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Multimorbidity in middle age predicts more subsequent hospital admissions than in older age

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Table 1
Baseline characteristics by multimorbidity status

Number of conditions	One	Two	Three or more	Total
n	80125	26191	14872	121188
Sex				
Female	36681 (45.8)	12438 (47.5)	7219 (48.5)	56338 (46.5)
Male	43444 (54.2)	13753 (52.5)	7653 (51.5)	64850 (53.5)
Age				
45-49	6983 (8.7)	1095 (4.2)	371 (2.5)	8449 (7.0)
50-54	7177 (9.0)	1441 (5.5)	507 (3.4)	9125 (7.5)
55-59	7064 (8.8)	1692 (6.5)	633 (4.3)	9389 (7.7)
60-64	6727 (8.4)	1769 (6.8)	751 (5.0)	9247 (7.6)
65-69	9760 (12.2)	2945 (11.2)	1490 (10.0)	14195 (11.7)
70-74	12412 (15.5)	4360 (16.6)	2427 (16.3)	19199 (15.8)
75-79	12101 (15.1)	4905 (18.7)	3055 (20.5)	20061 (16.6)
80-84	9278 (11.6)	4028 (15.4)	2863 (19.3)	16169 (13.3)
85-89	5413 (6.8)	2414 (9.2)	1814 (12.2)	9641 (8.0)
90-94	2417 (3.0)	1178 (4.5)	749 (5.0)	4344 (3.6)
95-99	664 (0.8)	286 (1.1)	184 (1.2)	1134 (0.9)
100+	129 (0.2)	78 (0.3)	28 (0.2)	235 (0.2)
CSSA ^a				
Non-recipient	62272 (77.7)	18706 (71.4)	9864 (66.3)	90842 (75.0)
Recipient	17853 (22.3)	7485 (28.6)	5008 (33.7)	30346 (25.0)
Care home				
Non-resident	72788 (90.8)	22187 (84.7)	11577 (77.8)	106552 (87.9)
Resident	7337 (9.2)	4004 (15.3)	3295 (22.2)	14636 (12.1)

^a CSSA stands for Comprehensive Social Security Assistance given by the Hong Kong Government to residents with low income and asset

Table 2
Frequencies (percentages) of chronic conditions ^a counted towards multimorbidity by age group and multimorbidity status

