

Supplementary table 1 Definitions of diseases in Hong Kong cohort

	ICPC-2	ICD-9-CM	Others
Type 2 diabetes mellitus	T90	250.x0, 250.x2	Use of anti-diabetic drugs
Cardiovascular disease	K74 - K76, K89 - K91, K89 - K91	410.x - 414.x, 428.x, 430.x - 438.x	NA
Coronary heart disease	K74 - K76	410.x - 414.x	NA
Stroke	K89 - K91	430.x - 438.x	NA
Heart failure	K77	428.x	NA
Obesity	T82	278.00, 278.01	NA
Hyperlipidaemia	T93	272.x	Use of lipid-lowering agents
Hypertension	K86, K87	401.x - 405.x	Use of anti-hypertensive drugs
Atrial fibrillation	K78	427.31	NA
Peripheral vascular disease	K92	250.6x, 440.2x, 997.2x, 997.6x	NA
Amputation	L81	997.2x, 997.6x	NA
Dementia	P70	290.0 - 290.9	NA
Chronic lung disease	R79, R95	490.x - 496.x	NA
Connective tissue disease	L99	710.x	NA
Peptic ulcer disease	D85, D86	531.0 - 534.91	NA
Liver disease	D97	570.x - 573.x	NA
Chronic kidney disease	NA	NA	eGFR < 60
Hemiplegia	NA	342.x	NA
Cancer	A79, B72 - B74, D74 - D77, F74, H75, K72, L71, N74, R84, R85, S77, T71, T73, U75 - U77, W72, X75 - X77, Y78	140.x - 209.x	NA

ICPC-2 = International Classification of Primary Care, 2nd edition (ICPC-2); ICD-9-CM = International Classification of Diseases, Ninth Revision, Clinical Modification; eGFR = estimated glomerular filtration rate; NA = not applicable

Supplementary table 2 Definitions of diseases in UK Biobank

	ICD-9	ICD-10	Self-reported	Others
Type 2 diabetes mellitus	250.x0, 250.x2	E11	1223	Use of anti-diabetic drugs
Cardiovascular disease	410.x - 414.x, 428.x, 429.79, 430.x - 438.x	I20 - I25, I46, I50, I60 - I64	1066, 1074, 1075, 1076, 1081, 1086, 1491, 1583	Algorithmically defined data fields 42000, 42002, 42004, 42006, 42008, 42010, 42012
Coronary heart disease	410.x - 414.x, 429.79	I20 - I25, I46	1074, 1075	Algorithmically defined data fields 42000, 42002, 42004
Stroke	430.x - 438.x	I60 - I64	1081, 1086, 1491, 1583	Algorithmically defined data fields 42006, 42008, 42010, 42012
Heart failure	428.x	I50	1076	NA
Obesity	278.00, 278.01	E66	NA	NA
Hyperlipidaemia	272.x	E78.0 - E78.5	NA	Use of lipid-lowering agents
Hypertension	401.x - 405.x	I10 - I13, I15	1065, 1072, 1073	Use of anti-hypertensive drugs
Atrial fibrillation	427.31	I48	1471	NA
Peripheral vascular disease	250.6x, 440.2x, 443.1, 443.8, 443.9, 444.22, 444.81, 997.2, 997.6x	I73, I74.3 - I74.5	1067, 1088	NA
Amputation	997.2, 997.6x	NA	NA	NA
Dementia	290.x, 291.2, 294.1, 331.0 - 331.2, 331.5, 437.8	A81.0, F00 - F03, F05.1, F10.6, G30, G31.0, G31.1, G31.8, I67.3	1263	Algorithmically defined data fields 42018
Chronic lung disease	490.x - 496.x	J40, J41.0, J41.1, J41.8, J42, J43.9, J44, J44.1, J44.9, J47.1, J47.9	1111, 1112, 1113, 1114	NA
Connective tissue disease	710.x	M32.10, M33.03, M33.13, M33.9, M33.93, M34.0, M34.1, M34.9, M35.00, M35.01, M35.5, M35.8, M35.9	1373	NA
Peptic ulcer disease	531.0 - 534.91	K25 - K28, K56.699	1142, 1400, 1457	NA
Liver disease	570.x - 573.9	K70 - K77	1157, 1158, 1604	NA
Chronic kidney disease	582.x, 583.x, 585.x, 586.x, 588.x	N18, I12.0, I12.9, I13.0 - I13.2, I13.9, E08.22, E09.22, E10.22, E11.22, E13.22	1192, 1193, 1194, 1519, 1520	NA
Hemiplegia	342.x	G81	NA	NA
Cancer	140.x-239.x	C00 - D49	1659, 1432, 1233, 1238, 1682, 1683, 1449, 1438, 1230, 1460, 1658	Data fields 20001, 40006, 40013

ICD-9 = International Classification of Diseases, Ninth Revision; ICD-10 = International Classification of Diseases, Tenth Revision; NA = not applicable

Supplementary table 3. Baseline characteristics of subjects by patient groups in the Hong Kong cohort complete case analysis

