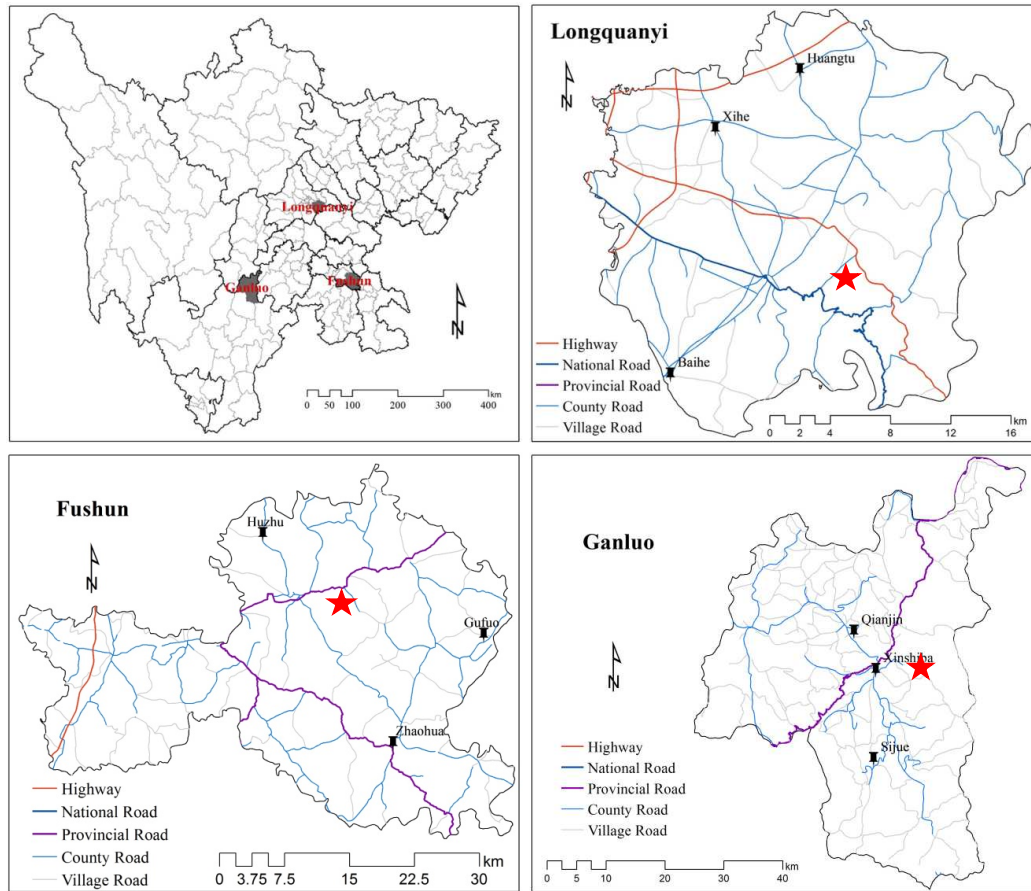


## Supplementary file



supplementary Figure 1 Study sites in Sichuan Province

Note: red star indicates county centre and the location the county hospitals

Supplementary Table 1 Socioeconomics demographics of Sichuan and China

Characteristics	Sichuan	China
Population	83.7 million	1.41 billion
Male Female ratio	1.05	1.05
No. of races	55	56
Races other than Han (%)	6.59	8.49
Population per KM <sup>2</sup>	174	148
Urban population (%)	6	64
Mean education year of aged 15 above	9.24	9.91
GDP per capita (yuan)	58126	72000
Age expectancy (year)	74.7	76.3
Maternal mortality (1/100 thousand)	16.84	16.90
Infant mortality (‰)	5.22	5.40
Under 5 mortality (‰)	7.3	7.5
Doctors (assistant) per 1000	2.8	2.9
Registered nurses per 1000	3.4	3.3

China and Sichuan Yearbook (Statistics) 2020, and National Bureau of Statistics National data

<https://data.stats.gov.cn/index.htm>

Supplementary Table 2 Socioeconomic, demographic and health system characteristics of the three counties

Dimension	Characteristics	LQY	FS	GL
<b>Geography</b>	Landscape	Plateau	Hills	Mountains
	Land size (KM <sup>2</sup> )	558	1336	2151
<b>Population</b>	Total (thousand)	643	1083	223
	Rural residents, thousand (%)	301(46.8)	835(77.1)	214(95.9)
	Ethnic other Han, thousand (%)	(0.9)	(0.1)	(76.7)
<b>Economics</b>	GDP per capita (RMB)	117,854	24,928	12,781
<b>Health institutions</b>	Hospitalsxinsij	24	12	4
	THCs	9	26	28
<b>Health facilities</b>	Beds	3,820	2,818	845
	Beds per 1000	5.9	2.6	3.8
	THCs beds, n (%)	267 (7.0)	1,095 (38.9)	246 (29.1)
	THCs beds per 1000 rural residents	0.89	1.31	1.15
<b>Health workforce</b>	Licensed doctors (assistant)	1,962	1,346	237
	Licensed doctors per 1000	3.1	1.2	1.1
	Licensed doctors per 1000 rural residents	0.48	0.44	0.41
	Registered nurses	2,109	1,150	272
	Registered nurses in THCs (%)	105 (5.0)	266 (23.1)	59 (21.7)
	Registered nurses per 1000	3.3	1.1	1.2
	Registered nurses per 1000 rural residents	0.35	0.32	0.28
<b>Health services</b>	Total admissions	113,086	146,236	37,058
	THCs admissions (%)	11,241 (9.9)	63,726 (43.6)	8,491 (22.9)
	Admissions per 1000 residents	175.8	135.0	166.1
	THCs admissions per 1000 rural residents	37.35	76.32	39.68
	Average length of stay, day	8.98	8.02	5.36
	Bed days per doctor per day	2.18	3.48	3.49
	Total outpatient visits, thousand	4461	4321	360
	*Primary care outpatient visits, thousand (%)	2,519 (56.5) <sup>#</sup>	3,240 (75.0)	140 (38.7)
<b>Health finance</b>	Expenditure per admission (RMB)	5,674	4,140	2,639
	Expenditure per outpatient visit (RMB)	208	148	95
	Total revenue of health sector (RMB Million)	15,149	8,100	2,128