Multimorbidity status	One chronic condition			Two chronic conditions			Three or more chronic conditions		
	45-64	65-74	75+	45-64	65-74	75+	45-64	65-74	75+
n	27951	22172	30002	5997	7305	12889	2262	3917	8693
Hypertension	2732 (9.8)	3034 (13.7)	5344 (17.8)	1842 (30.7)	2927 (40.1)	5327 (41.3)	999 (44.2)	2353 (60.1)	5373 (61.8)
Depression	526 (1.9)	327 (1.5)	898 (3.0)	649 (10.8)	375 (5.1)	844 (6.5)	496 (21.9)	513 (13.1)	1010 (11.6)
Painful condition	633 (2.3)	380 (1.7)	636 (2.1)	743 (12.4)	521 (7.1)	773 (6.0)	611 (27.0)	546 (13.9)	984 (11.3)
Asthma	599 (2.1)	366 (1.7)	504 (1.7)	212 (3.5)	331 (4.5)	573 (4.4)	138 (6.1)	332 (8.5)	692 (8.0)
Coronary heart disease	2952 (10.6)	2482 (11.2)	2298 (7.7)	1041 (17.4)	1660 (22.7)	2725 (21.1)	655 (29.0)	1652 (42.2)	3866 (44.5)
Dyspepsia	111 (0.4)	76 (0.3)	98 (0.3)	40 (0.7)	34 (0.5)	62 (0.5)	21 (0.9)	38 (1.0)	117 (1.3)
Diabetes	671 (2.4)	722 (3.3)	861 (2.9)	381 (6.4)	538 (7.4)	726 (5.6)	409 (18.1)	750 (19.1)	1166 (13.4)
Rheumatoid arthritis, other inflammatory polyarthropathies & systematic connective tissue disorders	224 (0.8)	107 (0.5)	94 (0.3)	80 (1.3)	57 (0.8)	55 (0.4)	26 (1.1)	43 (1.1)	66 (0.8)
Hearing loss	161 (0.6)	51 (0.2)	36 (0.1)	24 (0.4)	25 (0.3)	45 (0.3)	19 (0.8)	27 (0.7)	78 (0.9)
Chronic obstructive pulmonary disease	856 (3.1)	2230 (10.1)	4065 (13.5)	655 (10.9)	1350 (18.5)	2775 (21.5)	280 (12.4)	897 (22.9)	2447 (28.1)
Anxiety & other neurotic, stress related & somatoform disorders	975 (3.5)	569 (2.6)	731 (2.4)	1336 (22.3)	819 (11.2)	990 (7.7)	893 (39.5)	890 (22.7)	1213 (14.0)
Irritable bowel syndrome	59 (0.2)	31 (0.1)	47 (0.2)	65 (1.1)	54 (0.7)	57 (0.4)	91 (4.0)	64 (1.6)	78 (0.9)
Cancer	11009 (39.4)	5335 (24.1)	4810 (16.0)	1130 (18.8)	1071 (14.7)	1312 (10.2)	414 (18.3)	514 (13.1)	1001 (11.5)
Alcohol problems	169 (0.6)	45 (0.2)	26 (0.1)	63 (1.1)	18 (0.2)	6 (0.0)	47 (2.1)	16 (0.4)	15 (0.2)
Other psychoactive substance misuse	66 (0.2)	4 (0.0)	1 (0.0)	40 (0.7)	7 (0.1)	2 (0.0)	24 (1.1)	4 (0.1)	1 (0.0)
Constipation	214 (0.8)	277 (1.2)	733 (2.4)	64 (1.1)	146 (2.0)	358 (2.8)	63 (2.8)	153 (3.9)	447 (5.1)
Stroke & transient ischaemic attack	649 (2.3)	710 (3.2)	952 (3.2)	472 (7.9)	715 (9.8)	965 (7.5)	233 (10.3)	549 (14.0)	1054 (12.1)
