Computer simulation models of prediabetes populations: a systematic review protocol

Appendices

Appendix 1: Search strategy

Table A.1.1: Ovid MEDLINE

Searches	Search Terms
1	exp prediabetic state/
2	exp insulin resistance/
3	prediab$.ti,ab.
4	pre diab$.ti,ab.
5	(glucose adj2 impair$).ti,ab.
6	(glucose adj2 intol$).ti,ab.
7	IGT.ti,ab.
8	IFG.ti,ab.
9	IGR.ti,ab.
10	(impair$ adj2 glycem$).ti,ab.
11	(impair$ adj2 glycaem$).ti,ab.
12	(insulin adj2 resistan$).ti,ab.
13	impaired fasting glucose.ti,ab.
14	impaired fasting glycaem$.ti,ab.
15	impaired fasting glycem$.ti,ab.
16	impaired glucose tolerance.ti,ab.
17	impaired glucose regulation.ti,ab.
18	glucose intolerance.ti,ab.
19	borderline diabetes.ti,ab.
20	impaired fasting insulin.ti,ab.
21	1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20
22	Type 2 Diab$.ti.
23	diabetes.ti.
24	exp insulin resistance/
25	Type II diab$.ti.
26	NIDDM.ti.
27	Non insulin dependent diabetes.ti.
28	T2DM.ti.
29	exp diabetes mellitus, Type 2/
30	obese diabetes.ti.
31	obesity diabetes.ti.
32	((adult or mature or late) and onset).ti.
33	MODY.ti.
34	22 or 23 or 24 or 25 or 26 or 27 or 28 or 29 or 30 or 31 or 32 or 33
35	screen$.ti,ab.
36	prevent$.ti,ab.
37	lifestyle.ti,ab.
38	early detection.ti,ab.
39	(risk adj2 stratifi$).ti,ab.
40	(risk adj2 identification$).ti,ab.
41	35 or 36 or 37 or 38 or 39 or 40
42	34 and 41
43	simulation model$.ti,ab.
44	markov.ti,ab.
45	monte carlo.ti,ab.
46	decision tree$.ti,ab.
47	decision analy$.ti,ab.
48	qaly$.ti,ab.
49	(valu$ adj2 quality).ti,ab.
50	utility value$.ti,ab.
51	((disability or quality) adj adjusted).ti,ab.
52	((life adj2 year$) or health year equivalent$).ti,ab.
53	(health adj utilit$).ti,ab.
54	hui$1.ti,ab.

55	(quality adj3 well$).ti,ab.
56	qwb.ti,ab.
57	(qald$ or qale$ or qtime$).ti,ab.
58	(well being or wellbeing).tw.
59	(health adj2 stat$).tw.
60	((adjusted adj2 life) or qaly$).ti,ab.
61	(daly or qol or hql or hqol or hrqol or hr ql or hrql).tw.
62	cost-utility.ti,ab.
63	cost-effectiveness.ti,ab.
64	cost-benefit.ti,ab.
65	cost-minimisation.ti,ab.
66	cost-minimization.ti,ab.
67	modelling.ti,ab.
68	modeling.ti,ab.
69	decision model.ti,ab.
70	QALY.ti,ab.
71	quality adjusted life year$.ti,ab.
72	cost.ti,ab.
73	life year$.ti,ab.
74	incremental cost-effectiveness ratio.ti,ab.
75	(qtwist or q twist).ti,ab.
76	(quality adj2 life).ti,ab.
77	43 or 44 or 45 or 46 or 47 or 48 or 49 or 50 or 51 or 52 or 53 or 54 or 55 or 56 or 57 or 58 or 59 or 60 or 61 or 62 or 63 or 64 or 65 or 66 or 67 or 68 or 69 or 70 or 71 or 72 or 73 or 74 or 75 or 76
78	21 or 42
79	77 and 78
80	non-diabet$.ti,ab.
81	79 not 80
82	exp animals/ not human.sh.
83	81 and 82
84	limit 83 to yr="2000 -Current"
85	limit 84 to english language