Demographic	Total (N = 502,456)	No DM and CVD (N = 316,844)	DM with HbA1c <7% (N = 36,559)	DM with HbA1c 7-7.9% (N = 38,232)	DM with HbA1c 8-8.9% (N = 23,539)	DM with HbA1c ≥ 9% (N = 28,995)	CVD only (N = 28,959)	CVD and DM (N = 29,328)
Male	250,205 (49.8%)	152,384 (48.1%)	17,675 (48.3%)	17,402 (45.5%)	11,001 (46.7%)	16,341 (56.4%)	18,576 (64.1%)	16,826 (57.4%)
Age, year	59.7 (12.9)	57.1 (12.7)	63.8 (12.0)	63.4 (11.4)	62.1 (11.4)	58.1 (11.8)	67.3 (12.1)	69.1 (10.6)
Smoker	26,589 (5.3%)	16,483 (5.2%)	1,824 (5.0%)	2,100 (5.5%)	1,329 (5.6%)	2,051 (7.1%)	1,767 (6.1%)	1,035 (3.5%)
Charlson's Index	2.6 (1.5)	2.3 (1.3)	3.1 (1.5)	3.0 (1.4)	2.9 (1.5)	2.5 (1.4)	3.6 (1.6)	4.1 (1.7)
Obesity	21,737 (4.3%)	12,508 (3.9%)	2,228 (6.1%)	2,295 (6.0%)	1,313 (5.6%)	1,284 (4.4%)	1,006 (3.5%)	1,103 (3.8%)
Hyperlipidaemia	106,688 (21.2%)	37,617 (11.9%)	10,511 (28.8%)	11,302 (29.6%)	6,678 (28.4%)	6,740 (23.2%)	16,169 (55.8%)	17,671 (60.3%)
Hypertension	300,579 (59.8%)	161,127 (50.9%)	27,334 (74.8%)	28,324 (74.1%)	16,722 (71.0%)	16,052 (55.4%)	23,884 (82.5%)	27,136 (92.5%)
Atrial fibrillation	7,146 (1.4%)	2,281 (0.7%)	409 (1.1%)	371 (1.0%)	217 (0.9%)	219 (0.8%)	1,709 (5.9%)	1,940 (6.6%)
Peripheral vascular disease	2,001 (0.4%)	209 (0.1%)	243 (0.7%)	298 (0.8%)	200 (0.8%)	354 (1.2%)	93 (0.3%)	604 (2.1%)
Amputation	334 (0.1%)	193 (0.1%)	29 (0.1%)	36 (0.1%)	9 (0.0%)	25 (0.1%)	16 (0.1%)	26 (0.1%)
Dementia	1,473 (0.3%)	453 (0.1%)	155 (0.4%)	107 (0.3%)	50 (0.2%)	40 (0.1%)	277 (1.0%)	391 (1.3%)
Chronic lung disease	8,243 (1.6%)	3,793 (1.2%)	694 (1.9%)	618 (1.6%)	348 (1.5%)	341 (1.2%)	1,342 (4.6%)	1,107 (3.8%)
Connective tissue disease	870 (0.2%)	608 (0.2%)	73 (0.2%)	60 (0.2%)	27 (0.1%)	28 (0.1%)	42 (0.1%)	32 (0.1%)
Peptic ulcer disease	8,456 (1.7%)	3,380 (1.1%)	807 (2.2%)	762 (2.0%)	474 (2.0%)	482 (1.7%)	1,113 (3.8%)	1,438 (4.9%)
Liver disease	7,671 (1.5%)	3,698 (1.2%)	810 (2.2%)	746 (2.0%)	489 (2.1%)	662 (2.3%)	519 (1.8%)	747 (2.5%)
Chronic kidney disease	25,653 (5.1%)	6,574 (2.1%)	3,235 (8.8%)	3,018 (7.9%)	1,913 (8.1%)	1,934 (6.7%)	3,020 (10.4%)	5,959 (20.3%)
Hemiplegia	3,791 (0.8%)	14 (0.0%)	4 (0.0%)	2 (0.0%)	1 (0.0%)	2 (0.0%)	1,703 (5.9%)	2,065 (7.0%)
Cancer	10,017 (2.0%)	4,419 (1.4%)	1,301 (3.6%)	1,147 (3.0%)	718 (3.1%)	586 (2.0%)	799 (2.8%)	1,047 (3.6%)
DM duration, year	8.2 (7.4)	NA	7.1 (6.2)	8.8 (7.1)	9.8 (7.7)	7.1 (7.7)	NA	8.6 (7.9)
Metformin	109,522 (21.8%)	NA	21,146 (57.8%)	28,152 (73.6%)	19,054 (80.9%)	23,386 (80.7%)	NA	17,784 (60.6%)
Sulfonylurea	98,221 (19.5%)	NA	18,309 (50.1%)	25,090 (65.6%)	17,346 (73.7%)	19,242 (66.4%)	NA	18,234 (62.2%)
Other DM drugs	1,101 (0.2%)	NA	106 (0.3%)	271 (0.7%)	241 (1.0%)	253 (0.9%)	NA	230 (0.8%)
Bolus	15,969 (3.2%)	NA	1,064 (2.9%)	2,193 (5.7%)	2,866 (12.2%)	5,660 (19.5%)	NA	4,186 (14.3%)
Basal-bolus	2,039 (0.4%)	NA	144 (0.4%)	307 (0.8%)	460 (2.0%)	735 (2.5%)	NA	393 (1.3%)

The values are presented as mean(SD) or number(%), as appropriate.

