

Incidence and characteristics of remission of type 2 diabetes in England: A cohort study using the National Diabetes Audit

Supplementary Material

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Figure S1: Cohort flow diagram

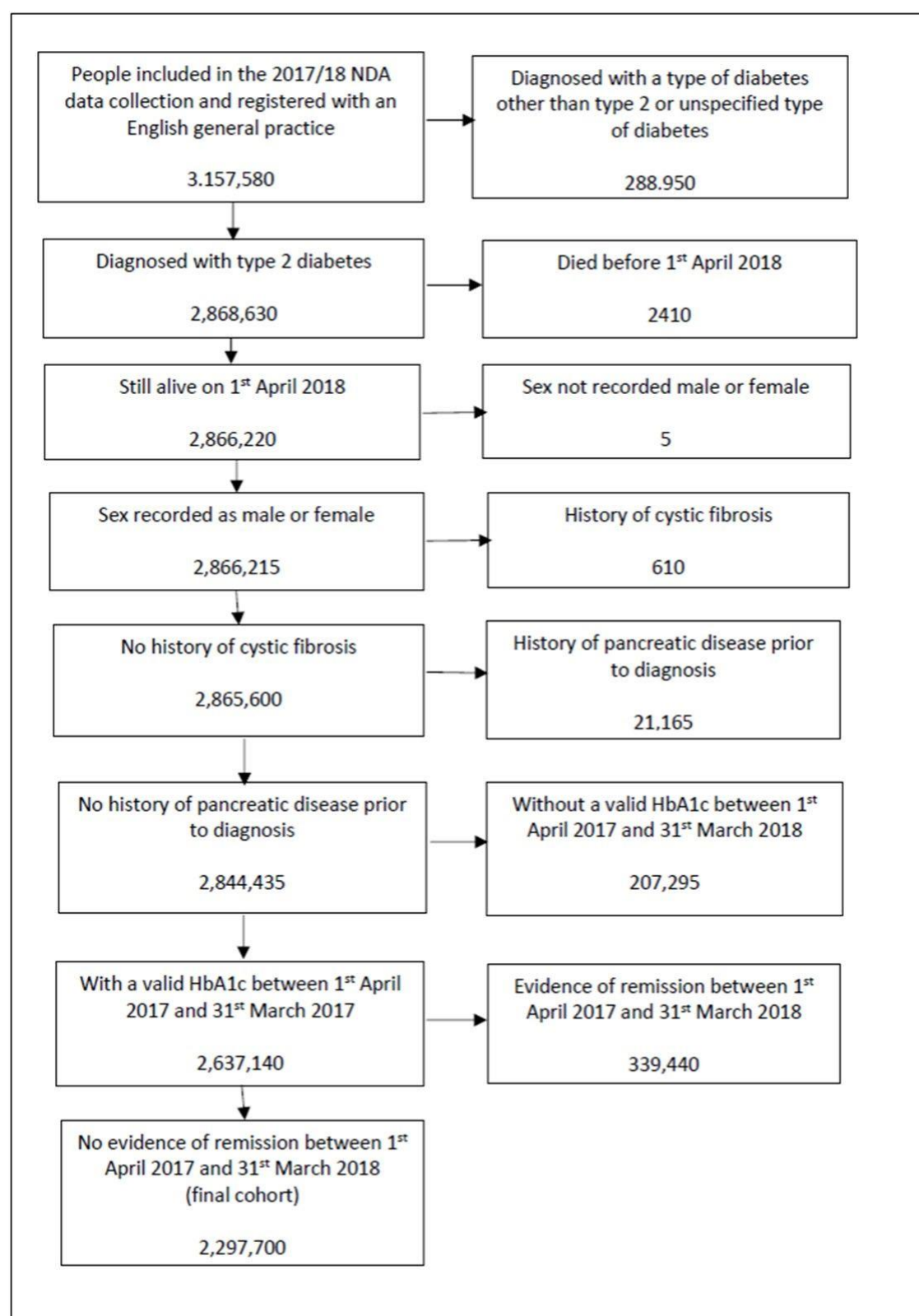


Table S1: List of OPCS-4 codes used to identify bariatric surgery

OPCS Code	Description
G011	Oesophagogastrectomy and anastomosis of oesophagus to stomach
G012	Oesophagogastrectomy and anastomosis of oesophagus to transposed jejunum
G013	Oesophagogastrectomy and anastomosis of oesophagus to jejunum NEC
G018	Other specified excision of oesophagus and stomach
G019	Unspecified excision of oesophagus and stomach
G021	Total oesophagectomy and anastomosis of pharynx to stomach
G022	Total oesophagectomy and interposition of microvascularily attached jejunum
G023	Total oesophagectomy and interposition of jejunum NEC
G024	Total oesophagectomy and interposition of microvascularily attached colon
G025	Total oesophagectomy and interposition of colon NEC
G028	Other specified total excision of oesophagus
G029	Unspecified total excision of oesophagus
G031	Partial oesophagectomy and end to end anastomosis of oesophagus
G032	Partial oesophagectomy and interposition of microvascularily attached jejunum
G033	Partial oesophagectomy and anastomosis of oesophagus to transposed jejunum
G034	Partial oesophagectomy and anastomosis of oesophagus to jejunum NEC
G035	Partial oesophagectomy and interposition of microvascularily attached colon
G036	Partial oesophagectomy and interposition of colon NEC
G038	Other specified partial excision of oesophagus
G039	Unspecified partial excision of oesophagus
G271	Total gastrectomy and excision of surrounding tissue
G272	Total gastrectomy and anastomosis of oesophagus to duodenum
G273	Total gastrectomy and interposition of jejunum
G274	Total gastrectomy and anastomosis of oesophagus to transposed jejunum
G275	Total gastrectomy and anastomosis of oesophagus to jejunum NEC
G278	Other specified total excision of stomach
G279	Unspecified total excision of stomach