ti: title; ab: abstract

Table A.1.2: OVID Embase

Searches	Search Terms
1	exp impaired glucose tolerance/
2	exp insulin resistance/
3	prediab$.ti,ab.
4	pre diab$.ti,ab.
5	(glucose adj2 impair$).ti,ab.
6	(glucose adj2 impair$).ti,ab.
7	IGT.ti,ab.
8	IFG.ti,ab.
9	IGR.ti,ab.
10	(impair$ adj2 glycem$).ti,ab.
11	(impair$ adj2 glycaem$).ti,ab.
12	(insulin adj2 resistan$).ti,ab.
13	impaired fasting glucose.ti,ab.
14	impaired fasting glycaem$.ti,ab.
15	impaired fasting glycem$.ti,ab.
16	impaired glucose tolerance.ti,ab.
17	impaired glucose regulation.ti,ab.
18	glucose intolerance.ti,ab.
19	borderline diabetes.ti,ab.
20	impaired fasting insulin.ti,ab.
21	1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20
22	Type 2 Diab$.ti.
23	diabetes.ti.
24	exp insulin resistance/
25	Type II diab$.ti.
26	NIDDM.ti.
27	Non insulin dependent diabetes.ti.
28	T2DM.ti.
29	exp non insulin dependent diabetes mellitus/
30	obese diabetes.ti.
31	obesity diabetes.ti.
32	((adult or mature or late) and onset).ti.
33	MODY.ti.
34	22 or 23 or 24 or 25 or 26 or 27 or 28 or 29 or 30 or 31 or 32 or 33
35	screen$.ti,ab.
36	prevent$.ti,ab.
37	lifestyle.ti,ab.
38	early detection.ti,ab.
39	(risk adj2 stratifi$).ti,ab.
40	(risk adj2 identification$).ti,ab.
41	35 or 36 or 37 or 38 or 39 or 40
42	34 and 41
43	simulation model$.ti,ab.
44	markov.ti,ab.
45	monte carlo.ti,ab.
46	decision tree$.ti,ab.
47	decision analy$.ti,ab.
48	qaly$.ti,ab.
49	(valu$ adj2 quality).ti,ab.
50	utility value$.ti,ab.
51	((disability or quality) adj adjusted).ti,ab.
52	((life adj2 year$) or health year equivalent$).ti,ab.
53	(health adj utilit$).ti,ab.
54	hui$1.ti,ab.
55	(quality adj3 well$).ti,ab.
56	qwb.ti,ab.
57	(qald$ or qale$ or qtime$).ti,ab.
58	(well being or wellbeing).tw.
59	(health adj2 stat$).tw.
60	((adjusted adj2 life) or qaly$).ti,ab.
61	(daly or qol or hql or hqol or hrqol or hr ql or hrql).tw.
62	cost-utility.ti,ab.
63	cost-effectiveness.ti,ab.

64	cost-benefit.ti,ab.
65	cost-minimisation.ti,ab.
66	cost-minimization.ti,ab.
67	modelling.ti,ab.
68	modeling.ti,ab.
69	decision model.ti,ab.
70	QALY.ti,ab.
71	quality adjusted life year$.ti,ab.
72	cost.ti,ab.
73	life year$.ti,ab.
74	incremental cost-effectiveness ratio.ti,ab.
75	(qtwist or q twist).ti,ab.
76	(quality adj2 life).ti,ab.
77	43 or 44 or 45 or 46 or 47 or 48 or 49 or 50 or 51 or 52 or 53 or 54 or 55 or 56 or 57 or 58 or 59 or 60 or 61 or 62 or 63 or 64 or 65 or 66 or 67 or 68 or 69 or 70 or 71 or 72 or 73 or 74 or 75 or 76
78	21 or 42
79	77 and 78
80	non-diabet$.ti,ab.
81	79 not 80
82	exp animals/ not human.sh.
83	81 not 82
84	limit 83 to yr="2000 -Current"
85	limit 84 to english language

ti: title; ab: abstract

Table A.1.3: NHS EED (via the Cochrane Library)

