

Electronic Supplementary Materials: Rising Rates And Widening Socio-economic Disparities In Diabetic Ketoacidosis In Type 1 Diabetes In Scotland: A Nationwide Retrospective Cohort Observational Study

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ESM Statistical Techniques

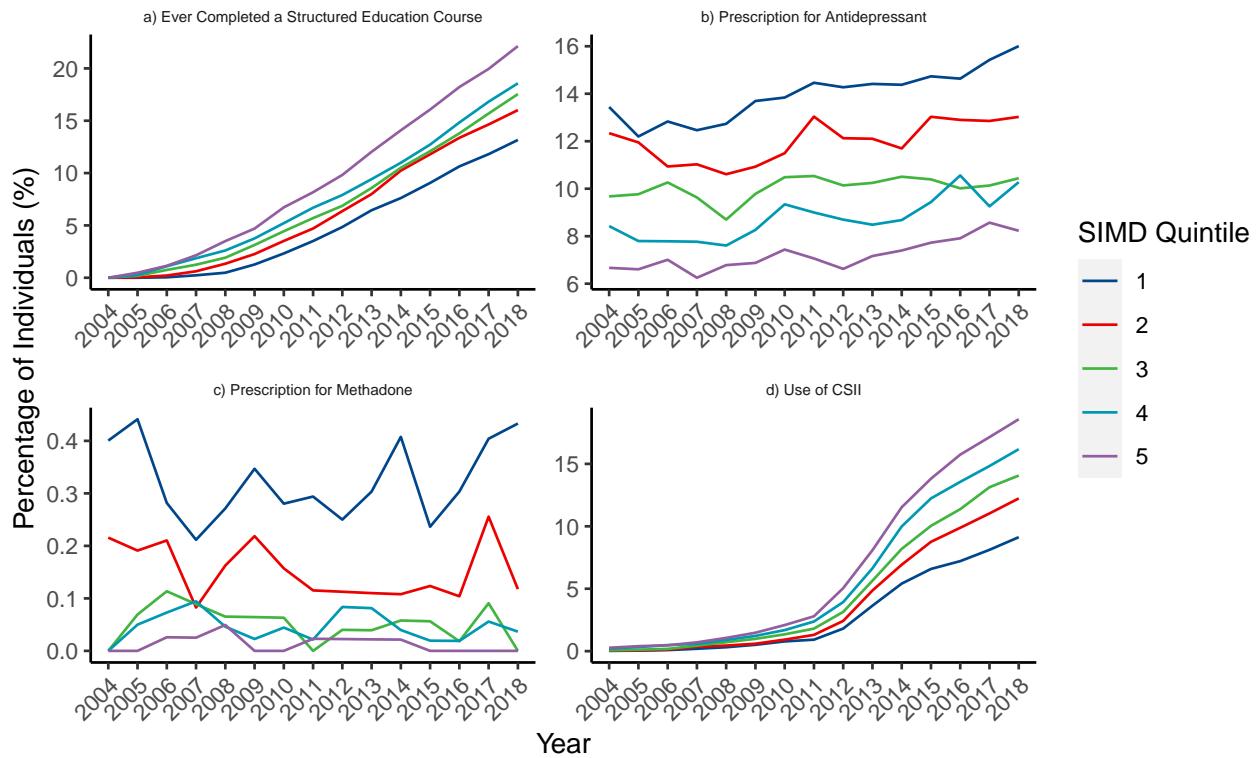
As DKA event counts are a non-negative integer valued outcome, we applied a Poisson likelihood function in the GLM framework with an offset equal to the log of the duration of observable person-time. To account for potential over dispersion of events caused by repeated measurement of the outcome we applied a hierarchical regression framework with individual subject specific random intercepts. All regression analyses were performed with the R package brms (1).

