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Cost-effectiveness of home versus hospital management of children at onset of Type 1 Diabetes: The DECIDE randomised controlled trial

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Title: Cost-effectiveness of home versus hospital management of children at onset of Type 1 Diabetes: The DECIDE randomised controlled trial

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ABSTRACT

Objective The aim of this economic evaluation was to assess whether home management could represent a cost-effective strategy in the patient pathway of Type 1 diabetes (T1D). This is based on the DECIDE trial (ISRCTN78114042), which compared home versus hospital management from diagnosis in childhood diabetes and found no statistically significant difference in glycaemic control at 24 months.

Design Cost-effectiveness analysis alongside a randomised controlled trial.

Setting Eight paediatric diabetes centres in England, Wales and Northern Ireland.

Participants 203 clinically well children aged under 17 years, with newly diagnosed type 1 diabetes and their carers.

Outcome measures The base case analysis adopted an NHS perspective. A scenario analysis assessed costs from a broader societal perspective. The incremental cost-effectiveness ratio (ICER) expressed as cost per mmol/mol reduction in HbA1c, was based on the mean difference in costs between the home and hospital groups, divided by mean differences in effectiveness (HbA1c). Uncertainty was considered in terms of the probability of cost-effectiveness.

Results At 24 months post-intervention, the base case analysis showed a significant difference in costs between home and hospital, in favour of home management (mean difference -£2,217; 95% CI -£2,825 to -£1,609; $p<0.05$). Home care dominated, with an ICER of £7,434 (saved) per mmol/mol reduction of HbA1c. The results of the scenario analysis also favoured home management. The greatest driver of cost differences was hospitalisation during the initiation period.

Conclusions Home management from diagnosis of children with T1D who are medically stable represents a less costly approach for the NHS in the UK, without impacting clinical effectiveness.

Strengths and limitations of this study

- Cost-effectiveness analysis based on a randomised controlled trial, using patient-level data on resource use, collected prospectively.
- Methods were consistent with the NICE reference case, as recommended for the NHS in the UK.
- Quality-adjusted life years were not used as the health outcome and therefore interpretation of cost-effectiveness is more challenging.
- Cost-effectiveness was assessed over the trial period only; lifetime extrapolation was not performed to identify long-term costs and benefits.
- Clinical practice has evolved since the trial commenced and consequently resource use and costs will have changed.

Trial registration number ISRCTN78114042

INTRODUCTION

A diagnosis of Type 1 diabetes (T1D) poses a significant economic burden on healthcare systems, due to the resources required for effective management, the associated complications, and its life-long course. As a result, it is estimated that the National Health Service (NHS) spends £1billion a year on T1D; 11% of this expenditure is on inpatient care.(1) The cost of keeping someone in hospital is high and, as a result, there has been a growing emphasis on delivery of care within primary care and community settings.(2) Patients' attitudes are also shifting towards wanting to be more involved in their own care and wishing to be treated closer to home, as highlighted in the NHS England Five Year Forward Plan.(3) There is evidence that initial management of T1D can be successfully delivered at home rather than in hospital, though the cost-effectiveness of this approach is unknown.(4-6)

T1D affects 24.5 per 100,000 children and young people in the United Kingdom (UK) and the incidence is rising.(7) It is a life-long condition which can lead to serious short (e.g. diabetic ketoacidosis (DKA)) and long-term (e.g. renal, vascular and retinal damage) complications.(8) The risk of complications is reduced if blood glucose is kept within healthy targets.(9) To achieve this, the National Institute for Health and Care Excellence (NICE) recommends offering children and their families intensive education on insulin management from diagnosis and a long-term package of care, delivered through a multidisciplinary team. The NICE guidelines state that the choice of where this initial care is delivered should be made based on clinical need, family circumstances and wishes.(10) Hospitalisation has been shown to be a substantially stressful event for both the child and their parents and so should be avoided unless clinically necessary.(11-13) Most children with T1D are not acutely unwell at diagnosis and therefore could be managed at home.(14)

However, there have been few, well-designed studies evaluating home versus hospital management.(5) A Cochrane review in 2007 concluded that the results of prior studies were inconclusive but suggested that home management at diagnosis does not lead to any clinical, psychological or cost disadvantages.(4) Since this review, further randomised controlled trials (RCTs) have been conducted. One was carried out in Sweden, where home management was described as 'hospital-based-home-care' as it involved staying in a facility which was designed to replicate a home environment but was located in the hospital grounds.(15) This was found to be as clinically effective as hospital management, in terms of glycated haemoglobin (HbA1c) (mean difference between groups 0.6mmol/mol; p=0.777) and a cost-effectiveness analysis reported significantly lower healthcare (direct) costs in the home managed group (- SEK 16,212 (-£1,318); p<0.05).(5)

More recently, the Delivering Early Care In Diabetes Evaluation (DECIDE) RCT evaluated home versus hospital management at diagnosis in childhood diabetes.(16) It was conducted between 2008-2013 in eight paediatric diabetes centres in England, Wales and Northern Ireland. Children aged <17years old with newly diagnosed T1D were randomised to receive either home or hospital management (n=203 in total). Home management of the initiation period from diagnosis was for a minimum of three days and included at least six supervised insulin injections plus delivery of educational care. The primary outcome was HbA1c at 24 months post-

diagnosis and secondary outcomes included coping, anxiety, quality of life (QoL) and use of NHS resources. The trial found no statistically significant difference in HbA1c between home and hospital management (1.01mmol/mol, 95% CI 0.93 to 1.09) and there were no differences in secondary outcomes at 24 months, other than a higher self-esteem in children who were managed at home.

The aim of the present analysis was to estimate the cost effectiveness of home versus hospital management of children diagnosed with T1D from the perspective of the NHS in the UK.

METHODS

The DECIDE trial protocol and results are described in detail elsewhere. (16, 17) Briefly, DECIDE was a superiority RCT, designed to compare the clinical effectiveness of home care from diagnosis with hospital-based care in the management of T1D. The sample size needed to detect a difference in mean HbA1c of 5 mmol/mol (with an SD of 14 mmol/mol; equivalent to an effect size of 0.4) was 200 participants (100 per group) at a 5% significance level and 80% power.

Following informed consent, 203 clinically well children aged less than 17 years old with newly diagnosed diabetes, from eight paediatric diabetes centres across the UK, were randomised to home or hospital management. Participants were eligible to take part if they or their carers were deemed able to complete the study requirements and gave informed assent or consent. Participants were excluded if they were not medically stable at diagnosis or required hospitalisation for other reasons. Full inclusion and exclusion criteria are described in the trial protocol.(17)

Trial governance

Multicentre approval was granted by Research Ethics Committee for Wales (07/MRE09/59). Site-specific approval was granted by participating Acute Trust Research and Development Departments. The trial sponsor was Cardiff University.

Study perspective

The base case analysis of this economic evaluation follows the cost perspective of the NHS and Personal Social Services (PSS), as recommended by NICE.(18) Indirect costs (impact on productivity) and direct non-medical costs (incurred by the patient and his/her carer) were also evaluated through separate scenario analyses as T1D has been shown to have wider economic impacts.(19)

Intervention and comparator

The intervention involved management of the initiation period from diagnosis in the family's own home, for a minimum of 3 days, to include at least six supervised injections and delivery of pragmatic educational care. In comparison, participants in the hospital group were admitted to hospital on the day of diagnosis, for a minimum of three days and received education and support in line with local practice.

Discount rate

A discount rate of 3.5% per annum was applied to costs and consequences after 12 months, as recommended by NICE.(18)

Estimating resources and costs

Data on resource use were collected using case report forms (CRFs) at baseline, then at 3, 12 and 24 months which were summed to calculate total resource use over 24 months (Supplementary Materials Table 1). Resource use prior to diagnosis was not included.

The base case analysis considered direct NHS and PSS resource use. This encompassed hospital stay, tests and investigations, insulin usage, nurse and dietician travel, and contacts with healthcare professionals.

Contacts with healthcare professionals, along with distance travelled, was collected with each CRF. These were costed using the PSSRU 2019 compendium of NHS unit costs.(20)

All eight centres were contacted for unit costs of a paediatric overnight hospital stay; however, none were able to provide an estimation. Instead, the cost was sourced from the NHS Reference Costs database 2019/20.(21)

Tests and investigations were costed through contacting the Biochemistry and Immunology Department within the University Hospital of Wales**,** the main centre for the trial. Unit costs not provided were inflated from previously supplied figures from Cwm Taf Health Board to 2019/20 figures, using the CCEMG-EPPI-Centre Cost Converter.(22)

Insulin regimen data were collected at all time points. This included type of insulin, number of units prescribed throughout the day and related equipment usage (at follow-up only). The British National Formulary for Children (BNFc) and the NHS Electronic Drug Tariff were used to reference insulin costs and equipment.(23, 24)

Broader perspectives, considering non-healthcare resource use, were adopted in scenario analyses. These covered productivity losses incurred by the patient and their family (indirect costs), including days off school and work, as well as travel and out of pocket expenses (direct costs) related to managing T1D. Days taken off work were costed based on average salary earnings in the UK.(25) Time taken off school was costed based on calculating an average cost spent per pupil per day, based on the Annual Report on Education Spending in England.(26) Reported out of pocket expenses incurred by patients and their carers were inflated to 2019/20 costs using the UK Consumer Price Index.(27)

Currency and cost year

Costs were reported in British pounds sterling for 2019/20.

Choice of model

The results of the main DECIDE trial demonstrated no statistically significant clinical difference between home and hospital groups and therefore it was deemed that an evaluation of lifetime costs using an economic model was neither necessary nor informative.

Assumptions

The CRFs did not collect data on length of consultations with healthcare professionals and so assumptions were made based on PSSRU data and through communication with healthcare professionals. Further assumptions relating to the

calculation and estimation of costs are reported in Supplementary Materials Tables 2-7.

Outcome measures and economic analysis

The primary measure of clinical effectiveness was HbA1c at 24 months. As alternative measures to enable the calculation of quality-adjusted life years (QALYs) were not used in DECIDE, HbA1c was used as the measure of effect for the cost-effectiveness analysis.

The mean total costs of each scenario were calculated for both the intervention and control groups over 24 months. This follow-up period was chosen as it was expected that most participants would have no significant endogenous insulin secretion by this time point. Costs are also reported for the initiation period (0-3 days).

Cost-effectiveness was assessed through estimation of the incremental cost per unit change in HbA1c (mmol/mol). This is based on the difference in mean total cost per patient between the intervention and control group (home and hospital management), divided by the difference in mean HbA1c. The resulting incremental cost-effectiveness ratio (ICER) was compared with reference to what the NHS is willing to pay (WTP) for an additional unit change in HbA1c; this being inferred from existing interventions in diabetes.

A cost consequences analysis (CCA) was conducted, in which the costs and outcomes are presented in a tabular format to support decision makers and allow them to attach their own weighting to each result. These outcomes include measures of physical, psychological and social consequences based on parent answers about their child.

Analytical methods

Data collected were inputted into IBM SPSS Version 25 for analysis.(28) The data were assessed for accuracy and missing data. Any outliers identified were checked against the original CRF and then investigated through a sensitivity analysis. An analysis of randomness was carried out on missing data to compare against patients' socio-demographic data.(29)

Uncertainty in the cost-effectiveness ratio was considered by use of non-parametric bootstrapping using Stata.(30) This involved sampling (with replacement) pairs of mean cost and HbA1c 10,000 times as a means of estimating the sampling distribution.(31) Regression analyses were conducted to adjust total costs (by arm and centre) and 24 month HbA1c (on arm, centre and baseline HbA1c). This produced 95% confidence intervals for each cost variable and the differences in both costs and effect for calculating the ICER. This was done for direct healthcare costs with and without patient or carer borne costs. Microsoft Excel was then used to bootstrap HbA1c and total direct healthcare costs at 24 months (1000 replications) and results are displayed on a cost-effectiveness plane. A cost acceptability curve was drawn to represent the probability of cost-effectiveness for different values of WTP.(32) This was repeated for the wider perspective, encompassing direct non-healthcare costs and indirect productivity losses.

A univariate sensitivity analysis was also conducted, adjusting the cost of an overnight stay in hospital for an alternative value, to assess the impact on the ICER.

Reporting

The economic analysis of DECIDE is reported in accordance with the Consolidated Health Economic Evaluation Reporting Standards (CHEERS).(33)

RESULTS

Sample

Of the 203 children involved in the trial, one participant dropped out within the first few days, eight were missing a 24-month HbA1c measurement and one patient did not have a baseline HbA1c. Therefore, the primary analysis of the clinical data reported results on the remaining 193 participants. To ensure consistency and allow for calculation of the ICER, the same participants were included in the economic analysis.

Healthcare outcomes

The DECIDE trial found no significant difference in HbA1c at 24 months between home and hospital management (72.1mmol/mol and 72.6mmol/mol; p=0.863, respectively). This was not affected by repeated measures or sensitivity analyses. Baseline characteristics were explored and both groups were considered to have reasonable similarities.(16)

Direct healthcare resource use and costs

Over 24 months, home management was less costly than hospital management (-£2,217.38; 95% CI -£2,825.38 to -£1,609.38; p<0.05) (Table 1). The greatest difference in direct NHS costs, in favour of home management, was seen during days 0-3 (-£2,222.58; 95% CI -£2,373.35 to -£2,071.81; p<0.05). During this time, participants in the home management group had fewer contacts with consultants and junior doctors but more non face-to-face interactions with nurses (i.e. telephone calls and email correspondence) *(Table 2).* Overall, this led to costs during days 0-3 of £974.20 per child for home management and £720.09 for hospital management, in terms of contacts with the Diabetes Team (mean difference in cost of £254.11; 95% CI £147.22 to £361.00; p<0.05). The cost of nurse travel was also significantly higher for home management (mean difference £114.69; 95% CI £86.30 to £143.07; p<0.05). However, this increased expense was outweighed by the cost of the hospital stay in the first three days for those in the hospital group (£2,582.87; 95% CI £2,464.15 to £2,701.59 per child). This had the greatest contribution to the total direct healthcare costs.

Non-healthcare resource use and costs

There were no significant differences between home or hospital in either the number of days off school or work during the initiation period (0-3 days) (Table 2); and this remained similar between groups over the 24-month follow-up period. Home management was not found to be significantly less costly than hospital management for patients and their carers at 0-3 days (-£20.96; 95% CI -£100.82 to £58.90; p=0.607) or 24 months (£338.45; 95% CI -£962.89 to £285.99; p=0.288) (Table 1).

Healthcare and non-healthcare costs

Overall, home management was significantly less costly than hospital management for the base case analysis (-£2217.38; 95% CI -£2,825.38 to -£1,609.38, p<0.05). The difference in costs to the patient and their carers between home and hospital management was not statistically significant. However, adopting a wider perspective which encompasses direct NHS costs and patient/carer borne costs, led to home management being significantly less costly (-£2,555.83; 95% CI -£3,493.72 to -

£1,617.93; p<0.05) (Table 3). Full costs, confidence intervals and significance levels for all resource use data collected are presented in Supplementary Materials Table 8-13.

Table 1 Costs relating to resource use

		Home management (n=98), mean (95% CI) (£)	Hospital management (n=95), mean (95% CI) (£)	Difference between Home and Hospital, mean (95% CI) (£)
DIRECT HEALTHCARE COSTS				
Days 0-3	Contact with diabetes team	974.20 (889.49 to 1058.91)	720.09 (658.01 to 782.17)	254.11 (147.22 to 361.00)
	Other Health Professionals	0.07 (-0.07 to 0.21)	1.48 (-0.80 to 3.77)	-1.41 (-3.67 to 0.84)
	Tests and Investigations	54.93 (49.07 to 60.80)	61.74 (56.11 to 67.37)	-6.81 (-14.98 to 1.36)
	Hospital stay	0.00	2582.87 (2464.15 to 2701.59)	-2582.87 (-2702.48 to -2463.27)
	Nurse travel	132.69 (106.65 to 158.72)	18.00 (7.63 to 28.37)	114.69 (86.30 to 143.07)
	Dietician travel	3.06 (1.25 to 4.88)	0.67 (-0.63 to 1.97)	2.40 (0.14 to 4.66)
	Total cost days 0-3	1163.43 (1078.55 to 1248.32)	3386.01 (3260.81 to 3511.21)	-2222.58 (-2373.35 to -2071.81)
Follow-up (24months)	Contact with the diabetes team	1984.28 (1876.30 to 2092.26)	2017.21 (1915.43 to 2118.99)	-32.93 (-182.23 to 116.37)
	- Outpatient Visits	1399.87 (1344.26 to 1455.48)	1391.98 (1341.24 to 1442.72)	7.89 (-67.44 to 83.22)
	- Contact with the diabetes team (other)	584.41 (501.50 to 667.31)	625.23 (541.03 to 709.42)	-40.82 (-160.32 to 78.68)
	Hospital contacts	896.90 (568.81 to 1224.99)	859.96 (553.20 to 1166.73)	36.94 (-413.15 to 487.02)
	Tests and Investigations	8.15 (5.48 to 10.82)	8.23 (5.65 to 10.80)	-0.76 (-3.76 to 3.61)
	Total Insulin	457.21 (402.00 to 512.42)	446.15 (397.17 to 495.13)	11.06 (-63.07 to 85.19)
	Equipment	1745.14 (1566.61 to 1923.67)	1713.71 (1544.17 to 1883.24)	31.43 (-217.64 to 280.50)
	Other Health Professional Visits	195.03 (148.98 to 241 to 08)	236.25 (177.13 to 295.37)	-41.22 (-115.34 to 32.89)
	Total follow-up cost	5286.71 (4864.22 to 5709.20)	5281.51 (4882.67 to 5680.35)	5.20 (-583.51 to 593.90)
Total cost at 24months		6450.14 (6003.52 to 6896.75)	8667.52 (8255.35 to 9079.69)	-2217.38 (-2825.38 to -1609.38)
PATIENT/CARER COSTS				
Days 0-3	Days off school	65.50 (56.18 to 74.81)	57.05 (47.08 to 67.02)	8.45 (-5.34 to 22.23)
	Days off work	250.28 (203.29 to 297.27)	255.55 (200.81 to 310.29)	-5.27 (-76.95 to 66.41)
	Travel	10.65 (9.14 to 12.16)	18.31 (15.45 to 21.18)	-7.66 (-10.90 to -4.43)
	Out of pocket expenses	8.37 (6.75 to 9.98)	22.25 (17.03 to 27.48)	-13.89 (-19.33 to -8.44)
	Total cost days 0-3	331.25 (279.76 to 382.74)	352.21 (292.14 to 412.27)	-20.96 (-100.82 to 58.90)
Follow-up	Days off school	443.35 (363.28 to 523.43)	454.19 (348.95 to 559.42)	-10.83 (-143.31 to 121.65)

(24months)	Days off work	868.55 (609.27 to 1127.82)	1180.47 (679.45 to 1681.49)	-311.92 (-871.30 to 247.46)
	Travel	63.39 (55.90 to 70.88)	60.58 (49.06 to 72.11)	2.81 (-11.07 to 16.68)
	Out of pocket expenses	44.34 (32.23 to 56.44)	41.88 (29.77 to 54.00)	2.45 (-14.89 to 19.79)
	Total follow-up cost	1419.63 (1134.35 to 1704.91)	1737.12 (1207.22 to 2267.023)	-317.49 (-916.19 to 281.21)
Total cost at 24months		1750.88 (1447.80 to 2053.95)	2089.33 (1547.32 to 2631.33)	-338.45 (-962.89 to 285.99)
TOTAL COST		8201.02 (7585.40 to 8816.63)	10756.85 (10050.29 to 11463.41)	-2555.83 (-3493.73 to -1617.93)