Searches	Search Terms
#1	MeSH descriptor: [Prediabetic State] explode all trees
#2	MeSH descriptor: [Insulin Resistance] explode all trees
#3	(prediab*) .ti,ab
#4	(pre diab*) .ti,ab
#5	(glucose near/2 impair*) .ti,ab
#6	(glucose adj2 intol*) .ti,ab
#7	(IGT) .ti,ab
#8	(IFG) .ti,ab
#9	(IGR) .ti,ab
#10	(impair* near/2 glycem*) .ti,ab
#11	(impair* near/2 glycaem*) .ti,ab
#12	(insulin near/2 resistan*) .ti,ab
#13	(impaired fasting glucose) .ti,ab
#14	(impaired fasting glycemia) .ti,ab
#15	(impaired fasting glycaemia) .ti,ab
#16	(impaired glucose tolerance) .ti,ab
#17	(impaired glucose regulation) .ti,ab
#18	(glucose intolerance) .ti,ab
#19	(borderline diabetes) .ti,ab
#20	(impaired fasting insulin) .ti,ab
#21	#1 or #2 or #3 or #4 or #5 or #6 or #7 or #8 or #9 or #10 or #11 or #12 or #13 or #14 or #15 or #16 or #17 or #18 or #19 or #20
#22	Type 2 Diab*.ti
#23	diabetes.ti
#24	MeSH descriptor: [Insulin Resistance] explode all trees
#25	Type II diab*.ti
#26	NIDDM.ti
#27	Non insulin dependent diabetes.ti
#28	T2DM.ti
#29	MeSH descriptor: [Diabetes Mellitus] explode all trees
#30	obese diabetes.ti
#31	obesity diabetes.ti
#32	((adult or mature or late) and onset) .ti
#33	MODY.ti
#34	#22 or #23 or #24 or #25 or #26 or #27 or #28 or #29 or #30 or #31 or #32 or #33
#35	(screen*) .ti,ab.
#36	(prevent*) .ti,ab
#37	lifestyle.ti,ab
#38	(early detection) .ti,ab
#39	(risk near/2 identification$) .ti,ab
#40	(risk near/2 stratif$*) .ti,ab
#41	#35 or #36 or #37 or #38 or #39 or #40
#42	#34 and #41
#43	#21 or #42
#44	(non-diabet*) ti.ab
#45	animals.sh. not (humans.sh. and animals.sh.)
#46	#43 not #44
#47	#46 not #45
#48	*:ti,ab,kw Publication Year from 2000 to 2016 (Word variations have been searched)
#49	#47 and #48
#50	*:ti,ab,kw in Economic Evaluations (Word variations have been searched)
#51	#49 and #50

ti: title; ab: abstract

Table A.1.4: Econlit (via ProQuest)

(ti,ab(prediab*) OR ti,ab(pre-diab*) OR ti,ab(glucose NEAR/2 impair*) OR ti,ab(glucose NEAR/2 intol*) OR ti,ab(voigt) OR ti,ab(ifs) OR ti,ab(igor) OR ti,ab(impair* NEAR/2 glycem*) OR ti,ab(impair* NEAR/2 glycaem*) OR ti,ab(insulin NEAR/2 resistan*) OR ti,ab(impaired fasting glucose) OR ti,ab(impaired fasting glycemia) OR ti,ab(impaired fasting glycaemia) OR ti,ab(impaired glucose tolerance) OR ti,ab(impaired glucose regulation) OR ti,ab(glucose intolerance) OR ti,ab(borderline diabetes) OR ti,ab(impaired fasting insulin))

OR

((ti(Type 2 Diab*) OR ti(diabetes) OR ti(Type II diab*) OR ti(NIDDM) OR ti(Non insulin dependent diabetes) OR ti(T2DM) OR ti(obese diabetes) OR ti((adult OR mature OR late) AND onset) OR ti(MODY))

AND

(ti,ab(screen*) OR ti,ab(prevent*) OR ti,ab(lifestyle) OR ti,ab(early detection) OR ti,ab(risk NEAR/2 identification*) OR (risk NEAR/2 stratif*)))

Restricted to English Language, peer-reviewed and studies published between 1st January 2000 and 1st August 2016.