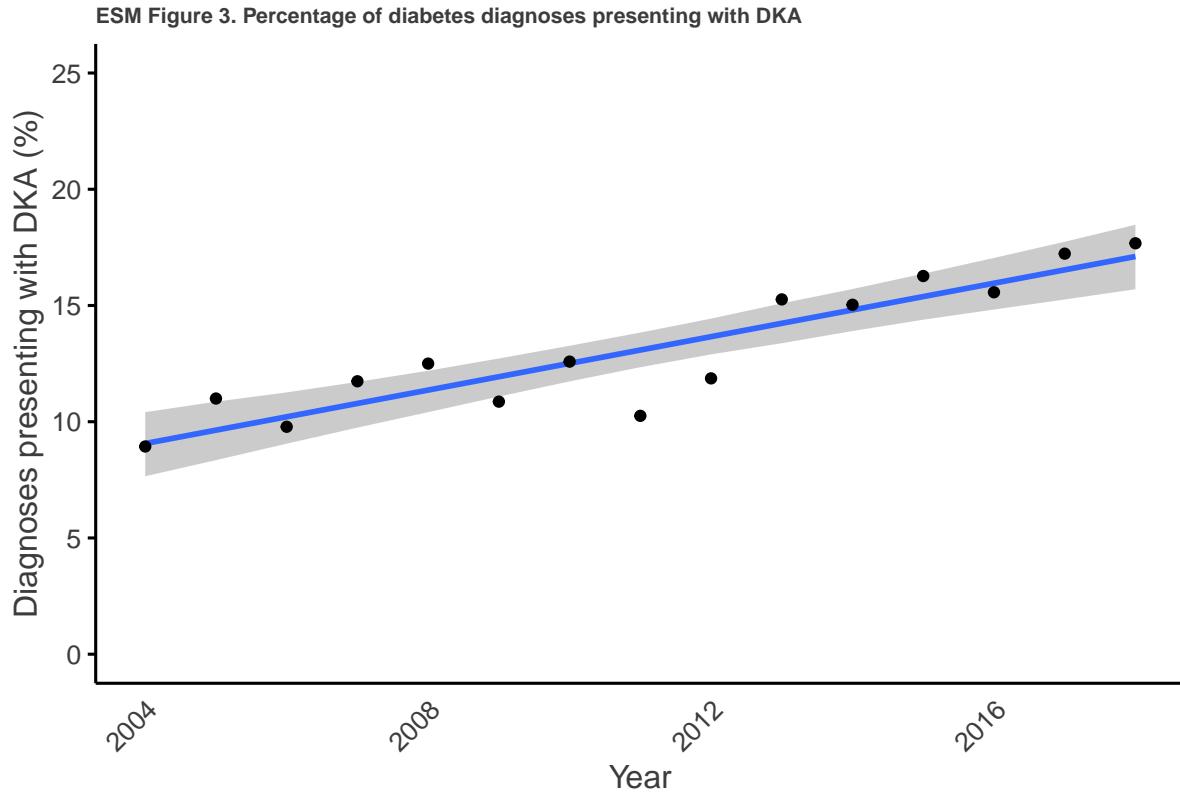
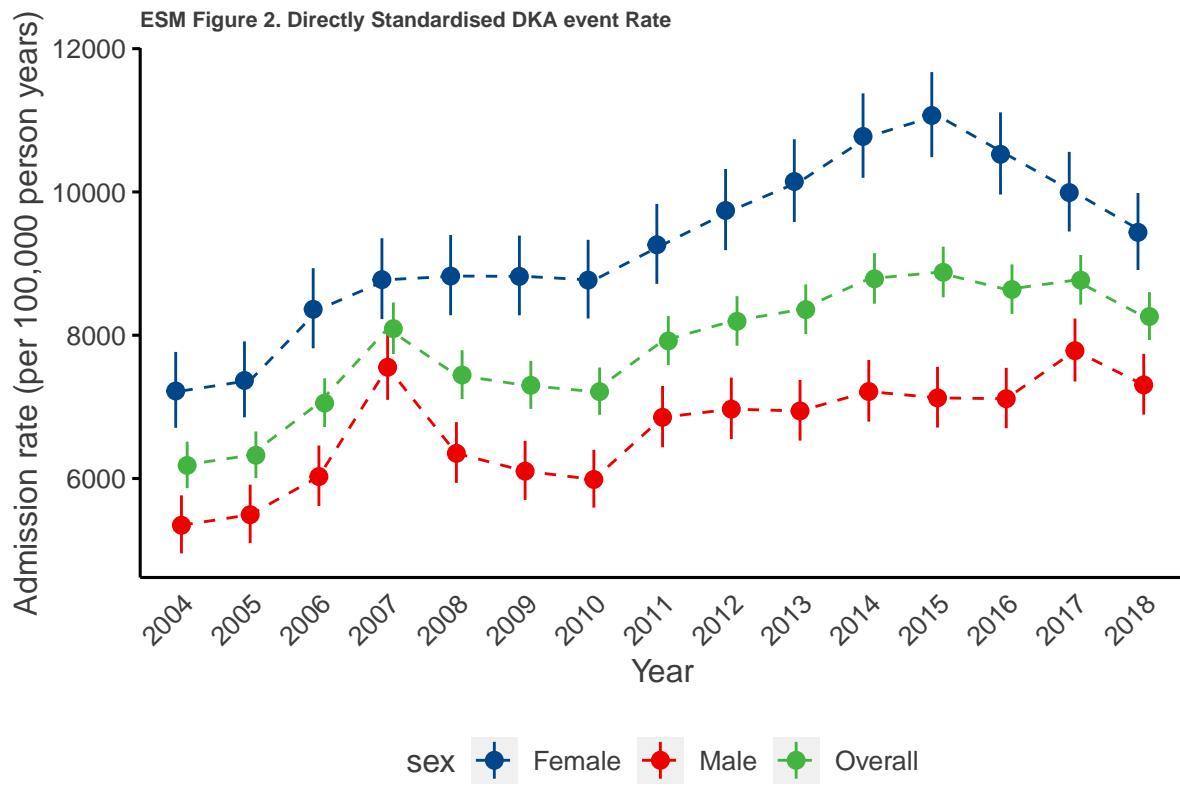
As crude DKA event rates varied non-linearly with age, when DKA event counts were the outcome variable we constructed the age covariate as age-bands consisting of ten year increments. When DKA case-fatality was the outcome we included a single linear term for age instead. Despite the total quantity of missing data being relatively small, a number of covariates had a ‘not completely at random’ distribution of missing data. This was particularly driven by missing data for biochemical tests in younger individuals. Accordingly, we employed multiple imputation, as implemented in the R package Amelia (2). Regression analyses were performed on each one of 5 imputed datasets, and posterior samples were combined across replicate analyses.

