

Disease network analysis to reveal comorbidity patterns in hospitalized patients with COPD using large-scale administrative health data

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Supplementary Table S1 The Diseases with a prevalence significantly greater than 1% in patients with COPD.

ICD-10	Chronic disease	N	Prevalence (%, 95 CI)
B18	Chronic viral hepatitis	35908	1.79(1.77-1.81)
B90	Sequelae of tuberculosis	25186	1.26(1.24-1.27)
C15	Malignant neoplasm of oesophagus	28101	1.4(1.39-1.42)
C34	Malignant neoplasm of bronchus and lung	77101	3.85(3.82-3.87)
C77	Secondary and unspecified malignant neoplasm of lymph nodes	23594	1.18(1.16-1.19)
C78	Secondary malignant neoplasm of respiratory and digestive organs	36764	1.83(1.82-1.85)
C79	Secondary malignant neoplasm of other sites	28930	1.44(1.43-1.46)
D50	Iron deficiency anaemia	47678	2.38(2.36-2.4)
D61	Other aplastic anaemias	27985	1.4(1.38-1.41)
D64	Other anaemias	315458	15.73(15.68-15.78)
D68	Other coagulation defects	45788	2.28(2.26-2.3)
D69	Purpura and other haemorrhagic conditions	94145	4.7(4.67-4.73)
D70	Agranulocytosis	55956	2.79(2.77-2.81)
D86	Sarcoidosis	61840	3.08(3.06-3.11)
E03	Other hypothyroidism	36006	1.8(1.78-1.81)
E04	Other nontoxic goitre	49633	2.48(2.45-2.5)
E11	Non-insulin-dependent diabetes mellitus	286858	14.31(14.26-14.36)
E14	Unspecified diabetes mellitus	61189	3.05(3.03-3.08)
E16	Other disorders of pancreatic internal secretion	21975	1.1(1.08-1.11)
E41	Nutritional marasmus	43260	2.16(2.14-2.18)
E46	Unspecified protein-energy malnutrition	51741	2.58(2.56-2.6)
E72	Other disorders of amino-acid metabolism	39348	1.96(1.94-1.98)
E77	Disorders of glycoprotein metabolism	337630	16.84(16.79-16.89)
E78	Disorders of lipoprotein metabolism and other lipidaemias	361607	18.04(17.98-18.09)
E79	Disorders of purine and pyrimidine metabolism	192123	9.58(9.54-9.62)
E83	Disorders of mineral metabolism	38072	1.9(1.88-1.92)
F41	Other anxiety disorders	48005	2.39(2.37-2.42)
G20	Parkinson's disease	24402	1.22(1.2-1.23)
G31	Other degenerative diseases of nervous system, not elsewhere classified	196531	9.8(9.76-9.84)
G37	Other demyelinating diseases of central nervous system	21092	1.05(1.04-1.07)
G44	Other headache syndromes	42059	2.1(2.08-2.12)
G45	Transient cerebral ischaemic attacks and related syndromes	196584	9.81(9.76-9.85)
G47	Sleep disorders	90047	4.49(4.46-4.52)
G93	Other disorders of brain	82473	4.11(4.09-4.14)
H10	Conjunctivitis	21209	1.06(1.04-1.07)
H25	Senile cataract	136000	6.78(6.75-6.82)
H26	Other cataract	48591	2.42(2.4-2.44)

H81	Disorders of vestibular function	63850	3.18(3.16-3.21)
I07	Rheumatic tricuspid valve diseases	20571	1.03(1.01-1.04)
I08	Multiple valve diseases	33034	1.65(1.63-1.67)
I10	Essential (primary) hypertension	808022	40.3(40.23-40.37)
I11	Hypertensive heart disease	158569	7.91(7.87-7.95)
I20	Angina pectoris	86118	4.3(4.27-4.32)
I21	Acute myocardial infarction	33171	1.65(1.64-1.67)
I24	Other acute ischaemic heart diseases	29040	1.45(1.43-1.46)
I25	Chronic ischaemic heart disease	639527	31.9(31.83-31.96)
I27	Other pulmonary heart diseases	558983	27.88(27.82-27.94)
I31	Other diseases of pericardium	65490	3.27(3.24-3.29)
I34	Nonrheumatic mitral valve disorders	23832	1.19(1.17-1.2)
I35	Nonrheumatic aortic valve disorders	35362	1.76(1.75-1.78)
I38	Endocarditis, valve unspecified	79197	3.95(3.92-3.98)
I42	Cardiomyopathy	30834	1.54(1.52-1.55)
I44	Atrioventricular and left bundle-branch block	46367	2.31(2.29-2.33)
I45	Other conduction disorders	39229	1.96(1.94-1.98)
I47	Paroxysmal tachycardia	41059	2.05(2.03-2.07)
I48	Atrial fibrillation and flutter	163169	8.14(8.1-8.18)
I49	Other cardiac arrhythmias	231199	11.53(11.49-11.58)
I50	Heart failure	579512	28.9(28.84-28.97)
I51	Complications and ill-defined descriptions of heart disease	207383	10.34(10.3-10.39)
I61	Intracerebral haemorrhage	45612	2.28(2.25-2.3)
I63	Cerebral infarction	521403	26.01(25.95-26.07)
I65	Occlusion and stenosis of precerebral arteries, not resulting in cerebral infarction	106325	5.3(5.27-5.33)
I66	Occlusion and stenosis of cerebral arteries, not resulting in cerebral infarction	26335	1.31(1.3-1.33)
I67	Other cerebrovascular diseases	399207	19.91(19.86-19.97)
I69	Sequelae of cerebrovascular disease	110706	5.52(5.49-5.55)
I70	Atherosclerosis	392878	19.6(19.54-19.65)
I77	Other disorders of arteries and arterioles	21014	1.05(1.03-1.06)
I84	Haemorrhoids	49609	2.47(2.45-2.5)
J18	Pneumonia, organism unspecified	275849	13.76(13.71-13.81)
J31	Chronic rhinitis, nasopharyngitis and pharyngitis	44802	2.23(2.21-2.26)
J32	Chronic sinusitis	72872	3.63(3.61-3.66)
J34	Other disorders of nose and nasal sinuses	27572	1.38(1.36-1.39)
J45	Asthma	97547	4.87(4.84-4.9)
J46	Status asthmaticus	23664	1.18(1.17-1.2)
J47	Bronchiectasis	197055	9.83(9.79-9.87)
J62	Pneumoconiosis due to dust containing silica	27501	1.37(1.36-1.39)
J64	Unspecified pneumoconiosis	21983	1.1(1.08-1.11)
J84	Other interstitial pulmonary diseases	65730	3.28(3.25-3.3)
J96	Respiratory failure, not elsewhere classified	332532	16.59(16.53-16.64)