CVD includes coronary heart disease, heart failure and stroke. DM = diabetes mellitus; CVD = cardiovascular disease; HbA1c = hemoglobin A1c; Other DM drugs: other anti-diabetic drugs excluding insulin; NA = not applicable

Supplementary table 4. Baseline characteristics of subjects by patient groups in UK Biobank complete case analysis

Demographic	Total (N = 448,107)	No DM and CVD (N = 405,411)	DM with HbA1c <7% (N = 7,499)	DM with HbA1c 7-7.9% (N = 3,242)	DM with HbA1c 8-8.9% (N = 1,292)	DM with HbA1c ≥ 9% (N = 894)	CVD only (N = 25,819)	CVD and DM (N = 3,950)
Male	204,990 (45.7%)	177,451 (43.8%)	4,511 (60.2%)	1,939 (59.8%)	784 (60.7%)	569 (63.6%)	16,819 (65.1%)	2,917 (73.8%)
Caucasian	423,171 (94.44%)	383,916 (94.70%)	6,565 (87.55%)	2,821 (87.01%)	1,081 (83.67%)	728 (81.43%)	24,606 (95.30%)	3,454 (87.44%)
Age, year	56.5 (8.1)	56.1 (8.1)	59.6 (7.2)	59.6 (7.0)	58.5 (7.2)	56.4 (7.4)	61.5 (6.3)	62.1 (5.8)
Previous smoker	154,932 (34.6%)	135,529 (33.4%)	3,125 (41.7%)	1,353 (41.7%)	525 (40.6%)	322 (36.0%)	12,009 (46.5%)	2,069 (52.4%)
Current smoker	46,790 (10.4%)	41,625 (10.3%)	741 (9.9%)	322 (9.9%)	152 (11.8%)	106 (11.9%)	3,347 (13.0%)	497 (12.6%)
Charlson index	2.8 (1.6)	2.7 (1.6)	3.2 (1.7)	3.2 (1.6)	3.0 (1.7)	2.8 (1.6)	3.6 (1.7)	3.8 (1.7)
Obesity	11,712 (2.6%)	8,532 (2.1%)	606 (8.1%)	275 (8.5%)	122 (9.4%)	103 (11.5%)	1,528 (5.9%)	546 (13.8%)
Hyperlipidaemia	80,212 (17.9%)	46,495 (11.5%)	5,697 (76.0%)	2,726 (84.1%)	1,036 (80.2%)	686 (76.7%)	19,865 (76.9%)	3,707 (93.8%)
Hypertension	121,134 (27.0%)	94,305 (23.3%)	4,796 (64.0%)	2,042 (63.0%)	820 (63.5%)	539 (60.3%)	15,462 (59.9%)	3,170 (80.3%)
Atrial fibrillation	3,337 (0.7%)	2,356 (0.6%)	82 (1.1%)	26 (0.8%)	12 (0.9%)	12 (1.3%)	739 (2.9%)	110 (2.8%)
Peripheral vascular disease	4,939 (1.1%)	3,559 (0.9%)	109 (1.5%)	42 (1.3%)	23 (1.8%)	11 (1.2%)	957 (3.7%)	238 (6.0%)
Amputation	8 (0.0%)	5 (0.0%)	1 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (0.0%)	1 (0.0%)
Dementia	220 (0.0%)	160 (0.0%)	5 (0.1%)	1 (0.0%)	0 (0.0%)	0 (0.0%)	45 (0.2%)	9 (0.2%)
Chronic lung disease	58,328 (13.0%)	51,219 (12.6%)	1,178 (15.7%)	491 (15.1%)	184 (14.2%)	135 (15.1%)	4,351 (16.9%)	770 (19.5%)
Connective tissue disease	321 (0.1%)	279 (0.1%)	6 (0.1%)	0 (0.0%)	1 (0.1%)	0 (0.0%)	32 (0.1%)	3 (0.1%)
Peptic ulcer disease	11,301 (2.5%)	9,036 (2.2%)	265 (3.5%)	115 (3.5%)	44 (3.4%)	17 (1.9%)	1,540 (6.0%)	284 (7.2%)
Liver disease	4,228 (0.9%)	3,354 (0.8%)	183 (2.4%)	63 (1.9%)	38 (2.9%)	18 (2.0%)	413 (1.6%)	159 (4.0%)
Chronic kidney disease	5,902 (1.3%)	3,967 (1.0%)	307 (4.1%)	134 (4.1%)	40 (3.1%)	33 (3.7%)	1,097 (4.2%)	324 (8.2%)
Hemiplegia	843 (0.2%)	192 (0.0%)	3 (0.0%)	3 (0.1%)	1 (0.1%)	0 (0.0%)	555 (2.1%)	89 (2.3%)
Cancer	60,621 (13.5%)	53,596 (13.2%)	1,169 (15.6%)	453 (14.0%)	178 (13.8%)	110 (12.3%)	4,410 (17.1%)	705 (17.8%)
Townsend deprivation index	-1.33 (3.07)	-1.40 (3.03)	-0.58 (3.33)	-0.61 (3.33)	-0.38 (3.41)	0.17 (3.60)	-0.79 (3.32)	0.05 (3.55)
DM duration, year	3.02 (4.37)	NA	2.47 (3.75)	2.87 (4.58)	2.92 (4.43)	3.15 (4.61)	NA	4.18 (4.96)
Use of anti-diabetic drugs	0.03 (0.17)	NA	0.77 (0.42)	0.93 (0.25)	0.96 (0.21)	0.97 (0.18)	NA	0.79 (0.40)

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CVD includes coronary heart disease, heart failure and stroke. DM = diabetes mellitus; CVD = cardiovascular disease; HbA1c = hemoglobin A1c; Other DM drugs: other anti-diabetic drugs excluding insulin; NA = not applicable