For Bayesian regression analyses a diffuse improper prior was assigned to all regression coefficients. Samples from the posterior distribution were obtained using Stan via the brms R package and were summarised as 95% credible intervals (CrI) and median posterior estimates. For each imputed dataset we used two independent chains of 2000 generations which were subsequently combined when assessing convergence. Convergence was accepted when all covariates possessed an r-hat close to 1.00 and no divergent transitions were reported. Individual chains were also visually inspected for stationarity. We calculated an equivalent to the classical p-value for each regression coefficient, assessed at an approximation of the maximum likelihood estimate. This was achieved by fitting a quadratic function to the sampled likelihood and obtaining an approximation of the maximum-likelihood estimate and standard error from this function.

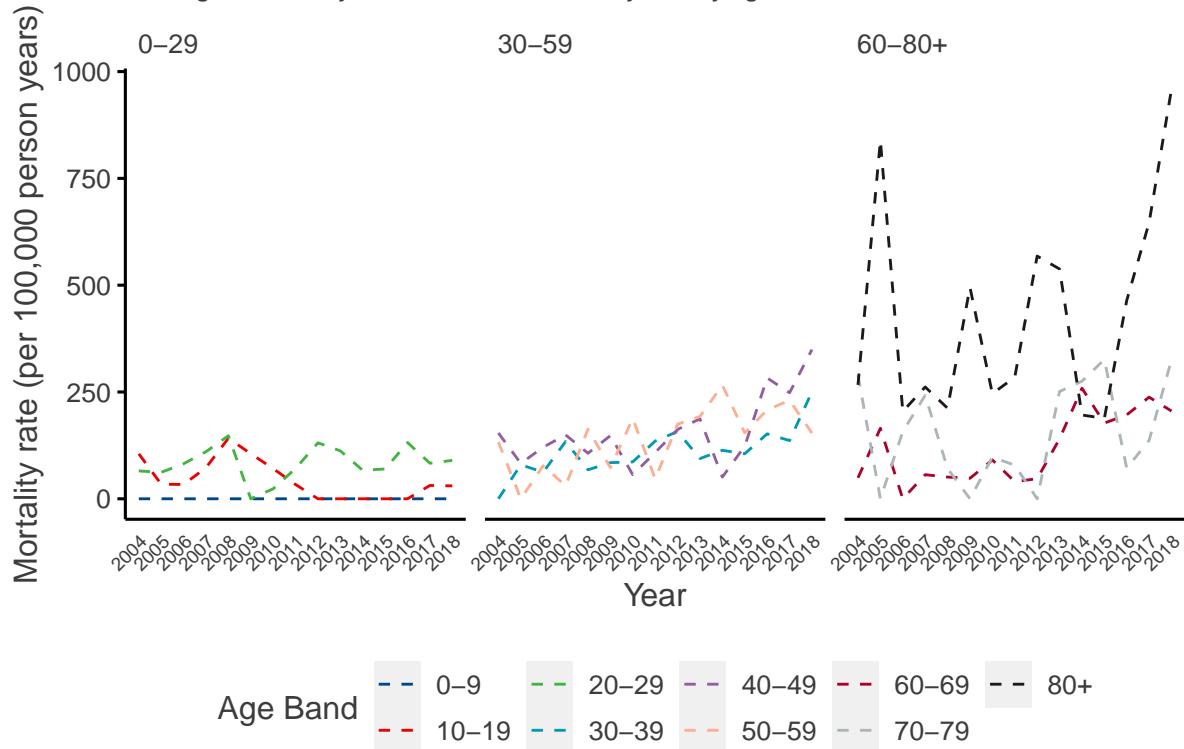
ESM Figures

ESM Figure 1. Distribution of risk factors over the study period, by SIMD quintile





ESM Figure 4. Directly Standardised DKA Mortality Rate By Age Band



ESM table 1. Cohort Characteristics At Time Of Entry To Study. SD = Standard Deviation