Table 2 Units of resource use

		Home Management (n = 98)			Hospital Management (n = 95)		
		Median	Range		Median	Range	
			Minimum	Maximum		Minimum	Maximum
DIRECT HEALTHCARE RESOURCE USE							
Days 0-3	Contacts with the diabetes team						
	- Consultant	1.0	0.0	9.0	2.0	0.0	5.0
	- Junior doctor	1.0	0.0	5.0	3.0	0.0	10.0
	- Nurse						
	• Face to face	6.0	0.0	13.0	6.0	0.0	32.0
	• Telephone calls/emails	2.0	0.0	28.0	0.0	0.0	3.0
	- Dietitian	1.0	0.0	3.0	1.0	0.0	3.0
	Other health care professionals	0.0	0.0	1.0	0.0	0.0	2.0
	Test and investigations						
	- Diagnosis related	4.0	0.0	8.0	5.0	1.0	12.0
	- Other	2.0	0.0	4.0	3.0	0.0	6.0
	Hospital stay (days)	0.0	0.0	0.0	3.0	0.0	6.0
	Travel						
	- Nurse travel distance (miles)	40.0	0.0	214.0	0.0	0.0	192.0
	- Dietician travel distance (miles)	0.0	0.0	24.0	0.0	0.0	32.0
Follow-up (24months)	Contacts with the diabetes team						
	- Outpatient*	9.0	6.0	18.0	9.0	6.0	16.0
	- Other**	28.5	2.0	128.0	31.0	2.0	158.0
	Hospital contacts						
	- A&E	0.0	0.0	8.0	0.0	0.0	6.0
	- Ward	0.0	0.0	16.0	0.0	0.0	8.0
	Tests and investigations***	0.0	0.0	11.0	0.0	0.0	8.0
	Insulin	18889.5	2138.0	64354.0	19669.0	2351.5	48858.0
	Other health professionals						
	- GP	2.0	0.0	14.0	2.0	0.0	19.0
	- Nurse	1.0	0.0	8.0	0.0	0.0	31.0

	- Other	0.0	0.0	11.0	0.0	0.0	22.0
PATIENT/CARER RESOURCE USE							
Days 0-3	Days off school	2.0	0.0	5.0	2.0	0.0	5.0
	Days off work	2.0	0.0	9.0	2.0	0.0	14.0
	Travel (hours)	2.0	0.0	7.0	3.0	0.0	16.0
	Out of pocket expenses (£)	10.9	0.0	38.1	16.3	0.0	87.0
Follow-up (24months)	Days off school	11.0	0.0	64.0	11.0	0.0	129.0
	Days off work	3.3	0.0	70.0	4.0	0.0	164.0
	Travel (hours)	10.0	0.0	96.0	9.0	0.0	92.0
	Out of pocket expenses (£)	33.0	0.0	546.0	27.0	0.0	467.5
Total Patient/carer resource use	Days off school	13.0	0.0	66.0	13.5	0.0	132.0
	Days off work	5.0	0.0	78.0	6.5	0.0	167.5
	Travel (hours)	12.0	3.0	99.0	13.0	0.0	94.0
	Out of pocket expenses (£)	42.8	0.0	546.0	47.7	0.0	554.8

***Two patients had visits with the nurse outside of the patient setting. **Home visits, telephone calls and emails. ***From CRF 7 only.**

Cost effectiveness

Home management dominated hospital management. In the base case analysis, the ICER was £7,434 saved per additional mmol/mol reduction of HbA1c (Table 3). Based on the bootstrapped analysis for consideration of the joint uncertainly in costs and effects, the cost-effectiveness plane shows that home management has the potential to be cost saving for the NHS without changing clinical effectiveness (Figure 1a). The cost-effectiveness acceptability curve (CEAC) is somewhat counterintuitive for cost-saving interventions, in that the probability of home management being cost-effective reduces to 50% when the willingness to pay increases to £7,770 per unit reduction of HbA1c (mmol/mol) (Figure 1b).

An alternative unit cost for an overnight paediatric stay in hospital was explored through a univariate sensitivity analysis. This figure was based on a previous study (34), inflated to the current year, to give a value of £691.95. This had no significant impact on the ICER (£5,451 saving per additional unit reduction in HbA1c (mmol/mol)) and the difference in direct healthcare costs between home and hospital at 24 months remained statistically significant (Table 3, Supplementary Materials Table 16 and Supplementary Materials Figure 2).

Adopting a broader cost perspective by incorporating both direct healthcare and non-healthcare costs, the ICER increased to £8,585 saving per additional mmol/mol reduction of HbA1c (Table 3). This does not have a significant effect on the distribution on the cost-effectiveness plane or on the probability of home management being cost-effective (Supplementary materials tables 15 and Supplementary Materials Figure 1). Home management remained the dominant strategy.

Cost Consequences Analysis

A table presenting costs alongside psychological, physical and social consequences reported in the main trial is displayed in Supplementary Materials Table 17. Outcomes are taken from the child questionnaires.

Table 3 Cost-effectiveness results for each analysis scenario

Analysis Scenario	Incremental cost (£)*	Incremental effect (HbA1c in mmol/mol)	ICER**	Cost-effectiveness probability for given WTP (%)		
				£5,000	£10,000	£15,000
Direct Healthcare perspective	-2182.29	-0.294	Dominant (7434)	51.2	48.8	48.1
Direct Healthcare + Patient/carer perspective	-2520.20	-0.294	Dominant (8585)	51.9	49.6	48.3
Sensitivity analysis	-1600.11	-0.294	Dominant (5451)	50.3	48.4	47.6

*** difference in cost between home and hospital management. **(£ saved per additional unit change in HbA1c (mmol/mol))**

Discussion

This economic evaluation was designed to assess whether delivering management at home for children with T1D who are clinically well at diagnosis would represent a cost-effective strategy for the NHS. The results indicate that the difference between home and hospital management in terms of direct NHS costs over 24 months, of £2,182 per patient, is significant, and in favour of home management. Uncertainty analysis indicated that the probability of home management being cost saving was 1.0. The greatest driver of differences in healthcare costs was the cost of hospitalisation during the initiation period. The ICER for the base-case analysis indicated that home management was dominant, with £7,434 saved per additional unit reduction in mmol/mol of HbA1c. Sensitivity analysis indicated that the cost-effectiveness was stable to the choice of which costs were included. However, there is considerable uncertainty around the difference in effect (HbA1c), reflected in the probability of the cost-effectiveness on the CEAC being ~0.5 even at high thresholds of willingness to pay.

Strengths and weaknesses

The major strength of this evaluation is that it is based on an RCT, which reduces the risk for potential bias and uses patient-level data. The analysis was conducted in line with the main trial to ensure consistency and methods followed the NICE reference case.

A limitation of this study is that QALYs were not used as the measure of health outcome. The main trial did not collect data on health-utility in order to estimate QALYs due to the lack of a validated paediatric utility measure at the time of study commencement, especially in younger children.(35) Therefore, we are unable to determine whether the ICER would be acceptable, given the NICE threshold of £20,000-30,000 per QALY. However, HbA1c is known to be a useful surrogate outcome measure in assessing the effectiveness of interventions for T1D as it is positively associated with an increased risk of long-term complications.(36, 37) The ADaPT study of a diabetes-specific psychological intervention administered by diabetes nurses is an example of a trial which reports costs alongside HbA1c improvement, in addition to QALYs. The authors state that basing cost-effectiveness on HbA1c outcomes rather than QALYs can lead to higher probabilities of cost-effectiveness and this is an important point to be aware of when interpreting our results.(38) However, their ICER of £457 per 1mmol/mol decrease in HbA1c is based on spending more for decreases in HbA1c, not saving costs as in our ICER, and therefore is not comparable for interpreting WTP.

This leads to a second limitation in that we chose not to perform long-term extrapolation to assess the cost-effectiveness over a patient's lifetime. Life-time extrapolation relies on economic models which use QALYs as the measure of effect. However, despite many models existing for use in T1D, a lack of validation in the paediatric setting undermines their application in the context of the DECIDE trial.(39) Moreover, as there was no statistically significant difference in clinical effectiveness, this would also require assumptions on long-term benefits which could introduce bias.

The accuracy of the final unit costings may have been impacted by varying interpretation of case report forms and ability to recall, as parents were asked to recall answers by nurses who then completed the forms. However, questions about resource use were limited to a 3-month recall period, which is the general recall period for trial-based economic evaluations.(40) Completion rates of forms were also high, with a small proportion of missing data.

A final limitation is that there have been changes in practice and consequently resource use and costs since the trial commenced. For example, test and investigation use was costed from one site only and this figure is likely to differ across centres. However, all costs were updated to, or based on, most recent figures to ensure relevance to the current NHS costs and any differences between sites to the overall outcomes was considered likely to be small and therefore unlikely to effect the overall findings.

Context in the current literature

This is the first cost-effectiveness evaluation to compare home versus hospital management of T1D at diagnosis in children and young people in a UK setting. Costs were based on the UK healthcare system (NHS) and taken from national UK databases. The trial was conducted over eight different centres throughout the UK and hospital management was pragmatic, following local standard practice, which increases our confidence in the generalisability of the results to other areas of the UK.

The findings of this evaluation are comparable to other studies.(4, 5) However, interpretation of previous studies is limited by the use of small sample sizes, non-UK settings and all of them involved 'hybrid' models of care; meaning 'home management' involved care within the hospital and home/outpatient setting. Therefore, previous studies have not evaluated home care exclusively from the day of diagnosis and their reproducibility within the UK healthcare setting may be limited.

Implications for practice and research

Home management led to significant cost reductions for the NHS at both three days and 24 months. This economic evaluation, alongside the main trial provides evidence for home care being the first line approach for management of T1D at diagnosis in children who are clinically well. However, since the start of this trial, education has become more intensive and insulin delivery and blood glucose monitoring more complex. As a result, many centres choose to admit all patients by default, despite NICE guidance supporting home management.(10) The identified cost-saving of around £2,000 per patient (over 2 years) could be invested in community services to manage this increased demand on healthcare professionals, increasing the feasibility of delivering a package of care which would normally be delivered in hospital.

It is envisaged that the results of this analysis will contribute to the evidence supporting future updates of NICE Guidelines on management of T1D in children and adolescents at diagnosis. Further research could involve testing a hybrid model of care within the UK-setting, incorporating updates in the management approach, and measuring costs and utility.

Conclusion

Home management from diagnosis of T1D for children who are medically stable represents a saving of £2,182 per patient with no significant impact on clinical effectiveness. These findings add to the main DECIDE trial which demonstrated that home management at the onset of T1D did not lead to any significant differences in glycaemic control. With incidence of T1D increasing and the demand for hospital beds rising, implementation of this approach as standard practice could prove to be a cost-saving step in the patient pathway.

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Role of the funding source
The funders of the study had no role in study design, data collection, data analysis, data interpretation, or writing of the report.

Competing interests statement
All authors have completed the ICMJE uniform disclosure form at www.icmje.org/coi_disclosure.pdf and declare: no support from any organisation for the submitted work; no financial relationships with any organisations that might have an interest in the submitted work in the previous three years; no other relationships or activities that could appear to have influenced the submitted work.

Author contributions
ZMcC had full access to all the data in the study, conducted the analyses and drafted the manuscript. JT, JWG, TP and DH supervised ZMcC and take responsibility of the study in its entirety and for the decision to submit for publication.
JWG, RP and MR were responsible for developing the initial DECIDE research question and trial design, and implementation of the trial protocol. DH, TP and RP were responsible for all statistical considerations and analysis. DH was responsible for designing the health economics study. All those listed as authors contributed to the trial delivery and health economics study and were responsible for reading, commenting upon, and approving the final manuscript. The manuscript's guarantors (JT,JWG and DH) affirm that the manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as planned (and, if relevant, registered) have been explained.

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Data sharing

De-identified participant data will be made available to the scientific community with as few restrictions as feasible, whilst retaining exclusive use until the publication of major outputs. Data will be available via the corresponding author.

Patient and public involvement

There was no direct involvement of patients or the public in this health economics study. However, two parents of children diagnosed with T1D were involved in the initial design of the DECIDE trial. One of these parents was a co-applicant on the funding application and was instrumental in ensuring that the trial was informed by the families' experience. She also attended the ethics committee meeting to provide a service user perspective of the value of the trial to inform the committee's decision. She and another parent were part of the Trial Management Group which met monthly and provided input on the conduct of the trial throughout.

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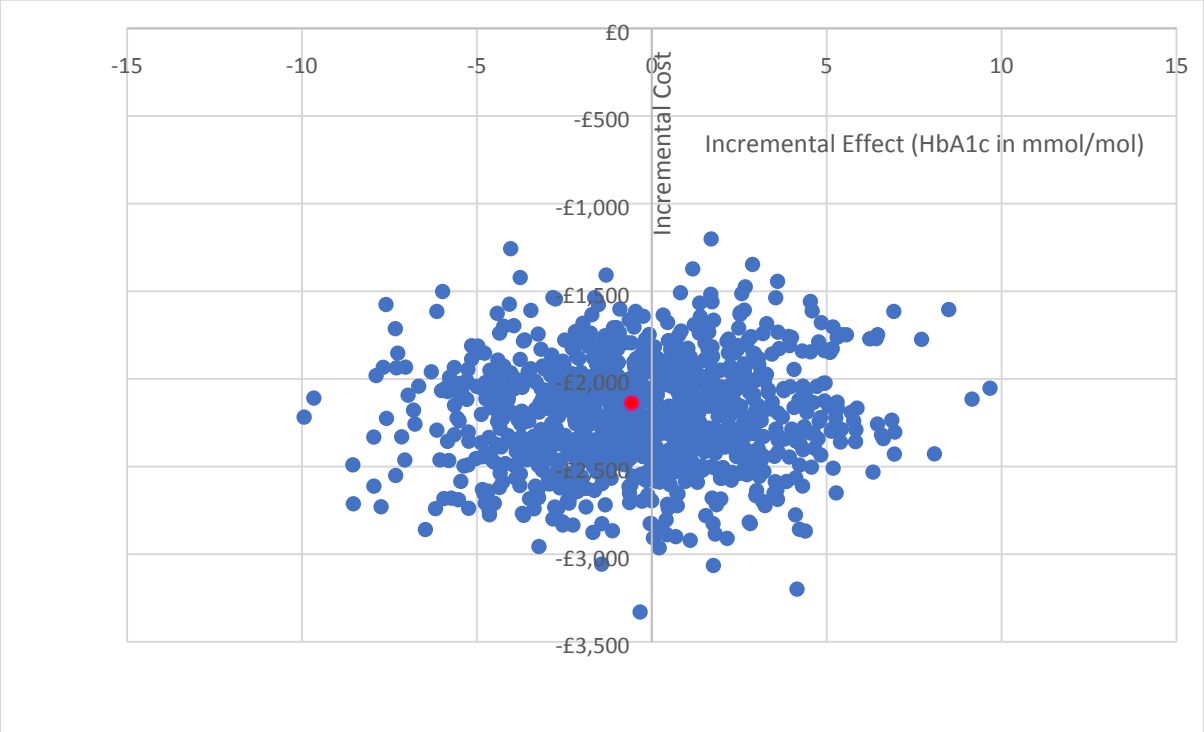
Figure 1a and 1b

Figure 1

(a) Cost-effectiveness plane of base case analysis



(b) Cost-effectiveness acceptability curve for base case analysis.

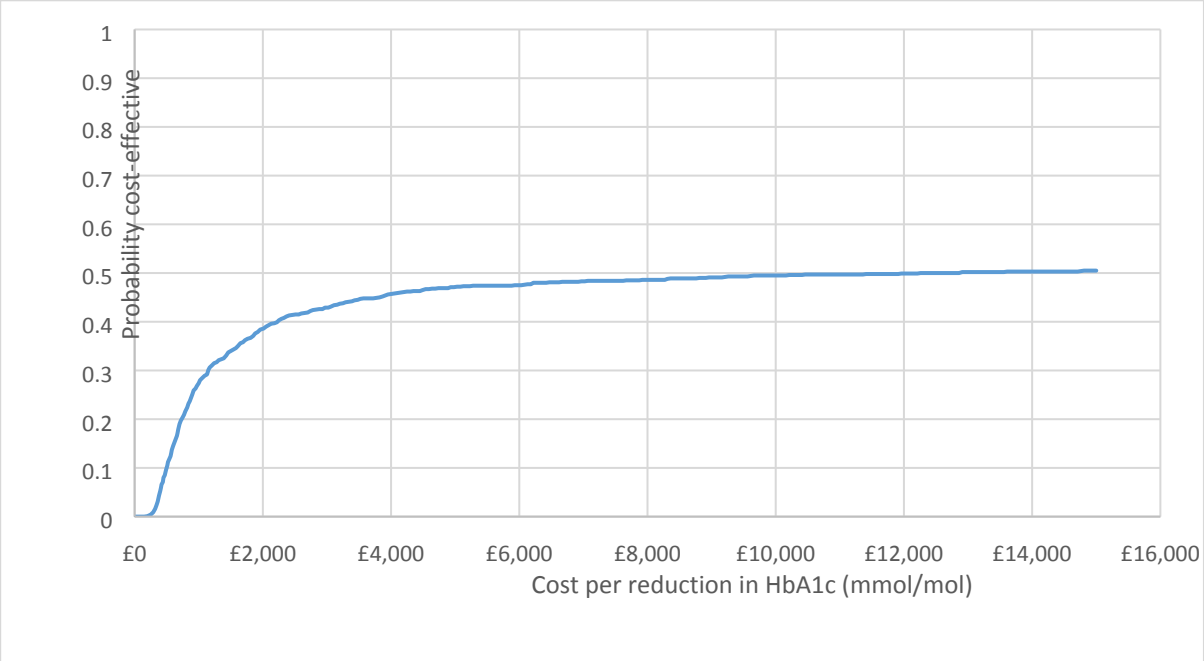


Figure 1

(a) Reduction in HbA1c represents improvement.

● = point estimate ICER £7,434 per mmol/mol reduction of HbA1c (-0.294, -£2,182)

(b) Represents the probability of home management being cost-effective at different willingness to pay thresholds.

