

## **A cost-effectiveness analysis of a telephone-linked care intervention for individuals with Type 2 diabetes**

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**Abstract**

**Aim:** To assess the cost-effectiveness of an automated telephone-linked care intervention, Australian TLC Diabetes, delivered over 6 months to patients with established Type 2 diabetes mellitus and high glycated haemoglobin level, compared to usual care.

**Methods:** A Markov model was designed to synthesize data from a randomized controlled trial of TLC Diabetes (n=120) and other published evidence. The 5-year model consisted of three health states related to glycaemic control: 'sub-optimal'  $HbA_{1c} \geq 58$  mmol/mol (7.5%); 'average'  $\geq 48$ -57 mmol/mol (6.5- 7.4%) and 'optimal'  $< 48$  mmol/mol (6.5%) and a fourth state 'all-cause death'. Key outcomes of the model include discounted health system costs and quality-adjusted life years (QALYS) using SF-6D utility weights. Univariate and probabilistic sensitivity analyses were undertaken.

**Results:** Annual medication costs for the intervention group were lower than usual care [Intervention: £1076 (95%CI: £947, £1206) versus usual care £1271 (95%CI: £1115, £1428,)  $p=0.052$ ]. The estimated mean cost for intervention group participants over five years, including the intervention cost, was £17,152 versus £17,835 for the usual care group. The corresponding mean QALYs were 3.381 (SD 0.40) for the intervention group and 3.377 (SD 0.41) for the usual care group. Results were sensitive to the model duration, utility values and medication costs.

**Conclusion:** The Australian TLC Diabetes intervention was a low-cost investment for individuals with established diabetes and may result in medication cost-savings to the health system. Although QALYs were similar between groups, other benefits arising from the intervention should also be considered when determining the overall value of this strategy.

**Key words:** tele-health, cost-effectiveness analysis, Type 2 diabetes

## Introduction

With the rapidly rising prevalence of Type 2 diabetes worldwide [3], the use of information and communication technology could be an very effective way of delivering diabetes self-management programs to large numbers of people with established diabetes [4]. The Telephone-Linked Care (TLC) program is an automated and interactive telephone system designed to simulate natural patient and health professional encounters and to complement standard medical care [5-7]. This technology has been previously found to be effective in screening for specific health conditions, promoting self-care behaviours and for improving health care outcomes for a range of chronic diseases [8-10] .

A recent Australian randomized controlled trial evaluated a TLC program targeting Type 2 diabetes management, the Australian TLC Diabetes [4, 11]. The primary outcomes of the trial were glycated haemoglobin (HbA<sub>1c</sub>) and health-related quality of life (HRQoL) [4]. Following a 6-month intervention period, TLC-Diabetes patients compared to usual care controls showed significantly greater improvements in HbA<sub>1c</sub> (mean reduction 15 mmol/mol or 0.8%, p=0.002) and quality of life mental health scores (SF-36 Mental Component Score difference=3.0, p=0.007.) There are potentially large benefits in the longer term if these benefits are enduring. For example, it has been reported that a decrease of 13 mmol/mol (1%) in HbA<sub>1c</sub> is linked to 21% fewer deaths, 14% fewer non-fatal myocardial infarctions and a reduction in microvascular complications (retinopathy, nephropathy) by 37% [12].

Population-level interventions that successfully generate patient benefits will also help to stem the rising economic burden of diabetes care faced by health systems. Cost-effectiveness analysis is a useful technique that presents both the costs and health benefits of alternative population-level strategies for delivering health services and is invaluable for health policy makers and reimbursement agencies. The purpose of this study was to assess the relative costs and health benefits of the Australian TLC Diabetes program compared to usual care, using information collected as part of an Australian randomized control trial, and therefore assess the value for money of the intervention [4, 11].