	No DKA (SD)	1 DKA (SD)	2 DKA (SD)	> 2 DKA (SD)				
N	27523.00	-	5722.00	-	1750.00	-	2916.00	-
Mean age at cohort entry	37.35 (19.16)	29.56 (18.77)	28.89 (18.55)	26.37 (16.14)				
Mean age at diagnosis of type 1 diabetes	24.72 (16.98)	21.11 (15.64)	19.51 (14.36)	18.01 (12.91)				
Male (%)	57.22	-	54.32	-	51.20	-	47.94	-
Mean diabetes duration at cohort entry	12.66 (12.75)	8.50 (11.38)	9.41 (11.50)	8.39 (10.15)				
Mean HbA1c (mmol/mol)	72.23 (19.30)	77.28 (21.46)	80.67 (21.25)	84.49 (22.79)				
Prescription for methadone (%)	0.07	-	0.16	-	0.46	-	0.55	-
Prescription for any antidepressant medication (%)	8.66	-	8.74	-	10.46	-	12.14	-
Percentage of individuals in SIMD 1 (%)	16.80	-	22.67	-	28.97	-	35.15	-
Percentage of individuals in SIMD 2 (%)	19.14	-	21.71	-	22.46	-	22.36	-
Percentage of individuals in SIMD 3 (%)	19.33	-	17.21	-	15.14	-	14.88	-
Percentage of individuals in SIMD 4 (%)	18.46	-	16.59	-	14.06	-	9.50	-
Percentage of individuals in SIMD 5 (%)	17.84	-	14.37	-	10.06	-	6.62	-

ESM table 2. Age-Band Stratified DKA Event IRR Estimates Obtained With Multivariable Poisson Regression

Covariate	IRR	Q2.5	Q97.5	Approx. p-value	Age Band
Year	1.044	1.039	1.050	<0.001	0-29
Age 1-10	Ref.	-	-	-	0-29
Age 11-19	1.087	0.994	1.189	0.049	0-29
Age 20-29	0.817	0.738	0.905	<0.001	0-29
Median HbA1c <7.5 %, <58 (mmol/mol)	Ref.	-	-	-	0-29
Median HbA1c 7.5-9.0 %, 58-75 (mmol/mol)	1.628	1.476	1.797	<0.001	0-29
Median HbA1c 9.1-10.0 %, 76-86 (mmol/mol)	3.227	2.929	3.570	<0.001	0-29
Median HbA1c >10.0 %, >86 (mmol/mol)	6.458	5.867	7.103	<0.001	0-29
Diabetes duration	0.966	0.961	0.971	<0.001	0-29
Male	0.766	0.720	0.815	<0.001	0-29
Female	Ref.	-	-	-	0-29
SIMD Quintile 1 (most deprived)	Ref.	-	-	-	0-29
SIMD Quintile 2	0.732	0.661	0.830	<0.001	0-29
SIMD Quintile 3	0.622	0.564	0.694	<0.001	0-29
SIMD Quintile 4	0.506	0.454	0.558	<0.001	0-29
SIMD Quintile 5 (least deprived)	0.463	0.413	0.519	<0.001	0-29
Current CSII therapy	0.741	0.672	0.817	<0.001	0-29
Current methadone prescription	1.586	1.154	2.145	0.009	0-29
Current antidepressant prescription	1.502	1.436	1.573	<0.001	0-29
Completed a structured education course	0.968	0.884	1.059	0.490	0-29
Year	1.066	1.060	1.072	<0.001	30-59
Age 30-39	Ref.	-	-	-	30-59
Age 40-49	0.890	0.839	0.945	<0.001	30-59
Age 50-59	0.896	0.828	0.972	0.006	30-59
Median HbA1c <7.5 %, <58 (mmol/mol)	Ref.	-	-	-	30-59
Median HbA1c 7.5-9.0 %, 58-75 (mmol/mol)	1.512	1.370	1.676	<0.001	30-59
Median HbA1c 9.1-10.0 %, 76-86 (mmol/mol)	2.539	2.295	2.811	<0.001	30-59
Median HbA1c >10.0 %, >86 (mmol/mol)	3.673	3.302	4.088	<0.001	30-59
Diabetes duration	0.974	0.970	0.977	<0.001	30-59
Male	0.821	0.760	0.887	<0.001	30-59
Female	Ref.	-	-	-	30-59
SIMD Quintile 1 (most deprived)	Ref.	-	-	-	30-59
SIMD Quintile 2	0.728	0.661	0.803	<0.001	30-59
SIMD Quintile 3	0.539	0.482	0.612	<0.001	30-59
SIMD Quintile 4	0.453	0.392	0.513	<0.001	30-59
SIMD Quintile 5 (least deprived)	0.359	0.312	0.415	<0.001	30-59
Current CSII therapy	1.072	0.915	1.248	0.405	30-59
Current methadone prescription	1.437	1.162	1.770	0.002	30-59
Current antidepressant prescription	1.497	1.424	1.572	<0.001	30-59
Completed a structured education course	0.712	0.636	0.794	<0.001	30-59
Year	1.096	1.081	1.110	<0.001	60+
Age 60-69	Ref.	-	-	-	60+
Age 70-79	1.482	1.317	1.678	<0.001	60+
Age 80+	2.417	2.017	2.893	<0.001	60+
Median HbA1c <7.5 %, <58 (mmol/mol)	Ref.	-	-	-	60+
Median HbA1c 7.5-9.0 %, 58-75 (mmol/mol)	1.601	1.369	1.884	<0.001	60+
Median HbA1c 9.1-10.0 %, 76-86 (mmol/mol)	2.737	2.295	3.257	<0.001	60+
Median HbA1c >10.0 %, >86 (mmol/mol)	4.493	3.765	5.394	<0.001	60+
Diabetes duration	1.008	1.003	1.013	0.001	60+
Male	0.824	0.710	0.954	0.014	60+
Female	Ref.	-	-	-	60+
SIMD Quintile 1 (most deprived)	Ref.	-	-	-	60+
SIMD Quintile 2	0.943	0.715	1.200	0.497	60+
SIMD Quintile 3	0.662	0.539	0.811	<0.001	60+
SIMD Quintile 4	0.726	0.580	0.903	0.002	60+
SIMD Quintile 5 (least deprived)	0.718	0.569	0.907	0.004	60+
Current CSII therapy	1.574	1.026	2.412	0.043	60+
Current methadone prescription	3.572	0.097	56.836	0.807	60+
Current antidepressant prescription	1.832	1.631	2.052	<0.001	60+
Completed a structured education course	0.571	0.418	0.778	<0.001	60+