Supplementary table 5. Baseline characteristics of subjects by patient groups in the Hong Kong cohort multiple imputation analysis

Demographic	Total (N = 3,839,391)	No DM and CVD (N = 3,396,417)	DM with HbA1c <7% (N = 59,105)	DM with HbA1c 7-7.9% (N = 55,648)	DM with HbA1c 8-8.9% (N = 33,413)	DM with HbA1c ≥ 9% (N = 40,860)	CVD only (N = 179,974)	CVD and DM (N = 73,974)
Male	1,711,732 (44.6%)	1,474,865 (43.4%)	28,063 (47.5%)	25,007 (44.9%)	15,641 (46.8%)	22,891 (56.0%)	105,820 (58.8%)	39,445 (53.3%)
Age, year	50.5 (17.7)	48.3 (16.9)	65.5 (12.8)	64.5 (11.9)	63.2 (12.0)	59.1 (12.6)	70.3 (14.1)	71.8 (11.5)
Smoker	97,473 (2.5%)	81,776 (2.4%)	2,377 (4.0%)	2,573 (4.6%)	1,639 (4.9%)	2,491 (6.1%)	5,122 (2.8%)	1,495 (2.0%)
Charlson index	1.8 (1.7)	1.6 (1.6)	3.3 (1.6)	3.2 (1.5)	3.1 (1.5)	2.7 (1.6)	4.1 (1.9)	4.5 (1.8)
Obesity	39,067 (1.0%)	27,034 (0.8%)	2,649 (4.5%)	2,618 (4.7%)	1,496 (4.5%)	1,506 (3.7%)	2,145 (1.2%)	1,619 (2.2%)
Hyperlipidaemia	305,073 (7.9%)	137,068 (4.0%)	16,194 (27.4%)	16,520 (29.7%)	9,554 (28.6%)	9,436 (23.1%)	75,453 (41.9%)	40,848 (55.2%)
Hypertension	957,291 (24.9%)	613,895 (18.1%)	44,790 (75.8%)	41,967 (75.4%)	24,273 (72.6%)	23,314 (57.1%)	141,063 (78.4%)	67,989 (91.9%)
Atrial fibrillation	46,933 (1.2%)	17,648 (0.5%)	1,085 (1.8%)	802 (1.4%)	429 (1.3%)	429 (1.0%)	19,086 (10.6%)	7,454 (10.1%)
Peripheral vascular disease	5,421 (0.1%)	1,176 (0.0%)	513 (0.9%)	523 (0.9%)	330 (1.0%)	605 (1.5%)	483 (0.3%)	1,791 (2.4%)
Amputation	2,716 (0.1%)	2,259 (0.1%)	51 (0.1%)	63 (0.1%)	21 (0.1%)	39 (0.1%)	176 (0.1%)	107 (0.1%)
Dementia	18,297 (0.5%)	8,269 (0.2%)	623 (1.1%)	336 (0.6%)	144 (0.4%)	143 (0.3%)	5,969 (3.3%)	2,813 (3.8%)
Chronic lung disease	72,722 (1.9%)	52,125 (1.5%)	1,627 (2.8%)	1,180 (2.1%)	630 (1.9%)	626 (1.5%)	12,487 (6.9%)	4,047 (5.5%)
Connective tissue disease	7,999 (0.2%)	7,023 (0.2%)	161 (0.3%)	102 (0.2%)	46 (0.1%)	38 (0.1%)	531 (0.3%)	98 (0.1%)
Peptic ulcer disease	57,145 (1.5%)	38,508 (1.1%)	1,664 (2.8%)	1,316 (2.4%)	785 (2.3%)	816 (2.0%)	9,201 (5.1%)	4,855 (6.6%)
Liver disease	41,710 (1.1%)	30,024 (0.9%)	1,656 (2.8%)	1,247 (2.2%)	793 (2.4%)	1,117 (2.7%)	4,451 (2.5%)	2,422 (3.3%)
Chronic kidney disease	134,199 (3.5%)	60,956 (1.8%)	7,685 (13.0%)	5,805 (10.4%)	3,430 (10.3%)	3,634 (8.9%)	31,681 (17.6%)	21,008 (28.4%)
Hemiplegia	22,479 (0.6%)	234 (0.0%)	12 (0.0%)	5 (0.0%)	7 (0.0%)	7 (0.0%)	14,790 (8.2%)	7,424 (10.0%)
Cancer	99,698 (2.6%)	82,296 (2.4%)	2,645 (4.5%)	2,038 (3.7%)	1,194 (3.6%)	1,129 (2.8%)	7,105 (3.9%)	3,291 (4.4%)
DM duration, year	6.9 (6.9)	NA	6.2 (6.0)	7.9 (7.0)	8.8 (7.6)	6.5 (7.5)	NA	6.2 (6.7)
Metformin	164,500 (4.3%)	NA	31,459 (53.2%)	39,387 (70.8%)	26,050 (78.0%)	31,692 (77.6%)	NA	35,912 (48.5%)
Sulfonylurea	159,358 (4.2%)	NA	29,170 (49.4%)	36,368 (65.4%)	24,546 (73.5%)	27,467 (67.2%)	NA	41,807 (56.5%)
Other DM drugs	2,106 (0.1%)	NA	238 (0.4%)	453 (0.8%)	406 (1.2%)	425 (1.0%)	NA	584 (0.8%)
Bolus	31,389 (0.8%)	NA	2,642 (4.5%)	3,678 (6.6%)	4,340 (13.0%)	8,657 (21.2%)	NA	12,072 (16.3%)
Basal-bolus	3,419 (0.1%)	NA	276 (0.5%)	514 (0.9%)	665 (2.0%)	1,093 (2.7%)	NA	871 (1.2%)