Chronic kidney disease	935 (3.3)	491 (2.2)	459 (1.5)	518 (8.6)	466 (6.4)	511 (4.0)	401 (17.7)	550 (14.0)	796 (9.2)
Diverticular disease of intestine	7 (0.0)	3 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Atrial fibrillation	771 (2.8)	761 (3.4)	1449 (4.8)	443 (7.4)	844 (11.6)	1966 (15.3)	272 (12.0)	868 (22.2)	2728 (31.4)
Peripheral vascular disease	69 (0.2)	101 (0.5)	247 (0.8)	45 (0.8)	64 (0.9)	168 (1.3)	62 (2.7)	147 (3.8)	363 (4.2)
Heart failure	417 (1.5)	749 (3.4)	2262 (7.5)	471 (7.9)	946 (13.0)	2772 (21.5)	412 (18.2)	1169 (29.8)	3715 (42.7)
Prostate disorder	826 (3.0)	1966 (8.9)	1720 (5.7)	135 (2.3)	457 (6.3)	877 (6.8)	93 (4.1)	440 (11.2)	1091 (12.6)
Glaucoma	327 (1.2)	459 (2.1)	413 (1.4)	88 (1.5)	99 (1.4)	104 (0.8)	40 (1.8)	53 (1.4)	117 (1.3)
Epilepsy	335 (1.2)	133 (0.6)	182 (0.6)	191 (3.2)	115 (1.6)	208 (1.6)	194 (8.6)	213 (5.4)	397 (4.6)
Dementia	15 (0.1)	51 (0.2)	255 (0.8)	14 (0.2)	49 (0.7)	288 (2.2)	16 (0.7)	91 (2.3)	379 (4.4)
Schizophrenia (and related non-organic psychosis) or bipolar disorder	126 (0.5)	41 (0.2)	34 (0.1)	108 (1.8)	59 (0.8)	28 (0.2)	115 (5.1)	69 (1.8)	47 (0.5)
Psoriasis or eczema	109 (0.4)	59 (0.3)	92 (0.3)	40 (0.7)	35 (0.5)	61 (0.5)	23 (1.0)	31 (0.8)	92 (1.1)
Inflammatory bowel disease	105 (0.4)	24 (0.1)	8 (0.0)	13 (0.2)	3 (0.0)	2 (0.0)	7 (0.3)	8 (0.2)	3 (0.0)
Migraine	156 (0.6)	57 (0.3)	93 (0.3)	155 (2.6)	90 (1.2)	111 (0.9)	107 (4.7)	66 (1.7)	133 (1.5)
Blindness or low vision	18 (0.1)	6 (0.0)	24 (0.1)	5 (0.1)	9 (0.1)	21 (0.2)	11 (0.5)	7 (0.2)	36 (0.4)
Chronic sinusitis	150 (0.5)	27 (0.1)	13 (0.0)	12 (0.2)	7 (0.1)	3 (0.0)	2 (0.1)	5 (0.1)	6 (0.1)
Anorexia or bulimia	3 (0.0)	2 (0.0)	14 (0.0)	0 (0.0)	0 (0.0)	6 (0.0)	0 (0.0)	3 (0.1)	7 (0.1)
Bronchiectasis	0 (0.0)	0 (0.0)	0 (0.0)	339 (5.7)	344 (4.7)	488 (3.8)	135 (6.0)	230 (5.9)	493 (5.7)
Parkinson's disease	72 (0.3)	189 (0.9)	399 (1.3)	42 (0.7)	134 (1.8)	367 (2.8)	25 (1.1)	148 (3.8)	430 (4.9)
Multiple sclerosis	9 (0.0)	0 (0.0)	0 (0.0)	7 (0.1)	0 (0.0)	0 (0.0)	4 (0.2)	1 (0.0)	0 (0.0)
Viral hepatitis	405 (1.4)	80 (0.4)	39 (0.1)	240 (4.0)	92 (1.3)	56 (0.4)	127 (5.6)	106 (2.7)	58 (0.7)
Chronic liver disease	490 (1.8)	227 (1.0)	165 (0.5)	291 (4.9)	149 (2.0)	146 (1.1)	165 (7.3)	156 (4.0)	171 (2.0)