ESM table 3. Recurrent DKA IRR Estimates Obtained With Multivariable Logistic Regression

Covariate	IRR	Q2.5	Q97.5	Approx. p-value
Year	1.037	1.030	1.044	<0.001
Age 1-10	Ref.	-	-	-
Age 11-19	3.924	2.840	5.569	<0.001
Age 20-29	2.696	1.954	3.829	<0.001
Age 30-39	1.585	1.135	2.259	0.004
Age 40-49	0.987	0.705	1.419	0.933
Age 50-59	1.054	0.755	1.502	0.664
Age 60-69	0.982	0.684	1.433	0.963
Age 70-79	1.546	1.063	2.290	0.017
Age 80+	2.124	1.395	3.303	0.001
Median HbA1c <7.5 %, <58 (mmol/mol)	Ref.	-	-	-
Median HbA1c 7.5-9.0 %, 58-75 (mmol/mol)	2.268	1.872	2.766	<0.001
Median HbA1c 9.1-10.0 %, 76-86 (mmol/mol)	5.821	4.860	7.055	<0.001
Median HbA1c >10.0 %, >86 (mmol/mol)	16.361	13.610	19.734	<0.001
Diabetes duration	0.994	0.991	0.997	<0.001
Male	0.742	0.700	0.785	<0.001
Female	Ref.	-	-	-
SIMD Quintile 1 (most deprived)	Ref.	-	-	-
SIMD Quintile 2	0.686	0.634	0.743	<0.001
SIMD Quintile 3	0.556	0.511	0.604	<0.001
SIMD Quintile 4	0.398	0.360	0.440	<0.001
SIMD Quintile 5 (least deprived)	0.323	0.283	0.368	<0.001
Current CSII therapy	0.796	0.660	0.954	0.017
Current methadone prescription	3.346	2.472	4.444	<0.001
Current antidepressant prescription	2.250	2.103	2.406	<0.001
Completed a structured education course	0.735	0.640	0.838	<0.001

ESM table 4. Case-Fatality Odds-Ratio Estimates Obtained With Multivariable Logistic Regression

Covariate	OR	Q2.5	Q97.5	Approx. p-value
Year	1.026	1.003	1.050	0.018
Age	1.045	1.038	1.051	<0.001
Median HbA1c <7.5 %, <58 (mmol/mol)	Ref.	-	-	-
Median HbA1c 7.5-9.0 %, 58-75 (mmol/mol)	0.609	0.417	0.906	0.012
Median HbA1c 9.1-10.0 %, 76-86 (mmol/mol)	0.657	0.445	0.997	0.047
Median HbA1c >10.0 %, >86 (mmol/mol)	0.717	0.498	1.081	0.106
Diabetes duration	1.009	1.002	1.017	0.016
Male	2.322	1.915	2.816	<0.001
Female	Ref.	-	-	-
SIMD Quintile 1 (most deprived)	Ref.	-	-	-
SIMD Quintile 2	0.851	0.668	1.091	0.226
SIMD Quintile 3	0.606	0.438	0.830	0.001
SIMD Quintile 4	0.906	0.672	1.215	0.471
SIMD Quintile 5 (least deprived)	0.677	0.465	0.971	0.031
Current CSII therapy	0.533	0.204	1.179	0.095
Current methadone prescription	5.676	3.359	9.241	<0.001
Current antidepressant prescription	1.996	1.640	2.429	<0.001
Completed a structured education course	0.765	0.442	1.264	0.226

ESM table 5. Age-Band Stratified Case-Fatality Odds-Ratio Estimates Obtained With Multivariable Logistic Regression