K20	Oesophagitis	23083	1.15(1.14-1.17)
K21	Gastro-oesophageal reflux disease	98233	4.9(4.87-4.93)
K22	Other diseases of oesophagus	24154	1.2(1.19-1.22)
K25	Gastric ulcer	64993	3.24(3.22-3.27)
K26	Duodenal ulcer	23163	1.16(1.14-1.17)
K27	Peptic ulcer, site unspecified	47951	2.39(2.37-2.41)
K29	Gastritis and duodenitis	802396	40.02(39.95-40.09)
K31	Other diseases of stomach and duodenum	111482	5.56(5.53-5.59)
K52	Other noninfective gastroenteritis and colitis	115914	5.78(5.75-5.81)
K59	Other functional intestinal disorders	131785	6.57(6.54-6.61)
K72	Hepatic failure, not elsewhere classified	144416	7.2(7.17-7.24)
K74	Fibrosis and cirrhosis of liver	36977	1.84(1.83-1.86)
K76	Other diseases of liver	392701	19.59(19.53-19.64)
K80	Cholelithiasis	221792	11.06(11.02-11.11)
K82	Other diseases of gallbladder	58399	2.91(2.89-2.94)
K83	Other diseases of biliary tract	45330	2.26(2.24-2.28)
L30	Other dermatitis	30130	1.5(1.49-1.52)
L89	Decubitus ulcer	24714	1.23(1.22-1.25)
M06	Other rheumatoid arthritis	34701	1.73(1.71-1.75)
M10	Gout	48222	2.41(2.38-2.43)
M13	Other arthritis	25847	1.29(1.27-1.3)
M17	Gonarthrosis [arthrosis of knee]	77030	3.84(3.82-3.87)
M25	Other joint disorders, not elsewhere classified	22623	1.13(1.11-1.14)
M43	Other deforming dorsopathies	23131	1.15(1.14-1.17)
M47	Spondylosis	196766	9.81(9.77-9.86)
M48	Other spondylopathies	196648	9.81(9.77-9.85)
M50	Cervical disc disorders	78019	3.89(3.86-3.92)
M51	Other intervertebral disc disorders	255332	12.74(12.69-12.78)
M81	Osteoporosis without pathological fracture	207189	10.33(10.29-10.38)
M89	Other disorders of bone	68817	3.43(3.41-3.46)
N18	Chronic renal failure	85648	4.27(4.24-4.3)
N19	Unspecified renal failure	105821	5.28(5.25-5.31)
N28	Other disorders of kidney and ureter, not elsewhere classified	348222	17.37(17.32-17.42)
N30	Cystitis	22872	1.14(1.13-1.16)
N39	Other disorders of urinary system	133949	6.68(6.65-6.72)
N40	Hyperplasia of prostate	133949	6.68(6.65-6.72)

*N: number of patients

Supplementary Table S2 The comorbidities enriched in different sexes and regions

Group	ICD-10	Prevalence1 (95%CI)	Prevalence 2(95%CI)	Absolute Difference (95%CI)	Relative Difference	Enriched in
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Sex

B18	2.1(2.1-2.1)	1.3(1.3-1.3)	0.8(0.7-0.8)	0.6	Male
C34	4.9(4.8-4.9)	2.3(2.2-2.3)	2.6(2.5-2.6)	1.1	Male
C78	2.3(2.3-2.3)	1.1(1.1-1.1)	1.2(1.1-1.2)	1.1	Male
D61	1.6(1.6-1.6)	1.0(1.0-1.1)	0.6(0.5-0.6)	0.5	Male
E72	2.3(2.3-2.3)	1.5(1.4-1.5)	0.8(0.8-0.9)	0.6	Male
J84	3.8(3.8-3.8)	2.5(2.4-2.5)	1.4(1.3-1.4)	0.6	Male
L30	1.8(1.7-1.8)	1.1(1.1-1.1)	0.7(0.6-0.7)	0.6	Male
M10	3.3(3.2-3.3)	1.0(1.0-1.1)	2.2(2.2-2.3)	2.1	Male
E03	1.3(1.3-1.4)	2.5(2.5-2.5)	-1.2(-1.2- -1.1)	0.9	Female
E04	1.6(1.5-1.6)	3.9(3.8-3.9)	-2.3(-2.4- -2.3)	1.5	Female
E78	15.1(15.0- 15.1)	22.7(22.6- 22.8)	-7.6(-7.7- -7.5)	0.5	Female
F41	1.7(1.7-1.7)	3.5(3.5-3.5)	-1.8(-1.9- -1.8)	1.1	Female
H81	2.4(2.4-2.4)	4.4(4.3-4.4)	-2.0(-2.0- -1.9)	0.8	Female
J45	4.0(4.0-4.1)	6.2(6.1-6.2)	-2.1(-2.2- -2.1)	0.5	Female
K80	9.1(9.1-9.2)	14.1(14.0- 14.2)	-5.0(-5.1- -4.9)	0.5	Female
M06	1.2(1.2-1.2)	2.6(2.5-2.6)	-1.4(-1.4- -1.3)	1.1	Female
M13	1.0(1.0-1.0)	1.7(1.7-1.7)	-0.7(-0.7- -0.6)	0.7	Female
M17	2.8(2.7-2.8)	5.5(5.5-5.6)	-2.8(-2.8- -2.7)	1.0	Female
M81	6.6(6.5-6.6)	16.2(16.1- 16.3)	-9.6(-9.7- -9.5)	1.5	Female

Region

E04	3.7(3.6-3.7)	1.7(1.7-1.7)	2.0(1.9-2.0)	1.2	Urban
F41	3.0(3.0-3.1)	2.0(2.0-2.0)	1.0(1.0-1.1)	0.5	Urban
G47	6.4(6.3-6.4)	3.3(3.2-3.3)	3.1(3.1-3.2)	1.0	Urban
I20	5.7(5.7-5.8)	3.4(3.3-3.4)	2.3(2.3-2.4)	0.7	Urban
I65	7.0(6.9-7.0)	4.2(4.2-4.3)	2.8(2.7-2.8)	0.7	Urban
I70	26.1(26.0- 26.1)	15.4(15.4- 15.5)	10.6(10.5- 10.7)	0.7	Urban
J31	3.0(3.0-3.1)	1.7(1.7-1.7)	1.3(1.3-1.4)	0.8	Urban
K59	8.4(8.3-8.4)	5.4(5.4-5.4)	3.0(2.9-3.1)	0.6	Urban
L30	2.0(2.0-2.0)	1.2(1.2-1.2)	0.8(0.8-0.8)	0.7	Urban
N18	5.4(5.3-5.4)	3.6(3.5-3.6)	1.8(1.8-1.9)	0.5	Urban

N40	22.0(21.9-22.1)	6.1(6.1-6.2)	15.9(15.8-16.0)	2.6	Urban
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*Prevalence1: prevalence in male patients with COPD or in urban patients with COPD;
Prevalence2: prevalence in female patients with COPD or in rural patients with COPD.

Supplementary Table S3 Central diseases defined by different centrality measures in COPD comorbidity networks.

