Title: Understanding the relationship between the frequency of HbA1c monitoring, changes over time, and the achievement of targets: a retrospective cohort study.

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Supplementary material

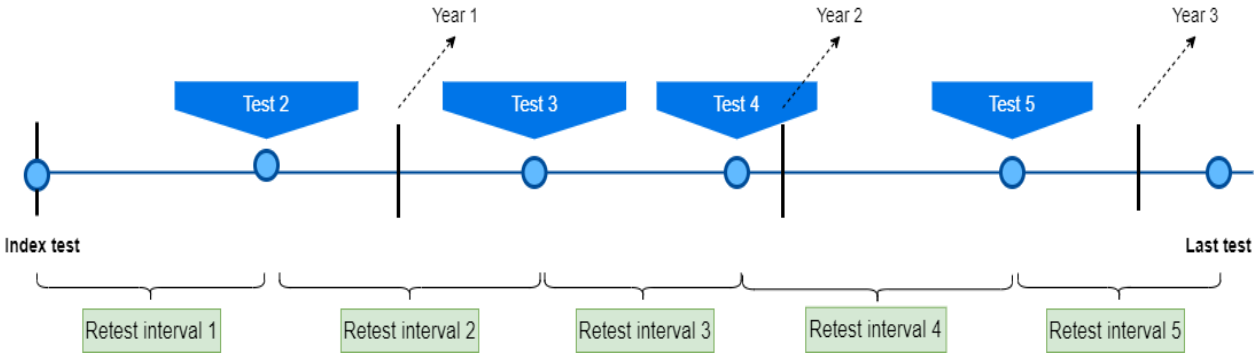

Figure S1 Timeline plot of the tests

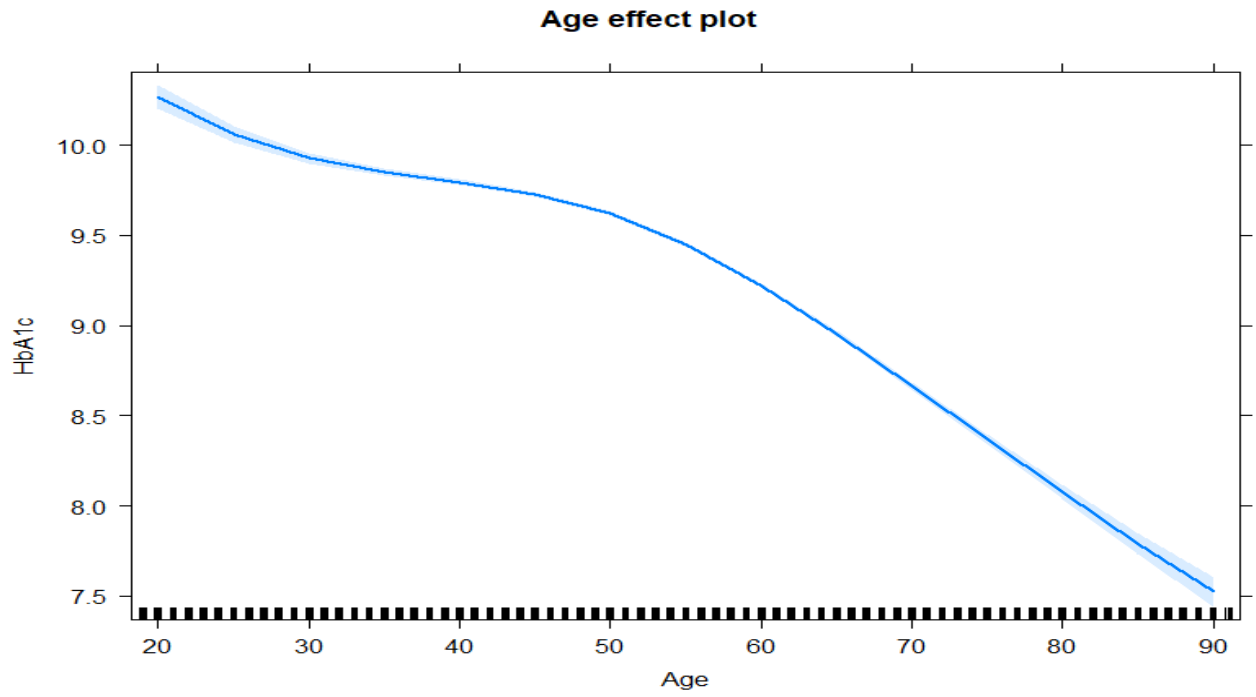

Figure S2: Age effect plot- Overall study cohort

Figure S3 Age effect plot- index HbA1c ≥ 7

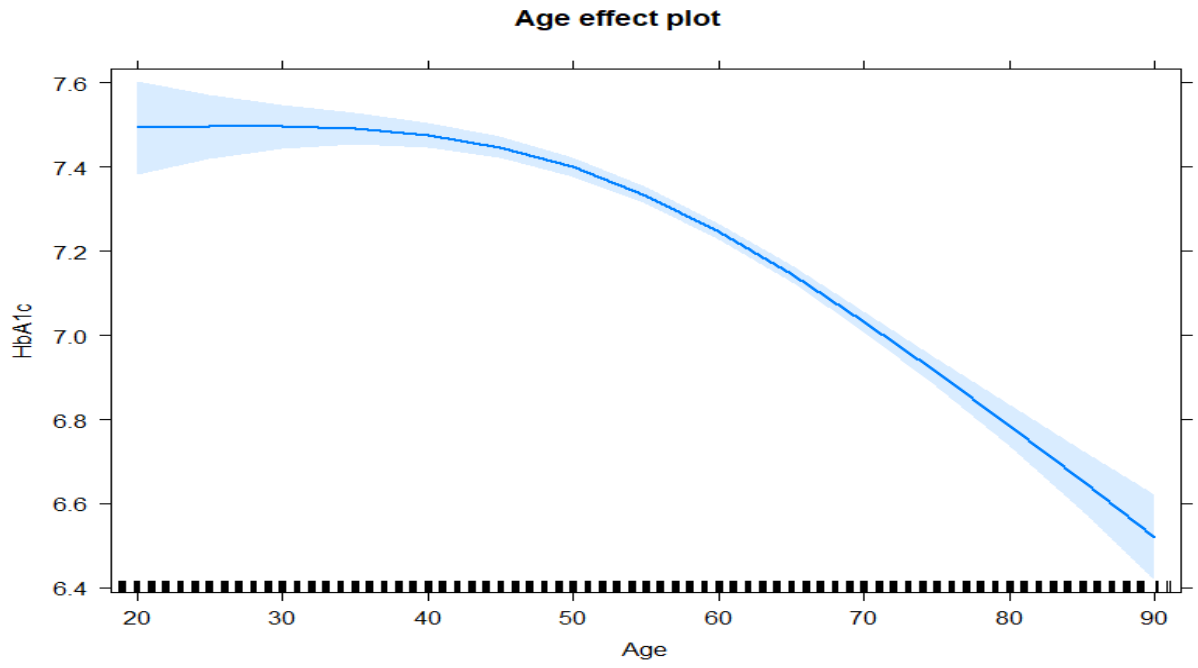

Figure S4 Age effect plot HbA1c<7

Sensitivity analyses

Table S1 : Patient and test characteristics for sensitivity analysis

	Overall	Index HbA1c ≥8	Index HbA1c <8	P-value
Number of PLWD	132,859	88,733	44,126	-
Number of test requests	445,536	306,453	139,084	-
Mean age at index test	55·0 (12·55)	53·5 (12·2)	58·0 (12·7)	<0·001
Baseline age group				<0·001
18-24 years	1,565 (1·2%)	1,275 (1·4%)	290 (0·7%)	
25-34 years	7,056 (5·3%)	5,311 (6·0%)	1,746 (4·0%)	
35-44 years	17,334 (13·0%)	12,870 (15%)	4,464 (10%)	
45-54 years	35,601 (26·8%)	25,813 (29%)	9,788 (22%)	
55-64 years	40,622 (30·6%)	27,157 (31%)	13,465 (31%)	
65+ years	30,679 (23·1%)	16,308 (18%)	14,371 (33%)	
Sex				0·078
Female	87,185 (65·6%)	58,372 (66%)	28,813 (65%)	
Median HbA1c (%) index test	9·1 (7·5, 11·1)	10·4 (9·1, 11·9)	7·1 (6·7, 7·5)	<0·001
Median retest interval (months)	10·3(5·5, 14·7)	9·7(5·5, 14·3)	11·0(6·2, 15·6)	<0·001