SUPPLEMENTARY MATERIALS

Table 1 Case Report Forms and Data Collected

Case Report Form	Data Collected
2 & 3	• Admission/discharge • Additional tests • Insulin Regimen • Contacts with diabetes team
4, 5 & 6	• Insulin regime • Medical equipment • Contact with diabetes team • Hospital contacts • Contacts with other HCPs
7	• Additional tests • Insulin regime • Contact with diabetes team • Hospital contacts • Contacts with other HCPs
3.1, 4.1, 5.1, 6.1, 7.1	• Time off work/school • Travel expenses

Table 2 Unit costs for contact with healthcare professionals

Contact with Healthcare Professional	Unit Cost (£)	Source
Hospital based care		
Overnight stay in hospital (up to 5days)	894.00	NHS Reference Costs 2019/20
Overnight stay in hospital (exceeding 5days)	417.00	
Consultant ward visit	109.00	PSSRU 2019
Junior Doctor ward visit	29.00	
Nurse ward visit	47.00	
Dietitian ward visit	46.00	
Hospital Pharmacist	6.92	
Home based care		
Initial home visit	220.00	PSSRU 2019
Community Nurse home visit	55.00	
Community Nurse telephone calls & emails	12.25	
Practice Nurse clinic visit	6.45	
Practice Nurse telephone calls & emails	4.59	
Dietitian home visit	16.00	PSSRU 2010,2019
Dietitian telephone calls & emails	5.25	PSSRU 2019
GP home visit	85.00	
GP Surgery visit	39.23	
Telephone calls	17.00	
Consultant-led Outpatient attendance	205.00	
Non-Consultant-led outpatient attendance	155.00	

Table 3 Unit Costs of Contact with Health Care Professionals

Resource item	Details	Cost source	Unit Cost (£)
Hospital Based Care			
Overnight stay in Hospital	NHS Reference cost 2019/20 PK68C CC Score 0, cost of combined day case/ordinary elective spell.	a	894.00
	Per day long stay payment (for days exceeding trim point of 5 days).	a	417.00
Consultant ward visit	Medical Consultant, hourly rate.	b	109.00
Junior Doctor ward visit	Foundation House Officer Year 1, hourly rate.	b	29.00
Nurse ward visit	Nurse team leader, hourly rate.	b	47.00
Dietitian ward visit	Hospital Dietitian, Average visit 1hour, hourly rate (Band 6).	b	46.00
Hospital Pharmacist	£45 per hour. Assumed length of consultation same as GP = 9.22minutes. = £6.92.	b	6.92
Home Based Care			
Initial home visit	Community Nurse, hourly rate £55.2 hourly visits. 2 x daily to supervise injections.	b	220.00
Community Nurse home visit	PSSRU 2019: Band 7 =£55.00 per hour.	b	55.00
Community Nurse telephone calls & emails	Patient-related work, hourly rate £112 (Band 7). Average length of Nurse-led telephone triage = 6.56minutes.	b	12.25
Practice Nurse clinic visit	Hourly rate £42 per hour. Assumed surgery length same as GPs = 9.22minutes.	b	6.45
Practice Nurse telephone calls & emails	Hourly rate £42 per hour. Average length of Nurse-led telephone triage = 6.56minutes.	b	4.59

Dietitian home visit	No rates for Community Dietician. Community Occupational Therapist hourly rate = £48 per hour. No information for average length of visit. If assume 20minutes from PSSRU 2010 = £16.00.	b, c	16.00
Dietitian telephone calls & emails	Hourly rate £48.00. Assumed duration of 6.56minutes (same as Nurse telephone triage).	b	5.25
GP home visit	£255/hour of patient contact. Assuming duration of 20minutes.	b	85.00
GP Surgery visit	Cost per surgery consultation lasting 9.22minutes	b	39.23
Telephone calls	Average length of GP-led triage is 4minutes so x hourly rate of £255	b	17.00
Consultant-led Outpatient attendance	Paediatric Consultant-led Outpatient attendance.	b	205.00
Non-Consultant-led outpatient attendance	Paediatric non-consultant-led outpatient attendance.	b	155.00
Other Contact with Health Care Professionals			
Consultant Telephone Call	Hourly rate £109. Assumed duration of 6.56minutes (same as Nurse-led telephone triage).	b	11.92
Registrar ward visit	Hourly rate £47. Assumed 20minute consultation.	b	15.67
Clinical Psychologist	Hourly rate.	b	54.00
CAMHS Nurse	Hourly rate (Band 7 Nurse).	b	57.00
Speech and Language Therapist	Hourly rate (Band 6).	b	46.00
Physiotherapist	Scientific and professional staff. Hourly rate (Band 6).	b	45.00
Podiatrist	Hospital-based scientific and professional staff. Hourly rate (Band 6).	b	46.00
Family Advocate	Not rates for general family advocate. Advocacy for parents requiring learning disability support. Hourly rate.	b	31.00

Social Worker	Hourly rate.	b	50.00
Dentist	Hourly rate £104. Assumed duration same as GP = 9.22minutes.	b	15.98
Osteopath	No rates for osteopath. Scientific and Professional Staff. Hourly rate (Band 5).	b	34.00
Phlebotomist	No rates for phlebotomist. Nurse (Band 4). Hourly rate £28. Assumed duration same as GP = £9.22.	b	4.30

Table 4 Unit costs for Insulin

Insulin	**Details**	**Cost Source**	**Unit Cost (£)**
Mixtard 30	Discontinued on 31 Dec 2010. Previously available as 5 x prefilled 3ml *InnoLet*® £19.87 (range 2-78 units).	d, e	19.87
Novomix 30	5 x FlexPen 100units/ml suspension for injection 3ml pre-filled pen = £29.89.	e	29.89
Humulin M3	5 x Humulin M3 KwikPen 100units/ml suspension for injection 3ml pre-filled pen (Eli Lilly and Company Ltd).	e	21.70
Insulin Aspart (Novorapid)	5 x NovoRapid FlexTouch 100units/ml solution for injection 3ml pre-filled pen (Novo Nordisk Ltd) = £32.13.	e	32.13
Insulin Lispro (Humalog)	5 x Humalog KwikPen 100units/ml solution for injection 3ml pre-filled pen (Eli Lilly and Company Ltd) = £29.46.	e	29.46
Actrapid	Actrapid 100units/ml for injection 10ml vials (Novo Nordisk Ltd), 100 units per 1ml, net price 10mL vial = £7.48. Novopen devices no longer available so previous price of £26.86 used.	e	34.34
Insulin Detemir (Levemir)	5 x Levemir InnotLet 100units/ml solution for injection 3ml pre-filled pen (Novo Nordisk Ltd) = £42	e	44.85
Insulin Glargine (Lantus)	5 x Lantus 100units/ml solution for injection 3ml pre-filled SoloStar pen (Sanofi) = £37.77	e	37.77
Isophane Insulin (Insulatard)	5 x Insulatard InnoLet 100units/ml suspension for injection 3ml pre-filled pen (Novo Nordisk Ltd) = £20.40 NHS	e	20.40

Humalog Mix 25	Humalog Mix25 KwikPen 100units/ml suspension for injection 3ml pre-filled pen (Eli Lilly and Company Ltd) 5 x Insulin lispro 75 unit per 1 ml and Insulin lispro 25 unit per 1 ml = £30.98	e	30.98
Humalog Mix 50	Humalog Mix50 KwikPen 100units/ml suspension for injection 3ml pre-filled pen (Eli Lilly and Company Ltd) 5 x Insulin lispro 50 unit per 1 ml = £30.98	e	30.98
Humulin I	Humulin I KwikPen 100units/ml suspension for injection 3ml pre-filled pen (Eli Lilly and Company Ltd) 5 x Insulin human (as Insulin isophane humane) 100 unit per ml = £21.70	e	21.70

Table 5 Unit costs for tests and investigations

Test and Investigations	**Details**	**Cost Source**	**Unit Cost (£)**
Blood Gas		f	4.86
Thyroid Function		f	3.02
Anti TTG	Anti-tissue Transglutaminase Antibodies test	f	12.35
IgA P	Immunoglobulin A test	f	4.62
Islet cell Antibodies	Islet Antigen 2 Antibody	f	23.16
GAD Antibodies	Glutamic Acid Decarboxylase Autoantibodies test (Send away)	f, g	22.06
U&E	Urea and Electrolytes	f	3.92
Chest X ray		i	11.00
LFT	Liver Function Test	f	4.76
FBC	Full Blood Count	f	4.23
Urine culture		f	13.60
lanti tpo	Thyroid peroxidase IgG Ab	f	3.21
APTT	Activated Partial Thromboplastin Time test	f	3.52
C Peptide		f	22.50
Coeliac Screen	IgA Tissue Transglutaminase antibody	f	12.35
CRP	C-Reactive Protein	f	3.21
ECG	Electrocardiogram	g	9.56
Ferritin		f	4.71

HBA1C		f	2.42
ICCP	Anti-MCV Antibodies	f	6.96
Lipid Profile		f	3.92
MRSA	Methicillin-resistant Staphylococcus aureus test	f	18.52
Pancreatic Cabs	Anti-GAD	f	N/A
Plasma Osmolality		f	6.16
Thyroid Antibodies		f	3.21
Amylase		f	1.35
Anti TPO	Anti-thyroid peroxidase test	f	3.21
Bilirubin	Total	f	1.35
Glucose		f	1.35
Magnesium		f	1.35
Others	Blood culture	h	7.33
	Insulin	h	2.25
	Sickle cell	h	8.28
	Urine ketones	h	3.21
	Viral titres	h	11.59
	3 Hydroxybutyrate	h	3.76
	X TRT	h	4.50
	Serum Chloride	h	1.44
	Lactate	h	1.44
	Bone profile	h	5.11
	Blood film	h	6.48
	Urine dip	h	3.50
	Rheumatoid Factor	h	8.43
Blood glucose testing strips	Based on average cost of strips (£696.96 / 64 = £10.89)	e	10.89
Blood glucose testing cassette	Betacheck C50 casette: 100 device = £29.98 Mobile cassette: 50 device = £9.99 (Assumed 50 strips unless stated)	e	9.99

Urine ketone testing strips	Based on average cost (2.25+3.06/2 = £2.66).	e	2.66
Blood ketone testing strips	Based on average cost of ketone testing strips.	e	16.95
Lancets (pack of 100)	Based on average cost of pack of 100.	j	3.93
Lancets (pack of 204)	FastClix (Roche Diabetes Care Ltd.)	j	5.90
Hypostop/glucogel	GlucoGel 40% gel original (BBI Healthcare Ltd): Glucose 400mg per 1g - 75gram = £7.16	e	7.16
Glucagon	Glucagon hydrochloride 1mg: 1 vial = £11.52	e	11.52
Insulin needles	Pack of 100 Safety needles 0.3ml or 0.5ml syringe and needle = £13.34	j	13.34
Insulin pens	Based on average cost of insulin pens.	e	19.35
Sharps bin	Sharpsafe 1L = £0.85.	j	0.85

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g) (Inflated)* NICE. Appendix M: Routine preoperative tests for elective surgery. Centre NCG; 2015 [accessed 10/03/2020]. Available from: https://www.nice.org.uk/guidance/ng45/history/
h) (Inflated)* from previous cost supplied by 2012 Cwm Taf Health Board
i) Personal communication with Swansea Bay Health Board
j) NHS. NHS Electronic Drug Tariff. NHS Business Services Authority; 2020. http://www.drugtariff.nhsbsa.nhs.uk/#/00774110-DC/DC00773743#d2e9682/Part%20IXA-Appliances

*Costs inflated using the CCEMG-EPPI-Centre Cost Converter. Available at: http://eppi.ioe.ac.uk/costconversion/default.aspx

Table 6 Unit costs for patient/carer borne costs

Resource item	Details	Cost source	Unit cost (£)
Time off work	Median weekly earnings £585 April 2019 Daily wage (£585 divided by 5 = £117)	a	117.00
Time off school	Total annual spending per pupil of £5,872; Divided by the number of school days in a year (195) = a cost of £30.11 per day missed	b	30.11
Travelling by car	AA Mileage calculator used to calculate miles travelled in 1 hour = 48.9miles. Average price per mileage = £1.238. Average miles per gallon = 50.5mpg. = £5.44 per hour	c, d, e	5.44
Travelling by bus	Captured by OOP£		
Travelling by train	Captured by OOP£		
Travelling by taxi	Captured by OOP£		

References:

a) Office for National Statistics. Employee earnings in the UK. Office for National Statistics –; 2019 [accessed 10/03/2020]. Available from: https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/earningsandworkinghours/bulletins/annualsurveyofhoursandearnings/2019

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Table 7 Other Hospital Contacts

Resource item	Notes	Cost data source	Unit cost used (£)
A&E	Cost per A&E attendance. Inflated from £160.	a	166.20
ITU	Paediatric ICU, basic critical care average cost	b	1,389.00
HTU	Paediatric HDU, basic critical care average cost	b	780.00
Other ward	PK68C CC Score 0, cost of combined day case/ordinary elective spell.	c	894.00
Ambulance call out	See and treat and convey	b	258.00

References:

a) NHS Improvement. 2017/18 reference costs and guidance. 2018 [accessed 03/05/2020]. Available from: https://improvement.nhs.uk/resources/reference-costs/

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Table 8 Total Costs

	Arm	

	Home management (n=98), mean (95% CI) (£)	Hospital management (n=95), mean (95% CI) (£)	Difference between Home and Hospital, mean (95% CI) (£)
Direct Healthcare Costs Days 0-3	1163.43 (1078.55 to 1248.32)	3386.01 (3260.81 to 3511.21)	-2222.58 (-2373.35 to -2071.81)
Direct Healthcare Costs 24months	5286.71 (4864.22 to 5709.20)	5281.51 (4882.67 to 5680.35)	5.20 (-583.51 to 593.90)
TOTAL Direct Healthcare Costs	6450.14 (6003.52 to 6896.75)	8667.52 (8255.35 to 9079.69)	-2217.38 (-2825.38 to -1609.38)
Patient/carer Costs Days 0-3	331.25 (279.76 to 382.74)	352.21 (292.14 to 412.27)	-20.96 (-100.82 to 58.90)
Patient/carer Costs 24months	1419.63 (1134.35 to 1704.91)	1737.12 (1207.22 to 2267.023)	-317.49 (-916.19 to 281.21)
TOTAL Patient/carer Costs	1750.88 (1447.80 to 2053.95)	2089.33 (1547.32 to 2631.33)	-338.45 (-962.89 to 285.99)
TOTAL Healthcare + Patient/carer Costs	8201.02 (7585.40 to 8816.63)	10756.85 (10050.29 to 11463.41)	-2555.83 (-3493.73 to -1617.93)

Table 9 DIRECT COSTS (NHS): Initiation Period (Days 0-3)

Variable	Arm	Observed Coef.(£)	Bootstrap Std. Error.(£)	z (£)	P>|z |	Normal-based [95% CI] (£)	
Contact with Diabetes Team	Home	974.1981	43.22146	22.54	0.000	889.4855	1058.911
	Hospital	720.0925	31.67475	22.73	0.000	658.0111	782.1739
	Difference	254.1055	54.53267	4.66	0.000	147.2235	360.9876
Other Health Professionals	Home	0.0706122	0.0713645	0.99	0.322	-0.0692596	0.2104841
	Hospital	1.484211	1.164536	1.27	0.202	-0.7982382	3.766659
	Difference	-1.413598	1.150576	-1.23	0.219	-3.668687	0.8414902
Tests and Investigations	Home	54.93276	2.993705	18.35	0.000	49.0652	60.80031
	Hospital	61.73947	2.873441	21.49	0.000	56.10763	67.37131
	Difference	-6.806719	4.168999	-1.63	0.103	-14.97781	1.364369
Hospital Stay	Home	0	-	-	-	-	-
	Hospital	2582.874	60.57222	42.64	0.000	2464.154	2701.593
	Difference	-2582.874	61.02397	-42.33	0.000	-2702.478	-2463.269
Nurse Travel	Home	132.685	13.28487	9.99	0.000	106.6471	158.7228
	Hospital	17.99988	5.292204	3.40	0.001	7.627349	28.37241

	Difference	114.6851	14.48314	7.92	0.000	86.29865	143.0715
Dietician Travel	Home	3.064048	0.9243985	3.31	0.001	1.252436	4.875659
	Hospital	0.6680702	0.6638656	1.01	0.314	-0.6330826	1.969223
	Difference	2.395977	1.152625	2.08	0.038	0.1368736	4.655081
Total Cost Days 0-3	Home	1163.431	43.30878	26.86	0.000	1078.548	1248.315
	Hospital	3386.011	63.88057	53.01	0.000	3260.807	3511.214
	Difference	-2222.58	76.92329	-28.89	0.000	-2373.346	-2071.813

Table 10: DIRECT COSTS (NHS): Follow-up period (24months)

Variable	Arm	Observed Coef.(£)	Bootstrap Std. Error.(£)	z (£)	P>|z |	Normal-based [95% CI] (£)	
Equipment	Home	1745.139	91.08601	19.16	0.000	1566.614	1923.665
	Hospital	1713.707	86.50011	19.81	0.000	1544.17	1883.244
	Difference	31.43227	127.0783	0.25	0.805	-217.6366	280.5012
Insulin	Home	457.2095	28.16661	16.23	0.000	402.0039	512.415
	Hospital	446.1523	24.99017	17.85	0.000	397.1725	495.1322
	Difference	11.05713	37.82228	0.29	0.770	-63.07317	85.18744
Tests and Investigations	Home	8.14933	1.362176	5.98	0.000	5.479514	10.81914
	Hospital	8.225684	1.314776	6.26	0.000	5.648771	10.8026
	Difference	-0.763541	1.8789	-0.04	0.968	-3.75893	3.606222
Contact with Diabetes Team (Other)	Home	584.4067	42.29807	13.82	0.000	501.504	667.3094
	Hospital	625.2271	42.95843	14.55	0.000	541.0301	709.4241
	Difference	-40.82041	60.97088	-0.67	0.503	-160.3211	78.68032
Outpatient contacts	Home	1399.871	28.37326	49.34	0.000	1344.261	1455.482
	Hospital	1391.982	25.88918	53.77	0.000	1341.24	1442.723
	Difference	7.88985	38.43638	0.21	0.837	-67.44407	83.22377
Other health professional	Home	195.0289	23.49622	8.30	0.000	148.9771	241.0806
	Hospital	236.2501	30.16264	7.83	0.000	177.1324	295.3678

visits	Difference	-41.22124	37.81442	-1.09	-0.276	-115.3361	32.89367
Hospital contacts	Home	896.902	167.3965	5.36	0.000	568.811	1224.993
	Hospital	859.9642	156.5175	5.49	0.000	553.1956	1166.733
	Difference	36.93783	229.64	0.16	0.872	-413.1483	487.024
Contact with diabetes team	Home	1984.278	55.09216	36.02	0.000	1876.299	2092.257
	Hospital	2017.209	51.92769	38.85	0.000	1915.432	2118.985
	Difference	-32.93056	76.1765	-0.43	0.666	-182.2338	116.3726
Total Cost of Follow-up	Home	5287.707	215.5606	24.53	0.000	4864.216	5709.198
	Hospital	5281.508	203.492	25.95	0.000	4882.671	5680.345
	Difference	5.199081	300.3655	0.02	0.986	-583.5064	593.9046

Table 11: INDIRECT COSTS (patient/carer): Initiation period (days 0-3)

Variable	Arm	Observed Coef.(£)	Bootstrap Std. Error.(£)	z (£)	P>|z |	Normal-based [95% CI] (£)	
Days off work	Home	250.2835	23.97491	10.44	0.000	203.2935	297.2735
	Hospital	255.5526	27.93019	9.15	0.000	200.8105	310.2948
	Difference	-5.269126	36.57225	-0.14	0.885	-76.94942	66.41117
Travel	Home	10.65095	0.7721741	13.79	0.000	9.137514	12.16438
	Hospital	18.31467	1.461535	12.53	0.000	15.45011	21.17922
	Difference	-7.663719	1.651384	-4.64	0.000	-10.90037	-4.427066
Out of pocket expenses	Home	8.366368	0.8257938	10.13	0.000	6.747842	9.984894
	Hospital	22.25256	2.66553	8.35	0.000	17.02821	27.4769
	Difference	-13.8619	2.776957	-5.00	0.000	-19.32892	-8.443455
Days off school	Home	65.49701	4.75125	13.79	0.000	56.18473	74.80929
	Hospital	57.05053	5.086391	11.22	0.000	47.08138	67.01967
	Difference	8.446484	7.034962	1.20	0.230	-5.341788	22.23476

Total Cost Days 0-3	Home	331.2495	26.2718	12.61	0.000	279.7578	382.7413
	Hospital	352.2065	30.64495	11.49	0.000	292.1435	412.2695
	Difference	-20.95692	40.74511	-0.51	0.607	-100.8159	58.90204