Group	Subgroup	Degree	W.Degree	Bet.Centrality	Eig.Centrality	PageRank
Overall	-	D64	D64	D64	D64	D64
		K76	N40	N40	E77	N40
		E77	E77	K76	K76	E77
		N40	K76	E77	E79	K76
		M51	I50	M51	I50	I50
		I50	K29	I50	M51	M51
		E79	M51	J18	M48	K29
		M48	I63	K29	I10	I63
		E11	I10	I70	I67	I10
		I67	I67	G47	E11	I67
		K29	E79	E11	N40	E79
Male	18-44	D64	K76	D64	D64	K76
		K76	D64	K76	E77	D64
		E77	E77	E77	K76	E77
		K29	K29	K29	K29	K29
		I50	J96	E79	I50	J96
		E79	I50	J96	G47	I50
		G47	E79	I50	E79	E79
	45-59	K76	N40	N40	D64	N40
		D64	K76	K76	K76	K76
		N40	D64	D64	E77	D64
		E77	E77	E77	N40	E77
		K29	K29	J18	E79	K29
		E79	I50	K29	K29	I50
		N28	E79	J96	I67	J18
		I50	E11	N28	I50	E79
		J18	J18	E79	M51	J96
		I67	J96	I50	N28	E11
	60-69	D64	D64	D64	D64	D64
		K76	K76	K76	K76	K76
		E77	E77	K29	E77	E77
		K29	K29	J18	E79	K29
		I50	I50	E77	I50	I50

		M51	M51	N28	M51	J18
		E79	N28	M51	M48	M51
		N28	I10	I50	I10	N28
		J18	I63	J96	I67	I63
		I67	I67	G47	K29	N40
	70-79	D64	D64	D64	D64	D64
		E77	E77	E77	E77	E77
		K76	K76	K76	E79	K76
		I50	I50	N40	K76	I50
		E79	I10	I25	I10	I63
		M51	I63	J18	I50	N40
		I10	I67	I50	M48	I10
		M48	N28	M51	M51	I70
		I63	N40	I70	I67	I67
		I67	E79	I63	E11	N28
		E11	I70	E11	I63	M51
		N28	M51	N28	I49	K29
	80+	D64	D64	D64	D64	D64
		E77	E77	E77	E77	E77
		K76	I50	K76	E79	K76
		I50	K76	I63	K76	I50
		I63	I63	I25	I50	I63
		E79	I10	N40	I10	I10
		I10	N28	C61	I67	N28
		M51	E79	N28	M51	I25
		I67	I67	I48	I49	N40
		I49	N40	I50	I63	I70
Female	18-44	D64	D64	D64	D64	D64
		K76	K76	K76	K76	K76
		K29	K29	K29	K29	K29
		G47	E77	G47	G47	E77
		J47	J96	J47	E77	J47
		E77	J47	N73	J18	J96
		J18	G47	G44	J47	G47
	45-59	D64	K76	D64	D64	K76
		K76	D64	K76	K76	D64
		K29	K29	K29	E77	K29
		E77	E77	G47	K29	E77
		G47	G47	J18	I50	G47
		I50	I50	E77	E79	I50
		M51	M51	D70	G47	M51
		E79	E78	M51	M51	E78
		D70	E11	E11	D70	J18

		J18	J18	I50	I67	E11
	60-69	D64	D64	D64	D64	D64
		K76	K76	K29	K76	K76
		K29	K29	J18	E77	K29
		E77	I50	E11	I10	M51
		M51	M51	E77	E79	I50
		E11	E77	M51	I50	E77
		I50	E11	K76	M48	E11
		I10	I10	G47	E11	I10
		M48	I63	I67	M51	I25
		I67	I67	I25	K29	I67
	70-79	D64	D64	D64	D64	D64
		M51	K76	M51	M51	M51
		E77	M51	E77	E77	K76
		M48	I50	I25	M48	E77
		K76	E77	G47	K76	I50
		I50	I63	E11	I50	I63
		E11	I10	I50	I10	I25
		G47	K29	M48	E79	I10
		E79	E11	I63	E11	E11
		I10	I25	K76	I67	K29
	80+	D64	D64	D64	D64	D64
		E77	E77	E77	E77	E77
		M51	I50	M51	M51	I50
		I50	I63	K29	I50	I63
		K76	K76	E11	K76	M51
		M48	M51	I50	M48	K76
		I10	I10	K76	E79	I10
		E79	I25	G47	I10	I25
		G47	K29	I63	I67	K29
		I63	I67	I25	I49	I70
Urban	18-44	K76	K76	K76	D64	K76
		D64	D64	D64	K76	D64
		G47	K29	K29	G47	K29
		K29	E77	G47	E77	E77
		E77	G47	E78	K29	G47
		J18	J96	E77	J18	E78
	45-59	D64	K76	K76	D64	K76
		K76	D64	D64	K76	D64
		E77	K29	K29	E77	K29
		K29	E77	E77	E79	E77
		E79	G47	G47	K29	G47
		G47	M51	N28	I67	M51

		M51	E11	J18	M51	E11
		N28	E79	J96	I10	J18
		E11	I10	M51	G47	E79
		I10	I50	E79	M48	I10
	60-69	D64	K76	D64	D64	D64
		K76	D64	K76	K76	K76
		E77	E77	E77	E77	E77
		M51	I50	M51	E79	M51
		E79	M51	K29	M51	K29
		I50	K29	J18	I10	I50
		E11	I63	N28	E11	I63
		I63	E11	J96	M48	E11
		I10	I10	I50	I50	I10
		M48	I67	E11	I67	I67
		K29	I70	G47	I63	I70
	70-79	D64	D64	D64	D64	D64
		M51	K76	J18	M51	K76
		E77	E77	M51	E77	E77
		M48	I50	K76	M48	I50
		K76	M51	E77	E79	M51
		I50	I10	I50	I10	I10
		E11	I63	E11	K76	I63
		E79	E11	M48	I50	E11
		I10	I67	I70	E11	I70
		G47	I70	G47	I63	I67
		I63	E79	G31	I67	G47
	80+	D64	D64	D64	D64	D64
		E77	E77	E77	E77	E77
		M51	I50	M51	E79	I63
		K76	I63	I63	M51	K76
		E79	K76	K76	I10	I50
		M48	I10	G47	I50	M51
		I63	M51	E79	M48	I10
		I50	I67	I48	K76	E79
		I10	E79	G31	I63	I67
		G47	G47	M48	I67	G47
		I67	I70	I50	I49	I70
Rural	18-44	D64	K76	D64	D64	K76
		K76	D64	K76	K76	D64
		E77	E77	K29	E77	K29
		K29	K29	E77	K29	E77
		G47	J96	G47	J18	J96
		E79	I50	J47	I50	I50