^aZero frequency of learning disability and thyroid disease was recorded and omitted from the table.

Table 3Adjusted ^a relative risks (95% confidence interval) of hospitalization by the cross-classification between multimorbidity status and age group

Hospital admissions		Follow-year								
Age	Conditions	1	2	3	4	5	6	7	8	9
45-64	1	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref
65-74	1	0.62 (0.59, 0.65)	0.48 (0.45, 0.51)	0.46 (0.43, 0.49)	0.46 (0.43, 0.49)	0.46 (0.42, 0.49)	0.44 (0.41, 0.47)	0.42 (0.39, 0.46)	0.43 (0.40, 0.46)	0.46 (0.42, 0.49)
75+	1	0.45 (0.43, 0.47)	0.35 (0.33, 0.37)	0.33 (0.31, 0.35)	0.32 (0.30, 0.34)	0.33 (0.30, 0.35)	0.34 (0.32, 0.36)	0.35 (0.32, 0.38)	0.35 (0.33, 0.38)	0.37 (0.35, 0.41)
45-64	2	1.43 (1.33, 1.55)	1.53 (1.39, 1.69)	1.56 (1.40, 1.73)	1.54 (1.38, 1.71)	1.64 (1.47, 1.84)	1.62 (1.45, 1.83)	1.73 (1.53, 1.95)	1.60 (1.42, 1.81)	1.61 (1.42, 1.82)
65-74	2	0.77 (0.72, 0.82)	0.65 (0.60, 0.70)	0.66 (0.60, 0.72)	0.61 (0.55, 0.67)	0.55 (0.50, 0.61)	0.53 (0.48, 0.58)	0.57 (0.51, 0.63)	0.60 (0.54, 0.67)	0.54 (0.48, 0.61)
75+	2	0.50 (0.47, 0.52)	0.37 (0.34, 0.39)	0.37 (0.34, 0.39)	0.38 (0.35, 0.41)	0.37 (0.34, 0.40)	0.38 (0.35, 0.42)	0.39 (0.35, 0.43)	0.36 (0.33, 0.40)	0.40 (0.36, 0.45)
45-64	3+	2.04 (1.83, 2.27)	1.92 (1.67, 2.21)	1.96 (1.69, 2.28)	1.98 (1.68, 2.33)	1.94 (1.64, 2.29)	1.85 (1.56, 2.20)	1.86 (1.55, 2.23)	1.83 (1.52, 2.21)	1.66 (1.38, 2.01)
65-74	3+	1.10 (1.01, 1.19)	1.00 (0.90, 1.11)	0.94 (0.84, 1.05)	0.88 (0.78, 0.99)	0.85 (0.75, 0.97)	0.83 (0.72, 0.95)	0.79 (0.68, 0.91)	0.60 (0.52, 0.71)	0.64 (0.54, 0.75)
75+	3+	0.69 (0.65, 0.74)	0.50 (0.46, 0.54)	0.46 (0.42, 0.50)	0.47 (0.42, 0.51)	0.46 (0.42, 0.51)	0.50 (0.45, 0.57)	0.52 (0.46, 0.59)	0.49 (0.43, 0.57)	0.53 (0.46, 0.62)
Hospitalized days		Follow-year								
Age	Conditions	1	2	3	4	5	6	7	8	9
45-64	1	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref
65-74	1	1.12 (1.08, 1.17)	1.02 (0.96, 1.08)	1.16 (1.09, 1.24)	1.18 (1.09, 1.28)	1.19 (1.10, 1.27)	1.24 (1.15, 1.33)	1.26 (1.16, 1.36)	1.25 (1.15, 1.35)	1.39 (1.28, 1.50)
75+	1	1.39 (1.34, 1.45)	1.28 (1.21, 1.35)	1.48 (1.40, 1.57)	1.58 (1.47, 1.70)	1.57 (1.46, 1.69)	1.64 (1.52, 1.76)	1.73 (1.60, 1.87)	1.76 (1.62, 1.92)	1.84 (1.69, 2.01)
45-64	2	1.28 (1.20, 1.36)	1.19 (1.09, 1.30)	1.37 (1.24, 1.51)	1.44 (1.27, 1.63)	1.37 (1.22, 1.53)	1.42 (1.26, 1.59)	1.54 (1.36, 1.74)	1.55 (1.36, 1.76)	1.52 (1.34, 1.73)
65-74	2	1.43 (1.35, 1.51)	1.31 (1.21, 1.41)	1.62 (1.49, 1.77)	1.61 (1.44, 1.80)	1.55 (1.40, 1.72)	1.53 (1.38, 1.71)	1.59 (1.42, 1.78)	1.68 (1.49, 1.90)	1.70 (1.51, 1.92)
75+	2	1.55 (1.48, 1.63)	1.45 (1.35, 1.54)	1.74 (1.62, 1.87)	1.83 (1.66, 2.01)	1.83 (1.67, 2.00)	1.91 (1.73, 2.10)	2.02 (1.82, 2.25)	1.94 (1.73, 2.17)	2.08 (1.83, 2.35)
45-64	3+	1.85 (1.68, 2.02)	1.66 (1.46, 1.87)	2.08 (1.81, 2.39)	1.89 (1.58, 2.28)	1.75 (1.48, 2.08)	1.90 (1.60, 2.26)	1.80 (1.50, 2.17)	1.91 (1.57, 2.33)	1.72 (1.41, 2.09)
65-74	3+	1.84 (1.72, 1.98)	1.74 (1.58, 1.92)	1.88 (1.69, 2.10)	1.96 (1.70, 2.26)	1.94 (1.69, 2.22)	1.91 (1.66, 2.21)	2.02 (1.73, 2.37)	2.01 (1.69, 2.39)	2.31 (1.92, 2.77)
75+	3+	1.94 (1.84, 2.05)	1.78 (1.66, 1.92)	2.02 (1.86, 2.20)	2.08 (1.86, 2.33)	1.90 (1.70, 2.12)	2.28 (2.02, 2.58)	2.25 (1.96, 2.58)	2.35 (2.02, 2.75)	2.26 (1.91, 2.67)

^a Adjusted for sex, comprehensive social security assistance recipient status, elderly home residential status, and number of days survived (as an offset term) in the follow-up year.