Appendix 2: Pro-forma for Data Extraction

Reviewer:
Date form completed:
Study Details:
Title:
Author:
Year Published:
Journal:
Citation:
Language:

Economic evaluation details					**Location in text** (page/figure/ table/other)
Objective/scope of model:					
Location (country/city)					
Economic study design:	CEA	☐	CBA	☐	
	CUA	☐	CMA	☐	
	CCA	☐	Cost(s) only	☐	
	Health outcomes(s)				
Perspective of analysis:	Societal	☐	Individual clinician	☐	
	Patient and patient family	☐	Insurer/third party payer	☐	
	Healthcare system	☐	Other:		
	Healthcare provider				
Costs/consequences/outcome measure(s) *(please list):*					
Strategies/comparators:					
Setting *(describe):*					
Patient population characteristics *(describe):*					
Prediabetes definition *(describe):*					
Time horizon of analysis:					
Was discounting used?	Discount rate for costs: ……	☐	No discounting	☐	
	Discount rate for health outcomes: …….		N/A (no information, not relevant)		

Modelling details				**Location in text** *(page/figure /table/other)*
Rationale for model structure:	Yes No	☐ ☐	If Yes please specify:	
Model structure *(paste structure):*				
Structural assumptions *(describe):*				
Have experts been asked to judge the appropriateness of the model?	Yes No	☐ ☐	If Yes please specify: 1. Who: 2. Why they are experts: 3. Level of agreement:	
Has the model been compared with other models found in the literature?	Yes No	☐ ☐	If Yes please provide reference/citation:	
Model type	Cohort-based decision tree (DT) Cohort-based State Transition model (MM) Individual patient-level DT Individual patient-level MM Discrete event simulation Agent-based model System dynamics model Other:	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐		
Rationale for model type:	Yes No	☐ ☐	If Yes please specify:	
Cycle length *(if relevant):*				
Well defined disease states/pathways?	Yes No	☐ ☐	If Yes please specify:	
Natural history of diabetes evolution *(describe, e.g. discrete, homogeneous)*				
Likelihood of glycaemia returning to normal?	Yes No	☐ ☐	If Yes please specify from which state:	
Well defined complications in prediabetes state?	Yes No	☐ ☐	If Yes please specify:	
Well defined complications in type 2 state?	Yes No	☐ ☐	If Yes please specify:	

Modelling details			**Location in text** *(page/figure /table/other)*
Was patient heterogeneity modelled?	Prediabetes: Yes ☐ No ☐	If Yes please specify:	
	Type 2 diabetes: Yes ☐ No ☐	If Yes please specify:	

Data details			**Location in text** *(page/figure /table/other)*
Are methods for identifying input data reported?	Yes ☐ No ☐ If Yes please specify:		
Have experts been asked to judge the appropriateness of the input data?	Yes ☐ No ☐	If Yes please specify: 1. Who: 2. Why they are experts: 3. Level of agreement:	
When input parameters are based on regression models, have statistical tests been performed?	Yes ☐ No ☐	If Yes please specify tests:	
Source of baseline clinical data: Prediabetes state(s)	**1** Case series or analysis of reliable administrative databases specifically conducted for the study covering patients solely from the jurisdiction of interest.	☐	
	2 Recent case series or analysis of reliable administrative databases covering patients solely from the jurisdiction of interest.	☐	
	3 Recent case series or analysis of reliable administrative databases covering patients solely from another jurisdiction.	☐	
	4 Old case series or analysis of reliable administrative databases. Estimates from RCTs	☐	
	5 Estimates from previously published economic analyses: unsourced	☐	
	6 Expert opinion	☐	
	Other: Specify relevant data sources: More than 1 data source per parameter? Reasons for excluding data sources? Evidence synthesis performed? Calibration?	☐	