Median test requests per patient	3 (2, 4)	3 (2, 4)	3 (2, 4)	<0·001
Median follow-up time (years)	2·30 (1·4, 3·2)	2·40 (1·4, 3·2)	2·3 (1·4, 3·2)	0·091
Monitoring adherence category				<0·001
Low (<33·3%)	86,335 (65%)	69,821 (79%)	16,514 (37%)	
Moderate (33·3-66·7%)	28,095 (21%)	14,620 (16%)	13,475 (31%)	
High (>66·7%)	18,428 (14%)	4,293 (4.8%)	14,135 (32%)	
Province				<0·001
Western Cape	127,624 (96·1%)	85,354 (96%)	42,270 (96%)	

Table S2 Results from the multi-state model for the transition from HbA1c ≥8% to HbA1c <8% indicating the achievement of glycaemic control for the entire cohort and patients with index HbA1c ≥8%

		Full cohort	Index HbA1c≥8
Covariate	**Comparison**	**Hazard Ratios (CI)**	**Hazard Ratios (CI)**
Age			
	18-24 years	**Ref**	**Ref**
	25-34 years vs	1.91(1.67-2.17)	2.03(1.77-2.33)
	35-44 years	1.77(1.56-2)	1.87(1.63-2.13)
	45-54 years	1.44(1.28-1.62)	1.45(1.27-1.64)
	55-64 years	1.48(1.32-1.67)	1.56(1.37-1.77)
	65+ years	1.75(1.56-1.97)	1.9(1.67-2.16)
Sex			
	Female	**Ref**	**Ref**
	Male	1.33(1.28-1.37)	1.29(1.24-1.34)
Adherence			
	Low	**Ref**	**Ref**
	Moderate	3.96(3.83-4.1)	3.47(3.33-3.63)
	High	8.41(7.98-8.87)	6.51(6.11-6.93)
Index HbA1c (%)			
	8-9	**Ref**	**Ref**
	<8	0.69(0.66-0.73)	-
	9-10	0.58(0.55-0.61)	0.59(0.56-0.62)
	10-12	0.37(0.35-0.39)	0.38(0.37-0.4)
	>12	0.33(0.32-0.35)	0.34(0.32-0.36)

Table S3 Estimated mean differences from linear random effects model for HbA1c (%) levels·