	J47	J47	E79	G47	J47
45-59	D64	K76	D64	D64	D64
	K76	D64	K76	K76	K76
	E77	E77	J96	E77	E77
	K29	K29	E77	K29	K29
	N40	N40	K29	I50	N40
	N28	I50	N40	E79	I50
	I50	J96	N28	N40	J96
	E79	I27	J18	I67	I27
	J96	J18	G47	N28	J18
	J18	E79	I50	I27	E79
60-69	D64	N40	D64	D64	N40
	N40	D64	N40	E77	D64
	E77	K29	K29	K76	K29
	K76	K76	K76	I50	K76
	K29	E77	E77	E79	E77
	I50	I50	I50	K29	I50
	M51	I27	M51	N40	M51
	N28	M51	J96	I10	I27
	E79	I10	N28	M48	I10
	I27	I63	J18	I67	I25
70-79	D64	N40	N40	D64	N40
	N40	D64	D64	E77	D64
	E77	E77	E77	K76	E77
	K76	I50	M51	M51	I50
	M51	K76	K29	E79	K76
	K29	K29	J18	M48	K29
	I50	I63	K76	I50	M51
	M48	M51	I50	I10	I63
	E79	I10	I63	K29	I10
	I63	I25	I25	I67	I25
80+	D64	D64	D64	D64	D64
	E77	N40	N40	E77	N40
	N40	E77	E77	K76	E77
	K76	I50	K76	I50	I50
	I50	K76	I63	E79	I63
	I63	I63	I50	I10	K76
	M51	K29	I48	N40	I25
	N28	I10	I25	M51	K29
	I10	I25	N28	I49	N28
	K29	N28	M51	I67	I10

*W.Degree: weighted degree; Bet.Centrality: betweenness centrality; Eig.Centrality: eigenvector centrality.

Supplementary Table S4 The top 50 comorbidity pairs with the highest SCI values in the male and female networks

Group	Rank	Disease1	Prevalence1 (%)	Disease2	Prevalence2 (%)	SCI
Male	1	I10	37.96	I63	24.91	0.453
	2	K29	36.27	N40	32.54	0.428
	3	I50	26.9	I51	9.3	0.422
	4	G31	9.82	I63	24.91	0.391
	5	C77	1.53	C78	2.3	0.386
	6	M48	8.69	M51	10.99	0.374
	7	E11	12.96	I10	37.96	0.361
	8	I49	11.18	I50	26.9	0.357
	9	I27	28.13	J96	17.34	0.351
	10	I20	4.17	I25	28.92	0.348
	11	K29	36.27	K76	20.32	0.339
	12	K29	36.27	N28	19.86	0.339
	13	I70	19.31	N28	19.86	0.338
	14	I70	19.31	K76	20.32	0.334
	15	C77	1.53	C79	1.82	0.334
	16	I10	37.96	K76	20.32	0.323
	17	M47	8.75	M51	10.99	0.317
	18	E77	18.35	K29	36.27	0.313
	19	E78	15.07	K76	20.32	0.309
	20	J32	3.56	J34	1.52	0.305
	21	E77	18.35	I27	28.13	0.301
	22	I27	28.13	K29	36.27	0.3
	23	E77	18.35	N40	32.54	0.3
	24	D64	15.27	E77	18.35	0.299
	25	I25	28.92	I48	7.29	0.297
	26	E77	18.35	J96	17.34	0.295
	27	D64	15.27	I50	26.9	0.294
	28	I67	18.62	K76	20.32	0.29
	29	E78	15.07	I25	28.92	0.289
	30	E79	10.07	I10	37.96	0.289
	31	I50	26.9	K76	20.32	0.287
	32	I67	18.62	N28	19.86	0.287
	33	E11	12.96	I25	28.92	0.287
	34	C78	2.3	C79	1.82	0.284
	35	E78	15.07	I63	24.91	0.282
	36	E11	12.96	E78	15.07	0.279
	37	I50	26.9	K29	36.27	0.277
	38	E11	12.96	N40	32.54	0.276
	39	I65	5.39	I67	18.62	0.274
	40	E77	18.35	I25	28.92	0.272

	41	E79	10.07	I25	28.92	0.271
	42	E77	18.35	I10	37.96	0.271
	43	E77	18.35	J18	14.01	0.27
	44	I49	11.18	I51	9.3	0.267
	45	I27	28.13	J47	9.58	0.266
	46	I11	7.21	I63	24.91	0.266
	47	G31	9.82	I25	28.92	0.265
	48	E77	18.35	N28	19.86	0.264
	49	I11	7.21	I25	28.92	0.264
	50	D64	15.27	I25	28.92	0.264
Female	1	I10	43.97	I63	27.72	0.464
	2	I50	32.04	I51	11.97	0.442
	3	E11	16.42	I10	43.97	0.416
	4	M48	11.56	M51	15.46	0.403
	5	G31	9.78	I63	27.72	0.383
	6	I49	12.09	I50	32.04	0.369
	7	E78	22.68	I25	36.55	0.367
	8	M47	11.49	M51	15.46	0.356
	9	E78	22.68	K76	18.44	0.355
	10	E78	22.68	I63	27.72	0.352
	11	K29	45.89	K76	18.44	0.349
	12	I27	27.49	J96	15.4	0.346
	13	I50	32.04	K29	45.89	0.337
	14	I10	43.97	K76	18.44	0.336
	15	E11	16.42	I25	36.55	0.335
	16	E11	16.42	E78	22.68	0.327
	17	I70	20.05	K76	18.44	0.326
	18	D64	16.47	I50	32.04	0.326
	19	I25	36.55	I48	9.47	0.325
	20	I20	4.49	I25	36.55	0.324
	21	I27	27.49	K29	45.89	0.317
	22	K29	45.89	N28	13.47	0.307
	23	I70	20.05	M81	16.21	0.306
	24	D64	16.47	I25	36.55	0.301
	25	I67	21.93	K76	18.44	0.3
	26	I70	20.05	N28	13.47	0.298
	27	M17	5.53	M51	15.46	0.295
	28	E11	16.42	K29	45.89	0.293
	29	E77	14.48	K29	45.89	0.291
	30	E11	16.42	I63	27.72	0.29
	31	I50	32.04	K76	18.44	0.289
	32	G93	4.14	J96	15.4	0.287
	33	I67	21.93	K29	45.89	0.287
	34	I27	27.49	J47	10.22	0.286

35	E78	22.68	I10	43.97	0.282
36	E11	16.42	K76	18.44	0.282
37	I11	9.01	I25	36.55	0.281
38	I70	20.05	M51	15.46	0.281
39	E78	22.68	G45	10.92	0.28
40	D64	16.47	I63	27.72	0.28
41	E79	8.82	I10	43.97	0.279
42	G31	9.78	I25	36.55	0.278
43	J32	3.74	J34	1.15	0.277
44	I49	12.09	I51	11.97	0.277
45	E77	14.48	I27	27.49	0.277
46	I11	9.01	I63	27.72	0.276
47	I50	32.04	J18	13.36	0.275
48	J45	6.16	J46	1.46	0.273
49	K29	45.89	K59	6.87	0.273
50	E79	8.82	I25	36.55	0.272