Table 12: INDIRECT COSTS (patient/carer): Follow-up period (24months)

Variable	Arm	Observed Coef.(£)	Bootstrap Std. Error.(£)	z (£)	P>|z |	Normal-based [95% CI] (£)	
Days off work	Home	868.5459	132.2863	6.57	0.000	609.2696	1127.822
	Hospital	1180.468	255.6274	4.62	0.000	679.4479	1681.489
	Difference	-311.9225	285.404	-1.09	0.274	-871.304	247.459
Travel	Home	63.39265	3.821086	16.59	0.000	55.90346	70.88184
	Hospital	60.58442	5.881266	10.30	0.000	49.05735	72.11149
	Difference	2.808232	7.079617	0.40	0.692	-11.06756	16.68403
Out of pocket expenses	Home	44.33534	6.17581	7.18	0.000	32.23098	56.43971
	Hospital	41.88275	6.181821	6.78	0.000	29.76661	53.9989
	Difference	2.452587	8.848013	0.28	0.782	-14.8892	19.79437
Days off school	Home	443.3544	40.85612	10.85	0.000	363.2779	523.4309
	Hospital	454.1856	53.69218	8.46	0.000	348.9508	559.4203
	Difference	-10.83119	67.59177	-0.16	0.873	-143.3086	121.6462
Total Costs of Follow-up	Home	1419.628	145.554	9.75	0.000	1134.348	1704.909
	Hospital	1737.121	270.3629	6.43	0.000	1207.22	2267.023
	Difference	-317.4929	305.4638	-1.04	0.299	-916.1909	281.2051

Table 13: Total Costs

Variable	Arm	Observed Coef.(£)	Bootstrap Std. Error.(£)	z (£)	P>|z |	Normal-based [95% CI] (£)	
Patient/carer Total Cost	Home	1750.878	154.6333	11.32	0.000	1447.802	2053.954
	Hospital	2089.328	276.5388	7.56	0.000	1547.322	2631.334
	Difference	-338.4498	318.5954	-1.06	0.288	-962.8854	285.9858
Direct Healthcare Total Cost	Home	6450.138	227.8686	28.31	0.000	6003.524	6896.753
	Hospital	8867.519	210.293	41.22	0.000	8255.352	9079.686
	Difference	-2217.38	310.2097	-7.15	0.000	-2825.38	-1609.381
Total Healthcare + Patient/carer	Home	8201.016	314.0942	26.11	0.000	7585.403	8816.63
	Hospital	10756.85	360.4966	29.84	0.000	10050.29	11463.41
	Difference	-2555.83	478.5273	-5.34	0.000	-3493.727	-1617.934

Table 14 ICER of Direct Healthcare Costs

	Coefficient	95% CI	P>|z|
Difference in cost (£)	-2182.289	-2783.101 to -1581.477	<0.001
Difference in HbA1c (mmol/mol)	-0.294	-6.282 to 5.695	0.923
ICER (£ saved per additional mmol/mol reduction in HbA1c)	**7434.334**	-73368.77 to 88236.77	0.857

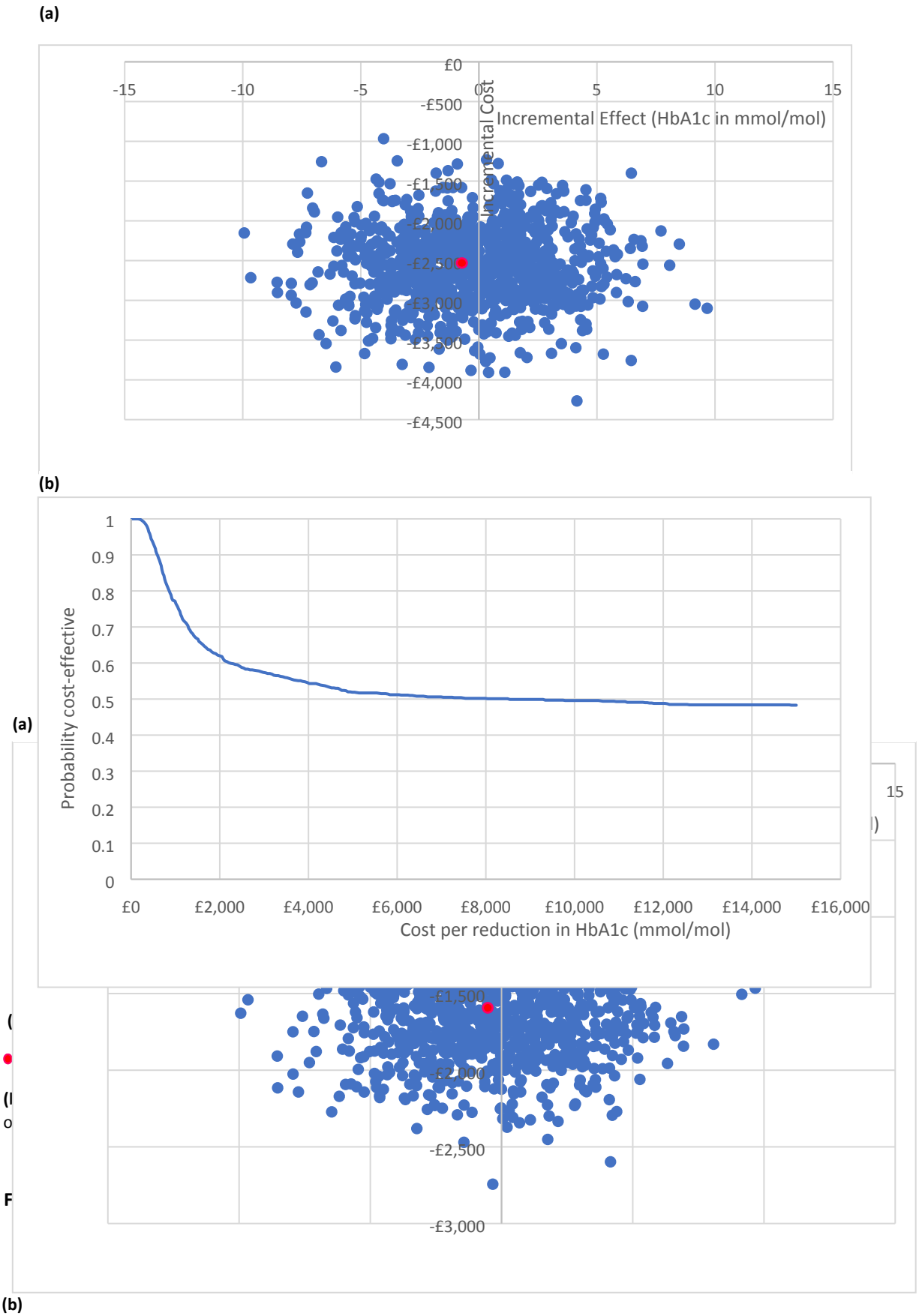
Table 15 ICER of healthcare + non-healthcare costs

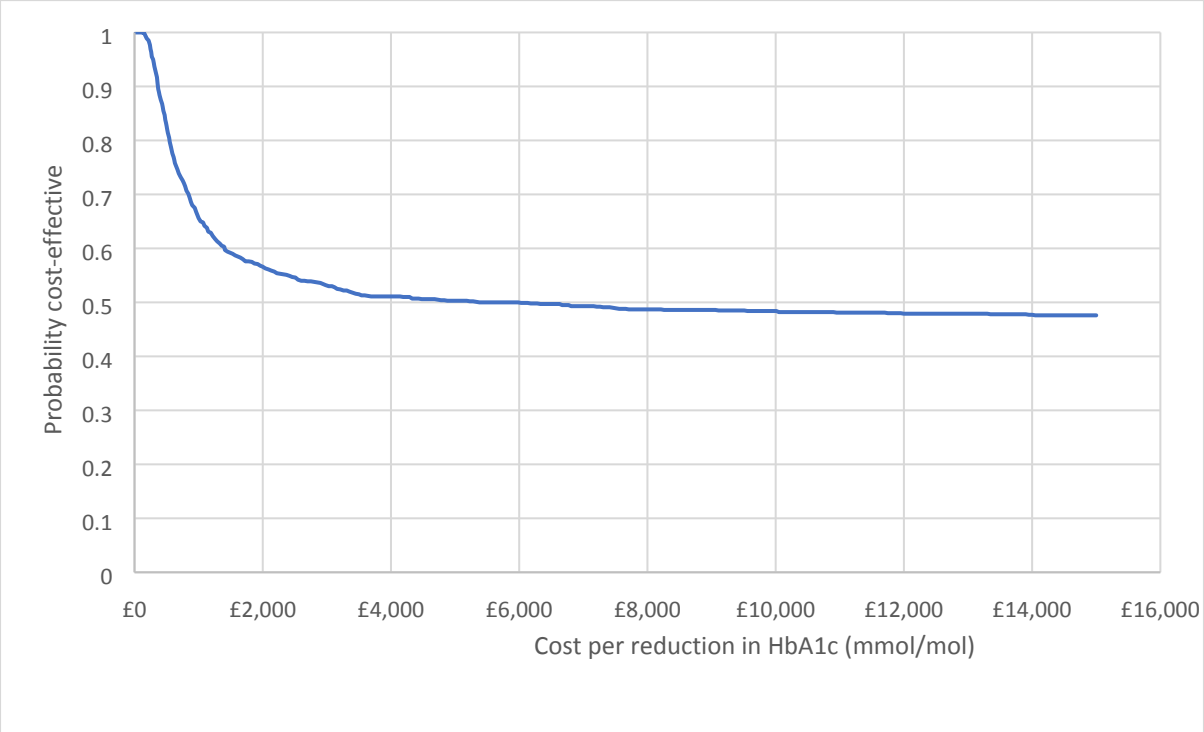
	Coefficient	95% CI	P>|z|
Difference in cost (£)	-2520.199	-3464.697 to -1575.701	<0.001
Difference in HbA1c (mmol/mol)	-0.294	-6.282 to 5.695	0.923
ICER (£ saved per additional mmol/mol reduction in HbA1c)	**8585.48**	-91610.05 to 108781	0.867

Table 16 Sensitivity Analyses

	Coefficient	95% CI	P>|z|
Difference in cost (£)	-1600.113	-2197.857 to -1002.37	<0.001
Difference in HbA1c (mmol/mol)	-0.294	-6.282 to 5.695	0.923
ICER (£ saved per additional mmol/mol reduction in HbA1c)	**5451.055**	-57926.34 to 68828.45	0.866

Figure 1





(a) Cost-effectiveness plane of healthcare costs with sensitivity analysis. Reduction in HbA1c represents improvement.

● = point estimate ICER £5,451.055 saved per additional mmol/mol reduction of HbA1c (-0.294, -£1,600.113)

(b) Cost-effectiveness acceptability curve for Direct Healthcare Costs with sensitivity analysis. Represents the probability of home management being cost-effective at different willingness to pay thresholds.

Table 17 Cost Consequences Analysis (CCA)

	Arm					
Costs and Consequences	**N**	**Home management,** mean (95% CI/SD) (£)	**N**	**Hospital management,** mean (95% CI/SD) (£)	**Difference between Home and Hospital,** mean (95% CI) (£)	**P value**
Costs Impact						
TOTAL Direct Healthcare Costs	98	£6450.14 (£6003.52 to £6896.75)	95	£8667.52 (£8255.35 to £9079.69)	-£2217.38 (-£2825.38 to -£1609.38)	<0.05
TOTAL Patient/Carer Costs	98	£1750.88 (£1447.80 to £2053.95)	95	£2089.33 (£1547.32 to £2631.33)	-£338.45 (-£962.89 to £285.99)	0.288
TOTAL NHS + Patient/Carer Costs	98	£8201.02 (£7585.40 to £8816.63)	95	£10756.85 (£10050.29 to 11463.41)	-£2555.83 (-£3493.73 to -£1617.93)	<0.05
Health Impact						
HbA1c 24months (mmol/mol)*	98	72.1 (SD = 21.7)	95	72.6 (SD = 21.9)	1.01 (0.93 to 1.09)	0.863
Physical Impact						
Physical well-being at 1month**	68	63.0 (SD = 20.38)	62	70.4 (SD = 19.07)	-7.5 (-14.3 to -0.6)	0.033
Physical well-being at 24months**	62	70.0 (SD = 17.64)	58	71.0 (SD = 15.90)	-1.0 (-7.1 to 5.1)	0.741
Symptoms at 1 month***	69	60.2 (SD = 14.23)	62	62.3 (SD = 13.09)	-2.1 (-6.8 to 2.6)	0.384
Symptoms at 24months***	62	62.0 (SD = 12.56)	58	63.3 (SD = 14.11)	-1.2 (-5.9 to 3.6)	0.633
Psychological Impact						
Worry at 1month***	68	72.7 (SD = 24.26)	63	74.7 (SD = 22.94)	-2.1 (-10.2 to 6.1)	0.616

Worry at 24months* **	62	73.3 (SD = 20.75)	58	71.1 (SD = 23.74)	2.1 (-5.9 to 10.2)	0.601
Emotional wellbeing at 1month**	68	75.5 (SD = 17.98)	61	77.6 (SD = 15.31)	-2.2 (-8.0 to 3.7)	0.464
Emotional wellbeing at 24months**	62	76.6 (SD = 18.18)	58	78.6 (SD = 12.35)	-2.0 (-7.7 to 3.6)	0.482
Self-esteem at 1month**	68	53.9 (SD = 24.19)	61	64.1 (SD = 21.22)	-10.4 (-18.3 to -2.4)	0.011
Self-esteem at 24months**	62	63.4 (SD = 19.92)	58	56.1 (SD = 18.71)	7.2 (0.2 to 14.2)	0.043
Social Impact						
Communication at 1month***	68	72.9 (SD = 28.01)	63	81.3 (SD = 18.25)	-8.4 (-16.7 to -0.2)	0.045
Communication at 24months***	62	72.8 (SD = 25.83)	58	78.2 (SD = 21.22)	-5.5 (-14.0 to 3.0)	0.200
Family at 1month**	69	76.0 (SD = 17.61)	61	79.7 (SD = 18.10)	-3.7 (-9.9 to 2.5)	0.242
Family at 24months**	61	79.3 (SD = 17.81)	58	77.9 (SD = 19.15)	1.5 (-5.1 to 8.2)	0.507
Friends at 1month**	69	79.3 (SD = 14.62)	60	78.6 (SD = 16.33)	0.5 (-4.8 to 5.9)	0.849
Friends at 24months**	60	79.5 (SD = 17.03)	58	77.4 (SD = 16.81)	2.1 (-4.1 to 8.2)	0.507
School at 1month**	65	67.0 (SD = 21.92)	60	68.1 (SD = 18.65)	-1.1 (-8.3 to 6.1)	0.763
School at 24months**	60	65.9 (SD = 17.32)	57	61.5 (SD = 18.14)	4.6 (-1.9 to 11.0)	0.163

***Controlled for HbA1c at baseline. **KINDL-R – parent answers about child; higher score is better. ***PedsQL 3.0 Diabetes Module – parent answers about child.**

Reporting checklist for economic evaluation of health interventions.

Based on the CHEERS guidelines.

Instructions to authors

Complete this checklist by entering the page numbers from your manuscript where readers will find each of the items listed below.

Your article may not currently address all the items on the checklist. Please modify your text to include the missing information. If you are certain that an item does not apply, please write "n/a" and provide a short explanation.

Upload your completed checklist as an extra file when you submit to a journal.

In your methods section, say that you used the CHEERSreporting guidelines, and cite them as:

Husereau D, Drummond M, Petrou S, Carswell C, Moher D, Greenberg D, Augustovski F, Briggs AH, Mauskopf J, Loder E. Consolidated Health Economic Evaluation Reporting Standards (CHEERS) statement.

	Reporting Item	Page Number
Title		
#1	Identify the study as an economic evaluation or use more specific terms such as “cost-effectiveness analysis”, and describe the interventions compared.	1

Abstract			
	#2	Provide a structured summary of objectives, perspective, setting, methods (including study design and inputs), results (including base case and uncertainty analyses), and conclusions	2
Introduction			
Background and objectives	#3	Provide an explicit statement of the broader context for the study. Present the study question and its relevance for health policy or practice decisions	3-4
Methods			
Target population and subgroups	#4	Describe characteristics of the base case population and subgroups analysed, including why they were chosen.	4
Setting and location	#5	State relevant aspects of the system(s) in which the decision(s) need(s) to be made.	4
Study perspective	#6	Describe the perspective of the study and relate this to the costs being evaluated.	4
Comparators	#7	Describe the interventions or strategies being compared and state why they were chosen.	4
Time horizon	#8	State the time horizon(s) over which costs and consequences are being evaluated and say why appropriate.	5

Discount rate	#9	Report the choice of discount rate(s) used for costs and outcomes and say why appropriate	4
Choice of health outcomes	#10	Describe what outcomes were used as the measure(s) of benefit in the evaluation and their relevance for the type of analysis performed	5
Meaurement of effectiveness	#11a	Single study-based estimates: Describe fully the design features of the single effectiveness study and why the single study was a sufficient source of clinical effectiveness data	6
Measurement of effectiveness	#11b	Synthesis-based estimates: Describe fully the methods used for identification of included studies and synthesis of clinical effectiveness data	N/A
Measurement and valuation of preference based outcomes	#12	If applicable, describe the population and methods used to elicit preferences for outcomes.	N/A
**Estimating resources and costs **	#13a	Single study-based economic evaluation: Describe approaches used to estimate resource use associated with the alternative interventions. Describe primary or secondary research methods for valuing each resource	5

		item in terms of its unit cost. Describe any adjustments made to approximate to opportunity costs	
Methods			
Estimating resources and costs	#13b	Model-based economic evaluation: Describe approaches and data sources used to estimate resource use associated with model health states. Describe primary or secondary research methods for valuing each resource item in terms of its unit cost. Describe any adjustments made to approximate to opportunity costs.	N/A
Currency, price date, and conversion	#14	Report the dates of the estimated resource quantities and unit costs. Describe methods for adjusting estimated unit costs to the year of reported costs if necessary. Describe methods for converting costs into a common currency base and the exchange rate.	5
Choice of model	#15	Describe and give reasons for the specific type of decision analytical model used. Providing a figure to show model structure is strongly recommended.	5
Assumptions	#16	Describe all structural or other assumptions underpinning the decision-analytical model.	5
Analytical methods	#17	Describe all analytical methods supporting the evaluation. This could include methods for dealing with skewed, missing, or censored data; extrapolation methods; methods for pooling data; approaches to validate or make adjustments (such as half cycle	6

		corrections) to a model; and methods for handling population heterogeneity and uncertainty.	
Results			
Study parameters	#18	Report the values, ranges, references, and, if used, probability distributions for all parameters. Report reasons or sources for distributions used to represent uncertainty where appropriate. Providing a table to show the input values is strongly recommended.	8
Incremental costs and outcomes	#19	For each intervention, report mean values for the main categories of estimated costs and outcomes of interest, as well as mean differences between the comparator groups. If applicable, report incremental cost-effectiveness ratios.	8
Characterising uncertainty	#20a	Single study-based economic evaluation: Describe the effects of sampling uncertainty for the estimated incremental cost and incremental effectiveness parameters, together with the impact of methodological assumptions (such as discount rate, study perspective).	8
Characterising uncertainty	#20b	Model-based economic evaluation: Describe the effects on the results of uncertainty for all input parameters, and uncertainty related to the structure of the model and assumptions.	N/A
Characterising heterogeneity	#21	If applicable, report differences in costs, outcomes, or cost effectiveness that can be explained by variations	N/A

		between subgroups of patients with different baseline characteristics or other observed variability in effects that are not reducible by more information.	
Discussion			
Study findings, limitations, generalisability, and current knowledge	#22	Summarise key study findings and describe how they support the conclusions reached. Discuss limitations and the generalisability of the findings and how the findings fit with current knowledge.	15
Other			
Source of funding	#23	Describe how the study was funded and the role of the funder in the identification, design, conduct, and reporting of the analysis. Describe other non-monetary sources of support	17
Conflict of interest	#24	Describe any potential for conflict of interest of study contributors in accordance with journal policy. In the absence of a journal policy, we recommend authors comply with International Committee of Medical Journal Editors recommendations	17

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Cost-effectiveness of home versus hospital management of children at onset of Type 1 Diabetes: The DECIDE randomised controlled trial

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Title: Cost-effectiveness of home versus hospital management of children at onset of Type 1 Diabetes: The DECIDE randomised controlled trial

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ABSTRACT

Objective The aim of this economic evaluation was to assess whether home management could represent a cost-effective strategy in the patient pathway of Type 1 diabetes (T1D). This is based on the DECIDE trial (ISRCTN78114042), which compared home versus hospital management from diagnosis in childhood diabetes and found no statistically significant difference in glycaemic control at 24 months.