	Overall		Index Hb ≥8		Index HbA1c < 8	
Predictors	**Estimates (CI)**	**p**	**Estimates (CI)**	**p**	**Estimates (CI)**	**p**
Age						
Age [1st degree]	-0.88(-0.95 – -0.80)	<0.001	-0.51(-0.59 – -0.43)	<0.001	-0.17(-0.26 – -0.09)	<0.001
Age [2nd degree]	-1.49(-1.55 – -1.43)	<0.001	-1.02(-1.09 – -0.95)	<0.001	-0.48(-0.54 – -0.41)	<0.001
Age [3rd degree]	-3.12(-3.29 – -2.94)	<0.001	-2.49(-2.69 – -2.29)	<0.001	-0.7(-0.90 – -0.50)	<0.001
Age [4th degree]	-1.9(-2.00 – -1.80)	<0.001	-1.53(-1.66 – -1.41)	<0.001	-0.83(-0.93 – -0.73)	<0.001
Sex						
Female	**Ref**	**Ref**	**Ref**	**Ref**	**Ref**	**Ref**
Male	-0.13(-0.15 – -0.11)	<0.001	-0.17(-0.20 – -0.15)	<0.001	0.02(-0.00 – 0.04)	0.07
Year since index test						
Year 1	**Ref**	**Ref**	**Ref**	**Ref**	**Ref**	**Ref**
Year 2	-0.14(-0.15 – -0.12)	<0.001	-0.29(-0.31 – -0.27)	<0.001	0.27(0.25 – 0.29)	<0.001
Year 3	-0.05(-0.06 – -0.03)	<0.001	-0.24(-0.26 – -0.22)	<0.001	0.39(0.37 – 0.41)	<0.001
Year 4	0.09(0.07 – 0.11)	<0.001	-0.15(-0.17 – -0.12)	<0.001	0.59(0.57 – 0.62)	<0.001
Year 5	0.12(0.05 – 0.19)	0.001	-0.17(-0.26 – -0.09)	<0.001	0.73(0.64 – 0.82)	<0.001
Adherence						
Low	**Ref**	**Ref**	**Ref**	**Ref**	**Ref**	**Ref**
Moderate	-1.24(-1.26 – -1.21)	<0.001	-0.91(-0.94 – -0.88)	<0.001	-0.05(-0.07 – -0.03)	<0.001
High	-2.2(-2.23 – -2.17)	<0.001	-1.22(-1.28 – -1.17)	<0.001	-0.43(-0.45 – -0.40)	<0.001