Supplementary Table S5 The network statistics for sex- and age-specific networks

Age	Metrics	Male	Female	Difference	Expected difference (null model)	Standard deviation (null model)	P-value
18-44	Density	0.242	0.167	0.076	0.03	0.03	<0.001
	Diameter	4	5	-1	-0.21	0.6	<0.001
	Ave. degree	16.7	12.16	4.55	1.78	1.81	<0.001
	Ave.W. degree	1.81	1.43	0.38	1.78	1.81	<0.001
	Ave.clo.centraliity	0.547	0.509	0.038	0.025	0.026	<0.001
45-59	Density	0.225	0.229	-3.9e-3	-2.2e-3	3.5e-3	<0.001
	Diameter	3	3	0	0.23	0.64	<0.001
	Ave. degree	23.9	22.7	1.2	0.4	0.5	<0.001
	Ave.W. degree	2.47	2.37	0.1	0.42	0.51	<0.001
	Ave.clo.centraliity	0.557	0.555	1.9e-3	-4.6e-04	3.1e-3	<0.001
60-69	Density	0.227	0.226	3.8e-04	1.5e-04	2.9e-03	<0.001
	Diameter	4	4	0	0.02	0.26	<0.001
	Ave. degree	24.3	23.1	1.2	0.5	0.5	<0.001
	Ave.W. degree	2.7	2.78	-0.08	0.46	0.55	<0.001
	Ave.clo.centraliity	0.555	0.547	7.4e-3	2.4e-3	3.9e-3	<0.001
70-79	Density	0.215	0.229	-0.014	-5.2e-3	5.7e-3	<0.001
	Diameter	4	3	1	0.032	0.301	<0.001
	Ave. degree	25.8	23.6	2.2	0.9	0.9	<0.001
	Ave.W. degree	3.01	3.09	-0.08	0.89	0.94	<0.001
	Ave.clo.centraliity	0.547	0.555	-7.5e-3	-1.1e-3	3.3e-3	<0.001
80+	Density	0.219	0.217	1.8e-3	1.1e-3	2.9e-3	<0.001
	Diameter	5	4	1	0.02	0.4	<0.001

Ave. degree	23.0	21.7	1.3	0.5	0.6	<0.001
Ave.W. degree	3.07	2.91	0.16	0.53	0.60	<0.001
Ave.clo.centraliity	0.539	0.549	-0.010	-1.2e-4	3.8e-3	<0.001

*Ave. degree: Average degree; Ave.W. degree: Average weighted degree; Ave.clo.centraliity: Average closeness centrality.

Supplementary Table S6 Cluster communities in sex- and age- specific networks

Sex	Age	Community	Diseases	Core disease
Male	18-44	1	D64, D68, D69, D70, D75, E77, E83, K26, K70, K74, B90, E46, G93, I27, I31, J18, J47, J96, G47, I49, I70, K21, K52, K72, K80, K82, M10, M47, M48, M50, M51, M89, N28, N39, N40	D64
		2	E11, E14, E78, E79, F41, G44, G45, I10, I25, I63, I84, J31, K25, K59, K76, J45, J46	K76
		3	I11, I42, I50, I51, N18, N19, D86, I67, K29, K31	K29
		4	J32, J34, J62, J63, J64, J84	-
		5	B18, B24	-
	45-59	1	I45, I47, I49, I50, I51, C22, D50, D64, D68, D69, D70, D75, E77, E83, F10, K20, K22, K25, K26, K27, K31, K70, K74, C15, C34, C77, C78, C79, D61, E41, J18, G47, I65, I67, I70, J32, J34, J38, K21, K29, K52, K59, K72, K80, K82, K83, L30, M06, M10, M17, M47, M48, M50, M51, M81, M87, M89, N28, N39, N40	N40
		2	D86, E03, E04, E11, E14, E72, E78, E79, F41, G31, G40, G44, G45, H25, H26, H81, I10, I11, I20, I25, I63, I84, J31, K76, E05, I38, I42, I48	K76
		3	I61, I69, B18, B90, E46, G93, I27, I31, J45, J46, J47, J60, J84, J96	G93
		4	J62, J63, J64, N18, N19	-
	60-69	1	C16, C77, C78, C79, D61, I61, I69, G47, H10, I65, I67, I70, J32, J34, J45, J46, K21, K22, K27, K29, K31, K52, K59, K72, K80, K82, K83, L30, M06, M10, M13, M17, M47, M48, M50, M51, M81, M89, N18, N19, N28, N39, N40	N28

	2	D86, E03, E04, E11, E14, E72, E78, E79, F41, G31, G44, G45, H25, H26, H81, I10, I20, I21, I24, I25, I63, I84, J31, K76, I08, I11, I35, I38, I42, I44, I45, I47, I48, I49, I50, I51	K76
	3	B18, B90, C15, C34, D64, D68, D70, E41, E46, E77, E83, G40, G93, I27, I31, J18, J47, J84, J96	D64
	4	J62, J63, J64, C22, D69, K74	-
	5	D50, K20, K25, K26	-
70-79	1	D86, E03, E04, E11, E14, E16, E72, E78, F41, G20, G31, G37, G40, G44, G45, G91, H26, H81, I10, I21, I25, I63, I84, J31, K76, G47, I70, J45, K21, K52, K72, K80, K82, K83, M06, M10, M13, M81, M89, N18, N19, N28	I63
	2	C16, C61, C77, C78, C79, D50, I35, I38, I45, I47, I49, I50, I51, I71, J18, I61, I65, I66, I67, I69, I74, I77, D61, D70, I62, K29, K59, N30, N32, N39, N40, N41, N42	J18
	3	E79, I07, I08, I11, I20, I24, I31, I34, I42, I44, I48, B90, C34, E46, E83, G93, I27, J47, J84, J96, H10, J32, J34, L30, M17, M47, M48, M50, M51	M51
	4	E77, K20, K25, K26, K27, K31, L89	E77
	5	D64, D68, D69, E41, K22, K74	D64
	6	H25, H35, J62, J64	-
80+	1	D50, D69, E11, E14, E16, E79, I08, I10, I11, I20, I21, I24, I25, I31, I34, I42, I44, I48, I84, J18, K25, I35, I38, I45, I47, I49, I50, I51, I71, J84, G47, J32, K21, K52, L30, M17, M47, M48, M50, M51	E11
	2	D86, E04, E72, E78, F41, G20, G45, K76, H25, H26, H35, I65, I66, I67, I69, I74, I77, E41, E46, G93, I27, J47, J96, F03, G30, E03, G31, G37, G44, G91, H81, I61, I63	K76
	3	D64, D68, E83, I70, J45, K22, K27, K31, K80, K82, K83, L89, M81, M89, N28, D70, E43, E77, I62, K29, K59, K72, K74, M10, N18, N19, N30, N32, N39, N40	D64
	4	C61, C78, C79	-