## **Methods**

### **Overview**

Cost-effectiveness was assessed over a 5-year time period, using patient-level data from the Australian TLC Diabetes program wherever possible and supplemented with data for the post-trial period from a brief literature review. Details of the original protocol for the clinical and economic methods are provided in a previous publication [11]. Briefly, participants had a diagnosis of Type 2 diabetes of  $\geq 3$  months duration, were aged 18-70 years, had access to a telephone, had an HbA<sub>1c</sub> level  $\geq 58$  mmol/mol (7.5%) and, if medicated, were on stable diabetes pharmacotherapy. Exclusion criteria included: diagnosis of a condition with likely poor prognosis within one year; diagnosis with dementia or a psychiatric co-morbidity; pregnant, lactating, or planning to become pregnant within the next 12 months; currently enrolled in another intervention trial; or have undergone bariatric surgery in the past two years. The study randomized 120 patients to either the Australian TLC Diabetes

intervention or a usual care arm. The TLC Diabetes intervention was 24 weeks in duration. It consisted of educational advice and feedback on diabetes self-management provided to patients during weekly telephone calls to TLC Diabetes which promoted blood glucose monitoring, medication taking, healthy eating and regular physical activity. Patients received a TLC Diabetes kit containing a handbook, an ACCU-CHEK® *Advantage* blood glucose meter, a box of test strips, a cell phone and a Bluetooth™ device that uploaded their blood glucose readings from their ACCU-CHEK® meter to the TLC Diabetes computer server by transmitting them wirelessly using the cell phone. Advice was tailored to patient needs, for example, feedback on blood glucose testing frequency was based on individualized weekly frequency targets set prior to the intervention [4, 11]. Assessment times were at baseline, 6 and 12 months. Baseline characteristics of the study participants are provided in Appendix A.

### **Markov Model**

We constructed a health state transition Markov Model to synthesize data from the Australian TLC Diabetes project and other published evidence, using TreeAge Pro 2011 (TreeAge Software Inc, Williamstown, MA, USA). The model consisted of three health states related to glycemic control from a starting point using the trial eligibility level of  $HbA_{1c} \geq 58$  mmol/mol (7.5%): 'sub-optimal control' [ $\geq 58$  mmol/mol (7.5%)  $HbA_{1c}$ ]; 'average control' [ $\geq 48$ -57 mmol/mol (6.5 to <7.5%)  $HbA_{1c}$ ], 'optimal control' [ $< 48$  mmol/mol (6.5%)], and a fourth health state of 'all-cause death'. The health state categories were based on evidence that a 1% difference in  $HbA_{1c}$  levels is associated with clinically significant differences in glycemic control and risk of diabetes complications [12]. Individuals can move between these mutually exclusive

health states, once every six months, or remain in the same state. In an additional analysis, these categories were repeated for the alternative HbA<sub>1c</sub> cut-offs of >64 mmol/mol (8.0%), 53-64 mmol/mol (7.0-8.0%) and <53 mmol/mol (7.0%) to assess whether these categories influenced the results. Key outcomes of the model included costs and the generic outcome 'quality-adjusted life years' (QALYS). Guidelines for best-practice procedures for economic modelling were adhered to during our study [13].

### **Data Inputs and Sources**

*Resource Use and Costs.* We documented itemized labour costs and equipment costs (i.e., Bluetooth™ devices, cell phones and computer) that were part of the program delivery system. Healthcare costs included general practitioner and specialist visits, allied health encounters, hospitalizations and all medication use. Due to the very high volume of individual medicines used, medications used were collated into general therapeutic drug classes and a mean cost for these general classes was used, based on a prior diabetes cost analysis in Australia [14].

Hospitalization data were obtained from Queensland Health Admitted Patients Data Collection and other healthcare utilization was based on participants' self-reports of utilization during the prior six months that were collected at the three assessment time points (zero, six and 12 months). Resources were valued using national price schedules [15-17]).

*Health Utilities.* To determine health utilities, we used a 12-item subscale of the SF-36 (the SF-6D) [18] which is an acceptable preference-based utility tool for use in economic evaluations to generate the outcome 'quality-adjusted life years' (QALYs).