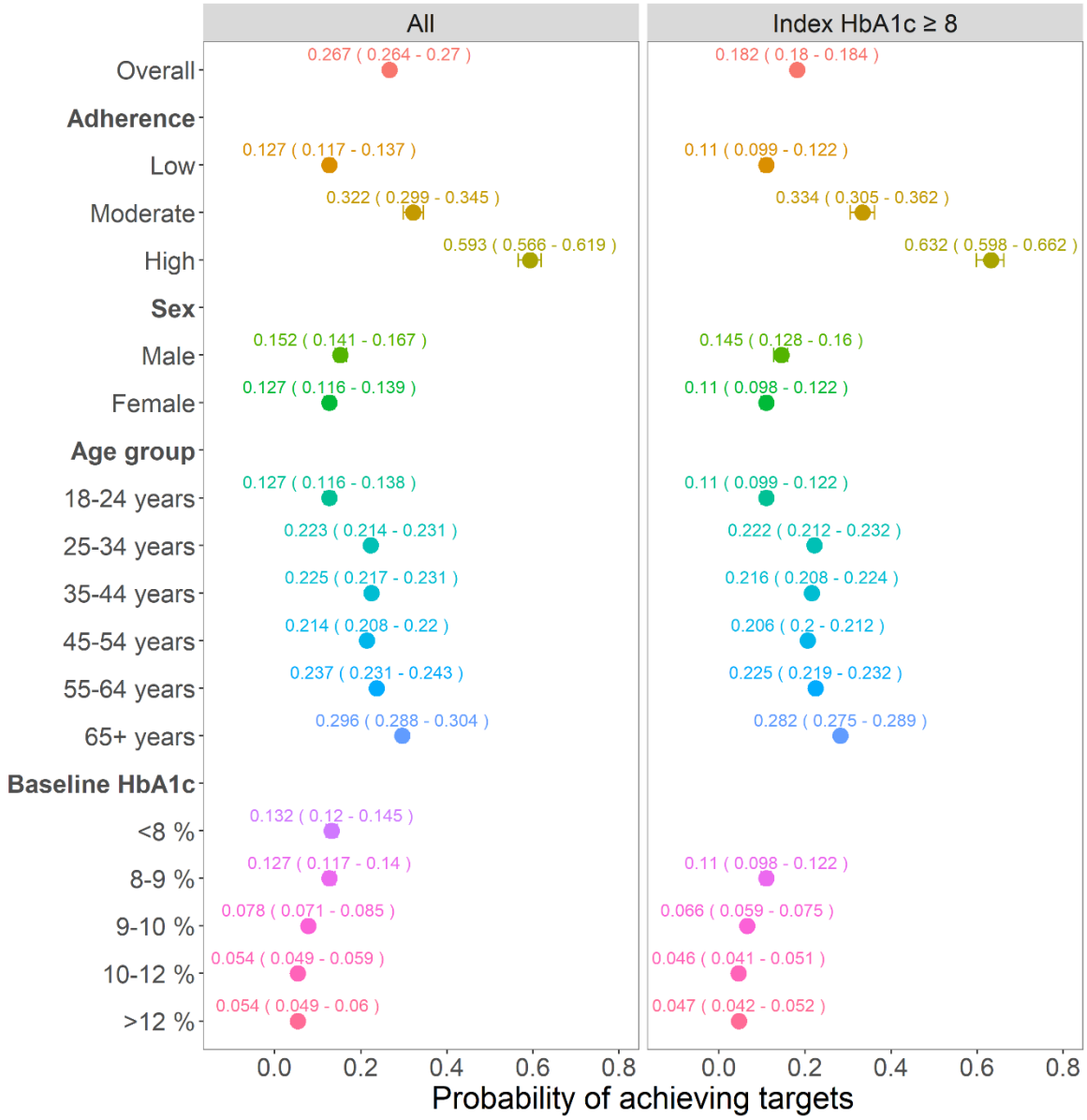

Figure S5 Estimated 1-year transition probabilities: The plot gives the probability of transitioning from HbA1c ≥8 to HbA1c <8 (95% CI) in one year overall and by each of the explanatory variables holding the values of other explanatory variables at their mean values