Covariate	OR	Q2.5	Q97.5	Approx. p-value	Age Band
Year	0.966	0.912	1.024	0.255	0-29
Age	1.112	1.051	1.175	<0.001	0-29
Median HbA1c <7.5 %, <58 (mmol/mol)	0.544	0.024	4.794	0.979	0-29
Median HbA1c 7.5-9.0 %, 58-75 (mmol/mol)	0.790	0.308	1.694	0.335	0-29
Median HbA1c 9.1-10.0 %, 76-86 (mmol/mol)	0.771	0.337	1.573	0.311	0-29
Median HbA1c >10.0 %, >86 (mmol/mol)	Ref.	-	-	-	0-29
Diabetes duration	1.028	0.990	1.069	0.157	0-29
Male	1.941	1.187	3.231	0.006	0-29
Female	Ref.	-	-	-	0-29
SIMD Quintile 1 (most deprived)	Ref.	-	-	-	0-29
SIMD Quintile 2	1.077	0.586	1.953	0.781	0-29
SIMD Quintile 3	0.729	0.321	1.513	0.316	0-29
SIMD Quintile 4	0.851	0.333	1.910	0.480	0-29
SIMD Quintile 5 (least deprived)	0.598	0.139	1.816	0.199	0-29
Current methadone prescription	6.959	1.977	20.142	0.005	0-29
Current antidepressant prescription	0.813	0.447	1.420	0.430	0-29
Completed a structured education course	0.159	0.007	1.040	0.071	0-29
Year	1.045	1.015	1.076	0.002	30-59
Age	1.045	1.029	1.061	<0.001	30-59
Median HbA1c <7.5 %, <58 (mmol/mol)	1.223	0.650	2.191	0.632	30-59
Median HbA1c 7.5-9.0 %, 58-75 (mmol/mol)	0.766	0.534	1.076	0.102	30-59
Median HbA1c 9.1-10.0 %, 76-86 (mmol/mol)	0.862	0.582	1.222	0.298	30-59
Median HbA1c >10.0 %, >86 (mmol/mol)	Ref.	-	-	-	30-59
Diabetes duration	1.011	1.000	1.022	0.059	30-59
Male	3.125	2.376	4.119	<0.001	30-59
Female	Ref.	-	-	-	30-59
SIMD Quintile 1 (most deprived)	Ref.	-	-	-	30-59
SIMD Quintile 2	0.775	0.569	1.043	0.124	30-59
SIMD Quintile 3	0.625	0.407	0.916	0.011	30-59
SIMD Quintile 4	0.930	0.635	1.334	0.589	30-59
SIMD Quintile 5 (least deprived)	0.616	0.344	1.054	0.047	30-59
Current CSII therapy	0.547	0.158	1.460	0.130	30-59
Current methadone prescription	3.987	2.174	6.986	<0.001	30-59
Current antidepressant prescription	1.966	1.552	2.491	<0.001	30-59
Completed a structured education course	0.828	0.436	1.484	0.363	30-59
Year	1.034	0.984	1.088	0.159	60+
Age	1.037	1.009	1.065	0.009	60+
Median HbA1c <7.5 %, <58 (mmol/mol)	2.087	0.927	4.313	0.076	60+
Median HbA1c 7.5-9.0 %, 58-75 (mmol/mol)	1.098	0.640	1.916	0.640	60+
Median HbA1c 9.1-10.0 %, 76-86 (mmol/mol)	0.974	0.470	1.951	0.868	60+
Median HbA1c >10.0 %, >86 (mmol/mol)	Ref.	-	-	-	60+
Diabetes duration	1.008	0.995	1.021	0.226	60+
Male	1.063	0.700	1.600	0.810	60+
Female	Ref.	-	-	-	60+
SIMD Quintile 1 (most deprived)	Ref.	-	-	-	60+
SIMD Quintile 2	1.050	0.587	1.897	0.896	60+
SIMD Quintile 3	0.561	0.260	1.154	0.089	60+
SIMD Quintile 4	0.985	0.510	1.913	0.846	60+
SIMD Quintile 5 (least deprived)	1.012	0.525	1.929	0.983	60+
Current CSII therapy	0.702	0.102	3.003	0.398	60+
Current antidepressant prescription	2.594	1.714	3.921	<0.001	60+
Completed a structured education course	0.761	0.174	2.483	0.431	60+

¹ HbA1c reference category is >86 due to the low number of events in the <58 category for certain age bands

² CSII not included in 0-29 analysis due to low prevalence of events

³ Methadone prescription not included in 60+ analysis due to low prevalence of events

ESM Table 6. Minimally adjusted association of social deprivation with each DKA outcome

Covariate	exp(B)	Q2.5	Q97.5	Approx. p-value	Outcome
SIMD Quintile 1 (most deprived)	Ref.	-	-	-	Any DKA Event
SIMD Quintile 2	0.703	0.649	0.762	<0.001	Any DKA Event
SIMD Quintile 3	0.525	0.489	0.563	<0.001	Any DKA Event
SIMD Quintile 4	0.430	0.398	0.463	<0.001	Any DKA Event
SIMD Quintile 5 (least deprived)	0.350	0.314	0.386	<0.001	Any DKA Event
SIMD Quintile 1 (most deprived)	Ref.	-	-	-	DKA Case-Fatality
SIMD Quintile 2	0.836	0.674	1.036	0.140	DKA Case-Fatality
SIMD Quintile 3	0.596	0.440	0.804	<0.001	DKA Case-Fatality
SIMD Quintile 4	0.853	0.655	1.120	0.261	DKA Case-Fatality
SIMD Quintile 5 (least deprived)	0.611	0.406	0.886	0.008	DKA Case-Fatality
SIMD Quintile 1 (most deprived)	Ref.	-	-	-	Recurrent DKA
SIMD Quintile 2	0.583	0.543	0.625	<0.001	Recurrent DKA
SIMD Quintile 3	0.426	0.394	0.461	<0.001	Recurrent DKA
SIMD Quintile 4	0.275	0.248	0.302	<0.001	Recurrent DKA
SIMD Quintile 5 (least deprived)	0.190	0.168	0.216	<0.001	Recurrent DKA

