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Illustrating the relationship between the number of hypoglycemic events, event rate reduction and the impact on estimates of quality of life improvement in health economic studies

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Introduction

In health economic evaluation, negative effects of hypoglycemia on patients' well being and health related quality of life (HRQoL) are commonly incorporated through a disutility assumption that describes the annual decline in quality adjusted life expectancy (QALY) that is associated with the occurrence of one hypoglycemic event.

Most commonly, a static approach is applied that assumes the same (static) reduction of QALY for each hypoglycemic event that occurs throughout one year.

Two independent studies (1, 2) have recently demonstrated that the health utility gain associated with the per-event avoidance of a non-severe hypoglycemia episode (NSHE) varies according the annual baseline rate of NSHE following the perception that QALE decline is worst for the first event but declines with each subsequent event occurring throughout one year.

Both studies have evaluated non-linear equations to evaluate the overall annual disutility as a function of annual event frequency for daytime and nocturnal NSHE. A comparison of overall marginal (single event) disutility as a function of annual NSHE frequency following both approaches is presented in Figure 1.

Similarities in the pattern of marginal declining utility for increasing event frequency and the fact that both studies were conducted independently and based on different data sets supports the claim that the observed trend reflects clinical practice.

Despite this many health technology assessments recommend using a mean (static) per-event health disutility.

Figure 1) Marginal disutility of daytime and nocturnal NSHE with increasing yearly event rate

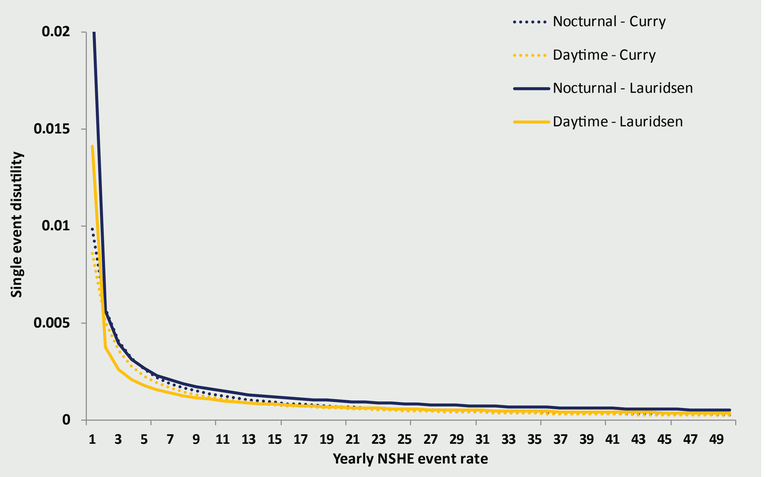


Figure 2) Annual QALE decline following daytime NSHE - non-linear vs. static approach

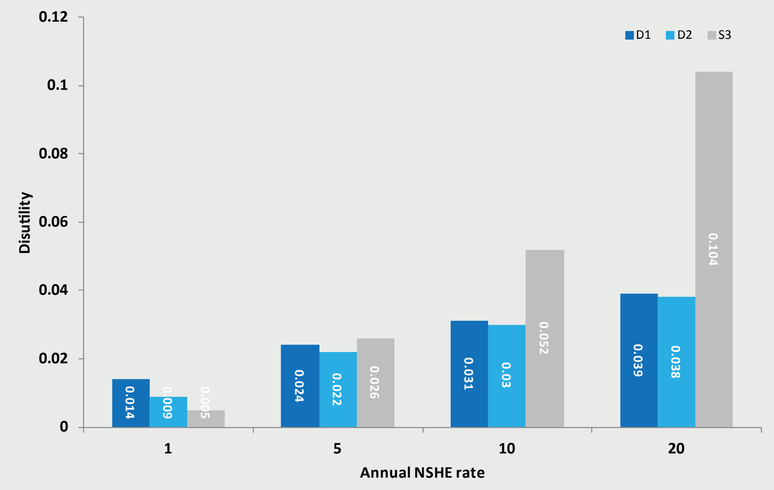


Figure 3) Incremental utility gain for 1 NSHE avoided - non-linear vs. static approach