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CVD includes coronary heart disease, heart failure and stroke. DM = diabetes mellitus; CVD = cardiovascular disease; HbA1c = hemoglobin A1c; Other DM drugs: other anti-diabetic drugs excluding insulin; NA = not applicable

Supplementary table 6. Baseline characteristics of subjects by patient groups in UK Biobank multiple imputation analysis

Demographic	Total (N = 497,779)	No DM and CVD (N = 449,936)	DM with HbA1c <7% (N = 8,207)	DM with HbA1c 7-7.9% (N = 3,556)	DM with HbA1c 8-8.9% (N = 1,429)	DM with HbA1c ≥ 9% (N = 999)	CVD only (N = 29,138)	CVD and DM (N = 4,514)
Male	226,528 (45.5%)	195,869 (43.5%)	4,884 (59.5%)	2,115 (59.5%)	870 (60.9%)	631 (63.2%)	18,847 (64.7%)	3,312 (73.4%)
Caucasian	469,457 (94.31%)	425,526 (94.57%)	7,174 (87.41%)	3,083 (86.70%)	1,194 (83.55%)	814 (81.48%)	27,727 (95.16%)	3,939 (87.26%)
Age, year	56.5 (8.1)	56.1 (8.1)	59.5 (7.3)	59.7 (7.0)	58.5 (7.2)	56.4 (7.4)	61.4 (6.4)	62.0 (5.8)
Previous smoker	171,639 (34.5%)	149,961 (33.3%)	3,390 (41.3%)	1,472 (41.4%)	588 (41.1%)	361 (36.1%)	13,501 (46.3%)	2,366 (52.4%)
Current smoker	52,497 (10.5%)	46,632 (10.4%)	827 (10.1%)	363 (10.2%)	166 (11.6%)	121 (12.1%)	3,826 (13.1%)	562 (12.5%)
Charlson index	2.8 (1.6)	2.7 (1.6)	3.2 (1.7)	3.2 (1.6)	3.0 (1.6)	2.8 (1.6)	3.6 (1.7)	3.8 (1.8)
Obesity	13,161 (2.6%)	9,534 (2.1%)	690 (8.4%)	299 (8.4%)	140 (9.8%)	119 (11.9%)	1,722 (5.9%)	657 (14.6%)
Hyperlipidaemia	105,830 (21.3%)	67,000 (14.9%)	6,416 (78.2%)	3,054 (85.9%)	1,174 (82.2%)	796 (79.7%)	23,103 (79.3%)	4,287 (95.0%)
Hypertension	135,181 (27.2%)	105,026 (23.3%)	5,272 (64.2%)	2,244 (63.1%)	908 (63.5%)	605 (60.6%)	17,482 (60.0%)	3,644 (80.7%)
Atrial fibrillation	10 (0.0%)	5 (0.0%)	2 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	2 (0.0%)	1 (0.0%)
Peripheral vascular disease	253 (0.1%)	183 (0.0%)	5 (0.1%)	1 (0.0%)	0 (0.0%)	0 (0.0%)	55 (0.2%)	9 (0.2%)
Amputation	65,070 (13.1%)	57,004 (12.7%)	1,298 (15.8%)	538 (15.1%)	202 (14.1%)	151 (15.1%)	4,974 (17.1%)	903 (20.0%)
Dementia	369 (0.1%)	313 (0.1%)	8 (0.1%)	0 (0.0%)	1 (0.1%)	0 (0.0%)	43 (0.1%)	4 (0.1%)
Chronic lung disease	12,663 (2.5%)	10,108 (2.2%)	293 (3.6%)	126 (3.5%)	50 (3.5%)	24 (2.4%)	1,739 (6.0%)	323 (7.2%)
Connective tissue disease	4,764 (1.0%)	3,755 (0.8%)	212 (2.6%)	77 (2.2%)	44 (3.1%)	24 (2.4%)	469 (1.6%)	183 (4.1%)
Peptic ulcer disease	6,613 (1.3%)	4,420 (1.0%)	334 (4.1%)	148 (4.2%)	43 (3.0%)	37 (3.7%)	1,252 (4.3%)	379 (8.4%)
Liver disease	1,031 (0.2%)	237 (0.1%)	7 (0.1%)	3 (0.1%)	1 (0.1%)	0 (0.0%)	674 (2.3%)	109 (2.4%)
Chronic kidney disease	67,944 (13.6%)	60,006 (13.3%)	1,291 (15.7%)	502 (14.1%)	201 (14.1%)	124 (12.4%)	5,012 (17.2%)	808 (17.9%)
Hemiplegia	10 (0.0%)	5 (0.0%)	2 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	2 (0.0%)	1 (0.0%)
Cancer	253 (0.1%)	183 (0.0%)	5 (0.1%)	1 (0.0%)	0 (0.0%)	0 (0.0%)	55 (0.2%)	9 (0.2%)
Townsend deprivation index	-1.31 (3.09)	-1.38 (3.04)	-0.57 (3.34)	-0.58 (3.35)	-0.36 (3.41)	0.21 (3.60)	-0.74 (3.35)	0.07 (3.53)
DM duration, year	3.03 (4.37)	NA	2.48 (3.76)	2.87 (4.58)	2.94 (4.43)	3.11 (4.57)	NA	4.18 (4.93)
Use of anti-diabetic drugs	0.03 (0.17)	NA	0.77 (0.42)	0.93 (0.25)	0.95 (0.22)	0.97 (0.18)	NA	0.79 (0.41)

The values are presented as mean(SD) or number(%), as appropriate.