Design Cost-effectiveness analysis alongside a randomised controlled trial.

Setting Eight paediatric diabetes centres in England, Wales and Northern Ireland.

Participants 203 clinically well children aged under 17 years, with newly diagnosed type 1 diabetes and their carers.

Outcome measures The base case analysis adopted an NHS perspective. A scenario analysis assessed costs from a broader societal perspective. The incremental cost-effectiveness ratio (ICER) expressed as cost per mmol/mol reduction in HbA1c, was based on the mean difference in costs between the home and hospital groups, divided by mean differences in effectiveness (HbA1c). Uncertainty was considered in terms of the probability of cost-effectiveness.

Results At 24 months post-intervention, the base case analysis showed a difference in costs between home and hospital, in favour of home management (mean difference -£2,217; 95% CI -£2,825 to -£1,609; p<0.001). Home care dominated, with an ICER of £7,434 (saved) per mmol/mol reduction of HbA1c. The results of the scenario analysis also favoured home management. The greatest driver of cost differences was hospitalisation during the initiation period.

Conclusions Home management from diagnosis of children with T1D who are medically stable represents a less costly approach for the NHS in the UK, without impacting clinical effectiveness.

Strengths and limitations of this study

- Cost-effectiveness analysis based on a randomised controlled trial, using patient-level data on resource use, collected prospectively.
- Methods were consistent with the NICE reference case, as recommended for the NHS in the UK.
- Quality-adjusted life years were not used as the health outcome and therefore interpretation of cost-effectiveness is more challenging.
- Cost-effectiveness was assessed over the trial period only; lifetime extrapolation was not performed to identify long-term costs and benefits.
- Clinical practice has evolved since the trial commenced and consequently resource use and costs will have changed.

Trial registration number ISRCTN78114042

INTRODUCTION

A diagnosis of Type 1 diabetes (T1D) poses a significant economic burden on healthcare systems, due to the resources required for effective management, the associated complications, and its life-long course. As a result, it is estimated that the National Health Service (NHS) spends £1billion a year on T1D; 11% of this expenditure is on inpatient care.[1]The cost of keeping someone in hospital is high and, as a result, there has been a growing emphasis on delivery of care within primary care and community settings.[2] Patients' attitudes are also shifting towards wanting to be more involved in their own care and wishing to be treated closer to home, as highlighted in the NHS England Five Year Forward Plan.[3] Evidence suggests that initial management of T1D can be successfully delivered at home rather than in hospital[4–6] although the cost-effectiveness of this approach is unknown in the UK.

T1D affects 25.1 per 100,000 children and young people in the United Kingdom (UK) and the incidence is rising.[7] It is a life-long condition which can lead to serious short (e.g. diabetic ketoacidosis (DKA)) and long-term (e.g. renal, vascular and retinal damage) complications.[8] The risk of complications is reduced if blood glucose is kept within healthy targets.[9]To achieve this, the National Institute for Health and Care Excellence (NICE) recommends offering children and their families intensive education on insulin management from diagnosis and a long-term package of care, delivered through a multidisciplinary team. The NICE guidelines state that the choice of where this initial care is delivered should be made based on clinical need, family circumstances and wishes.[10] Hospitalisation has been shown to be a substantially stressful event for both the child and their parents[11] and so should be avoided unless clinically necessary. Most children with T1D are not acutely unwell at diagnosis and therefore could be managed at home.[6,12]

However, there have been few, well-designed studies evaluating home versus hospital management. A Cochrane review in 2007 concluded that the results of prior studies were inconclusive but suggested that home management at diagnosis does not lead to any clinical, psychological or cost disadvantages.[5] Since this review, further randomised controlled trials (RCTs) have been conducted. One was carried out in Sweden, where home management was described as 'hospital-based-home-care' as it involved staying in a facility which was designed to replicate a home environment but was located in the hospital grounds.[13] There was no difference between 'hospital-based-home-care' and 'hospital care', in terms of glycated haemoglobin (HbA1c) (mean difference between groups 0.6mmol/mol; p=0.777) but a cost-effectiveness analysis reported significantly lower healthcare (direct) costs in the home managed group (- SEK 16,212 (-£1,318); p<0.05).[13]

More recently, the Delivering Early Care In Diabetes Evaluation (DECIDE) RCT evaluated home versus hospital management at diagnosis in childhood diabetes.[14] It was conducted between 2008-2013 in eight paediatric diabetes centres in England, Wales and Northern Ireland. . The primary outcome was HbA1c at 24 months post-diagnosis and secondary outcomes included coping, anxiety, quality of life (QoL) and use of NHS resources. The trial found no statistically significant difference in HbA1c between home and hospital management (1.01mmol/mol, 95%

CI 0.93 to 1.09) and there were no differences in secondary outcomes at 24 months, other than a higher self-esteem in children who were managed at home.

The aim of the present analysis was to estimate the cost effectiveness of home versus hospital management of children diagnosed with T1D from the perspective of the NHS in the UK.

METHODS

The DECIDE trial protocol and results are described in detail elsewhere.[14,15] Briefly, DECIDE was a superiority RCT, designed to compare the clinical effectiveness of home care from diagnosis with hospital-based care in the management of T1D. The sample size needed to detect a difference in mean HbA1c of 5 mmol/mol (with an SD of 14 mmol/mol; equivalent to an effect size of 0.4) was 200 participants (100 per group) at a 5% significance level and 80% power.

Following informed consent, 203 clinically well children aged less than 17 years old with newly diagnosed diabetes, from eight paediatric diabetes centres across the UK, were randomised to home or hospital management. Participants were eligible to take part if they or their carers were deemed able to complete the study requirements and gave informed assent or consent. Participants were excluded if they were not medically stable at diagnosis or required hospitalisation for other reasons. Full inclusion and exclusion criteria are described in the trial protocol.[15] The economic evaluation considered the intention to treat population.

Ethics statement

Multicentre approval was granted by Research Ethics Committee for Wales (07/MRE09/59). Site-specific approval was granted by participating Acute Trust Research and Development Departments. The trial sponsor was Cardiff University.

Study perspective

The base case analysis of this economic evaluation follows the cost perspective of the NHS[16]. Indirect costs (impact on productivity) and direct non-medical costs (incurred by the patient and his/her carer) were also evaluated through separate scenario analyses as T1D has been shown to have wider economic impacts.[17]

Intervention and comparator

The intervention involved management of the initiation period from diagnosis in the family's own home, for a minimum of 3 days, to include at least six supervised injections and delivery of pragmatic educational care. This meant that children were discharged on the day of diagnosis, with no overnight stays in hospital. All subsequent management, education (diabetes and dietetic) was provided by nursing staff and dietitians either in the child's home or as an outpatient. In comparison, participants in the hospital group were admitted to hospital on the day of diagnosis, for a minimum of three days and received education and support in line with local practice.

Discount rate

A discount rate of 3.5% per annum was applied to costs and consequences after 12 months, as recommended by NICE.[16] We used this rate because all economic

evaluations require that future costs and effects are discounted to present value to account for time preference. In the UK, the discount rate is set at 3.5% per annum.

Estimating resources and costs

Data on resource use were collected using case report forms (CRFs) at baseline, then at 3, 12 and 24 months which were summed to calculate total resource use over 24 months (Supplementary Materials Table 1). Baseline data comprised of data collected from the day of diagnosis until day 3 of either home or hospital management. Resource use prior to diagnosis was not included.

The base case analysis considered direct NHS resource use. This encompassed hospital stay, tests and investigations, insulin usage, nurse and dietician travel, and contacts with healthcare professionals.

Contacts with healthcare professionals, along with distance travelled, was collected with each CRF. These were costed using the PSSRU 2019 compendium of NHS unit costs.[18]

The unit costs of a paediatric overnight hospital stay were sourced from the NHS Reference Costs database 2019/20.[19]

Tests and investigations were costed through contacting the Biochemistry and Immunology Department within the University Hospital of Wales**,** the main centre for the trial. Unit costs not provided were inflated from previously supplied figures from Cwm Taf Health Board to 2019/20 figures, using the CCEMG-EPPI-Centre Cost Converter.[20]

Insulin regimen data were collected at all time points. This included type of insulin, number of units prescribed throughout the day and related equipment usage (at follow-up only). Medical equipment included items such as testing strips, needles, and lancets.The British National Formulary for Children (BNFc) and the NHS Electronic Drug Tariff were used to reference insulin costs and equipment.[21,22]

Broader perspectives, considering non-healthcare resource use, were adopted in scenario analyses. These covered productivity losses incurred by the patient and their family (indirect costs), including days off school and work, as well as travel and out of pocket expenses (direct costs) related to managing T1D. Days taken off work were costed based on average salary earnings in the UK.[23] Time taken off school was costed based on calculating an average cost spent per pupil per day, based on the Annual Report on Education Spending in England.[24] Reported out of pocket expenses incurred by patients and their carers were inflated to 2019/20 costs using the UK Consumer Price Index.[25]

Currency and cost year

Costs were reported in British pounds sterling for 2019/20.

Choice of model

The results of the main DECIDE trial demonstrated no statistically significant clinical difference between home and hospital groups and therefore it was deemed that an evaluation of lifetime costs using an economic model was neither necessary nor informative.

Assumptions
The CRFs did not collect data on length of consultations with healthcare professionals and so assumptions were made based on PSSRU data and through communication with healthcare professionals. Further assumptions relating to the calculation and estimation of costs are reported in Supplementary Materials Tables 2-7.

Outcome measures and economic analysis
The primary measure of clinical effectiveness was HbA1c at 24 months. As alternative measures to enable the calculation of quality-adjusted life years (QALYs) were not used in DECIDE, HbA1c was used as the measure of effect for the cost-effectiveness analysis.

The mean total costs of each scenario were calculated for both the intervention and control groups over 24 months. This follow-up period was chosen as it was expected that most participants would have no significant endogenous insulin secretion by this time point. Costs are also reported for the initiation period (0-3 days).

Cost-effectiveness was assessed through estimation of the incremental cost per unit change in HbA1c (mmol/mol). This is based on the difference in mean total cost per patient between the intervention and control group (home and hospital management), divided by the difference in mean HbA1c. The resulting incremental cost-effectiveness ratio (ICER) was compared with reference to what the NHS is willing to pay (WTP) for an additional unit change in HbA1c; this being inferred from existing interventions in diabetes.

A cost consequences analysis (CCA) was conducted, in which the costs and outcomes are presented in a tabular format to support decision makers and allow them to attach their own weighting to each result. These outcomes include measures of physical, psychological and social consequences based on parent answers about their child.

Analytical methods
Data collected were inputted into IBM SPSS Version 25 for analysis.[26] The data were assessed for accuracy and missing data. Any outliers identified were checked against the original CRF and then investigated through a sensitivity analysis. An analysis of randomness was carried out on missing data to compare against patients' socio-demographic data.[27] If participants left a blank response, we assumed that zero items of resources were used.

Uncertainty in the cost-effectiveness ratio was considered by use of non-parametric bootstrapping using Stata.[28] This involved sampling (with replacement) pairs of mean cost and HbA1c 10,000 times as a means of estimating the sampling distribution.[29] Separate regression analyses were conducted to adjust total costs (by arm and centre) and 24 month HbA1c (on arm, centre and baseline HbA1c). This produced 95% confidence intervals for each cost variable and the differences in both costs and effect for calculating the ICER. This was done for direct healthcare costs with and without patient or carer borne costs. Microsoft Excel was then used to bootstrap HbA1c and total direct healthcare costs at 24 months (1000 replications) and results are displayed on a cost-effectiveness plane. The cost-effectiveness plane is used to visually represent the differences in costs and health outcomes between

arms in two dimensions. A cost-effectiveness acceptability curve (CEAC) was drawn to represent the probability of cost-effectiveness for different values of WTP.[30] This was repeated for the wider perspective, encompassing direct non-healthcare costs and indirect productivity losses. The CEAC is used to summarise the impact of uncertainty on the result of an economic evaluation. It represents the probability of an intervention being cost-effective for any given value of the cost-effectiveness threshold.

A univariate sensitivity analysis was also conducted, adjusting the cost of an overnight stay in hospital for an alternative value, to assess the impact on the ICER.

Reporting

The economic analysis of DECIDE is reported in accordance with the Consolidated Health Economic Evaluation Reporting Standards (CHEERS).[31]

Patient and Public Involvement

There was no direct involvement of patients or the public in this health economics study. However, two parents of children diagnosed with T1D were involved in the initial design of the DECIDE trial. One of these parents was a co-applicant on the funding application and was instrumental in ensuring that the trial was informed by the families' experience. She also attended the ethics committee meeting to provide a service user perspective of the value of the trial to inform the committee's decision. She and another parent were part of the Trial Management Group which met monthly and provided input on the conduct of the trial throughout.

RESULTS

Sample

Of the 203 children involved in the trial, one participant dropped out within the first few days, eight were missing a 24-month HbA1c measurement and one patient did not have a baseline HbA1c. Therefore, the primary analysis of the clinical data reported results on the remaining 193 participants. To ensure consistency and allow for calculation of the ICER, the same participants were included in the economic analysis.

Healthcare outcomes

The DECIDE trial found no significant difference in HbA1c at 24 months between home and hospital management (72.1mmol/mol and 72.6mmol/mol; p=0.863, respectively). This was not affected by repeated measures or sensitivity analyses. Baseline characteristics were explored and both groups were considered to have reasonable similarities.[14]

Direct healthcare resource use and costs

Over 24 months, home management was less costly than hospital management (-£2,217; 95% CI -£2,825 to -£1,609; p<0.001) (Table 1). The greatest difference in direct NHS costs, in favour of home management, was seen during days 0-3 (-£2,223; 95% CI -£2,373 to -£2,072; p<0.001). During this time, participants in the home management group had fewer contacts with consultants and junior doctors but more non face-to-face interactions with nurses (i.e. telephone calls and email correspondence) *(Table 2)*. Overall, this led to costs during days 0-3 of £974 per child for home management and £720 for hospital management, in terms of contacts with the Diabetes Team (mean difference in cost of £254; 95% CI £147 to £361; p<0.001). The cost of nurse travel was also significantly higher for home management (mean difference £115; 95% CI £86 to £143; p<0.001). However, this increased expense was outweighed by the cost of the hospital stay in the first three days for those in the hospital group (£2,583; 95% CI £2,464 to £2,702 per child). This had the greatest contribution to the total direct healthcare costs.

Non-healthcare resource use and costs

There were no significant differences between home or hospital in either the number of days off school or work during the initiation period (0-3 days) (Table 2); and this remained similar between groups over the 24-month follow-up period. Home management was not found to be significantly less costly than hospital management for patients and their carers at 0-3 days (-£21; 95% CI -£101 to £59; p=0.607) or 24 months (£338; 95% CI -£963 to £286; p=0.288) (Table 1).

Healthcare and non-healthcare costs

Overall, home management was significantly less costly than hospital management for the base case analysis (-£2217; 95% CI -£2,825 to -£1,609, p<0.001). The difference in costs to the patient and their carers between home and hospital management was not statistically significant. However, adopting a wider perspective which encompasses direct NHS costs and patient/carer borne costs, led to home management being significantly less costly (-£2,556; 95% CI -£3,494 to -£1,618;

p<0.001) (Table 3). Full costs, confidence intervals and significance levels for all resource use data collected are presented in Supplementary Materials Table 8-13.

Table 1 Costs relating to resource use

		Home management (n=98), mean (95% CI) (£)	Hospital management (n=95), mean (95% CI) (£)	Difference between Home and Hospital, mean (95% CI) (£)	p-value for Difference between Home and Hospital
DIRECT HEALTHCARE COSTS					
Days 0-3	Contact with diabetes team	974 (889 to 1059)	720 (658 to 782)	254 (147 to 361)	<0.001
	Other Health Professionals	0 (-0. to 0)	1 (-1 to 4)	-1 (-4 to 1)	0.223
	Tests and Investigations	55 (49 to 61)	62 (56 to 67)	-7 (-15 to 1)	0.100
	Hospital stay	0	2583 (2464 to 2702)	-2583 (-2702 to -2463)	<0.001
	Nurse travel	133 (107 to 159)	18 (8 to 28)	115 (86 to 143)	<0.001
	Dietician travel	3 (1 to 5)	1 (-1 to 2)	2 (0 to 5)	0.039
	Total cost days 0-3	1163 (1079 to 1248)	3386 (3261 to 3511)	-2223 (-2373 to -2072)	<0.001
Follow-up (24months)	Contact with the diabetes team	1984 (1876 to 2092)	2017 (1915 to 2119)	-33 (-182 to 116)	0.664
	- Outpatient Visits	1400 (1344 to 1455)	1392 (1341 to 1443)	8 (-67 to 83)	0.837
	- Contact with the diabetes team (other)	584 (502 to 667)	625 (541 to 709)	-41 (-160 to 79)	0.502
	Hospital contacts	897 (569 to 1225)	860 (553 to 1167)	37 (-413 to 487)	0.874
	Tests and Investigations	8 (5 to 11)	8 (6 to 11)	-1 (-4 to 4)	0.968
	Total Insulin	457 (402 to 512)	446 (397 to 495)	11 (-63 to 85)	0.773
	Equipment	1745 (1567 to 1924)	1714 (1544 to 1883)	31 (-218 to 281)	0.803
	Other Health Professional Visits	195 (149 to 240)	236 (177 to 295)	-41 (-115 to 33)	0.278
	Total follow-up cost	5287 (4864 to 5709)	5282 (4883 to 5680)	5 (-584 to 594)	0.986
Total cost at 24months		6450 (6004 to 6897)	8668 (8255 to 9080)	-2217 (-2825 to -1609)	<0.001
PATIENT/CARER COSTS					
Days 0-3	Days off school	66 (56 to 75)	57 (47 to 67)	8 (-5 to 22)	0.235
	Days off work	250 (203 to 297)	256 (201 to 310)	-5 (-77 to 66)	0.886
	Travel	11 (9 to 12)	18 (15 to 21)	-8 (-11 to -4)	<0.001
	Out of pocket expenses	8 (7 to 10)	22 (17 to 27)	-14 (-19 to -8)	<0.001