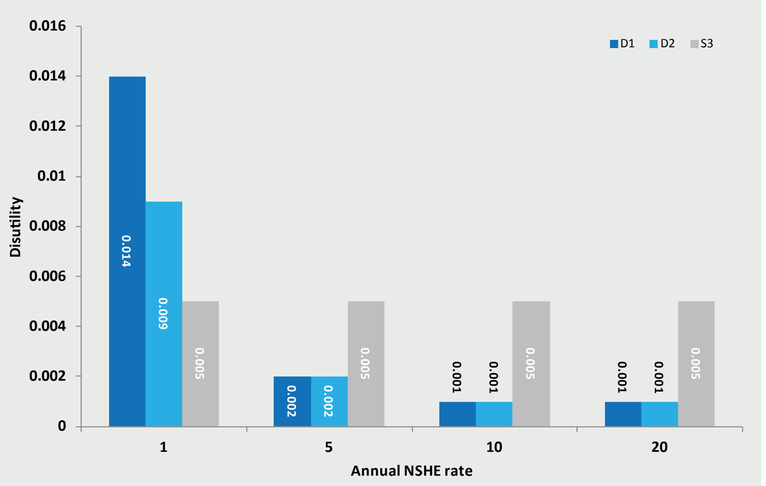
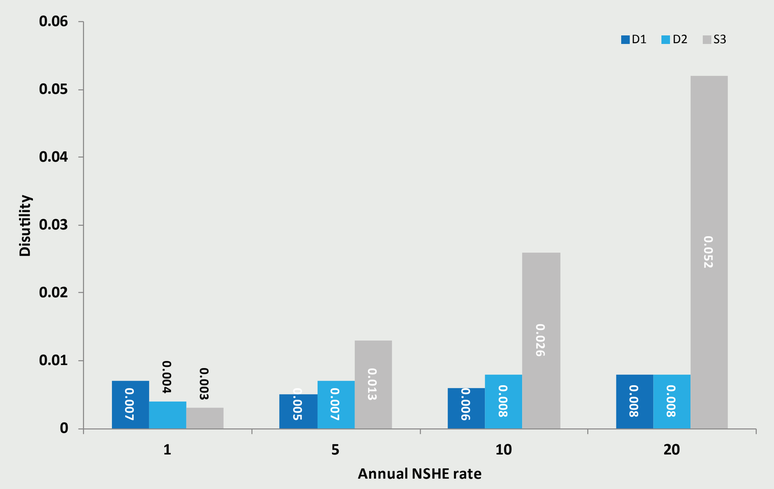


Figure 4) Annual utility gain following a 50% reduction of NSHE - non-linear vs. static approach



Objectives

The objective of this study is to quantify the bias introduced into an economic evaluation when using an average (static) disutility compared to a baseline event rate adjusted (diminishing) disutility.

Methods

This study used the IMS Core Diabetes Model (CDM) (3-5), a validated and established diabetes model, to compare the static versus non-linear (diminishing) approach to evaluate NSHE disutility for increasing annual event rates of 1, 5, 10 and 20 events per year.

Health utility impact following hypoglycemia was assessed using the below approaches:

D1 - Non linear approaches following log transformed regression equations to evaluate the disutility associated with daytime (diurnal) and nocturnal NSHE derived from time-trade-off (TTO) data reported by 8,268 individuals from Canada, Germany, Sweden, UK and USA (1).

D2 – Non linear approach following multivariate regression to evaluate the disutility associated with daytime and nocturnal NSHE derived from two postal surveys (1,305 responses) among subjects form the UK (2).

S3 - Static approach assuming a constant utility decline of 0.0052 per NSHE (6).

Utility differences as evaluated by the alternative approaches were assessed for the following scenarios:

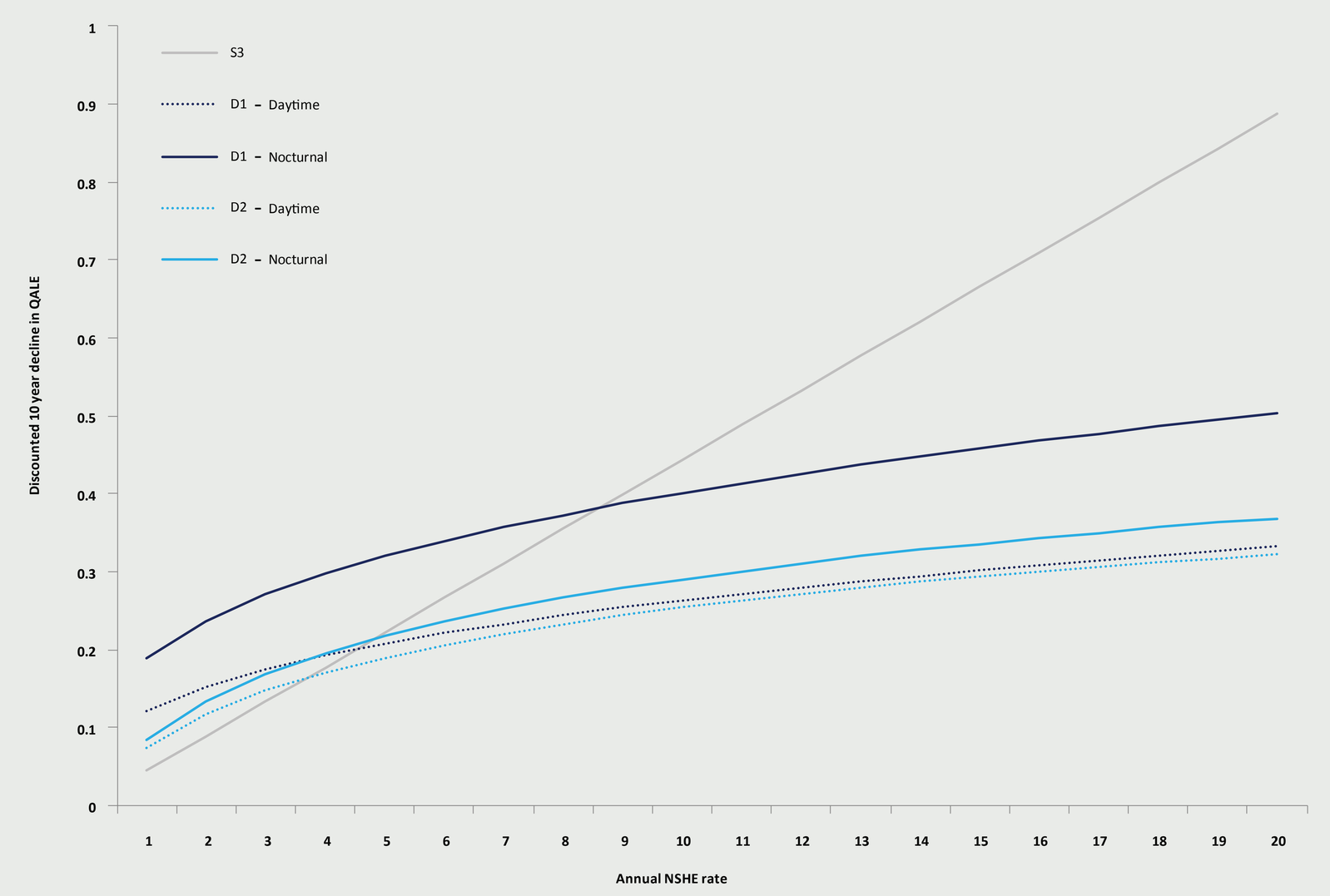
A) The overall one year decline in health utility following annual daytime NSHE rates of 1, 5, 10 and 20 events per year.

B) The incremental utility gain for one daytime NSHE avoided following annual NSHE rates of 1, 5, 10 and 20 events per year.

C) The annual utility gain following a 50% reduction of daytime NSHE for rates of 1, 5, 10 and 20 events per year.

D) The 10 year decline in health utility for increasing annual daytime and nocturnal NSHE rates from 1 to 20 events per year.

Figure 5) 10 year decline in health utility for increasing annual daytime and nocturnal NSHE rates - non-linear vs. static approach



Results

The two approaches assuming diminishing marginal disutility were associated with an overall one year decline in health utility of 0.014, 0.024, 0.031 and 0.039 (D1) and 0.009, 0.022, 0.030 and 0.038 (D2) for annual event rates of 1, 5, 10 and 20 events per year. This compared to a one year utility decline of 0.005, 0.026, 0.052 and 0.104 using the static approach (S3) (Figure 2).

Incremental utility gain for 1 NSHE avoided per year was 0.014, 0.002, 0.001 and 0.001 (D1), 0.009, 0.002, 0.001 and 0.001 (D2) and 0.005, 0.005, 0.005 and 0.005 (S3) for annual event rates of 1, 5, 10 and 20 events per year (Figure 3).

Assuming a 50% reduction in annual NSHE rate for the comparator intervention was associated with a utility gains of 0.007, 0.005, 0.006 and 0.008 (D1), 0.004, 0.007, 0.008 and 0.008 (D2) and 0.003, 0.013, 0.026 and 0.052 (S3) for the compared annual event rates (Figure 4).

Finally, the 10 year decline in health utility for increasing annual daytime and nocturnal NSHE rates from 1 to 20 events per year is presented in Figure 5.

Conclusions

Both nonlinear approaches assuming diminishing marginal disutility presented comparable findings.

Nonlinear models produced higher overall and incremental utility scores for 1 NSHE/year and considerably lower scores for >=5 NSHE/year.

Failure to account for the effects of diminishing marginal disutility may introduce bias when estimating the value of diabetes management strategies that minimize hypoglycemia risk.

References

[1] Lauridsen et al. Diminishing marginal disutility of hypoglycaemic events, poster presentation at ISPOR 16th Annual European Congress, Dublin 2013.
[2] Currie et al. Curr Med Res Opin 2006;22:S1523–S1534.
[3] Palmer et al. Curr Med Res Opin 2004;20:S5–S26.
[4] Palmer et al. Curr Med Res Opin 2004;20:S27–40.
[5] Foos, V et al. Value in Health 2012;15(7)p.A470
[6] Warren et al. Health Technol Assess. 2004 ;8(45): 1-57.

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