G281	Partial gastrectomy and anastomosis of stomach to duodenum
G282	Partial gastrectomy and anastomosis of stomach to transposed jejunum
G283	Partial gastrectomy and anastomosis of stomach to jejunum NEC
G284	Sleeve gastrectomy and duodenal switch
G285	Sleeve gastrectomy NEC
G288	Other specified partial excision of stomach
G289	Unspecified partial excision of stomach
G301	Gastroplasty NEC
G302	Partitioning of stomach NEC
G303	Partitioning of stomach using band
G304	Partitioning of stomach using staples
G305	Maintenance of gastric band
G308	Other specified plastic operations on stomach
G309	Unspecified plastic operations on stomach
G311	Bypass of stomach by anastomosis of oesophagus to duodenum
G312	Bypass of stomach by anastomosis of stomach to duodenum
G315	Closure of connection of stomach to duodenum
G316	Attention to connection of stomach to duodenum
G321	Bypass of stomach by anastomosis of stomach to transposed jejunum
G322	Revision of anastomosis of stomach to transposed jejunum
G323	Conversion to anastomosis of stomach to transposed jejunum
G324	Closure of connection of stomach to transposed jejunum
G325	Attention to connection of stomach to transposed jejunum
G328	Other specified connection of stomach to transposed jejunum
G329	Unspecified connection of stomach to transposed jejunum
G331	Bypass of stomach by anastomosis of stomach to jejunum NEC
G332	Revision of anastomosis of stomach to jejunum NEC
G338	Other specified other connection of stomach to jejunum
G387	Removal of gastric band
G491	Gastroduodenectomy
G492	Total excision of duodenum
G493	Partial excision of duodenum
G498	Other specified excision of duodenum
G499	Unspecified excision of duodenum
G511	Bypass of duodenum by anastomosis of stomach to jejunum
G513	Bypass of duodenum by anastomosis of duodenum to jejunum
G716	Duodenal switch
G717	Reversal of duodenal switch

Table S2: Incidence of remission type 2 diabetes defined as a single HbA1c measurement less than 48 mmol/mol in the absence of a prescription for glucose lowering drugs in the preceding 90 days of type 2 diabetes per 1000 person years