	Total cost days 0-3	331 (280 to 383)	352 (292 to 412)	-21 (-101 to 59)	0.601
Follow-up (24months)	Days off school	443 (363 to 523)	454 (349 to 559)	-11 (-143 to 122)	0.871
	Days off work	869 (609 to 1128)	1180 (679 to 1681)	-312 (-871 to 247)	0.275
	Travel	63 (56 to 71)	61 (49 to 72)	3 (-11 to 17)	0.687
	Out of pocket expenses	44 (32 to 56)	42 (30 to 54)	2 (-15 to 20)	0.779
	Total follow-up cost	1420 (1134 to 1705)	1737 (1207 to 2267)	-317 (-916 to 281)	0.297
Total cost at 24months		1751 (1448 to 2054)	2089 (1547 to 2631)	-338 (-963 to 286)	0.290
TOTAL COST		8201 (7585 to 8817)	10757 (10050 to 11463)	-2556 (-3494 to -1618)	<0.001

Table 2 Units of resource use

		Home Management (n = 98)			Hospital Management (n = 95)		
		Median	Range		Median	Range	
			Minimum	Maximum		Minimum	Maximum
DIRECT HEALTHCARE RESOURCE USE							
Days 0-3	Contacts with the diabetes team						
	- Consultant	1.0	0.0	9.0	2.0	0.0	5.0
	- Junior doctor	1.0	0.0	5.0	3.0	0.0	10.0
	- Nurse						
	• Face to face	6.0	0.0	13.0	6.0	0.0	32.0
	• Telephone calls/emails	2.0	0.0	28.0	0.0	0.0	3.0
	- Dietitian	1.0	0.0	3.0	1.0	0.0	3.0
	Other health care professionals	0.0	0.0	1.0	0.0	0.0	2.0
	Test and investigations						
	- Diagnosis related	4.0	0.0	8.0	5.0	1.0	12.0
	- Other	2.0	0.0	4.0	3.0	0.0	6.0
	Hospital stay (days)	0.0	0.0	0.0	3.0	0.0	6.0
	Travel						
	- Nurse travel distance (miles)	40.0	0.0	214.0	0.0	0.0	192.0
	- Dietician travel distance (miles)	0.0	0.0	24.0	0.0	0.0	32.0
Follow-up	Contacts with the diabetes team						

(24months)	- Outpatient*	9.0	6.0	18.0	9.0	6.0	16.0
	- Other**	28.5	2.0	128.0	31.0	2.0	158.0
	Hospital contacts						
	- A&E	0.0	0.0	8.0	0.0	0.0	6.0
	- Ward	0.0	0.0	16.0	0.0	0.0	8.0
	Tests and investigations***	0.0	0.0	11.0	0.0	0.0	8.0
	Insulin	18889.5	2138.0	64354.0	19669.0	2351.5	48858.0
	Other health professionals						
	- GP	2.0	0.0	14.0	2.0	0.0	19.0
	- Nurse	1.0	0.0	8.0	0.0	0.0	31.0
	- Other	0.0	0.0	11.0	0.0	0.0	22.0
PATIENT/CARER RESOURCE USE							
Days 0-3	Days off school	2.0	0.0	5.0	2.0	0.0	5.0
	Days off work	2.0	0.0	9.0	2.0	0.0	14.0
	Travel (hours)	2.0	0.0	7.0	3.0	0.0	16.0
	Out of pocket expenses (£)	11	0	38	16	0	87
Follow-up (24months)	Days off school	11.0	0.0	64.0	11.0	0.0	129.0
	Days off work	3.3	0.0	70.0	4.0	0.0	164.0
	Travel (hours)	10.0	0.0	96.0	9.0	0.0	92.0
	Out of pocket expenses (£)	33	0	546	27	0.0	468
Total Patient/carer resource use	Days off school	13.0	0.0	66.0	13.5	0.0	132.0
	Days off work	5.0	0.0	78.0	6.5	0.0	167.5
	Travel (hours)	12.0	3.0	99.0	13.0	0.0	94.0
	Out of pocket expenses (£)	43	0	546	48	0	555

***Two patients had visits with the nurse outside of the patient setting. **Home visits, telephone calls and emails. ***From CRF 7 only.**

Cost effectiveness

Home management dominated hospital management. In the base case analysis, the ICER was £7,434 saved per additional mmol/mol reduction of HbA1c (Table 3). Based on the bootstrapped analysis for consideration of the joint uncertainly in costs and effects, the cost-effectiveness plane shows that home management has the potential to be cost saving for the NHS without changing clinical effectiveness (Figure 1). The cost-effectiveness acceptability curve (CEAC) is somewhat counterintuitive for cost-saving interventions, in that the probability of home management being cost-effective reduces to 50% when the willingness to pay increases to £7,770 per unit reduction of HbA1c (mmol/mol) (Figure 2).

An alternative unit cost for an overnight paediatric stay in hospital was explored through a univariate sensitivity analysis. This figure was based on a previous study,[32] inflated to the current year, to give a value of £692. This had no significant impact on the ICER (£5,451 saving per additional unit reduction in HbA1c (mmol/mol)) and the difference in direct healthcare costs between home and hospital at 24 months remained statistically significant (Table 3 and Supplementary Materials Figure 1 and 2).

Adopting a broader cost perspective by incorporating both direct healthcare and non-healthcare costs, the ICER increased to £8,585 saving per additional mmol/mol reduction of HbA1c (Table 3). This does not have a significant effect on the distribution on the cost-effectiveness plane or on the probability of home management being cost-effective (Supplementary Materials Figure 3 and 4). Home management remained the dominant strategy.

Cost Consequences Analysis

A table presenting costs alongside psychological, physical and social consequences reported in the main trial is displayed in Supplementary Materials Table 14. Outcomes are taken from the child questionnaires.

Table 3 Cost-effectiveness results for each analysis scenario

Analysis Scenario	**Incremental cost** (£)*, 95% CI, p-value	**Incremental effect** (HbA1c in mmol/mol), 95% CI, p-value	**ICER****, 95% CI, p-value, Quadrant	**Cost-effectiveness probability for given WTP (%)**		
				£5,000	**£10,000**	**£15,000**
Direct Healthcare perspective	-2182, -2783 to -1581, <0.001	-0, -6 to6, 0.923	7434, -73369 to 88237, 0.857 Dominant	51.2	48.8	48.1
Direct Healthcare + Patient/carer perspective	-2520, -3465 to -1576, <0.001	-0, -6 to6, 0.923	8585, -91610 to 108781, 0.867 Dominant	51.9	49.6	48.3
Sensitivity analysis	-1600, -2198 to -1002, <0.001	-0, -6 to 6, 0.923	5451, -57926 to 68828, 0.866, Dominant	50.3	48.4	47.6

*** difference in cost between home and hospital management. **(£ saved per additional unit change in HbA1c (mmol/mol))**

Discussion

This economic evaluation was designed to assess whether delivering management at home for children with T1D who are clinically well at diagnosis would represent a cost-effective strategy for the NHS. The results indicate that the difference between home and hospital management in terms of direct NHS costs over 24 months, of £2,182 per patient, favours home management. Uncertainty analysis indicated that the probability of home management being cost saving was 1.0. The greatest driver of differences in healthcare costs was the cost of hospitalisation during the initiation period. The ICER for the base-case analysis indicated that home management was dominant, with £7,434 saved per additional unit reduction in mmol/mol of HbA1c. Sensitivity analysis indicated that the cost-effectiveness was stable to the choice of which costs were included. However, there is considerable uncertainty around the difference in effect (HbA1c), reflected in the probability of the cost-effectiveness on the CEAC being ~0.5 even at high thresholds of willingness to pay.

Strengths and weaknesses

The major strength of this evaluation is that it is based on an RCT, which reduces the risk for potential bias and uses patient-level data. The analysis was conducted in line with the main trial to ensure consistency and methods followed the NICE reference case.

A limitation of this study is that QALYs were not used as the measure of health outcome. The main trial did not collect data on health-utility in order to estimate QALYs due to the lack of a validated paediatric utility measure at the time of study commencement, especially in younger children.[33] Therefore, we are unable to determine whether the ICER would be acceptable, given the NICE threshold of £20,000-30,000 per QALY. However, HbA1c is known to be a useful surrogate outcome measure in assessing the effectiveness of interventions for T1D as it is positively associated with an increased risk of long-term complications.[34,35] The ADaPT study of a diabetes-specific psychological intervention administered by diabetes nurses is an example of a trial which reports costs alongside HbA1c improvement, in addition to QALYs. The authors state that basing cost-effectiveness on HbA1c outcomes rather than QALYs can lead to higher probabilities of cost-effectiveness and this is an important point to be aware of when interpreting our results.[36] However, their ICER of £457 per 1mmol/mol decrease in HbA1c is based on spending more for decreases in HbA1c, not saving costs as in our ICER, and therefore is not comparable for interpreting WTP.

This leads to a second limitation in that we chose not to perform long-term extrapolation to assess the cost-effectiveness over a patient's lifetime. Life-time extrapolation relies on economic models which use QALYs as the measure of effect. However, despite many models existing for use in T1D, a lack of validation in the paediatric setting undermines their application in the context of the DECIDE trial.[37]

Moreover, as there was no statistically significant difference in clinical effectiveness, this would also require assumptions on long-term benefits which could introduce bias.

The accuracy of the final unit costings may have been impacted by varying interpretation of case report forms and ability to recall, as parents were asked to recall answers by nurses who then completed the forms. However, questions about resource use were limited to a 3-month recall period, which is the general recall period for trial-based economic evaluations.[38] Completion rates of forms were also high, with a small proportion of missing data. In addition, there are a number of methodological challenges in assigning costs to days of missed schooling, with no clear consensus on the most appropriate approach.[39] We costed the time taken off school based on calculating an average cost spent per pupil per day, based on the Annual Report on Education Spending in England.[24] This may underestimate the economic consequences of forgone leisure time and educational achievement.

A final limitation is that there have been changes in practice and consequently resource use and costs since the trial commenced. For example, test and investigation use was costed from one site only and this figure is likely to differ across centres. However, all costs were updated to, or based on, most recent figures to ensure relevance to the current NHS costs and any differences between sites to the overall outcomes was considered likely to be small and therefore unlikely to effect the overall findings. It should also be noted that at the time this study was conducted, few patients were using continuous glucose monitoring to allow us to collect data on 'time in range'.

Context in the current literature

This is the first cost-effectiveness evaluation to compare home versus hospital management of T1D at diagnosis in children and young people in a UK setting. Costs were based on the UK healthcare system (NHS) and taken from national UK databases. The trial was conducted over eight different centres throughout the UK and hospital management was pragmatic, following local standard practice, which increases our confidence in the generalisability of the results to other areas of the UK.

The findings of this evaluation are comparable to other studies.[5,13] However, interpretation of previous studies is limited by the use of small sample sizes, non-UK settings and all of them involved 'hybrid' models of care; meaning 'home management' involved care within the hospital and home/outpatient setting. Therefore, previous studies have not evaluated home care exclusively from the day of diagnosis and their reproducibility within the UK healthcare setting may be limited.

Implications for practice and research

Home management led to significant cost reductions for the NHS at both three days and 24 months. This economic evaluation, alongside the main trial provides evidence for home care being the first line approach for management of T1D at diagnosis in children who are clinically well. However, since the start of this trial, education has become more intensive and insulin delivery and blood glucose monitoring more complex. As a result, many centres choose to admit all patients by default, despite NICE guidance supporting home management.[10] The identified

cost-saving of around £2,000 per patient (over 2 years) could be invested in community services to manage this increased demand on healthcare professionals, increasing the feasibility of delivering a package of care which would normally be delivered in hospital.

It is envisaged that the results of this analysis will contribute to the evidence supporting future updates of NICE Guidelines on management of T1D in children and adolescents at diagnosis. Further research could involve testing a hybrid model of care within the UK-setting, incorporating updates in the management approach, and measuring costs and utility.

Conclusion

Home management from diagnosis of T1D for children who are medically stable represents a saving of £2,182 per patient with no significant impact on clinical effectiveness. These findings add to the main DECIDE trial which demonstrated that home management at the onset of T1D did not lead to any significant differences in glycaemic control. With incidence of T1D increasing and the demand for hospital beds rising, implementation of this approach as standard practice could prove to be a cost-saving step in the patient pathway.

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Role of the funding source
The funders of the study had no role in study design, data collection, data analysis, data interpretation, or writing of the report.

Competing interests statement
All authors have completed the ICMJE uniform disclosure form at www.icmje.org/coi_disclosure.pdf and declare: no support from any organisation for the submitted work; no financial relationships with any organisations that might have an interest in the submitted work in the previous three years; no other relationships or activities that could appear to have influenced the submitted work.

Author contributions
ZMcC had full access to all the data in the study, conducted the analyses and drafted the manuscript. JT, JWG, TP and DH supervised ZMcC and take responsibility of the study in its entirety and for the decision to submit for publication.
JWG, RP and MR were responsible for developing the initial DECIDE research question and trial design, and implementation of the trial protocol. DH, TP and RP were responsible for all statistical considerations and analysis. DH was responsible for designing the health economics study. All those listed as authors contributed to the trial delivery and health economics study and were responsible for reading, commenting upon, and approving the final manuscript. The manuscript's guarantors (JT,JWG and DH) affirm that the manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as planned (and, if relevant, registered) have been explained.

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Data sharing

De-identified participant data will be made available to the scientific community with as few restrictions as feasible, whilst retaining exclusive use until the publication of major outputs. Data will be available via the corresponding author.

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Figure Legends

Figure 1

Cost-effectiveness plane of base case analysis

Reduction in HbA1c represents improvement.

- = point estimate ICER £7,434 per mmol/mol reduction of HbA1c (-0.294, -£2,182)

Figure 2

Cost-effectiveness acceptability curve for base case analysis. Represents the probability of home management being cost-effective at different willingness to pay thresholds.

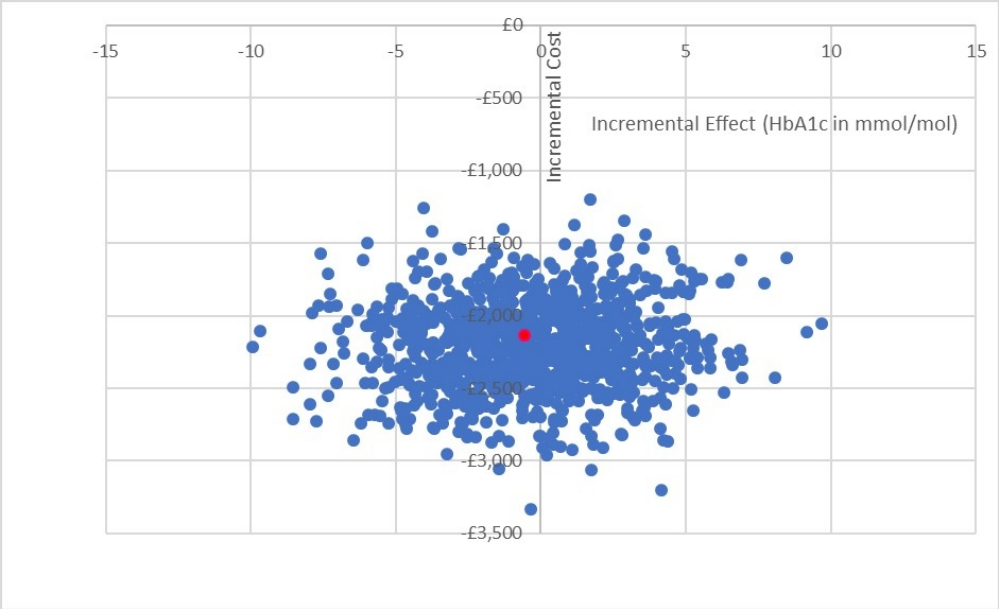


Figure 1
Cost-effectiveness plane of base case analysis
Reduction in HbA1c represents improvement.

- = point estimate ICER £7,434 per mmol/mol reduction of HbA1c (-0.294, -£2,182)

159x97mm (150 x 150 DPI)

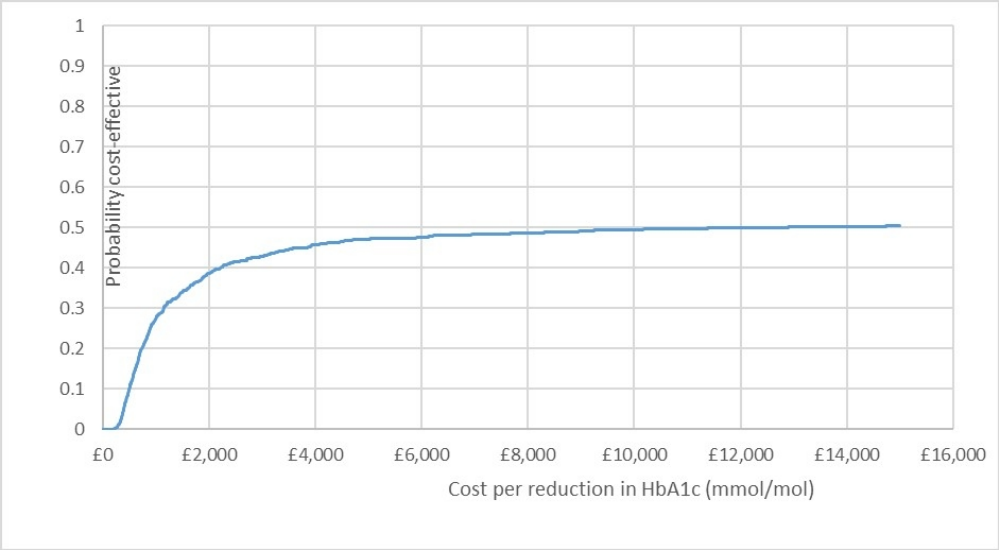


Figure 2
Cost-effectiveness acceptability curve for base case analysis. Represents the probability of home management being cost-effective at different willingness to pay thresholds.