ESM table 7. Age-Band Stratified Recurrent DKA IRR Estimates Obtained With Multivariable Logistic Regression

Covariate	IRR	Q2.5	Q97.5	Approx. p-value	Age Band
Year	1.014	1.005	1.023	0.003	0-29
Age 1-10	Ref.	-	-	-	0-29
Age 11-19	3.550	2.564	4.994	<0.001	0-29
Age 20-29	2.438	1.755	3.457	<0.001	0-29
Median HbA1c <7.5 %, <58 (mmol/mol)	Ref.	-	-	-	0-29
Median HbA1c 7.5-9.0 %, 58-75 (mmol/mol)	3.018	2.090	4.469	<0.001	0-29
Median HbA1c 9.1-10.0 %, 76-86 (mmol/mol)	8.739	6.245	12.703	<0.001	0-29
Median HbA1c >10.0 %, >86 (mmol/mol)	29.522	21.061	42.769	<0.001	0-29
Diabetes duration	0.993	0.986	1.000	0.041	0-29
Male	0.716	0.666	0.771	<0.001	0-29
Female	Ref.	-	-	-	0-29
SIMD Quintile 1 (most deprived)	Ref.	-	-	-	0-29
SIMD Quintile 2	0.639	0.576	0.708	<0.001	0-29
SIMD Quintile 3	0.532	0.474	0.597	<0.001	0-29
SIMD Quintile 4	0.366	0.319	0.420	<0.001	0-29
SIMD Quintile 5 (least deprived)	0.306	0.257	0.362	<0.001	0-29
Current CSII therapy	0.736	0.579	0.925	0.006	0-29
Current methadone prescription	2.719	1.629	4.297	<0.001	0-29
Current antidepressant prescription	2.342	2.135	2.564	<0.001	0-29
Completed a structured education course	0.903	0.754	1.068	0.221	0-29
Year	1.062	1.050	1.074	<0.001	30-59
Age 30-39	Ref.	-	-	-	30-59
Age 40-49	0.646	0.576	0.723	<0.001	30-59
Age 50-59	0.702	0.617	0.798	<0.001	30-59
Median HbA1c <7.5 %, <58 (mmol/mol)	Ref.	-	-	-	30-59
Median HbA1c 7.5-9.0 %, 58-75 (mmol/mol)	2.008	1.536	2.637	<0.001	30-59
Median HbA1c 9.1-10.0 %, 76-86 (mmol/mol)	4.950	3.805	6.466	<0.001	30-59
Median HbA1c >10.0 %, >86 (mmol/mol)	11.064	8.577	14.438	<0.001	30-59
Diabetes duration	0.982	0.977	0.987	<0.001	30-59
Male	0.755	0.684	0.833	<0.001	30-59
Female	Ref.	-	-	-	30-59
SIMD Quintile 1 (most deprived)	Ref.	-	-	-	30-59
SIMD Quintile 2	0.735	0.647	0.838	<0.001	30-59
SIMD Quintile 3	0.574	0.495	0.665	<0.001	30-59
SIMD Quintile 4	0.372	0.304	0.448	<0.001	30-59
SIMD Quintile 5 (least deprived)	0.291	0.231	0.364	<0.001	30-59
Current CSII therapy	1.245	0.898	1.687	0.246	30-59
Current methadone prescription	3.401	2.303	4.886	<0.001	30-59
Current antidepressant prescription	2.143	1.925	2.384	<0.001	30-59
Completed a structured education course	0.557	0.448	0.690	<0.001	30-59
Year	1.092	1.064	1.120	<0.001	60+
Age 60-69	Ref.	-	-	-	60+
Age 70-79	1.512	1.208	1.892	0.001	60+
Age 80+	2.068	1.542	2.734	<0.001	60+
Median HbA1c <7.5 %, <58 (mmol/mol)	Ref.	-	-	-	60+
Median HbA1c 7.5-9.0 %, 58-75 (mmol/mol)	2.271	1.527	3.506	<0.001	60+
Median HbA1c 9.1-10.0 %, 76-86 (mmol/mol)	5.131	3.386	8.040	<0.001	60+
Median HbA1c >10.0 %, >86 (mmol/mol)	9.630	6.452	14.913	<0.001	60+
Diabetes duration	1.011	1.004	1.018	0.002	60+
Male	0.774	0.628	0.950	0.017	60+
Female	Ref.	-	-	-	60+
SIMD Quintile 1 (most deprived)	Ref.	-	-	-	60+
SIMD Quintile 2	0.979	0.707	1.352	0.927	60+
SIMD Quintile 3	0.776	0.562	1.065	0.103	60+
SIMD Quintile 4	0.878	0.636	1.216	0.406	60+
SIMD Quintile 5 (least deprived)	0.660	0.457	0.943	0.016	60+
Current CSII therapy	1.074	0.375	2.524	0.765	60+
Current antidepressant prescription	2.171	1.707	2.749	<0.001	60+
Completed a structured education course	0.368	0.167	0.712	0.003	60+