CVD includes coronary heart disease, heart failure and stroke. DM = diabetes mellitus; CVD = cardiovascular disease; HbA1c = hemoglobin A1c; Other DM drugs: other anti-diabetic drugs excluding insulin; NA = not applicable

Supplementary table 7. Incidence rate of CVD-related mortality of the patient groups

	No DM and CVD	DM with HbA1c <7%	DM with HbA1c 7-7.9%	DM with HbA1c 8-8.9%	DM with HbA1c ≥ 9%	CVD only	DM and CVD
<b>Hong Kong cohort</b>							
No. of participants	3,396,417	59,105	55,648	33,413	40,860	179,974	73,974
No. of deaths (%)	22,383 (0.7%)	1,965 (3.3%)	1,739 (3.1%)	1,149 (3.4%)	1,351 (3.3%)	10,972 (6.1%)	6,850 (9.3%)
Median follow-up period (months)	108.5	130.5	130.5	130.5	121.5	96.5	90.5
Person-years	26,912,392	535,843	524,666	312,960	349,404	1,290,515	511,068
Incidence rate (cases/1000 person-years)	0.83	3.67	3.31	3.67	3.87	8.50	13.40
Hazard ratio (95% CI)	1 (Reference)	1.46 (1.39,1.53)	1.47 (1.40,1.55)	1.82 (1.72,1.93)	2.56 (2.42,2.71)	1.98 (1.93,2.03)	2.94 (2.85,3.03)
<b>UK Biobank</b>							
No. of participants	449,936	8,207	3,556	1,429	999	29,138	4,514
No. of deaths (%)	1,998 (0.4%)	113 (1.4%)	56 (1.6%)	36 (2.5%)	23 (2.3%)	1,051 (3.6%)	384 (8.5%)
Median follow-up period (months)	137.0	134.7	135.8	135.3	133.8	136.1	133.1
Person-years	5,070,539	89,928	39,160	15,632	10,795	316,542	46,723
Incidence rate (cases/1000 person-years)	0.39	1.26	1.43	2.30	2.13	3.32	8.22
Hazard ratio (95% CI)	1 (Reference)	1.63 (1.34,1.99)	1.85 (1.41,2.43)	3.26 (2.33,4.56)	3.39 (2.24,5.13)	3.40 (3.09,3.73)	6.57 (5.76,7.48)

Hazard ratios were adjusted with sex, age, smoking status, diseases statuses of atrial fibrillation, peripheral vascular disease, amputation, dementia, chronic lung disease, connective tissue disease, peptic ulcer disease, liver disease, chronic kidney disease, hemiplegia and cancer, obesity, hyperlipidaemia and hypertension at baseline in the Hong Kong cohort. In the case of UK Biobank, hazard ratios were adjusted with the above variables as well as ethnicity and Townsend deprivation index  
CVD includes coronary heart disease, heart failure and stroke; DM = diabetes mellitus; CVD = cardiovascular disease; HbA1c = hemoglobin A1c; CI = confidence interval

Supplementary table 8.: Sensitivity analysis of the association between atherosclerotic cardiovascular disease / Type 2 diabetes mellitus and all-cause mortality