The UK population scoring algorithm was applied to produce a score between 0 and 1, with 1 representing the best and 0 worst possible health status for each study participant. The analyses of SF-6D scores were not found to be minimally different across time and intervention group (Table 1) or across HbA<sub>1c</sub> health state categories. This outcome was inconsistent with what is known about health utilities by glucose control categories, namely, that patients with higher HbA<sub>1c</sub> levels report lower utilities [19]. Therefore, we used the average utility value for the whole study group at the 12 month follow-up (0.726) for the 'sub-optimal control' category and added an increment of 0.029 for 'average control' and 0.058 for 'optimal control' categories. These increments were calculated based on SF-6D scores reported in Australian patients with impaired glucose tolerance and Type 2 diabetes with similar age and BMI [19].

*Transition probabilities.* In each 6-month cycle after baseline, a proportion of individuals will either continue to live with sub-optimal glycaemic control or improve to average or optimal control, and all other combinations. The transition probabilities are taken directly from the HbA<sub>1c</sub> values collected during the 12 month study period and stratified by the intervention and control groups from baseline to 6 months and from 6 to 12 months (Table 2). Thereafter, an assumption was made to maintain the same transition probabilities as those during the maintenance phase (6 to 12 months) at a constant rate out to 5 years.

*Relative risk of mortality.* We used data from the Australian 'AusDiab' study which reports on the excess mortality attributed to elevated HbA<sub>1c</sub> levels over a 7-year follow-up [20] (Table 2). The relative risk of all-cause death in individuals with

established Type 2 diabetes was 2.3 (95%CI: 1.6, 3.2) with HbA<sub>1c</sub> >48 mmol/mol (6.5%), compared to individuals without diabetes. This relative risk was applied to background mortality rates based on Australian Bureau of Statistics age-dependent mortality tables for patients entering the 'optimal control' health state. Evidence suggests that the relative risk for excess mortality increases in a linear pattern as HbA<sub>1c</sub> levels rise [21] and therefore we linearly interpolated relative risks in higher HbA<sub>1c</sub> categories to align with the model health states.

## **Analyses**

All costs (Table 2) were inflated to 2011 dollars using the Australian Consumer Price Index and presented in pounds (AUD 1 = £0.657, 2011). Total healthcare costs across the two groups and by broad type of healthcare utilization were compared using non-parametric bootstrap statistics with replacement and the bias-corrected approach [22]. Differences across study groups were tested with the Wald test and results were significant at  $p < 0.05$ . Mean SF-6D scores across the time points and groups were assessed by repeated-measures analysis of variance. The 5-year mean costs and QALYs were generated using an expected value (mean per person) analysis which aggregates the probabilities and values assigned to the different health states. Costs and benefits were discounted at 5% per year to adjust to present values. The incremental cost-effectiveness ratio was calculated by the difference in costs divided by the difference in QALYs for the two groups.

One-way sensitivity analyses were undertaken where each parameter was varied through a range of plausible values (Table 2) and changes to the base results were observed. Starting age and model duration were varied and all other model

parameters were tested between high and low values using the 95% confidence intervals where available, values reported in the literature, or  $\pm 30\%$  (Table 1). Intervention costs that incorporate equipment were varied  $\pm 30\%$ . Higher equipment costs could be possible, for example, potentially covering a shorter life-span in cell phones or Bluetooth devices. A probabilistic sensitivity analysis was also performed by re-sampling 5000 times at random from assigned probability distributions for each parameter. This is similar to multivariate sensitivity analysis and addresses the uncertainty of data estimates simultaneously. Log-normal distributions were assigned to relative risks, gamma distributions for costs and beta distributions were used for probabilities and utility scores.

### *Scenario analyses*

To assess the uncertainty in the sustainability of the intervention effect, we also varied the transitions between HbA<sub>1c</sub> health states after the trial period ended. Two scenarios were tested which are labelled the 'optimistic' and 'pessimistic' scenarios. The optimistic scenario applied 0-6 month transition probabilities in the sub-optimal state across all cycles up to 5 years and the pessimistic scenario assumed higher probabilities for unfavourable transitions for remaining in the average state or transitioning from average to the sub-optimal state (Table 2). A third scenario simply averaged the 0-6 month and 6-12 month transitions and extrapolated these for the 5-year duration. The probability sensitivity analysis was repeated to account for the optimistic and pessimistic scenarios.