	All people	With co-morbidity	Without co-morbidity
Persons	23.5 (23.3-23.7)	32.6 (32.2-33)	21.7 (21.5-21.9)
Female	26.2 (25.9-26.4)	36.6 (35.9-37.3)	24.1 (23.9-24.4)
Male	21.5 (21.3-21.7)	29.7 (29.1-30.2)	19.8 (19.6-20)
Age			
<40 years	25.6 (24.7-26.6)	28 (20.7-37)	25.6 (24.7-26.5)
40-49 years	18.1 (17.7-18.6)	22.3 (19.6-25.1)	18 (17.5-18.4)
50-59 years	16.5 (16.2-16.8)	19.4 (18.2-20.5)	16.3 (16-16.6)
60-69 years	19.1 (18.8-19.3)	23.5 (22.7-24.3)	18.4 (18.1-18.7)
70-79 years	25.6 (25.3-25.9)	31.1 (30.4-31.8)	23.9 (23.6-24.3)
80+ years	40.3 (39.8-40.8)	45.2 (44.3-46.1)	37.7 (37.1-38.3)
Deprivation			
Most deprived	20.5 (20.2-20.8)	29.6 (28.7-30.4)	25.6 (24.7-26.5)
2nd most deprived	22.1 (21.7-22.4)	31.8 (30.9-32.8)	18 (17.5-18.4)
3rd most deprived	24.2 (23.9-24.6)	33 (32-34)	16.3 (16-16.6)
2nd least deprived	25.8 (25.4-26.2)	35.2 (34.2-36.3)	18.4 (18.1-18.7)
Least deprived	26.9 (26.5-27.4)	35.2 (34-36.5)	23.9 (23.6-24.3)
Ethnicity			
Asian	14.4 (14-14.7)	19.8 (18.5-21.2)	13.9 (13.5-14.2)
Black	20.3 (19.6-20.9)	26.8 (24.5-29.2)	19.5 (18.9-20.2)
Mixed	20.7 (19.3-22.1)	28.7 (23.8-34.2)	19.8 (18.3-21.2)
White	25.3 (25.1-25.5)	33.7 (33.1-34.2)	23.3 (23.1-23.5)
Other	15.8 (15.2-16.4)	20.9 (18.8-23.3)	15.3 (14.7-15.9)
Missing	27.3 (26.8-27.8)	37.4 (35.9-38.9)	25.6 (25.1-26.1)
Duration			
<1 year	93.2 (92-94.4)	120.8 (117-124.7)	89.3 (88.1-90.5)
1-2 years	37.4 (36.8-37.9)	57.6 (55.7-59.6)	34.4 (33.9-35)
3-5 years	27.1 (26.6-27.6)	46 (44.3-47.8)	24.2 (23.8-24.7)
5-9 years	18.8 (18.6-19.1)	33 (32.1-33.9)	16.4 (16.2-16.7)
10-14 years	13.4 (13.2-13.6)	23.2 (22.5-24)	11.3 (11-11.5)
15+ years	8.2 (8-8.4)	13.1 (12.6-13.7)	6.7 (6.5-6.9)
Treatment			
None	143.7 (142.3-145)	169.9 (166.6-173.4)	138 (136.6-139.4)
Metformin only	24.4 (24.1-24.7)	38.9 (38.1-39.8)	22 (21.7-22.2)
Other non-insulin glucose lowering agents +/- metformin	4.9 (4.8-5)	9.3 (9-9.6)	4 (3.9-4.1)
Insulin +/- other glucose lowering agents	3.6 (3.4-3.9)	4.3 (3.7-5.1)	3.5 (3.2-3.8)
Bariatric surgery			
No	23.4 (23.2-23.5)	32.5 (32-32.9)	21.6 (21.4-21.7)
Yes	270.7 (248.9-293.8)	150.9 (121.6-185)	319.5 (291.5-349.4)