159x87mm (150 x 150 DPI)

SUPPLEMENTARY MATERIALS

Table 1 Case Report Forms and Data Collected

Case Report Form	Data Collected
2 & 3	• Admission/discharge • Additional tests • Insulin Regimen • Contacts with diabetes team
4, 5 & 6	• Insulin regime • Medical equipment • Contact with diabetes team • Hospital contacts • Contacts with other HCPs
7	• Additional tests • Insulin regime • Contact with diabetes team • Hospital contacts • Contacts with other HCPs
3.1, 4.1, 5.1, 6.1, 7.1	• Time off work/school • Travel expenses

Table 2 Unit costs for contact with healthcare professionals

Contact with Healthcare Professional	Unit Cost (£)	Source
Hospital based care		
Overnight stay in hospital (up to 5days)	894.00	NHS Reference Costs 2019/20
Overnight stay in hospital (exceeding 5days)	417.00	
Consultant ward visit	109.00	PSSRU 2019
Junior Doctor ward visit	29.00	
Nurse ward visit	47.00	
Dietitian ward visit	46.00	
Hospital Pharmacist	6.92	
Home based care		
Initial home visit	220.00	PSSRU 2019
Community Nurse home visit	55.00	
Community Nurse telephone calls & emails	12.25	
Practice Nurse clinic visit	6.45	
Practice Nurse telephone calls & emails	4.59	
Dietitian home visit	16.00	PSSRU 2010,2019
Dietitian telephone calls & emails	5.25	PSSRU 2019
GP home visit	85.00	
GP Surgery visit	39.23	
Telephone calls	17.00	
Consultant-led Outpatient attendance	205.00	
Non-Consultant-led outpatient attendance	155.00	

Table 3 Unit Costs of Contact with Health Care Professionals

Resource item	Details	Cost source	Unit Cost (£)
Hospital Based Care			
Overnight stay in Hospital	NHS Reference cost 2019/20 PK68C CC Score 0, cost of combined day case/ordinary elective spell.	a	894.00
	Per day long stay payment (for days exceeding trim point of 5 days).	a	417.00
Consultant ward visit	Medical Consultant, hourly rate.	b	109.00
Junior Doctor ward visit	Foundation House Officer Year 1, hourly rate.	b	29.00
Nurse ward visit	Nurse team leader, hourly rate.	b	47.00
Dietitian ward visit	Hospital Dietitian, Average visit 1hour, hourly rate (Band 6).	b	46.00
Hospital Pharmacist	£45 per hour. Assumed length of consultation same as GP = 9.22minutes. = £6.92.	b	6.92
Home Based Care			
Initial home visit	Community Nurse, hourly rate £55.2 hourly visits. 2 x daily to supervise injections.	b	220.00
Community Nurse home visit	PSSRU 2019: Band 7 =£55.00 per hour.	b	55.00
Community Nurse telephone calls & emails	Patient-related work, hourly rate £112 (Band 7). Average length of Nurse-led telephone triage = 6.56minutes.	b	12.25
Practice Nurse clinic visit	Hourly rate £42 per hour. Assumed surgery length same as GPs = 9.22minutes.	b	6.45
Practice Nurse telephone calls & emails	Hourly rate £42 per hour. Average length of Nurse-led telephone triage = 6.56minutes.	b	4.59
Dietitian home visit	No rates for Community Dietician. Community Occupational Therapist hourly rate = £48 per hour. No information for average length of visit. If assume 20minutes from PSSRU 2010 = £16.00.	b, c	16.00
Dietitian telephone calls & emails	Hourly rate £48.00. Assumed duration of 6.56minutes (same as Nurse telephone triage).	b	5.25

GP home visit	£255/hour of patient contact. Assuming duration of 20minutes.	b	85.00
GP Surgery visit	Cost per surgery consultation lasting 9.22minutes	b	39.23
Telephone calls	Average length of GP-led triage is 4minutes so x hourly rate of £255	b	17.00
Consultant-led Outpatient attendance	Paediatric Consultant-led Outpatient attendance.	b	205.00
Non-Consultant-led outpatient attendance	Paediatric non-consultant-led outpatient attendance.	b	155.00
Other Contact with Health Care Professionals			
Consultant Telephone Call	Hourly rate £109. Assumed duration of 6.56minutes (same as Nurse-led telephone triage).	b	11.92
Registrar ward visit	Hourly rate £47. Assumed 20minute consultation.	b	15.67
Clinical Psychologist	Hourly rate.	b	54.00
CAMHS Nurse	Hourly rate (Band 7 Nurse).	b	57.00
Speech and Language Therapist	Hourly rate (Band 6).	b	46.00
Physiotherapist	Scientific and professional staff. Hourly rate (Band 6).	b	45.00
Podiatrist	Hospital-based scientific and professional staff. Hourly rate (Band 6).	b	46.00
Family Advocate	Not rates for general family advocate. Advocacy for parents requiring learning disability support. Hourly rate.	b	31.00
Dentist	Hourly rate £104. Assumed duration same as GP = 9.22minutes.	b	15.98
Osteopath	No rates for osteopath. Scientific and Professional Staff. Hourly rate (Band 5).	b	34.00
Phlebotomist	No rates for phlebotomist. Nurse (Band 4). Hourly rate £28. Assumed duration same as GP = £9.22.	b	4.30

Table 4 Unit costs for Insulin

Insulin	Details	Cost Source	Unit Cost (£)
Mixtard 30	Discontinued on 31 Dec 2010. Previously available as 5 x prefilled 3ml *InnoLet*® £19.87 (range 2-78 units).	d, e	19.87
Novomix 30	5 x FlexPen 100units/ml suspension for injection 3ml pre-filled pen = £29.89.	e	29.89
Humulin M3	5 x Humulin M3 KwikPen 100units/ml suspension for injection 3ml pre-filled pen (Eli Lilly and Company Ltd).	e	21.70
Insulin Aspart (Novorapid)	5 x NovoRapid FlexTouch 100units/ml solution for injection 3ml pre-filled pen (Novo Nordisk Ltd) = £32.13.	e	32.13
Insulin Lispro (Humalog)	5 x Humalog KwikPen 100units/ml solution for injection 3ml pre-filled pen (Eli Lilly and Company Ltd) = £29.46.	e	29.46
Actrapid	Actrapid 100units/ml for injection 10ml vials (Novo Nordisk Ltd), 100 units per 1ml, net price 10mL vial = £7.48. Novopen devices no longer available so previous price of £26.86 used.	e	34.34
Insulin Detemir (Levemir)	5 x Levemir InnotLet 100units/ml solution for injection 3ml pre-filled pen (Novo Nordisk Ltd) = £42	e	44.85
Insulin Glargine (Lantus)	5 x Lantus 100units/ml solution for injection 3ml pre-filled SoloStar pen (Sanofi) = £37.77	e	37.77
Isophane Insulin (Insulatard)	5 x Insulatard InnoLet 100units/ml suspension for injection 3ml pre-filled pen (Novo Nordisk Ltd) = £20.40 NHS	e	20.40
Humalog Mix 25	Humalog Mix25 KwikPen 100units/ml suspension for injection 3ml pre-filled pen (Eli Lilly and Company Ltd) 5 x Insulin lispro 75 unit per 1 ml and Insulin lispro 25 unit per 1 ml = £30.98	e	30.98
Humalog Mix 50	Humalog Mix50 KwikPen 100units/ml suspension for injection 3ml pre-filled pen (Eli Lilly and Company Ltd) 5 x Insulin lispro 50 unit per 1 ml = £30.98	e	30.98
Humulin I	Humulin I KwikPen 100units/ml suspension for injection 3ml pre-filled pen (Eli Lilly and Company Ltd) 5 x Insulin human (as Insulin isophane humane) 100 unit per ml = £21.70	e	21.70

Table 5 Unit costs for tests and investigations

Test and Investigations	Details	Cost Source	Unit Cost (£)
Blood Gas		f	4.86
Thyroid Function		f	3.02
Anti TTG	Anti-tissue Transglutaminase Antibodies test	f	12.35
IgA P	Immunoglobulin A test	f	4.62
Islet cell Antibodies	Islet Antigen 2 Antibody	f	23.16
GAD Antibodies	Glutamic Acid Decarboxylase Autoantibodies test (Send away)	f, g	22.06
U&E	Urea and Electrolytes	f	3.92
Chest X ray		i	11.00
LFT	Liver Function Test	f	4.76
FBC	Full Blood Count	f	4.23
Urine culture		f	13.60
lanti tpo	Thyroid peroxidase IgG Ab	f	3.21
APTT	Activated Partial Thromboplastin Time test	f	3.52
C Peptide		f	22.50
Coeliac Screen	IgA Tissue Transglutaminase antibody	f	12.35
CRP	C-Reactive Protein	f	3.21
ECG	Electrocardiogram	g	9.56
Ferritin		f	4.71
HBA1C		f	2.42
ICCP	Anti-MCV Antibodies	f	6.96
Lipid Profile		f	3.92
MRSA	Methicillin-resistant Staphylococcus aureus test	f	18.52
Pancreatic Cabs	Anti-GAD	f	N/A
Plasma Osmolality		f	6.16
Thyroid Antibodies		f	3.21
Amylase		f	1.35

Anti TPO	Anti-thyroid peroxidase test	f	3.21
Bilirubin	Total	f	1.35
Glucose		f	1.35
Magnesium		f	1.35
Others	Blood culture	h	7.33
	Insulin	h	2.25
	Sickle cell	h	8.28
	Urine ketones	h	3.21
	Viral titres	h	11.59
	3 Hydroxybutyrate	h	3.76
	X TRT	h	4.50
	Serum Chloride	h	1.44
	Lactate	h	1.44
	Bone profile	h	5.11
	Blood film	h	6.48
	Urine dip	h	3.50
	Rheumatoid Factor	h	8.43
Blood glucose testing strips	Based on average cost of strips (£696.96 / 64 = £10.89)	e	10.89
Blood glucose testing cassette	Betacheck C50 casette: 100 device = £29.98 Mobile cassette: 50 device = £9.99 (Assumed 50 strips unless stated)	e	9.99
Urine ketone testing strips	Based on average cost (2.25+3.06/2 = £2.66).	e	2.66
Blood ketone testing strips	Based on average cost of ketone testing strips.	e	16.95
Lancets (pack of 100)	Based on average cost of pack of 100.	j	3.93
Lancets (pack of 204)	FastClix (Roche Diabetes Care Ltd.)	j	5.90
Hypostop/glucogel	GlucoGel 40% gel original (BBI Healthcare Ltd): Glucose 400mg per 1g - 75gram = £7.16	e	7.16
Glucagon	Glucagon hydrochloride 1mg: 1 vial = £11.52	e	11.52
Insulin needles	Pack of 100 Safety needles 0.3ml or 0.5ml syringe and needle = £13.34	j	13.34
Insulin pens	Based on average cost of insulin pens.	e	19.35

Sharps bin	Sharpsafe 1L = £0.85.	j	0.85

References:

a) NHS Improvement and NHS England. Annex A: The national tariff workbook. 2020 [Accessed 10/03/2020]. Available from: https://improvement.nhs.uk/resources/national-tariff/
b) Curtis, Lesley A. and Burns, Amanda (2019) Unit Costs of Health and Social Care 2019. Unit Costs of Health and Social Care. PSSRU, Kent, UK, 176 pp. ISBN 978-1-911353-10-2. https://kar.kent.ac.uk/79286/1/UCFinalFeb20.pdf
c) Curtis L. Unit Costs of Health and Social Care 2010. University of Kent, Canterbury: Personal Social Services Research Unit; 2010. https://www.pssru.ac.uk/pub/uc/uc2010/uc2010_s10.pdf
d) Barton, J & Saunders J (2010) Discontinuation of Mixtard® 30 Insulin Products, Aneurin Bevan Health Board (August 2010) [Accessed: 10/03/2020]. Available from: http://www.wales.nhs.uk/sites3/docopen.cfm?orgid=814&id=161224)
e) NICE. BNF for Children: British National Formulary. NICE; 2020 [accessed 10/03/2020]. Available from: https://bnfc.nice.org.uk/
f) Cardiff and Vale University Health Board, Biochemistry and Immunology Dept, University Hospital of Wales. (Personal communication).
g) (Inflated)* NICE. Appendix M: Routine preoperative tests for elective surgery. Centre NCG; 2015 [accessed 10/03/2020]. Available from: https://www.nice.org.uk/guidance/ng45/history/
h) (Inflated)* from previous cost supplied by 2012 Cwm Taf Health Board
i) Personal communication with Swansea Bay Health Board
j) NHS. NHS Electronic Drug Tariff. NHS Business Services Authority; 2020. http://www.drugtariff.nhsbsa.nhs.uk/#/00774110-DC/DC00773743#d2e9682/Part%20IXA-Appliances

*Costs inflated using the CCEMG-EPPI-Centre Cost Converter. Available at: http://eppi.ioe.ac.uk/costconversion/default.aspx

Table 6 Unit costs for patient/carer borne costs

Resource item	Details	Cost source	Unit cost (£)
Time off work	Median weekly earnings £585 April 2019 Daily wage (£585 divided by 5 = £117)	a	117.00
Time off school	Total annual spending per pupil of £5,872; Divided by the number of school days in a year (195) = a cost of £30.11 per day missed	b	30.11
Travelling by car	AA Mileage calculator used to calculate miles travelled in 1 hour = 48.9miles. Average price per mileage = £1.238. Average miles per gallon = 50.5mpg. = £5.44 per hour	c, d, e	5.44
Travelling by bus	Captured by OOP£		
Travelling by train	Captured by OOP£		
Travelling by taxi	Captured by OOP£		

References:

a) Office for National Statistics. Employee earnings in the UK. Office for National Statistics –; 2019 [accessed 10/03/2020]. Available from: https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/earningsandworkinghours/bulletins/annualsurveyofhoursandearnings/2019
b) Belfield, C. F., C. Sibieta, L. 2018. Annual Report on Education Spending in England. In: Payne, J. ed. London: The Institute for Fiscal Studies. (2018-2019 prices).
c) Automobile Association Developments Ltd. 2018. Mileage calculator. AA. [Accessed: 29/03/2020]. Available at: https://www.theaa.com/driving/mileage-calculator.jsp
d) data.gov.uk. 2020. *Petrol and diesel prices*. Department for Business, Energy and Industrial Strategy. [Accessed: 29/03/2020]. Available at: https://data.gov.uk/dataset/c174a981-b0f2-4b39-adc0-1d0a27a7d8c9/petrol-and-diesel-prices
e) RAC Foundation. 2020. *FAQs about road transport and the environment*. London. [Accessed: 29/03/2020]. Available at: https://www.racfoundation.org/motoring-faqs/environment

Table 7 Other Hospital Contacts

Resource item	Notes	Cost data source	Unit cost used (£)
A&E	Cost per A&E attendance. Inflated from £160.	a	166.20
ITU	Paediatric ICU, basic critical care average cost	b	1,389.00
HTU	Paediatric HDU, basic critical care average cost	b	780.00
Other ward	PK68C CC Score 0, cost of combined day case/ordinary elective spell.	c	894.00
Ambulance call out	See and treat and convey	b	258.00

References:

a) NHS Improvement. 2017/18 reference costs and guidance. 2018 [accessed 03/05/2020]. Available from: https://improvement.nhs.uk/resources/reference-costs/

b) Curtis LAB, Amanda. Unit Costs of Health and Social Care 2019. Unit Costs of Health and Social Care. Kent, UK: PSSRU; 2019. p. 176.

c) NHS Improvement and NHS England. Annex A: The national tariff workbook. 2020 [accessed 10/03/2020]. Available from: https://improvement.nhs.uk/resources/national-tariff/

Table 8 Total Costs

	Arm		
	Home management (n=98), mean (95% CI) (£)	**Hospital management (n=95), mean (95% CI) (£)**	**Difference between Home and Hospital, mean (95% CI) (£)**
Direct Healthcare Costs Days 0-3	1163 (1079 to 1248)	3386 (3261 to 3511)	-2223 (-2373 to -2072)
Direct Healthcare Costs 24months	5287 (4864 to 5709)	5282 (4883 to 5680)	5 (-584 to 594)
TOTAL Direct Healthcare Costs	6450 (6004 to 6897)	8668 (8255 to 9080)	-2217 (-2825 to -1609)
Patient/carer Costs Days 0-3	331 (280 to 383)	352 (292 to 412)	-21 (-101 to 59)
Patient/carer Costs 24months	1420 (1134 to 1705)	1737 (1207 to 2267)	-317 (-916 to 281)
TOTAL Patient/carer Costs	1751 (1448 to 2054)	2089 (1547 to 2631)	-338 (-963 to 286)
TOTAL Healthcare + Patient/carer Costs	8201 (7585 to 8817)	10757 (10050 to 11463)	-2556 (-3494 to -1618)

Table 9 DIRECT COSTS (NHS): Initiation Period (Days 0-3)

Variable	Arm	Observed Coef.(£)	Bootstrap Std. Error.(£)	z (£)	P>|z |	Normal-based [95% CI] (£)	
Contact with Diabetes Team	Home	974	43	23	0.000	889	1059
	Hospital	720	32	23	0.000	658	782
	Difference	254	55	5	0.000	147	361
Other Health Professionals	Home	0	0	1	0.322	-0	0
	Hospital	1	1	1	0.202	-1	4
	Difference	-1	1	-1	0.219	-4	1
Tests and Investigations	Home	55	3	18	0.000	49	61
	Hospital	62	3	21	0.000	56	67
	Difference	-7	4	-2	0.103	-15	1
Hospital Stay	Home	0	-	-	-	-	-
	Hospital	2583	61	43	0.000	2464	2702
	Difference	-2583	61	-42	0.000	-2702	-2463
Nurse Travel	Home	133	13	10	0.000	107	159
	Hospital	18	5	3	0.001	8	28
	Difference	115	14	8	0.000	86	143
Dietician Travel	Home	3	1	3	0.001	1	5
	Hospital	1	1	1	0.314	-1	2
	Difference	2	1	2	0.038	0	4.655081
Total Cost Days 0-3	Home	1163	43	27	0.000	1079	1248
	Hospital	3386	64	53	0.000	3261	3511
	Difference	-2223	77	-29	0.000	-2373	-2072

Table 10: DIRECT COSTS (NHS): Follow-up period (24months)

Variable	Arm	Observed Coef.(£)	Bootstrap Std. Error.(£)	z (£)	P>|z |	Normal-based [95% CI] (£)	
Equipment	Home	1745	91	19	0.000	1567	1924
	Hospital	1714	87	20	0.000	1544	1883
	Difference	31	127	0	0.805	-218	281
Insulin	Home	457	28	16	0.000	402	512
	Hospital	446	25	18	0.000	397	495
	Difference	11	38	0	0.770	-63	85
Tests and Investigations	Home	8	1	6	0.000	5	11
	Hospital	8	1	6	0.000	6	11
	Difference	-1	2	-0	0.968	-4	4
Contact with Diabetes Team (Other)	Home	584	42	14	0.000	502	667
	Hospital	625	43	15	0.000	541	709
	Difference	-41	61	-1	0.503	-160	79
Outpatient contacts	Home	1400	28	49	0.000	1344	1455
	Hospital	1392	26	54	0.000	1341	1443
	Difference	8	38	0	0.837	-67	83
Other health professional visits	Home	195	23	8	0.000	149	241
	Hospital	236	30	8	0.000	177	295
	Difference	-41	38	-1	-0.276	-115	33
Hospital contacts	Home	897	167	5	0.000	569	1225
	Hospital	860	157	5	0.000	553	1167
	Difference	37	230	0	0.872	-413	487
Contact with diabetes team	Home	1984	55	36	0.000	1876	2092
	Hospital	2017	52	39	0.000	1915	2119
	Difference	-33	76	-0	0.666	-182	116
Total Cost of Follow-up	Home	5288	216	25	0.000	4864	5709
	Hospital	5282	203	26	0.000	4883	5680
	Difference	5	300	0	0.986	-584	594

Table 11: INDIRECT COSTS (patient/carer): Initiation period (days 0-3)

Variable	Arm	Observed Coef.(£)	Bootstrap Std. Error.(£)	z (£)	P>|z |	Normal-based [95% CI] (£)	
Days off work	Home	250	24	10	0.000	203	297
	Hospital	256	28	9	0.000	201	310
	Difference	-5	37	-0	0.885	-77	66
Travel	Home	11	1	14	0.000	9	12
	Hospital	18	1	13	0.000	15	21
	Difference	-8	2	-5	0.000	-11	-4
Out of pocket expenses	Home	8	1	10	0.000	7	10
	Hospital	22	3	8	0.000	17	27
	Difference	-14	3	-5	0.000	-19	-8
Days off school	Home	65	5	14	0.000	56	75
	Hospital	57	5	11	0.000	47	67
	Difference	8	7	1	0.230	-5	22
Total Cost Days 0-3	Home	331	26	13	0.000	280	383
	Hospital	352	31	11	0.000	292	412
	Difference	-21	41	-1	0.607	-101	59

Table 12: INDIRECT COSTS (patient/carer): Follow-up period (24months)