## **Results**

SF-6D scores were similar at baseline across the intervention 0.728 (SD 0.12) and usual care 0.727 (SD 0.14) groups. By 12 months, the intervention group had a

slightly higher mean SF-6D score 0.736 (0.14) than usual care 0.716 (0.13) but the difference was not statistically significant (Table 1). Annual mean costs were similar for both groups for GP and specialist visits, allied health and hospitalization and no statistically significant differences were shown (Table 1). However, medication use for the intervention group was lower than usual care's use with borderline significance [Intervention: £1076 (95%CI: £947, £1206) versus usual care £1271 (95%CI: £1115, £1428,)  $p=0.052$ ]. Lower medication costs over 12 months in the intervention group were attributed to a lower proportion of participants in the intervention group receiving medications across the entire range of medication categories, including lower use of lipid-modifying agents, anti-thrombotics and 'other' medicines (with the most common being analgesics, anti-inflammatory agents, and thyroid therapies). Further details of medication use are provided in the Supplementary File. Consequently, the group-specific mean values were used in the economic model for medication use. The total intervention cost was £533 per person, mostly made up of the mobile phone and blue tooth devices (Table 2).

In the base case, the predicted mean cost for the TLC intervention group over five years, including the costs for the intervention, was £17,152 versus £17,835 for the usual care group (Table 3), creating a cost-saving of £683 mean per person. The corresponding mean QALYs were 3.381 for the intervention group and 3.377 for the usual care group. The difference in QALYs (0.004) is not considered meaningful.

In one-way sensitivity analyses, the results were sensitive to the estimates for model duration, utilities and medication costs (Table 3). Unlike the other estimates, the choice of utility values for the optimal and sub-optimal HbA<sub>1c</sub> health states changed

the base findings so that there were fewer QALYs in the intervention group. High medication costs for the intervention group or lower medication costs for the usual care group lead to higher mean costs and very high incremental cost per QALY gained ratios. The results of the probabilistic sensitivity analyses indicated that the likelihood of the intervention being cost-effective was 55.4% at a willingness-to-pay threshold of \$50,000 (£33,000) per QALY gained (Figure 1). Changing the pattern of transition probabilities between the HbA<sub>1c</sub> health states did not materially alter the base findings that showed higher QALYs and lower costs than usual care. Under the optimistic scenario, where a larger proportion of intervention participants maintained or improved their HbA<sub>1c</sub> levels, the probability of cost-effectiveness was 59.4% compared to 53.8% for the pessimistic scenario.

## **Discussion**

The results show that the estimated healthcare costs were, on average, lower for the intervention group compared to the usual care group. However, health status as reported by the SF-6D was similar for both groups. The intervention costs were offset by lower medication use but the health utilities and mortality risks were similar across groups. Furthermore, the likelihood of the intervention being cost-effective was marginal at 55% according to acceptable cost-effectiveness thresholds.

Previous reviews have examined studies of self-management programs in community settings, focusing on lifestyle behaviour change, skills development and glucose self-monitoring among adults with Type 2 diabetes [1, 2]. These showed pooled glycated haemoglobin levels improving by 0.5% (95% CI: 0.1%, 1.1%) at 12

months in two home-based studies and improving by 0.26% at greater than 4 months in 31 studies across all settings [1, 2]. Compared with the findings of these studies, the glycated haemoglobin results of our study are comparable.

A balanced view of the intervention benefits should also incorporate other performance indicators of patient benefits as well. These include (1) improvements in the mental health of patients (as shown in the mental health component of the SF-36), (2) increased diabetes self-care activities by patients, and (3) improved access to diabetes resources and self-management support for patients living in rural and remote areas in Australia. The monitoring of blood glucose levels coupled with alerts to the TLC Diabetes coordinator for low (hypoglycaemic) and high (hyperglycaemic) events may lead to earlier intervention by clinicians than for diabetes patients who did not receive TLC Diabetes. The frequency and duration of contact by participants with the program were impressive with the majority of calls to the system completed [4]. The cost-savings for medications are encouraging, while at the same time the intervention was relatively low cost in relation to total healthcare costs for diabetes, an estimated £533 versus approximately £17,000 over 5 years. Furthermore, the ongoing variable costs are relatively small. Since the TLC system can support many more than the 60 enrollees in the evaluation study at any one time, its scalability to a large number of users in the future is very feasible and cost-effective. For example, delivery to 1000 patients would lower the cost per patient to £447 and delivery to 10,000 patients would cost only £301 per patient (Table 2).