¹ Methadone prescription not included in 60+ analysis due to low prevalence of events

ESM table 8. DKA Event (excluding events at time of diagnosis) IRR Estimates Obtained With Multivariable Poisson Regression

Covariate	IRR	Q2.5	Q97.5	Approx. p-value
Year	1.050	1.046	1.054	<0.001
Age 1-10	Ref.	-	-	-
Age 11-19	1.950	1.729	2.201	<0.001
Age 20-29	1.257	1.110	1.424	<0.001
Age 30-39	0.751	0.658	0.857	<0.001
Age 40-49	0.603	0.526	0.692	<0.001
Age 50-59	0.552	0.479	0.641	<0.001
Age 60-69	0.558	0.478	0.651	<0.001
Age 70-79	0.826	0.698	0.978	0.036
Age 80+	1.381	1.129	1.686	0.002
Median HbA1c <7.5 %, <58 (mmol/mol)	Ref.	-	-	-
Median HbA1c 7.5-9.0 %, 58-75 (mmol/mol)	1.725	1.609	1.848	<0.001
Median HbA1c 9.1-10.0 %, 76-86 (mmol/mol)	3.138	2.918	3.375	<0.001
Median HbA1c >10.0 %, >86 (mmol/mol)	5.419	5.025	5.832	<0.001
Diabetes duration	0.996	0.994	0.999	0.004
Male	0.803	0.763	0.846	<0.001
Female	Ref.	-	-	-
SIMD Quintile 1 (most deprived)	Ref.	-	-	-
SIMD Quintile 2	0.741	0.688	0.802	<0.001
SIMD Quintile 3	0.572	0.533	0.613	<0.001
SIMD Quintile 4	0.481	0.445	0.518	<0.001
SIMD Quintile 5 (least deprived)	0.414	0.375	0.456	<0.001
Current CSII therapy	0.915	0.842	0.994	0.033
Current methadone prescription	1.449	1.219	1.715	<0.001
Current antidepressant prescription	1.476	1.429	1.524	<0.001
Completed a structured education course	0.890	0.831	0.951	0.001

ESM table 9. Case-Fatality (with DKA as underlying cause) Odds-Ratio Estimates Obtained With Multivariable Logistic Regression

Covariate	OR	Q2.5	Q97.5	Approx. p-value
Year	1.030	1.005	1.055	0.017
Age	1.043	1.036	1.050	<0.001
Median HbA1c <7.5 %, <58 (mmol/mol)	Ref.	-	-	-
Median HbA1c 7.5-9.0 %, 58-75 (mmol/mol)	0.676	0.443	1.076	0.129
Median HbA1c 9.1-10.0 %, 76-86 (mmol/mol)	0.703	0.448	1.165	0.224
Median HbA1c >10.0 %, >86 (mmol/mol)	0.807	0.541	1.272	0.420
Diabetes duration	1.008	0.999	1.016	0.073
Male	2.313	1.877	2.860	<0.001
Female	Ref.	-	-	-
SIMD Quintile 1 (most deprived)	Ref.	-	-	-
SIMD Quintile 2	0.883	0.681	1.139	0.377
SIMD Quintile 3	0.587	0.406	0.829	0.003
SIMD Quintile 4	0.885	0.634	1.218	0.399
SIMD Quintile 5 (least deprived)	0.704	0.469	1.040	0.079
Current CSII therapy	0.598	0.236	1.307	0.153
Current methadone prescription	5.196	2.913	8.730	<0.001
Current antidepressant prescription	2.001	1.625	2.459	<0.001
Completed a structured education course	0.856	0.488	1.421	0.432

ESM Figure Captions

- ESM Figure 1 - Distribution of DKA risk factors over the study period, calculated within the population of people with type 1 diabetes residing in each quintile of social deprivation. a) Ever completed a structured education course, b) Prescription for an antidepressant in a given year, c) Prescription for methadone in a given year, d) use of CSII in a given year.
- ESM Figure 2 - Directly standardised diabetic ketoacidosis (DKA) event rate over the study period, separated by sex and also calculated for both males and females jointly. Vertical lines represent 95% confidence intervals for the standardised rate. The rate of DKA events for females always exceeded that of males, and all rates experienced an upward trend over the study period.
- ESM Figure 3 - The percentage of diagnoses of type 1 diabetes that occurred with a concurrent diabetic ketoacidosis (DKA) hospital admission. The solid line represents the modelled trend over the study period, and the shaded area represents the 95% credibility interval (95% CrI) for this trend. The modelled trend suggests a well-defined increase in the rate at which individuals are diagnosed with type 1 diabetes during a concurrent DKA hospital admission.
- ESM Figure 4 - Directly standardised diabetic ketoacidosis (DKA) mortality rate over the study period, separated in to 10 year age bands.

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