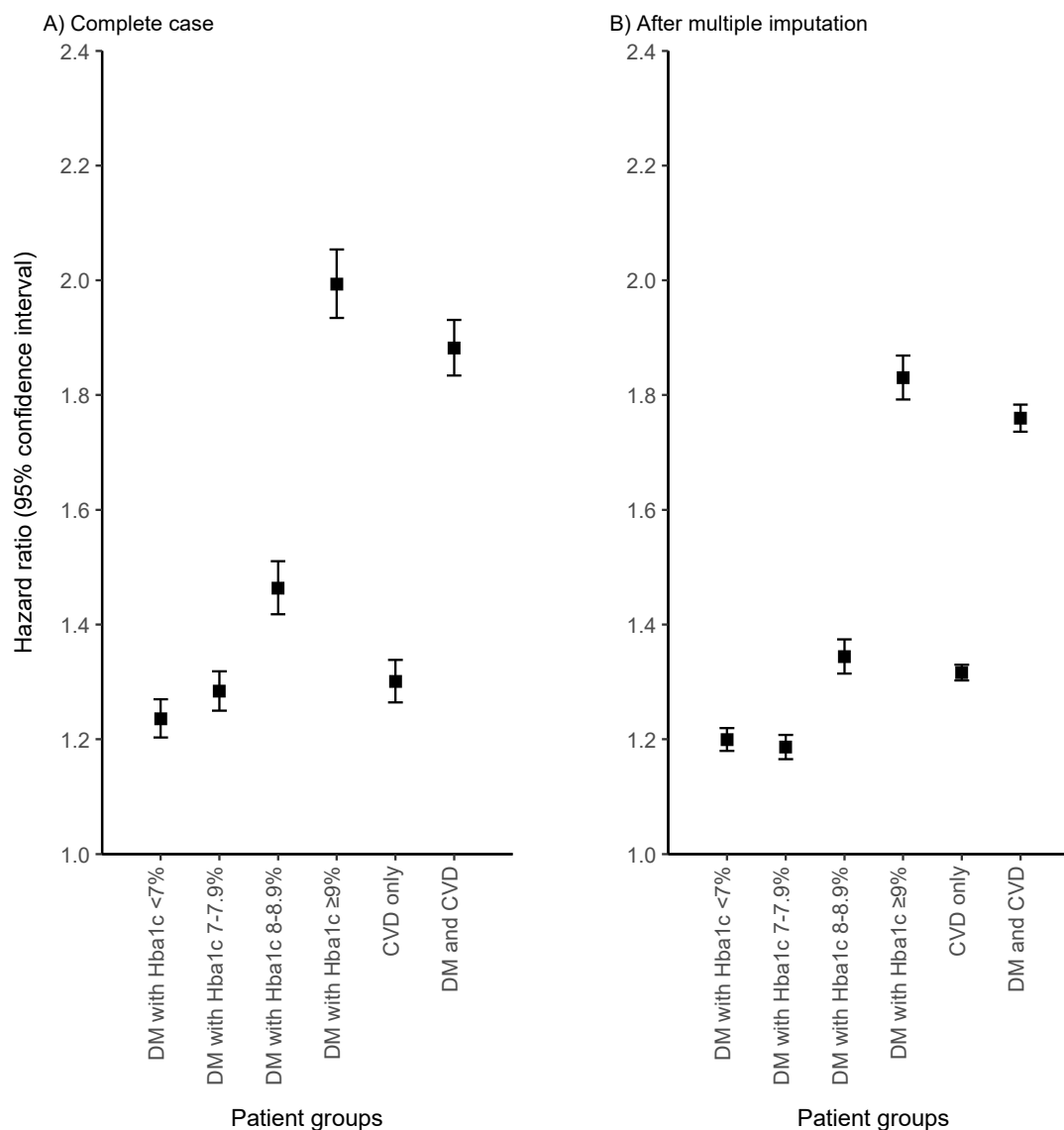
	No DM and ASCVD	DM with HbA1c <7%	DM with HbA1c 7-7.9%	DM with HbA1c 8-8.9%	DM with HbA1c ≥ 9%	ASCVD only	DM and ASCVD
<b>Hong Kong cohort</b>							
No. of participants	3,413,513	60,935	56,798	34,176	41,648	162,878	68,431
No. of deaths (%)	274,551 (8.0%)	17,653 (29.0%)	14,370 (25.3%)	8,796 (25.7%)	10,134 (24.3%)	62,885 (38.6%)	34,808 (50.9%)
Median follow-up period (months)	108.5	130.5	130.5	130.5	120.5	100.5	92.5
Person-years	27,013,335	545,949	531,485	317,371	353,950	1,189,573	479,550
Incidence rate (cases/1000 person-years)	10.16	32.33	27.04	27.72	28.63	52.86	72.58
Hazard ratio (95% CI)	1 (Reference)	1.25 (1.23,1.27)	1.21 (1.19,1.23)	1.37 (1.34,1.40)	1.81 (1.78,1.85)	1.29 (1.28,1.30)	1.74 (1.72,1.76)
<b>UK Biobank</b>							
No. of participants	450,561	8,265	3,588	1,438	1,002	28,513	4,405
No. of deaths (%)	15,193 (3.4%)	605 (7.3%)	266 (7.4%)	114 (7.9%)	97 (9.7%)	2,802 (9.8%)	765 (17.4%)
Median follow-up period (months)	137.0	134.7	135.8	135.3	133.8	136.2	133.1
Person-years	5,076,945	90,511	39,477	15,721	10,815	310,136	45,647
Incidence rate (cases/1000 person-years)	2.99	6.68	6.74	7.25	8.97	9.03	16.76
Hazard ratio (95% CI)	1 (Reference)	1.45 (1.34,1.58)	1.50 (1.33,1.70)	1.73 (1.43,2.08)	2.49 (2.03,3.04)	1.61 (1.54,1.69)	2.54 (2.34,2.75)

Hazard ratios were adjusted with sex, age, smoking status, diseases statuses of atrial fibrillation, peripheral vascular disease, amputation, dementia, chronic lung disease, connective tissue disease, peptic ulcer disease, liver disease, chronic kidney disease, hemiplegia and cancer, obesity, hyperlipidaemia and hypertension at baseline in the Hong Kong cohort. In the case of UK Biobank, hazard ratios were adjusted with the above variables as well as ethnicity and Townsend deprivation index

Atherosclerotic Cardiovascular Disease (ASCVD): includes coronary heart disease and stroke; DM = diabetes mellitus; CVD = cardiovascular disease; HbA1c = hemoglobin A1c; CI = confidence interval