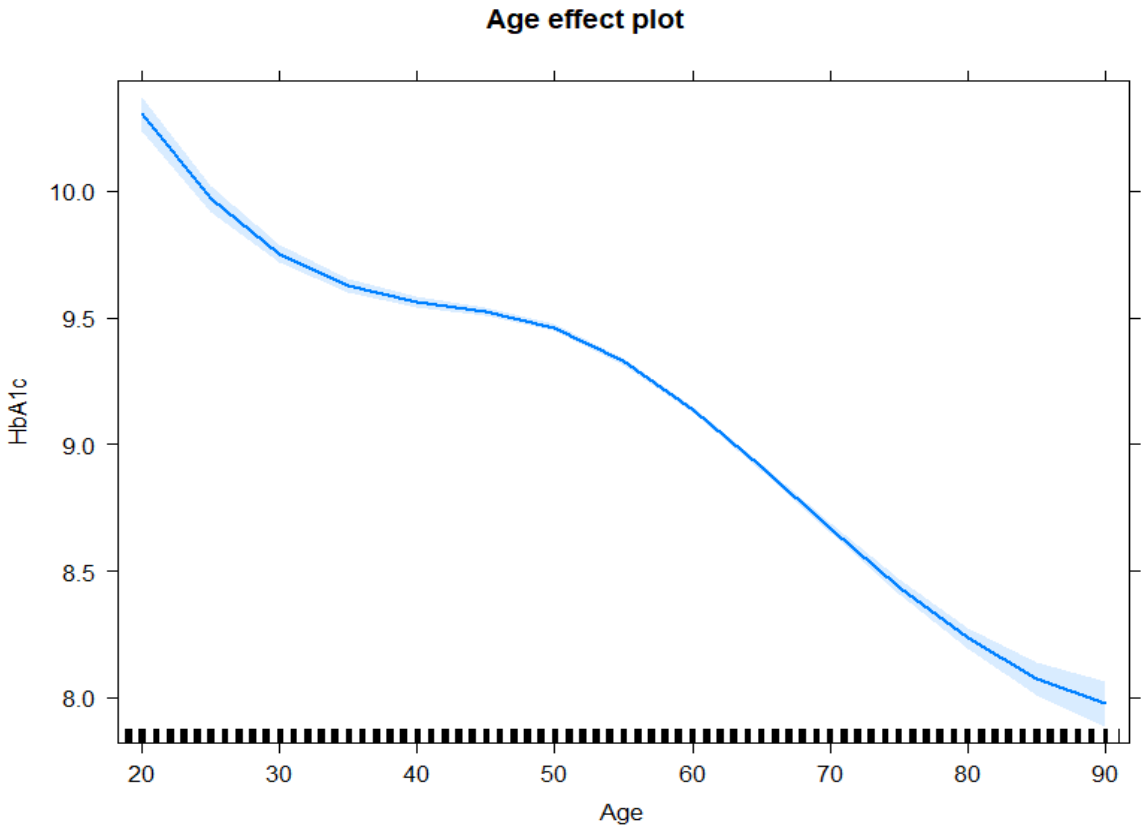

Figure S6 Age effect plot - Full cohort

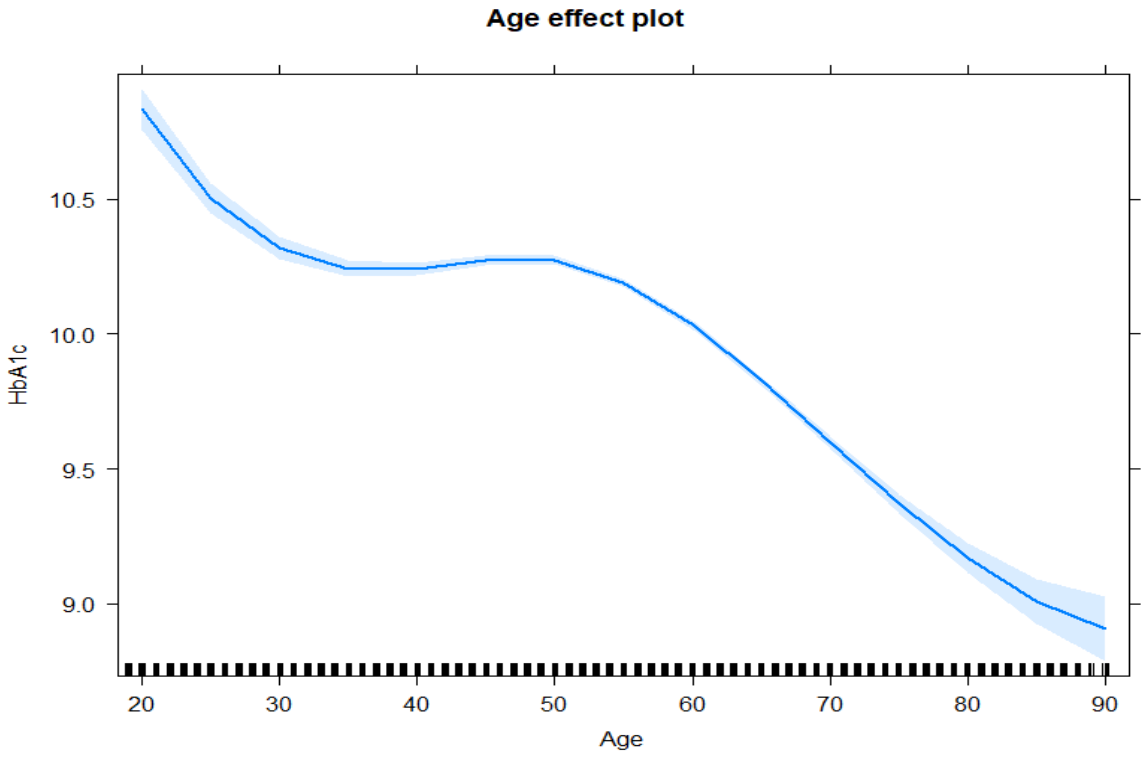

Figure S7 Age effect plot - Index HbA1c ≥ 8

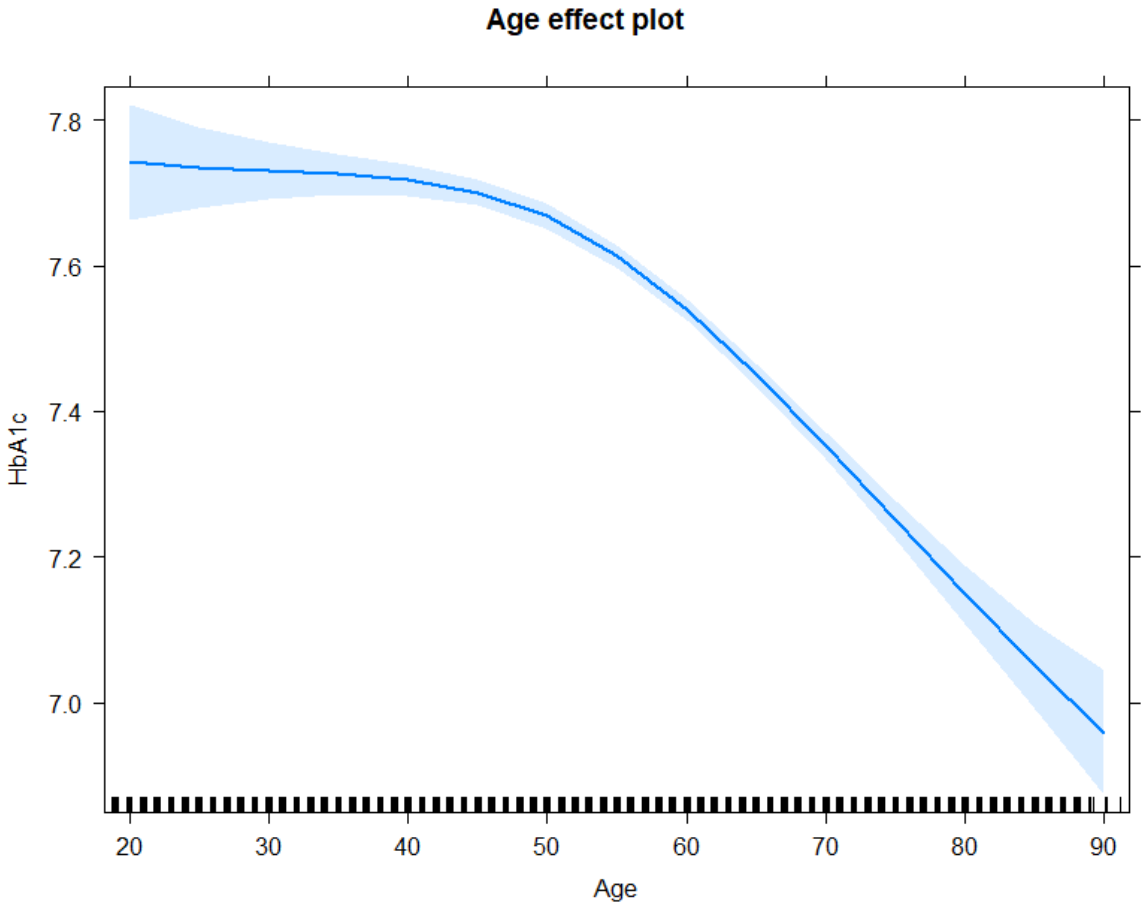

Figure S8 Age effect plot - Index HbA1c < 8

The RECORD statement – checklist of items, extended from the STROBE statement, that should be reported in observational studies using routinely collected health data.

	Item No.	STROBE items	Location in manuscript where items are reported	RECORD items	Location in manuscript where items are reported
Title and abstract					
	1	(a) Indicate the study's design with a commonly used term in the title or the abstract (b) Provide in the abstract an informative and balanced summary of what was done and what was found	Title	RECORD 1.1: The type of data used should be specified in the title or abstract. When possible, the name of the databases used should be included. RECORD 1.2: If applicable, the geographic region and timeframe within which the study took place should be reported in the title or abstract. RECORD 1.3: If linkage between databases was conducted for the study, this should be clearly stated in the title or abstract.	Page 3, Line 10 Page 3 Line 11 NA