Variable	Arm	Observed Coef.(£)	Bootstrap Std. Error.(£)	z (£)	P>|z |	Normal-based [95% CI] (£)	
Days off work	Home	869	132	7	0.000	609	1128
	Hospital	1180	256	5	0.000	679	1681
	Difference	-312	285	-1	0.274	-871	247
Travel	Home	63	4	17	0.000	56	71
	Hospital	61	6	10	0.000	49	72
	Difference	3	7	0	0.692	-11	17
Out of pocket expenses	Home	44	6	7	0.000	32	56
	Hospital	42	6	7	0.000	30	54
	Difference	2	9	0	0.782	-15	20
Days off school	Home	443	41	11	0.000	363	523
	Hospital	454	54	8	0.000	349	559
	Difference	-11	68	-0	0.873	-143	122
Total Costs of Follow-up	Home	1420	146	10	0.000	1134	1705
	Hospital	1737	270	6	0.000	1207	2267
	Difference	-317	305	-1	0.299	-916	281

Table 13: Total Costs

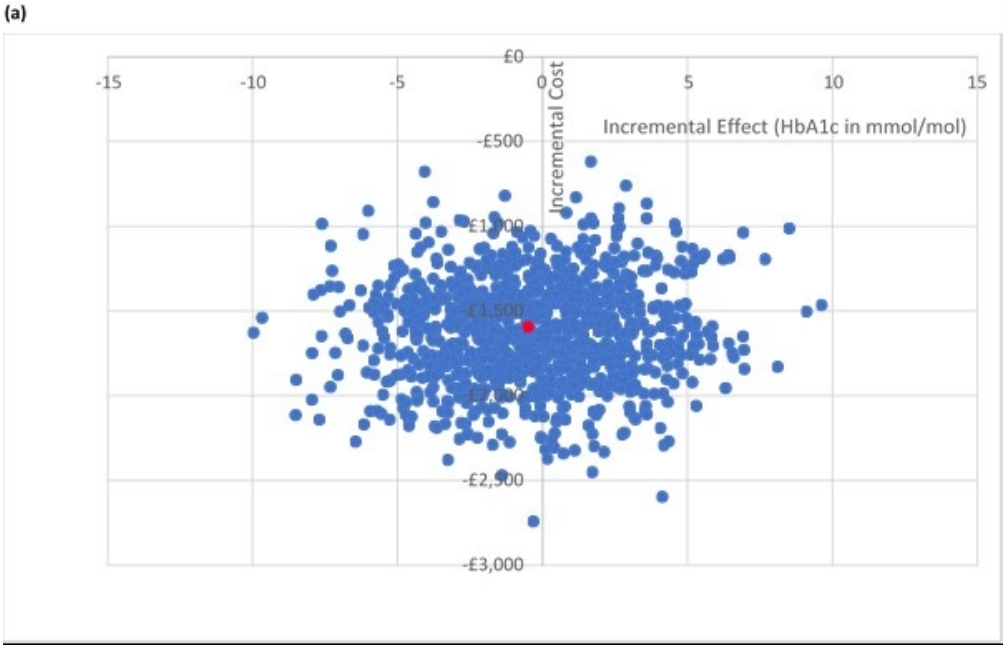
Variable	Arm	Observed Coef.(£)	Bootstrap Std. Error.(£)	z (£)	P>|z |	Normal-based [95% CI] (£)	
Patient/carer Total Cost	Home	1751	155	11	0.000	1448	2054
	Hospital	2089	277	8	0.000	1547	2631
	Difference	-338	319	-1	0.288	-963	286
Direct Healthcare Total Cost	Home	6450	228	28	0.000	6004	6897
	Hospital	8868	210	41	0.000	8255	9080
	Difference	-2217	310	-7	0.000	-2825	-1609
Total Healthcare + Patient/carer	Home	8201	314	26	0.000	7585	8817
	Hospital	10757	360	30	0.000	10050	11463
	Difference	-2556	479	-5	0.000	-3494	-1618

Table 14 Cost Consequences Analysis (CCA)

	Arm					
Costs and Consequences	**N**	**Home management,** mean (95% CI/SD) (£)	**N**	**Hospital management,** mean (95% CI/SD) (£)	**Difference between Home and Hospital,** mean (95% CI) (£)	**P value**
Costs Impact						
TOTAL Direct Healthcare Costs	98	£6450 (£6004 to £6897)	95	£8668 (£8255 to £9080)	-£2217 (-£2825 to -£1609)	<0.05
TOTAL Patient/Carer Costs	98	£1751 (£1448 to £2054)	95	£2089 (£1547 to £2631)	-£338 (-£963 to £286)	0.288
TOTAL NHS + Patient/Carer Costs	98	£8201 (£7585 to £8817)	95	£10757 (£10050 to 11463)	-£2556 (-£3494 to -£1618)	<0.05
Health Impact						
HbA1c 24months (mmol/mol)*	98	72.1 (SD = 21.7)	95	72.6 (SD = 21.9)	1.01 (0.93 to 1.09)	0.863
Physical Impact						
Physical well-being at 1month**	68	63.0 (SD = 20.38)	62	70.4 (SD = 19.07)	-7.5 (-14.3 to -0.6)	0.033
Physical well-being at 24months**	62	70.0 (SD = 17.64)	58	71.0 (SD = 15.90)	-1.0 (-7.1 to 5.1)	0.741
Symptoms at 1 month***	69	60.2 (SD = 14.23)	62	62.3 (SD = 13.09)	-2.1 (-6.8 to 2.6)	0.384
Symptoms at 24months***	62	62.0 (SD = 12.56)	58	63.3 (SD = 14.11)	-1.2 (-5.9 to 3.6)	0.633
Psychological Impact						
Worry at 1month***	68	72.7 (SD = 24.26)	63	74.7 (SD = 22.94)	-2.1 (-10.2 to 6.1)	0.616

Worry at 24months* **	62	73.3 (SD = 20.75)	58	71.1 (SD = 23.74)	2.1 (-5.9 to 10.2)	0.601
Emotional wellbeing at 1month**	68	75.5 (SD = 17.98)	61	77.6 (SD = 15.31)	-2.2 (-8.0 to 3.7)	0.464
Emotional wellbeing at 24months**	62	76.6 (SD = 18.18)	58	78.6 (SD = 12.35)	-2.0 (-7.7 to 3.6)	0.482
Self-esteem at 1month**	68	53.9 (SD = 24.19)	61	64.1 (SD = 21.22)	-10.4 (-18.3 to -2.4)	0.011
Self-esteem at 24months**	62	63.4 (SD = 19.92)	58	56.1 (SD = 18.71)	7.2 (0.2 to 14.2)	0.043
Social Impact						
Communication at 1month***	68	72.9 (SD = 28.01)	63	81.3 (SD = 18.25)	-8.4 (-16.7 to -0.2)	0.045
Communication at 24months***	62	72.8 (SD = 25.83)	58	78.2 (SD = 21.22)	-5.5 (-14.0 to 3.0)	0.200
Family at 1month**	69	76.0 (SD = 17.61)	61	79.7 (SD = 18.10)	-3.7 (-9.9 to 2.5)	0.242
Family at 24months**	61	79.3 (SD = 17.81)	58	77.9 (SD = 19.15)	1.5 (-5.1 to 8.2)	0.507
Friends at 1month**	69	79.3 (SD = 14.62)	60	78.6 (SD = 16.33)	0.5 (-4.8 to 5.9)	0.849
Friends at 24months**	60	79.5 (SD = 17.03)	58	77.4 (SD = 16.81)	2.1 (-4.1 to 8.2)	0.507
School at 1month**	65	67.0 (SD = 21.92)	60	68.1 (SD = 18.65)	-1.1 (-8.3 to 6.1)	0.763
School at 24months**	60	65.9 (SD = 17.32)	57	61.5 (SD = 18.14)	4.6 (-1.9 to 11.0)	0.163

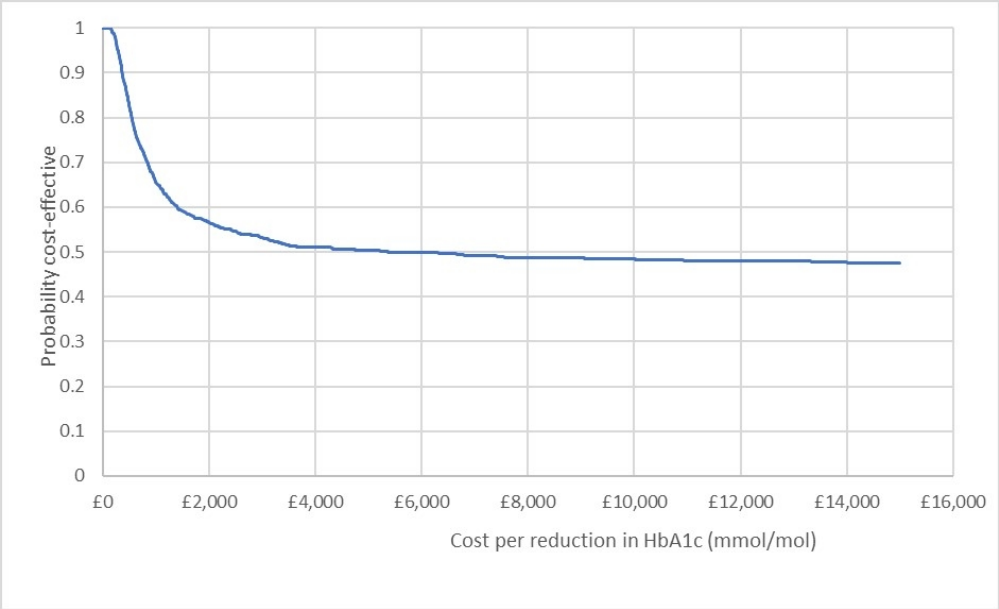
***Controlled for HbA1c at baseline. **KINDL-R – parent answers about child; higher score is better. ***PedsQL 3.0 Diabetes Module – parent answers about child.**



Supplementary material Figure 1
Cost-effectiveness plane of healthcare + non-healthcare costs. Reduction in HbA1c represents improvement.

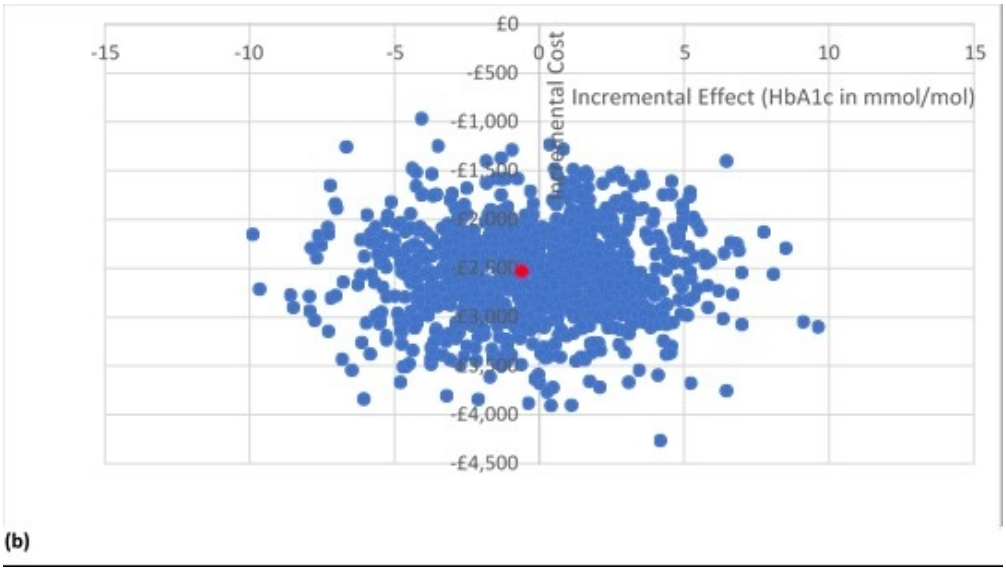
- = point estimate ICER £8,585 saved per additional mmol/mol reduction of HbA1c (-0.294, -£2,520)

159x102mm (96 x 96 DPI)



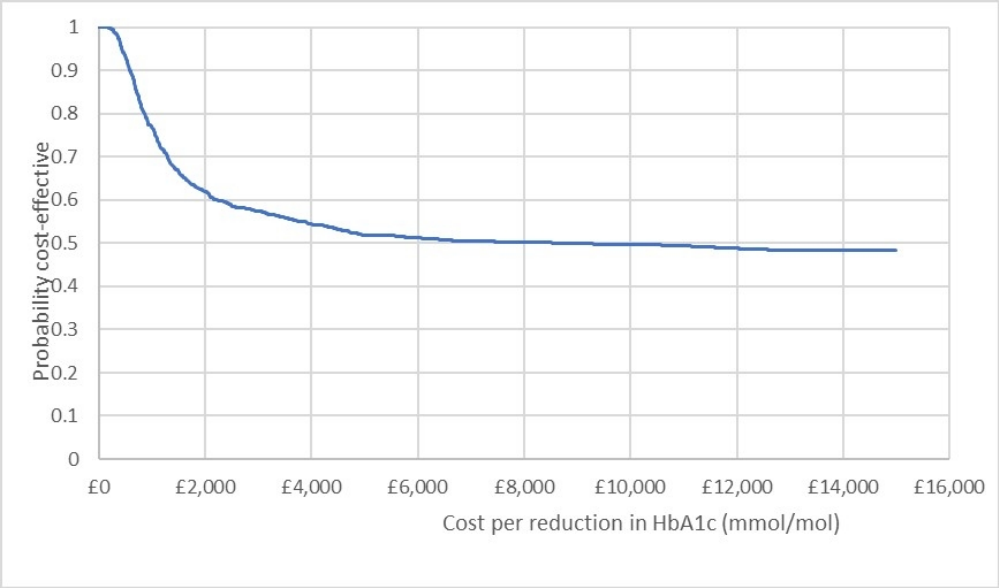
Supplementary material Figure 2
Cost-effectiveness acceptability curve for Direct Healthcare + non-healthcare Costs analysis. Represents the probability of home management being cost-effective at different willingness to pay thresholds.

159x97mm (150 x 150 DPI)



Supplementary material Figure 3
Cost-effectiveness plane of healthcare costs with sensitivity analysis. Reduction in HbA1c represents improvement. • = point estimate ICER £5,451 saved per additional mmol/mol reduction of HbA1c (-0.294, -£1,600)

143x80mm (96 x 96 DPI)



Supplementary material Figure 4
Cost-effectiveness acceptability curve for Direct Healthcare Costs with sensitivity analysis. Represents the probability of home management being cost-effective at different willingness to pay thresholds.

146x86mm (150 x 150 DPI)

Reporting checklist for economic evaluation of health interventions.

Based on the CHEERS guidelines.

Instructions to authors

Complete this checklist by entering the page numbers from your manuscript where readers will find each of the items listed below.

Your article may not currently address all the items on the checklist. Please modify your text to include the missing information. If you are certain that an item does not apply, please write "n/a" and provide a short explanation.

Upload your completed checklist as an extra file when you submit to a journal.

In your methods section, say that you used the CHEERSreporting guidelines, and cite them as:

Husereau D, Drummond M, Petrou S, Carswell C, Moher D, Greenberg D, Augustovski F, Briggs AH, Mauskopf J, Loder E. Consolidated Health Economic Evaluation Reporting Standards (CHEERS) statement.

	Reporting Item	Page Number
Title		
#1	Identify the study as an economic evaluation or use more specific terms such as “cost-effectiveness analysis”, and describe the interventions compared.	1

Abstract			
	#2	Provide a structured summary of objectives, perspective, setting, methods (including study design and inputs), results (including base case and uncertainty analyses), and conclusions	2
Introduction			
Background and objectives	#3	Provide an explicit statement of the broader context for the study. Present the study question and its relevance for health policy or practice decisions	3-4
Methods			
Target population and subgroups	#4	Describe characteristics of the base case population and subgroups analysed, including why they were chosen.	4
Setting and location	#5	State relevant aspects of the system(s) in which the decision(s) need(s) to be made.	4
Study perspective	#6	Describe the perspective of the study and relate this to the costs being evaluated.	4
Comparators	#7	Describe the interventions or strategies being compared and state why they were chosen.	4
Time horizon	#8	State the time horizon(s) over which costs and consequences are being evaluated and say why appropriate.	5

Discount rate	#9	Report the choice of discount rate(s) used for costs and outcomes and say why appropriate	4
Choice of health outcomes	#10	Describe what outcomes were used as the measure(s) of benefit in the evaluation and their relevance for the type of analysis performed	5
Meaurement of effectiveness	#11a	Single study-based estimates: Describe fully the design features of the single effectiveness study and why the single study was a sufficient source of clinical effectiveness data	6
Measurement of effectiveness	#11b	Synthesis-based estimates: Describe fully the methods used for identification of included studies and synthesis of clinical effectiveness data	N/A
Measurement and valuation of preference based outcomes	#12	If applicable, describe the population and methods used to elicit preferences for outcomes.	N/A
**Estimating resources and costs **	#13a	Single study-based economic evaluation: Describe approaches used to estimate resource use associated with the alternative interventions. Describe primary or secondary research methods for valuing each resource	5

		item in terms of its unit cost. Describe any adjustments made to approximate to opportunity costs	
Methods			
Estimating resources and costs	#13b	Model-based economic evaluation: Describe approaches and data sources used to estimate resource use associated with model health states. Describe primary or secondary research methods for valuing each resource item in terms of its unit cost. Describe any adjustments made to approximate to opportunity costs.	N/A
Currency, price date, and conversion	#14	Report the dates of the estimated resource quantities and unit costs. Describe methods for adjusting estimated unit costs to the year of reported costs if necessary. Describe methods for converting costs into a common currency base and the exchange rate.	5
Choice of model	#15	Describe and give reasons for the specific type of decision analytical model used. Providing a figure to show model structure is strongly recommended.	5
Assumptions	#16	Describe all structural or other assumptions underpinning the decision-analytical model.	5
Analytical methods	#17	Describe all analytical methods supporting the evaluation. This could include methods for dealing with skewed, missing, or censored data; extrapolation methods; methods for pooling data; approaches to validate or make adjustments (such as half cycle	6

		corrections) to a model; and methods for handling population heterogeneity and uncertainty.	
Results			
Study parameters	#18	Report the values, ranges, references, and, if used, probability distributions for all parameters. Report reasons or sources for distributions used to represent uncertainty where appropriate. Providing a table to show the input values is strongly recommended.	8
Incremental costs and outcomes	#19	For each intervention, report mean values for the main categories of estimated costs and outcomes of interest, as well as mean differences between the comparator groups. If applicable, report incremental cost-effectiveness ratios.	8
Characterising uncertainty	#20a	Single study-based economic evaluation: Describe the effects of sampling uncertainty for the estimated incremental cost and incremental effectiveness parameters, together with the impact of methodological assumptions (such as discount rate, study perspective).	8
Characterising uncertainty	#20b	Model-based economic evaluation: Describe the effects on the results of uncertainty for all input parameters, and uncertainty related to the structure of the model and assumptions.	N/A
Characterising heterogeneity	#21	If applicable, report differences in costs, outcomes, or cost effectiveness that can be explained by variations	N/A

		between subgroups of patients with different baseline characteristics or other observed variability in effects that are not reducible by more information.	
Discussion			
Study findings, limitations, generalisability, and current knowledge	#22	Summarise key study findings and describe how they support the conclusions reached. Discuss limitations and the generalisability of the findings and how the findings fit with current knowledge.	15
Other			
Source of funding	#23	Describe how the study was funded and the role of the funder in the identification, design, conduct, and reporting of the analysis. Describe other non-monetary sources of support	17
Conflict of interest	#24	Describe any potential for conflict of interest of study contributors in accordance with journal policy. In the absence of a journal policy, we recommend authors comply with International Committee of Medical Journal Editors recommendations	17