Female	18-44	1	J30, J32, J34, I67, J38, K21, K29, K31, D64 N94, D50, D64, D68, D69, E03, K72, N39, N60, N70, N73, N80, N85, N93	
		2	D61, D70, D86, E04, E11, E78, E79, K76 F41, G44, G45, H81, I10, I25, I63, I84, J31, K25, K59, K76	
		3	G47, I70, J45, K52, K80, K82, M17, M51 M47, M48, M50, M51, M89, N28, M06, M35, M81, E83, N18, N19	
		4	B18, B90, E77, G93, I27, I31, I49, I50, J47 I51, J18, J46, J47, J84, J96	
	45-59	1	C78, C79, D64, D68, D70, E77, E83, J84, D64 K72, K74, K83, M35, N18, N19, N39, N73, N80, N94, G47, I65, I70, J30, J32, J34, J38, J45, K21, K27, K52, K80, K82, L30, M06, M13, M17, M23, M25, M47, M48, M50, M51, M81, M89, N28, N95	
		2	D50, D69, D86, E03, E04, E05, E11, K76 E14, E78, E79, F41, F45, G31, G44, G45, H25, H26, H81, I10, I20, I25, I63, I84, J18, J31, K20, K25, K76	
		3	I07, I08, I09, I11, I38, I42, I47, I48, I49, I48 I50, I51	
		4	I61, I69, B18, B90, E46, G93, I27, I31, G93 J46, J47, J96	
		5	D61, I67, K29, K31, K59	-
	60-69	1	D86, E04, E05, E07, E11, E14, E16, E72, I25 E78, F41, G20, G31, G37, G44, G45, H26, H81, I10, I21, I25, I61, I63, I69, I84, J31, K76, E03, I35, I45, I47, I49, I50, I51, J84, D70, E41, E46, E83, G93, I27, I38, I67, J18, J47, J96	
		2	E79, I07, I08, I11, I20, I24, I31, I34, I42, M51 I44, I48, M10, G47, H10, I65, I66, I70, J32, J45, J46, K21, K27, K29, K31, K52, K59, K80, K82, M06, M13, M15, M17, M19, M25, M43, M47, M48, M50, M51, M81, M89, N28	
		3	D64, D68, D69, H25, H35, H43, N18, D64 N19, N39	
		4	D50, E77, K25, K72, K74, K83, L30, E77 L89	
	70-79	1	G47, H10, H25, H35, I65, I70, J32, J34, M51 J45, K21, K27, K29, K31, K52, K59,	

		K72, K80, K82, K83, M06, M13, M15, M17, M19, M23, M25, M43, M47, M48, M50, M51, M81, M89, N28	
	2	C78, C79, D86, E03, E04, E05, E11, E14, E16, E78, E79, F41, G31, G44, G45, H26, H81, I10, I20, I24, I25, I63, I84, J31, K20, K25, K76, N18, N19, N39	K76
	3	D61, D64, D68, D69, K74, I07, I08, I09, I11, I34, I38, I42, I44, I48, D70, E41, E46, E77, E83, G93, I27, I31, J18, J46, J47, J84, J96, L30	D64
	4	D50, I35, I45, I47, I49, I50, I51	I51
	5	I61, I66, I67, I69	-
80+	1	F03, G30, D50, D64, D68, D69, E41, E46, E72, E83, G31, G37, I24, I25, I31, I44, I48, J18, I07, I34, D86, E03, E04, E07, E78, F41, G20, G44, G45, H81, K76, E77, K72, K74, K80, K82, K83, L89, N18, G47, H25, H26, I20, I65, I67, K21, K31, K52, L30, M13, M17, M19, M43, M47, M48, M50, M51	D64
	2	E11, E14, E16, E43, E79, I10, I21, I61, I63, I69, K25, I08, I11, I35, I45, I47, I49, I50, I51, I74, I77, I84, J84, M10, M89, G93, I27, J47, J96	I49
	3	D70, I38, I66, I70, J32, J45, K27, K29, K59, M06, M41, M81, N19, N28, N39	K29

* -: The number of diseases in community ≤ 4 or the highest betweenness centrality of disease is equal to 0.

Supplementary Table S7 The top 50 comorbidity pairs with the highest SCI values in the urban and rural networks

Group	Rank	Disease1	Prevalence1 (%)	Disease2	Prevalence2 (%)	SCI
Urban	I10	43.34	I63	30.58	0.494	I10
	I50	28.7	I51	10.92	0.455	I50
	E11	16.95	I10	43.34	0.416	E11
	M48	11.05	M51	14.23	0.398	M48
	G31	10.1	I63	30.58	0.392	G31
	C77	1.29	C78	2.0	0.39	C77
	I49	14.22	I50	28.7	0.389	I49
	I20	5.72	I25	31.56	0.388	I20

	I70	26.05	K76	24.34	0.381	I70
	K29	39.47	K76	24.34	0.374	K29
	I70	26.05	N28	20.78	0.369	I70
	I10	43.34	K76	24.34	0.367	I10
	E78	21.45	K76	24.34	0.362	E78
	M47	11.36	M51	14.23	0.356	M47
	E78	21.45	I63	30.58	0.355	E78
	K29	39.47	N28	20.78	0.35	K29
	E78	21.45	I25	31.56	0.349	E78
	I67	23.53	K76	24.34	0.346	I67
	C77	1.29	C79	1.62	0.341	C77
	I27	24.24	J96	18.0	0.338	I27
	D64	17.25	I50	28.7	0.331	D64
	E11	16.95	I25	31.56	0.33	E11
	K29	39.47	N40	21.97	0.329	K29
	E11	16.95	E78	21.45	0.328	E11
	I67	23.53	N28	20.78	0.318	I67
	I25	31.56	I48	8.65	0.316	I25
	E77	18.2	K29	39.47	0.314	E77
	I11	9.33	I63	30.58	0.311	I11
	E79	11.07	I10	43.34	0.311	E79
	I70	26.05	M47	11.36	0.309	I70
	E11	16.95	I63	30.58	0.309	E11
	I50	28.7	K76	24.34	0.308	I50
	I70	26.05	M51	14.23	0.305	I70
	E77	18.2	J96	18.0	0.303	E77
	D64	17.25	I63	30.58	0.303	D64
	E77	18.2	I27	24.24	0.302	E77
	I11	9.33	I25	31.56	0.301	I11
	J32	4.05	J34	1.65	0.297	J32
	D64	17.25	I25	31.56	0.296	D64
	I65	6.99	I67	23.53	0.295	I65
	E79	11.07	I25	31.56	0.295	E79
	K29	39.47	K59	8.39	0.295	K29
	I70	26.05	M48	11.05	0.294	I70
	E11	16.95	I67	23.53	0.293	E11
	I70	26.05	M81	12.13	0.292	I70
	I11	9.33	I67	23.53	0.29	I11
	E77	18.2	I10	43.34	0.288	E77
	C78	2.0	C79	1.62	0.287	C78
	M17	4.66	M51	14.23	0.286	M17
	I27	24.24	J47	11.2	0.286	I27
Rural	1	K29	40.38	N40	6.12	0.542
	2	I10	38.34	I63	23.05	0.429