Introduction					
Background rationale	2	Explain the scientific background and rationale for the investigation being reported	Page 5-6		
Objectives	3	State specific objectives, including any prespecified hypotheses	Page 6, Line 10 - 23		
Methods					
Study Design	4	Present key elements of study design early in the paper			
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	Page 7, Line		

Participants	6	*(a) Cohort study* - Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up *Case-control study* - Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls *Cross-sectional study* - Give the eligibility criteria, and the sources and methods of selection of participants *(b) Cohort study* - For matched studies, give matching criteria and number of exposed and unexposed *Case-control study* - For matched studies, give matching criteria and the number of controls per case	Page 8, Line 18	RECORD 6.1: The methods of study population selection (such as codes or algorithms used to identify subjects) should be listed in detail. If this is not possible, an explanation should be provided. RECORD 6.2: Any validation studies of the codes or algorithms used to select the population should be referenced. If validation was conducted for this study and not published elsewhere, detailed methods and results should be provided. RECORD 6.3: If the study involved linkage of databases, consider use of a flow diagram or other graphical display to demonstrate the data linkage process, including the number of individuals with linked data at each stage.	Page 8, Line 11 Figure 1
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable.	Page 8 - 10	RECORD 7.1: A complete list of codes and algorithms used to classify exposures, outcomes, confounders, and effect modifiers should be provided. If these cannot be reported, an explanation should be provided.	Page 8, line 2 - 9 Page 9
Data sources/ measurement	8	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	Page 8, line 2 - 9		