* - no history of a hospital admission for heart failure, cancer, chronic obstructive pulmonary disease or dementia between 1st April 2015 and 31st March 2019

+ - history of a hospital admission for heart failure, cancer, chronic obstructive pulmonary disease or dementia between 1st April 2015 and 31st March 2019

Table S3: Odds ratios of entering remission of type 2 diabetes in England derived from multivariable models

	All people	People without a co-morbidity*	People with a co-morbidity+	People in early stages of type 2 diabetes"
Sex				
Female	1.00	1.00	1.00	
Male	0.96 (0.94-0.98)	0.98 (0.96-1)	0.89 (0.85-0.93)	1.04 (1-1.08)
Age				
<40 years	1.23 (1.15-1.31)	1.21 (1.13-1.29)	1.74 (1.15-2.63)	1.02 (0.93-1.12)
40-49 years	1.03 (0.98-1.08)	1.03 (0.98-1.08)	0.94 (0.75-1.18)	0.98 (0.92-1.05)
50-59 years	1.0	1.0	1.0	1.00
60-69 years	1.16 (1.12-1.2)	1.16 (1.12-1.21)	1.14 (1.02-1.27)	1.24 (1.18-1.31)
70-79 years	1.03 (0.98-1.08)	1.03 (0.98-1.08)	0.94 (0.75-1.18)	1.46 (1.38-1.54)
80+ years	1.23 (1.15-1.31)	1.21 (1.13-1.29)	1.74 (1.15-2.63)	1.42 (1.32-1.52)
Deprivation				
Most deprived	1.00	1.00	1.00	1.00
2nd most deprived	1.07 (1.03-1.1)	1.07 (1.03-1.11)	1.05 (0.98-1.12)	0.96 (0.91-1.01)
3rd most deprived	1.11 (1.07-1.14)	1.11 (1.07-1.15)	1.09 (1.01-1.16)	1.11 (1.05-1.18)
2nd least deprived	1.1 (1.07-1.14)	1.11 (1.07-1.16)	1.06 (0.99-1.14)	1.17 (1.1-1.24)
Least deprived	1.13 (1.09-1.18)	1.14 (1.1-1.19)	1.09 (1.01-1.18)	1.11 (1.05-1.18)
Missing	0.96 (0.5-1.87)	0.79 (0.36-1.74)	1.81 (0.53-6.16)	1.2 (1.13-1.28)
Ethnicity				
Asian	0.76 (0.73-0.79)	0.75 (0.72-0.79)	0.88 (0.78-0.99)	0.85 (0.8-0.91)
Black	0.76 (0.73-0.79)	0.75 (0.72-0.79)	0.88 (0.78-0.99)	0.85 (0.8-0.91)
Mixed	0.83 (0.74-0.93)	0.81 (0.72-0.92)	0.94 (0.69-1.28)	0.93 (0.78-1.11)
White	1.00	1.00	1.00	1.00
Other	0.72 (0.68-0.77)	0.72 (0.67-0.77)	0.72 (0.6-0.87)	0.97 (0.89-1.06)
Missing	0.93 (0.9-0.96)	0.93 (0.9-0.96)	0.94 (0.87-1.01)	0.8 (0.73-0.88)
Duration				
<1 year	2.78 (2.68-2.88)	2.89 (2.78-3.01)	2.26 (2.07-2.45)	1.00
1-2 years	1.12 (1.08-1.17)	1.13 (1.08-1.18)	1.08 (0.99-1.18)	0.67 (0.2-2.29)
3-5 years	1.00	1.00	1.00	-
5-9 years	0.98 (0.95-1.02)	0.97 (0.93-1.01)	1.01 (0.94-1.1)	-
10-14 years	0.85 (0.82-0.89)	0.83 (0.79-0.87)	0.89 (0.82-0.98)	-
15+ years	0.66 (0.63-0.7)	0.65 (0.61-0.69)	0.67 (0.6-0.74)	-
HbA1c in 2017/18 (mmol/mol)				
<48	6.84 (6.55-7.13)	7.03 (6.7-7.37)	5.87 (5.37-6.42)	4.78 (4.39-5.2)
48-53	1.00	1.00	1.00	1.00
54-58	0.36 (0.34-0.37)	0.35 (0.33-0.37)	0.36 (0.32-0.41)	-
59-74	0.24 (0.22-0.26)	0.25 (0.23-0.27)	0.21 (0.18-0.25)	-
75-85	0.24 (0.2-0.28)	0.25 (0.21-0.3)	0.16 (0.1-0.26)	-
86+	0.23 (0.2-0.27)	0.23 (0.2-0.28)	0.17 (0.1-0.28)	-
BMI (kg/m ²) in 2017/18				
<20	0.84 (0.77-0.92)	0.87 (0.78-0.97)	0.89 (0.78-1.02)	0.97 (0.8-1.18)
20-24.9	1.02 (0.98-1.06)	1.03 (0.99-1.07)	1.03 (0.96-1.1)	1.08 (1.01-1.15)
25-29.9	1.00	1.00	1.00	1.00
30-34.9	1 (0.97-1.03)	0.99 (0.96-1.02)	1 (0.94-1.07)	0.91 (0.87-0.96)
35-39.9	0.92 (0.89-0.96)	0.91 (0.87-0.95)	0.96 (0.87-1.05)	0.82 (0.77-0.88)
40+	0.95 (0.9-0.99)	0.93 (0.88-0.98)	0.96 (0.86-1.08)	0.78 (0.72-0.84)
Missing	0.34 (0.33-0.36)	0.29 (0.28-0.3)	0.57 (0.53-0.61)	0.29 (0.27-0.31)
Change in BMI (%)				
≥10% reduction	3.57 (3.42-3.72)	3.94 (3.75-4.13)	2.28 (2.08-2.5)	3.54 (3.28-3.82)
5-9.9% reduction	1.78 (1.71-1.85)	1.83 (1.75-1.92)	1.45 (1.32-1.6)	1.89 (1.77-2.02)
0-4.9% reduction	1.00	1.00	1.00	1.00
0.1-4.9% Increase	0.83 (0.8-0.87)	0.82 (0.79-0.86)	0.89 (0.82-0.98)	0.75 (0.7-0.8)
≥5% increase	1.01 (0.96-1.07)	1 (0.95-1.06)	1.01 (0.9-1.12)	0.9 (0.83-0.98)
Missing	4.04 (3.91-4.17)	4.81 (4.64-4.99)	2.12 (1.97-2.28)	4.27 (4.03-4.51)
Co-morbidities				