While there is accumulating evidence showing the potential clinical benefits of mobile phone tele-health solutions for blood glucose monitoring and self-management in

patients with diabetes [23], only a few have assessed their economic value [23-26]. Only one large multi-site UK study by Henderson *et al* (2013) has comprehensively assessed both the relative costs and QALY outcomes [25]. Matching our findings, the QALY gain between the telehealth intervention and usual care was similar but costs were found to be higher for the intervention group (£1500 -£2000 depending on site) and overall the findings were not considered cost-effective. The authors found that if returns to scale could be made and the program was at increased capacity, the probability of the intervention being cost-effective at £30,000 per QALY was increased to 61%. Despite there being many differences between our study and Henderson's in the intervention type, patient profile, scope of the costs included and modelling approach, this promise of better cost-effectiveness with scalability was similar to our finding.

This study has a number of limitations. Participants from the Australian TLC-Diabetes trial were carefully selected, and may not be representative of the wider population of patients with diabetes. Our cost-effectiveness model simplifies what is a complex disease for which optimal treatment depends on a variety of factors. For example, it is recommended that general practitioners individualize HbA<sub>1c</sub> targets to guide treatment and take into account the presence of disease comorbidities, which are common, patient motivation and harm minimization [27, 28]. The cut-offs chosen for the categories of HbA<sub>1c</sub> used in our model conform to generally accepted standards for defining improved or worsened diabetes status [27]. When these cut-offs were raised by 18 mmol/mol (0.5%) in each category and the analyses re-run, we found this did not materially alter the study findings. Our population-based model necessarily uses averaged costs and outcomes in a 'steady-state' and therefore

loses the precision and complexities of individual patient management. However, our comprehensive sensitivity analyses address this uncertainty and any potential bias in the model parameters chosen.

Systematic reviews suggest that longer interventions are better for controlling blood glucose and behavior improvement declines after interventions stop [2]. Our 'optimistic' scenario has demonstrated what may be possible if the TLC Diabetes intervention was offered over a longer period. However, this is an important assumption that should be substantiated with longer-term follow-up data. Other evidence suggests that improved HbA<sub>1c</sub> levels can be maintained for 36 months following an insulin-based intervention that specifically promotes glycemic control [29]. Similarly, utility values were assumed to be worse for worse glycemic control as supported in literature rather than using the study's data. Varied utility values were tested in the sensitivity analysis and were found to have a strong influence on the base results. However, regardless of the values chosen, the incremental cost-effectiveness ratios remained below acceptable levels.

A strength of this research is the use of patient-level data from a randomized controlled trial to compare across strategies, an approach that minimizes the threat of bias for intervention effect and reflects actual healthcare resource use. Participant groups were well-balanced according to baseline socio-demographic and clinical characteristics [4] and few were lost to follow-up. Further, we used Australian data for the relative risk of excess death based on a large study ( $n > 11,000$ ) and utility estimates in Australian patients with diabetes. For resource use, total annual costs for managing diabetes in our participants were very close to that reported in two

recent Australian studies (approximately \$5000 (£3284) per year [19, 30]), providing support for the validity of the cost estimates used in the model.

In conclusion, we found that the Australian TLC Diabetes intervention was a low-cost program investment for use by diabetes primary care clinicians to use with individuals with sub-optimally controlled diabetes and may result in medication cost-savings for the health system. Moreover, additional intangible benefits arising from the intervention should also be considered when weighing the cost-benefit trade-off with this strategy.