Bias	9	Describe any efforts to address potential sources of bias	Page 10, Line 20		
Study size	10	Explain how the study size was arrived at	Figure 1; Page 8 line 18		
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen, and why	Page 9		
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding (b) Describe any methods used to examine subgroups and interactions (c) Explain how missing data were addressed (d) *Cohort study* - If applicable, explain how loss to follow-up was addressed *Case-control study* - If applicable, explain how matching of cases and controls was addressed *Cross-sectional study* - If applicable, describe analytical methods taking account of sampling strategy (e) Describe any sensitivity analyses	Page 9		
Data access and cleaning methods		..		RECORD 12.1: Authors should describe the extent to which the investigators had access to the database population used to create the study population.	Page 8, Line 7

				RECORD 12.2: Authors should provide information on the data cleaning methods used in the study.	
Linkage		..		RECORD 12.3: State whether the study included person-level, institutional-level, or other data linkage across two or more databases. The methods of linkage and methods of linkage quality evaluation should be provided.	NA
Results					
Participants	13	(a) Report the numbers of individuals at each stage of the study (*e.g.*, numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed) (b) Give reasons for non-participation at each stage. (c) Consider use of a flow diagram	Figure 1	RECORD 13.1: Describe in detail the selection of the persons included in the study (*i.e.*, study population selection) including filtering based on data quality, data availability and linkage. The selection of included persons can be described in the text and/or by means of the study flow diagram.	Figure 1,
Descriptive data	14	(a) Give characteristics of study participants (*e.g.*, demographic, clinical, social) and information on exposures and potential confounders (b) Indicate the number of participants with missing data for each variable of interest (c) *Cohort study* - summarise follow-up time (*e.g.*, average and total amount)	Page 11 Line 3-12 Table 1		
Outcome data	15	*Cohort study* - Report numbers of outcome events or summary measures over time *Case-control study* - Report numbers in each exposure	Table 1		

		category, or summary measures of exposure *Cross-sectional study* - Report numbers of outcome events or summary measures			
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (e.g., 95% confidence interval). Make clear which confounders were adjusted for and why they were included (b) Report category boundaries when continuous variables were categorized (c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	Figure 2 Page 11, Line 14 - 21 Page 13 - 17 Figure 3, Table 2 and Table 3		
Other analyses	17	Report other analyses done—e.g., analyses of subgroups and interactions, and sensitivity analyses	Page 16, Line 11-16, Suppl mat page 5-10		
Discussion					
Key results	18	Summarise key results with reference to study objectives	Page 18, Line 3 - 12		
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	Page 20, line 1 - 20	RECORD 19.1: Discuss the implications of using data that were not created or collected to answer the specific research question(s). Include discussion of misclassification bias, unmeasured confounding, missing data, and changing eligibility over time, as they pertain to the study being reported.	Page 20, line 1 - 20
Interpretation	20	Give a cautious overall interpretation of results considering objectives,	Page 21, Line 5		

		limitations, multiplicity of analyses, results from similar studies, and other relevant evidence			
Generalisability	21	Discuss the generalisability (external validity) of the study results	Page 21, Line 9		
Other Information					
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	Page 22, line 11		
Accessibility of protocol, raw data, and programming code		.. Page 23		RECORD 22.1: Authors should provide information on how to access any supplemental information such as the study protocol, raw data, or programming code.	Page 23

*Reference: Benchimol EI, Smeeth L, Guttmann A, Harron K, Moher D, Petersen I, Sørensen HT, von Elm E, Langan SM, the RECORD Working Committee. The REporting of studies Conducted using Observational Routinely-collected health Data (RECORD) Statement. *PLoS Medicine* 2015; in press.