3	I50	29.04	I51	9.97	0.414
4	E77	15.96	N40	6.12	0.4
5	G31	9.61	I63	23.05	0.385
6	M48	9.01	M51	11.77	0.379
7	C77	1.1	C78	1.73	0.37
8	I27	30.23	N40	6.12	0.364
9	E11	12.6	I10	38.34	0.36
10	I27	30.23	J96	15.67	0.358
11	I49	9.79	I50	29.04	0.344
12	I50	29.04	N40	6.12	0.335
13	I27	30.23	K29	40.38	0.332
14	I50	29.04	K29	40.38	0.326
15	C77	1.1	C79	1.33	0.322
16	K29	40.38	K76	16.51	0.32
17	E11	12.6	N40	6.12	0.32
18	M47	8.82	M51	11.77	0.318
19	E78	15.83	I25	32.11	0.31
20	I25	32.11	I48	7.8	0.305
21	K29	40.38	N28	15.16	0.305
22	I20	3.38	I25	32.11	0.301
23	I10	38.34	K76	16.51	0.296
24	N39	6.12	N40	6.12	0.294
25	E77	15.96	K29	40.38	0.294
26	E11	12.6	I25	32.11	0.294
27	D64	14.75	E77	15.96	0.294
28	E78	15.83	K76	16.51	0.294
29	I67	17.57	N40	6.12	0.292
30	J32	3.37	J34	1.2	0.292
31	E79	8.62	N40	6.12	0.292
32	D64	14.75	I50	29.04	0.291
33	C78	1.73	C79	1.33	0.289
34	E77	15.96	I27	30.23	0.287
35	I70	15.42	N40	6.12	0.287
36	I70	15.42	K76	16.51	0.28
37	E11	12.6	E78	15.83	0.277
38	I70	15.42	N28	15.16	0.277
39	E78	15.83	I63	23.05	0.277
40	I67	17.57	K29	40.38	0.276
41	K80	10.38	N40	6.12	0.276
42	I50	29.04	K76	16.51	0.274
43	N30	1.11	N40	6.12	0.274
44	J45	4.12	J46	1.06	0.271
45	E77	15.96	J96	15.67	0.271
46	D64	14.75	I25	32.11	0.27

47	I27	30.23	J47	8.94	0.268
48	G31	9.61	I25	32.11	0.267
49	G93	3.93	J96	15.67	0.264
50	E79	8.62	I10	38.34	0.264

Supplementary Table S8 The network statistics for region- and age-specific networks

Age	Metrics	Urban	Rural	Difference	Expected difference (null model)	Standard deviation (null model)	P-value
18-44	Density	0.182	0.205	-0.023	-8.4e-3	9.1e-3	<0.001
	Diameter	4	4	0	-0.03	0.57	<0.001
	Ave. degree	12.4	14.7	-2.4	-0.9	0.9	<0.001
	Ave.W. degree	1.48	1.58	-0.10	-0.91	0.94	<0.001
	Ave.clo.centraliity	0.514	0.526	-0.012	-7.8e-3	9.5e-3	<0.001
45-59	Density	0.234	0.234	-1.2e-5	-4.4e-4	2.9e-3	<0.001
	Diameter	3	3	0	-0.14	0.68	<0.001
	Ave. degree	23.6	23.2	0.47	0.14	0.31	<0.001
	Ave.W. degree	2.46	2.31	0.16	0.14	0.31	<0.001
	Ave.clo.centraliity	0.557	0.560	-3.0e-3	-8.1e-4	3.0e-3	<0.001
60-69	Density	0.225	0.229	-3.9e-3	-2.1e-3	3.4e-3	<0.001
	Diameter	4	4	0	0.10	0.46	<0.001
	Ave. degree	24.5	24.3	0.2	0.03	0.28	<0.001
	Ave.W. degree	2.92	2.68	0.25	0.034	0.27	<0.001
	Ave.clo.centraliity	0.550	0.560	-9.2e-3	-4.1e-3	5.2e-3	<0.001
70-79	Density	0.217	0.226	-9.0e-3	3.4e-3	4.2e-3	<0.001
	Diameter	4	3	1	0.01	0.26	<0.001
	Ave. degree	25.4	23.9	1.4	0.6	0.6	<0.001
	Ave.W. degree	3.36	2.88	0.48	0.57	0.63	<0.001
	Ave.clo.centraliity	0.547	0.554	-6.3e-3	-6.8e-4	3.2e-3	<0.001
80+	Density	0.218	0.217	8.6e-4	1.4e-4	2.7e-3	<0.001
	Diameter	4	4	0	0.02	0.38	<0.001
	Ave. degree	24.4	21.5	2.9	1.1	1.1	<0.001
	Ave.W. degree	3.43	2.71	0.72	1.12	1.14	<0.001
	Ave.clo.centraliity	0.549	0.554	-5.1e-3	4.7e-4	3.6e-3	<0.001

*Ave. degree: Average degree; Ave.W. degree: Average weighted degree; Ave.clo.centraliity: Average closeness centrality.

Supplementary Table S9 Cluster communities in region- and age- specific networks

Sex	Age	Community	Diseases	Core disease
Urban	18-44	1	B18, D61, D86, E11, E78, E79, F41, G44, G45, H81, I10, I25, I63, I84, J31, K59, K76, E03, I11, I49, I50, I51, I67, M10, J30, J32, J34, J38, J45, J46, K29, K31, B90, E77, G93, I27, I31, J18, J47, J84, J96	K76
		2	E04, G47, I70, K21, K25, K26, K52, K80, K82, M17, M47, M48, M50, M51, M89, N28, N40	K21
		3	D64, D70, E83, N18, N19, N39, N73	D64
		4	D50, D69, K72, K74	-
	45-59	1	B18, C34, C77, C78, C79, D50, D61, D64, D68, D69, E41, E46, G40, J18, K70, K74, G47, H10, I65, I70, J30, J32, J34, J38, J45, K21, K52, K72, K80, K82, K83, L30, M06, M10, M17, M47, M48, M50, M51, M81, M89, N28, N39, N40	D64
		2	D86, E03, E04, E05, E11, E14, E72, E78, E79, F41, G31, G44, G45, H25, H26, H81, I10, I20, I25, I63, I84, J31, K20, K25, K26, K76, M25, B90, E77, E83, G93, I27, I31, J46, J47, J62, J84, J96, N18, N19	K76
		3	I11, I38, I42, I45, I47, I48, I49, I50, I51, D70, I67, K22, K27, K29, K31, K59	K29
		4	I61, I69	-
	60-69	1	D64, D68, K72, K74, M10, N18, N19, N39, G47, H10, I70, J32, J34, J45, K21, K22, K27, K29, K31, K52, K59, K80, K82, K83, L30, M06, M13, M17, M25, M43, M47, M48, M50, M51, M81, M89, N28, N40	D64
		2	D50, D70, D86, E03, E04, E05, E11, E14, E72, E78, E79, F41, G31, G44, G45, H26, H81, I10, I20, I21, I24, I25, I63, I84, J31, K25, K76	I25
		3	C77, C78, C79, D61, D69, E41, J18, J62, J64, B90, C34, E46, E77, E83, G93, I27, I31, J46, J47, J84, J96, K20, K26	J18
		4	I08, I11, I35, I38, I42, I44, I45, I47, I48, I49, I50, I51	I48