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**Table 1: Key results of mean SF-6D scores and costs (£ 2011)**

	n	Intervention	n	Usual care	P value
SF-6D scores: mean (SD)					
-baseline	58	0.728 (0.12)	58	0.727 (0.14)	0.726 <sup>1</sup>
-6 months	55	0.737 (0.12)	55	0.727 (0.15)	
-12 months	55	0.736 (0.14)	53	0.716 (0.13)	
Mean annual costs <sup>2</sup> : (£95% CIs)					
- GP & Specialist visits		284 (223, 345)		279 (221, 336)	0.901 <sup>2</sup>
- Allied health visits		114 (71, 159)		187 (42, 332)	0.355
- Hospitalizations		2110 (746, 3462)		2195 (342, 4047)	0.940
- Medications		1076 (947, 1206)		1271 (1115, 1428)	0.052
Total healthcare		3585 (2162, 5008)		3932 (1934, 5929)	0.783

1. Calculated using repeated-measures ANOVA
2. Calculated using bootstrap statistics with replacement and the bias-corrected approach with differences tested with the Wald statistic.

**Table 2: Model inputs and sources**

Description	Base Case	1-way sensitivity values <sup>1</sup> and source(s)		
Starting age (years)	57	50, 70	Trial population mean age	
Discount rate for costs and/or effects	5%	0%, 1.5%, 3.5%	Australian standard	
Model duration (years)	5	3, 7, 10		
<b>6-monthly transition probabilities between glycaemic control health states (HbA<sub>1c</sub>)<sup>1</sup></b>				
<b>Usual Care: 0-6 mths, 6-12 mths+</b>				
Sub-optimal				
- Stay	0.725,	0.846		
- To average	0.255,	0.154		
- To optimal	0.020,	0.000		
Average				
- Stay	n/a,	0.538	TLC project outcomes – HbA <sub>1c</sub> values collected within the trial. First 6 month primary outcomes are published [4].	
- To optimal	n/a,	0.308		
- To sub-optimal	n/a,	0.154		
Optimal				
- Stay	n/a,	0.000		
- To average	n/a,	0.000		
- To sub-optimal	n/a,	1.000		
<b>TLC intervention:</b>				
Sub-optimal				
- Stay	0.574,	0.931	1. Optimistic: transitions for 0-6 months in 'sub-optimal' are held constant to 5 yrs 2. Pessimistic: In the 'average' state, 6-12 months and beyond = 20% stay in 'average' and 60% move from 'average' to 'sub-optimal' 3. 0-6 and 6-12 month values averaged and held constant to 5 yrs	
- To average	0.352,	0.069		
- To optimal	0.074,	0.000		
Average				
- Stay	n/a,	0.400		
- To optimal	n/a,	0.400		
- To sub-optimal	n/a,	0.200		
Optimal				
- Stay	n/a,	0.250		
- To average	n/a,	0.500		
- To sub-optimal	n/a,	0.250		
<b>HRQoL/Utilities by health state</b>				
Sub-optimal	0.727	0.617,	0.835	TLC project baseline average, utilities varied ±15%
Average	0.755	0.641,	0.868	Sub-optimal utility + 0.029 [19], utilities varied ±15%
Optimal	0.783	0.666,	0.901	Average utility + 0.029 [19], ±15%
<b>Relative risk of mortality</b>				
Background mortality rates	Life Tables	-	Australian Bureau of Statistics	
Sub-optimal control	3.5	3.0,	5.6	Barr <i>et al.</i> 2011 [21], assumption
Average control	2.8	2.3,	4.4	“ “ “
Optimal control	2.3	1.6,	3.2	Barr <i>et al.</i> 2007 [20]
<b>Costs (\$AU/ £)</b>				
<b>Intervention</b>				
Equipment	583.98	-		
Running costs	39.78	-	Variable costs only = £420	
Coordinator costs	188.27	-	Low costs = per 1000 £447	
Total	(\$812.02) £533	£373,	£693	TLC project, costs varied ±30%
<b>6-monthly healthcare costs</b>				
GPs and specialist visits	(\$214) £141	£99,	£183	TLC project, all costs are varied ±30%
Allied health visits	(\$118) £77	£55,	£101	
Hospitalization	(\$1635) £1074	£752,	£1396	
Medications – Intervention	(\$823) £540	£372,	£703	
Medications – Usual care	(\$981) £644	£450,	£837	

1. HbA<sub>1c</sub> categories are defined as 'sub-optimal' ≥58 mmol/mol (7.5%), 'average' ≥48-57 mmol/mol (6.5-7.4%) and 'optimal' <48 mmol/mol or (6.5%).