Data details		Location in text *(page/figure /table/other)*
Source of baseline clinical data: Type 2 diabetes state(s)	**1** Case series or analysis of reliable administrative databases specifically conducted for the study covering patients solely from the jurisdiction of interest ☐ **2** Recent case series or analysis of reliable administrative databases covering patients solely from the jurisdiction of interest ☐ **3** Recent case series or analysis of reliable administrative databases covering patients solely from another jurisdiction ☐ **4** Old case series or analysis of reliable administrative databases. Estimates from RCTs ☐ **5** Estimates from previously published economic analyses: unsourced **6** Expert opinion Other: Specify relevant data sources: More than 1 data source per parameter? Reasons for excluding data sources? Evidence synthesis performed? Calibration?	
Source of data for duration of primary effect (i.e. after end of follow-up of source of primary effect size)	**1** Analysis of reliable administrative databases specifically conducted for the study covering patients solely from the jurisdiction of interest ☐ **2** Recent analysis of reliable administrative databases covering patients solely from the jurisdiction of interest ☐ **3** Recent analysis of reliable administrative databases covering patients solely from another jurisdiction ☐ **4** Old analysis of reliable administrative databases. ☐ **5** Estimates from previously published economic analyses: unsourced ☐ **6** Expert opinion Other: Specify relevant data sources: More than 1 data source per parameter? Reasons for excluding data sources? Evidence synthesis performed? Calibration?	

Data details		**Location in text** *(page/figure /table/other)*
Source of data for primary effect size measure(s):	**1**+ Meta-analysis of RCTs with direct comparison between comparator therapies, measuring final outcomes.	☐
	1 Single RCT with direct comparison between comparator therapies, measuring final outcomes	☐
	2+ Meta-analysis of RCTs with direct comparison between comparator therapies, measuring surrogate outcomes	☐
	Meta-analysis of placebo-controlled RCTs with similar trial populations, measuring final outcomes for each individual therapy	☐
	2 Single RCT with direct comparison between comparator therapies, measuring surrogate outcomes	☐
	Single placebo-controlled RCTs with similar trial populations, measuring final outcomes for each individual therapy	☐
	3+ Meta-analysis of placebo-controlled RCTs with similar trial populations, measuring surrogate outcomes	☐
	3 Single placebo-controlled RCTs with similar trial populations, measuring surrogate outcomes for each individual therapy	
	4 Case-control or cohort studies	
	5 Non-analytic studies, for example, case reports, case series	
	6 Expert opinion Specify relevant data sources: More than 1 data source per parameter? Reasons for excluding data sources? Evidence synthesis performed? Calibration?	

Data details		Location in text *(page/figure /table/other)*
Source of data for resource use:	**1** Prospective data collection or analysis of reliable administrative data from same jurisdiction for specific study ☐ **2** Recently published results of prospective data collection or recent analysis of reliable administrative data – same jurisdiction ☐ **3** Unsourced data from previous economic evaluations – same jurisdiction ☐ **4** Recently published results of prospective data collection or recent analysis of reliable administrative data – different jurisdiction ☐ **5** Unsourced data from previous economic evaluation – different jurisdiction ☐ **6** Expert opinion Other: Specify relevant data sources: More than 1 data source per parameter? Reasons for excluding data sources? Evidence synthesis performed? Calibration?	
Source of data for costs:	**1** Cost calculations based on reliable databases or data sources conducted for specific study – same jurisdiction ☐ **2** Recently published cost calculations based on reliable databases or data sources – same jurisdiction ☐ **3** Unsourced data from previous economic evaluation – same jurisdiction ☐ **4** Recently published cost calculations based on reliable databases or data sources – different jurisdiction ☐ **5** Unsourced data from previous economic evaluation – different jurisdiction ☐ **6** Expert opinion Other: Specify relevant data sources: More than 1 data source per parameter? Reasons for excluding data sources? Evidence synthesis performed? Calibration?	

