Insulin	7 (3.5%)	n/a
Oral + Non-insulin injectable	14 (6.9%)	n/a
Oral + Insulin	23 (11.4%)	n/a
Non-insulin injectable + Insulin	1 (0.5%)	n/a
Oral + Non-insulin injectable + Insulin	5 (2.5%)	n/a

Estimating Utility Change for Weight Change Not Represented in the Health States

- All regression models found that percentage weight decrease (PWD) was a highly significant predictor of change in health state utility ($p < 0.0001$). This was consistent across the linear, logarithmic, and quadratic models with and without covariates. The data were examined graphically to help determine which type of model best represented the relationship between these two variables.
- As depicted in Figure 1, the relationship between weight change and utility change did not appear to be linear. Because utility increase continues to trend upward as PWD increases, the logarithmic model appeared to best represent this relationship.
- Covariates hypothesized to modify the relationship between weight change and utility change were added to the models above (i.e., gender, age, BMI). Interaction with gender did not appear to add any predictive value. However, there did appear to be some interaction of weight change with age and BMI.
- Based on consideration of all regression models run for the current study, four potential equations are proposed for estimating utility change based on weight change (Table 3).

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Table 3. Four Equations Proposed for Estimating Utility Change Based on Weight Decrease

Intended Population	Covariates and Interaction Terms	Equation for Predicting Utility Change Based on Percentage Weight Decrease
With obesity and T2D	None	Utility change = -0.0086 + 0.022 (LogPWD)
With obesity without T2D	None	Utility change = -0.0078 + 0.024 (LogPWD)
With obesity and T2D	Age, BMI, weight change by age interaction, weight change by BMI interaction	Utility change = -0.014 + 0.028 (LogPWD) + 0.00026 (age) – 0.00027 (BMI) – 0.00055 (LogPWD*age) + 0.00069 (LogPWD*BMI)
With obesity without T2D	Age, weight change by age interaction	Utility change = -0.022 + 0.040 (LogPWD) + 0.00027 (age) – 0.00030 (LogPWD*age)

LogPWD = natural log of weight change quantified as the percentage of weight decrease; BMI = body mass index of each patient

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