		5	I07, I34, I61, I65, I66, I67, I69, I77	I67
		6	H25, H35	-
70-79	1		E77, G40, K74, L89, M10, N18, N19, G47, H10, I66, I70, J32, J34, J45, J46, K21, K25, K27, K29, K31, K52, K59, K72, K80, K82, K83, L30, M06, M17, M19, M25, M43, M47, M48, M50, M51, M81, M89, N28, N39, N40	E77
	2		D61, D64, D68, D69, E16, E41, K22, D50, E03, E79, I07, I08, I11, I20, I21, I24, I25, I31, I34, I42, I44, I48, E43, E46, E83, G93, I27, J47, J96	D64
	3		D86, E04, E07, E11, E72, E78, F41, G20, G31, G37, G44, G45, G91, H81, I10, I63, I84, J31, J84, K76, M13, I61, I65, I67, I69, I74, I77, N30, N32	G31
	4		H25, H26, H35, K20, K26, D70, E14, I35, I38, I45, I47, I49, I50, I51, I71, J18	I50
	5		C77, C78, C79	-
80+	1		E79, I11, I12, I61, I62, I65, I67, I69, I74, I77, I84, J84, M10, G47, H10, J32, J45, K21, K52, K80, L30, M17, M19, M43, M47, M48, M50, M51, D64, D68, E07, E16, I70, K27, K31, L89, M06, M81, M89	D64
	2		I07, I31, I34, I08, I35, I47, I49, I50, I51, I71, K82, M13, E41, E83, G93, I27, J47, J96, K72, K74, K83, D70, E43, E77, G40, I38, I66, K25, K29, K59, N18, N19, N28, N30, N32, N39, N40	E77
	3		F01, F03, G30, D50, D69, D86, E03, E04, E11, E14, E46, E72, E78, F41, G20, G31, G37, G44, G45, G91, H25, H26, H35, H81, I10, I20, I21, I24, I25, I42, I44, I45, I48, I63, J18, J31, K76	I25
Rural	18-44	1	D64, D68, D69, D70, D75, E03, K74, N19, N39, N73, B90, E46, E77, E83, G93, I27, I31, J18, J45, J46, J47, J96, E04, E05, G47, I70, K21, K52, K72, K80, K82, M47, M48, M50, M51, M89, N28, N40	D64
		2	E11, E14, E78, E79, F41, G40, G44, G45, H81, I10, I25, I63, I84, J31, K25,	K76

		K59, K76, J32, J34, D50, D86, I67, K29, K31	
	3	I11, I42, I49, I50, I51, M10	I50
	4	J62, J64, J84	-
	5	B18, B24	-
45-59	1	C77, C78, C79, D61, D68, D70, I67, K22, K29, K31, K59, D64, D69, D75, E77, E83, K70, K72, K74, K83, M10, N18, N19, N39, G47, I65, I70, J32, J34, J45, K21, K27, K52, K80, K82, L30, M06, M17, M25, M47, M48, M50, M51, M81, M89, N28, N40	D64
	2	D86, E03, E04, E05, E11, E14, E78, E79, F41, G31, G40, G44, G45, H25, H26, H81, I10, I20, I25, I38, I48, I63, I84, J31, K76, I11, I42, I47, I49, I50, I51, I61, I69	I63
	3	B18, B90, C34, E41, E46, G93, I27, I31, J18, J46, J47, J96	J96
	4	D50, K20, K25, K26	-
	5	J62, J63, J64, J84	-
60-69	1	C16, C77, C78, C79, D61, D69, D86, E03, E04, E11, E14, E72, E78, E79, F41, G31, G44, G45, H25, H26, H81, I10, I11, I20, I21, I24, I25, I34, I48, I63, I84, J31, K31, K76, G47, I65, I70, J32, J34, J45, J46, K21, K22, K27, K29, K52, K59, K72, K80, K82, K83, L30, M06, M10, M13, M17, M25, M43, M47, M48, M50, M51, M81, M89, N18, N19, N28, N39, N40, B18, D50, D68, K20, K25, K26	N40
	2	B90, C34, D64, D70, E41, E46, E77, E83, G93, I27, I31, I44, I67, J18, J47, J84, J96, K74	J96
	3	I08, I35, I38, I42, I45, I47, I49, I50, I51	I49
	4	J62, J63, J64	-
	5	I61, I69	-
70-79	1	D86, E03, E04, E11, E14, E16, E72, E78, E79, F41, G20, G31, G37, G44, G45, G91, H26, H81, I10, I21, I25, I61, I63, I69, I84, J31, K76, J62, J64, G47, I65, I66, I70, J32, J45, K21, K27, K29, K31, K52, K59, K80, K82, M06, M13, M17, M25, M43, M47, M48, M50, M51, M81, M89, N28	M51

	2	D50, D70, I35, I38, I45, I47, I49, I50, D64 I51, J18, D64, D68, E77, E83, K25, K72, K74, K83, L89, M10, N18, N19, N39	
	3	C16, C78, C79, E41, E46, G93, I27, I67, I27 J47, J84, J96	
	4	C16, C78, C79, E41, E46, G93, I27, I67, I48 J47, J84, J96	
	5	B90, D61, D69, K22, L30, N30, N40	N40
	6	H25, H43	-
80+	1	F03, G30, D50, D69, E11, E14, E16, I25 E79, I08, I10, I11, I20, I21, I24, I25, I31, I34, I42, I44, I48, I84, J18, K25, E41, E46, G93, I27, I38, J45, J47, J84, J96	
	2	G47, H25, I70, J32, K21, K27, K29, K52, M51 K59, K72, K80, K83, M06, M17, M47, M48, M50, M51, M81, M89, N28	
	3	D64, D68, D86, E03, E04, E72, E78, D64 E83, F41, G20, G31, G37, G44, G45, G91, H26, H81, I63, K76	
	4	I35, I45, I47, I49, I50, I51, I71, I74, K82, I50 I61, I65, I66, I67, I69, K31, D70, K74	
	5	E77, I62, L30, L89, M10, N18, N19, N40 N30, N32, N39, N40	

* -: The number of diseases in community is ≤ 4 or the highest betweenness centrality of disease is equal to 0.