Data details							**Location in text** *(page/figure /table/other)*
Costs included:	Direct medical Direct treatment In-patient Out-patient Day care Community healthcare Medication Side effect costs or Staff Medication Labs/diagnostic Overhead Capital equipment Real estate Other:	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	Direct non-medical Social care Social benefits Travel costs Caregiver out-of-pocket Criminal Justice Training of staff	☐ ☐ ☐ ☐ ☐ ☐ ☐	Productivity losses Income forgone due to illness Income forgone due to death Income forgone due to death	☐ ☐ ☐ ☐	
Currency/Price year:							
Were QOL estimates derived:	Yes ☐ No ☐						

Data details				Location in text *(page/figure /table/other)*
Source of data for quality of life/utilities:	**1** Direct utility assessment for the specific study from a sample: a) of the general population b) with knowledge of the disease(s) of interest c) of patients with the disease(s) of interest **1** Indirect utility assessment from specific study from a patient sample with disease(s) of interest: using a tool validated for the patient population **2** Indirect utility assessment from specific study from a patient sample with disease(s) of interest using tool not validated for the patient population **3** Direct utility assessment from a previous study from a sample either: a) of the general population b) with knowledge of the disease(s) of interest c) of patients with the disease(s) of interest **3** Indirect utility assessment from previous study from patient sample with disease(s) of interest: using tool validated for the patient population **4** Indirect utility assessment from previous study from patient sample with disease(s) of interest: using tool not validated for the patient population or method of elicitation unknown **5** Patient preference values obtained from a visual analogue scale **6** Delphi panels, expert opinion Specify relevant data sources: More than 1 data source per parameter? Reasons for excluding data sources? Evidence synthesis performed? Calibration?	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐		
If validated tools were used, which instrument(s):	Rosser Index	☐	Health Utilities Index (HUI)	☐
	EQ-5D	☐	Quality of Well Being (QWB)	☐
	15D	☐	SF-36	☐
	SF-12	☐	SF-6	☐

Data details		Location in text *(page/figure /table/other)*
Converted into utilities?	Yes ☐ No ☐ If Yes report value set:	
If direct elicitation was used, which approach(s):	Standard Gamble ☐ VAS ☐ Time trade-off ☐ Person trade-off ☐	
Utility values combined with survival to form QALYs?	Yes ☐ No ☐	
Were all data sources described and reported?	Yes ☐ No ☐	
Were mutually inconsistent data reported in the model?	Yes ☐ No ☐	If Yes were the choices justified?
Were data incorporated as point estimate or distribution?	Point estimate ☐ Distribution ☐ Both ☐	Which model inputs were incorporated as distributions (delete)? All; majority; minority; none Was the choice of distribution justified?
Model uncertainty	Methodological uncertainty ☐ If yes, describe: Structural uncertainty ☐ If yes, describe: Heterogeneity ☐ If yes, list subgroups: Parameter uncertainty ☐ If yes, list method:	
Model internal validation (mathematical logic and accuracy of coding)	Mathematical logic tested thoroughly before use ☐ Computerised model examined by modelling experts ☐ Model run for specific, extreme sets of parameter values to detect coding errors ☐ Patients tracked through model to determine if its logic is correct ☐ Tested individual sub-modules of the computerised model ☐ Other:	
Model external validation	Model outcomes compared with the outcomes of other models that address similar problems ☐ Counterintuitive results from model explained and justified ☐ Model outcomes compared with the outcomes obtained when using alternative input data ☐ Model outcomes compared with empirical data ☐ Model calibrated against independent data with differences explained and justified ☐ Other:	

Data details	**Location in text** *(page/figure /table/other)*
Result(s):	

Quality checklist score			
Risk of bias	High ☐	Medium ☐	Low ☐
Comments, limitations of the study			
Study, natural history and effectiveness data:			
Cost, Effects, methodology, uncertainty:			
Generalizability:			