Heart failure	0.86 (0.83-0.9)	-	-	-
Cancer	0.97 (0.93-1.01)	-	-	-
COPD	0.85 (0.82-0.89)	-	-	-
Dementia	0.82 (0.77-0.88)	-	-	-
Treatment in 2017/18				
No glucose lowering drugs	1.00	1.00	1.00	1.00
Metformin only	0.06 (0.06-0.06)	0.06 (0.06-0.06)	0.08 (0.07-0.09)	0.08 (0.07-0.08)
Other non-insulin glucose lowering drugs +/- metformin	0.03 (0.02-0.03)	0.02 (0.02-0.03)	0.03 (0.03-0.04)	-
Insulin +/- other glucose lowering drugs	0.03 (0.03-0.04)	0.04 (0.03-0.04)	0.03 (0.02-0.04)	-
C-statistic	0.901	0.908	0.877	0.806

* - no history of a hospital admission for heart failure, cancer, chronic obstructive pulmonary disease or dementia between 1st April 2015 and 31st March 2019

+ - history of a hospital admission for heart failure, cancer, chronic obstructive pulmonary disease or dementia between 1st April 2015 and 31st March 2019

“ – diagnosed for less than 2 years with a baseline HbA_{1c} of 53mmol/mol or less, prescribed metformin only or no glucose lowering drugs at baseline and no history of a hospital admission for heart failure, cancer, chronic obstructive pulmonary disease or dementia between 1st April 2015 and 31st March 2019