**Table 3: Results of cost-effectiveness and sensitivity analyses**

<b>Base model (5 years)</b>	<b>TLC</b>	<b>Usual Care</b>	<b>Δ Costs</b>	<b>Δ Effects</b>	<b>ICER</b>
Mean costs <sup>1</sup>	£17152	£17835			
Mean QALYs <sup>1</sup>	3.381	3.377	-£683	0.004	Dominant <sup>2</sup>
<b>Scenario analyses of health state transitions<sup>3</sup></b>					
- Averaged over 1 <sup>st</sup> & 2 <sup>nd</sup> 6 mths until 5 years			-£683	0.009	Dominant
- Optimistic: Held constant as for 1 <sup>st</sup> 6 mths until 5 years			-£669	0.024	Dominant
- Pessimistic: 2 <sup>nd</sup> 6 mths: Stay in avr 20% and avr to sub-optimal 60% until 5 years			-£685	0.001	Dominant
- Alternative % HbA <sub>1c</sub> cut-offs for good, average and sub-optimal			-£678	0.014	Dominant
<b>Sensitivity analyses</b>					
Model duration					
- 3 years			-£378	0.004	Dominant
- 7 years			-£947	0.004	Dominant
- 10 years			-£1275	0.003	Dominant
Starting age					
- 50 years			-£703	0.004	Dominant
- 70 years			-£575	0.007	Dominant
Discount rate (costs & effects)					
- 0%			-£817	0.005	Dominant
- 3.5%			--£720	0.004	Dominant
Utilities					
- Sub-optimal control (high 0.835)			-£683	-0.011	\$95,545
- Sub-optimal control (low 0.617)			-£683	0.020	Dominant
- Average control (high 0.868)			-£683	0.024	Dominant
- Average control (low 0.641)			-£683	-0.015	\$69,333
- Optimal control (high 0.901)			-£683	0.002	Dominant
- Optimal control (low 0.666)			-£683	0.008	Dominant
Relative risk of excess death by diabetes category					
- Sub-optimal control (high 5.6)			-£644-£692	0.003	Dominant
- Sub-optimal control (low 3.0)			-£696	0.009	Dominant
- Average control (high 4.4)			-£679	0.006	Dominant
- Average control (low 2.3)			-£682	0.002	Dominant
- Optimal control (high 3.2)			-£684	0.005	Dominant
- Optimal control (low 1.6)				0.005	Dominant
Costs					
- Intervention (low £373, variable costs)			-£950-£950	0.004	Dominant
- Intervention (low £447, per 1000)			-£950	0.004	Dominant
- Intervention (high £693)			-£683	0.004	Dominant
- GPs/Specialists (low £99)			-£683	0.004	Dominant
- GPs/Specialists (high £183)			-£683	0.004	Dominant
- Allied health (low £55)			-£683	0.004	Dominant
- Allied health (high £101)			-£684	0.004	Dominant
- Hospitalization (low £752)			-£682-	0.004	Dominant
- Hospitalization (high £1396)			£2178	0.004	Dominant
- Medications TLC group (low £372)			£812£1102	0.004	Dominant
- Medications TLC group (high £703)			-£2462	0.004	£202920
- Medications Usual care (low £450)				0.004	£275486
- Medications Usual care (high £837)				0.004	Dominant

ICER = incremental cost-effectiveness ratio, QALYs = quality-adjusted life years, TLC = telephone-linked care

1. Discounted at 5% per year to present values.

2. Dominant or superior means the TLC strategy produced fewer costs and higher QALYs than usual care.
3. HbA<sub>1c</sub> categories are defined as 'sub-optimal'  $\geq 58$  mmol/mol (7.5%), 'average'  $\geq 48$ -57 mmol/mol (6.5-7.4%) and 'optimal'  $< 48$  mmol/mol or (6.5%).

**Figure legends:**

**Figure 1: Results of probabilistic sensitivity analysis**

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