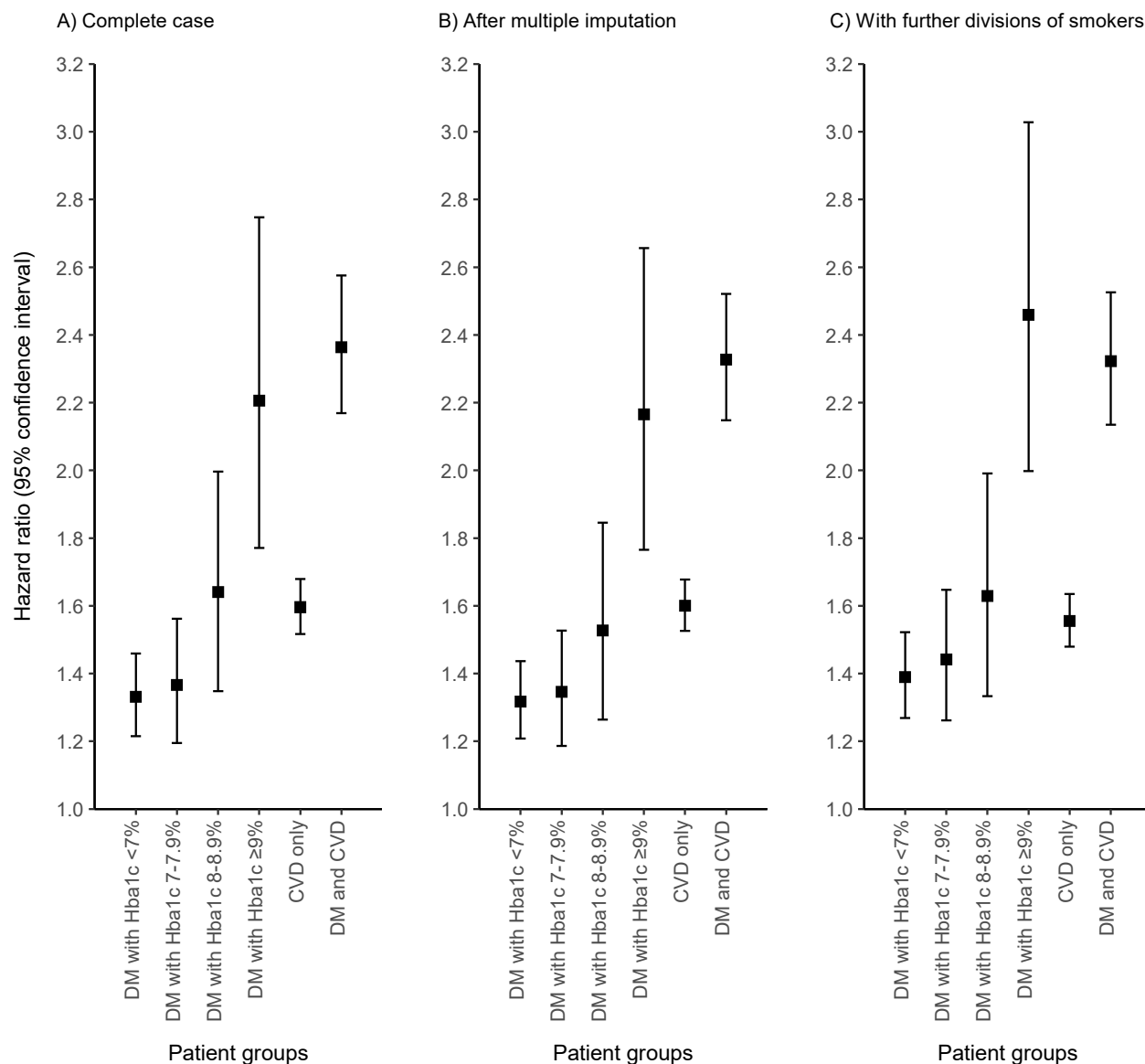
Supplementary figure 1a. Sensitivity analysis on the associations of mortality and patient groups in the Hong Kong cohort



Cox regressions were adjusted with sex, age, smoking status, systolic and diastolic blood pressure, body mass index, low-density lipoprotein cholesterol, estimated glomerular filtration rate, diseases statuses of atrial fibrillation, peripheral vascular disease, amputation, dementia, chronic lung disease, connective tissue disease, peptic ulcer disease, liver disease, chronic kidney disease, hemiplegia, cancer, obesity, hyperlipidaemia and hypertension at baseline. There were 502,456 individuals in the complete case analysis. The baseline characteristics in complete case analysis and after multiple imputation were shown in Supplementary tables 2 and 3 respectively.

CVD includes coronary heart disease, heart failure and stroke; DM = diabetes mellitus; CVD = cardiovascular disease; HbA1c = hemoglobin A1c; CI = confidence interval

Supplementary figure 1b. Sensitivity analysis on the associations of mortality and patient groups in UK Biobank



Cox regressions were adjusted with sex, age, smoking status, diseases statuses of atrial fibrillation, peripheral vascular disease, amputation, dementia, chronic lung disease, connective tissue disease, peptic ulcer disease, liver disease, chronic kidney disease, hemiplegia and cancer, obesity, hyperlipidaemia, hypertension, ethnicity and Townsend deprivation index at baseline. In A and B, in addition to the above variables, the models were adjusted with systolic and diastolic blood pressure, body mass index, low-density lipoprotein cholesterol, estimated glomerular filtration rate as well. There were 448,107 individuals in complete case analysis. The baseline characteristics in complete case analysis and after multiple imputation were shown in Supplementary tables 2 and 3 respectively. In C, patients were classified as (i)Never smoker, (ii)Current smoker with pack year<24; (iii)Current smoker with pack year≥24; (iv)Previous smoker with quit year<19; (v)Previous smoker with quit year≥19 CVD includes coronary heart disease, heart failure and stroke; DM = diabetes mellitus; CVD = cardiovascular disease; HbA1c = hemoglobin A1c; CI = confidence interval