LQY: Longquanyi district, FS: Fushun county, GL: Ganluo county, Data source: 2015 Health and Family Planning Statistics Yearbook of Sichuan Province. THCs: township health centres. \*Primary health care institutions included both township health centres (and village clinics) in the in rural areas and community health centres in the urban areas.

Supplementary Table 3 Coverage of disease systems in township health centres

System	LQY			FS			GL			All THs			All CHs		
	N	%	Rank	N	%	Rank	N	%	Rank	N	%	Rank	N	%	Rank
Respiratory	967	57.2	1	1,824	45.3	1	546	56.8	1	3,337	50.0	1	6,439	25.8	1
Digestive	199	11.8	2	611	15.2	2	140	14.6	2	950	14.2	2	4,206	16.9	2
Circulation	63	3.7	5	385	9.6	3	58	6.0	4	506	7.6	3	2,582	10.3	3
Urinary	158	9.3	3	177	4.4	4	135	14.0	3	470	7.0	4	1,193	4.8	6
Musculoskeletal	154	9.1	4	166	4.1	5	21	2.2	6	341	5.1	5	834	3.3	8
Nervous	30	1.8	8	150	3.7	6	1	0.1	13	181	2.7	6	823	3.3	9
Injury Poisoning	10	0.6	11	125	3.1	7	5	0.5	9	140	2.1	7	2,300	9.2	4
Infectious & Parasitic	3	0.2	13	99	2.5	10	33	3.4	5	135	2.0	8	869	3.5	7
Cancer	14	0.8	10	110	2.7	9	3	0.3	10	127	1.9	9	722	2.9	10
Pregnancy/Childbirth	0	0.0	/	123	3.1	8	0	0.0	/	123	1.8	10	2,108	8.4	5
Ear	34	2.0	7	86	2.1	11	2	0.2	11	122	1.8	11	117	0.5	18
Skin	16	0.9	9	66	1.6	12	6	0.6	8	88	1.3	12	139	0.6	16
Abnormal	37	2.2	6	35	0.9	13	7	0.7	7	79	1.2	13	282	1.1	15
Endocrine	4	0.2	12	17	0.4	14	1	0.1	14	22	0.3	14	604	2.4	12
Mental	/	0.0	/	17	0.4	15	1	0.1	15	18	0.3	15	110	0.4	19
Blood	/	0.0	/	11	0.3	17	/	0.0	/	11	0.2	17	124	0.5	17
Eye	/	0.0	/	2	0.0	19	/	0.0	/	2	0.0	19	463	1.9	13
Congenital	/	0.0	/	1	0.0	20	/	0.0	/	1	0.0	20	30	0.1	20
Perinatal	/	0.0	/	0	0.0	21	/	0.0	/	/	0.0	/	353	1.4	14
Other contact	2			18			2			22			660	2.6	11
Total	1,691			4,023			961			6,675			24958		

LQY: Longquanyi district, FS: Fushun county, GL: Ganluo county. \*All disease systems were covered in county hospitals of the three counties, respectively

Supplementary Table 4 Top 20 diseases in township health centres

Rank	Longquanyi				Fushun				Ganluo			
	ICD-10	Disease	n	%	ICD-10	Disease	n	%	ICD-10	Disease	n	%
1	J18.9	Pneumonia, unspecified* <sup>#</sup>	489	25.2	J20.9	Acute bronchitis, unspecified*	693	17.1	J06.9	Acute upper respiratory infection, unspecified* <sup>#</sup>	288	28.4
2	J20.9	Acute bronchitis, unspecified	197	10.1	J42.x	Unspecified chronic bronchitis	564	13.9	J20.9	Acute bronchitis, unspecified*	143	14.1
3	J44.1	Chronic obstructive pulmonary disease with (acute) exacerbation* <sup>#</sup>	169	8.7	J06.9	Acute upper respiratory infection, unspecified* <sup>#</sup>	214	5.3	N73.9	Female pelvic inflammatory disease, unspecified <sup>#</sup>	103	10.2
4	H81.0	Gastroenteritis and colitis, unspecified causes	121	6.2	K29.5	Unspecified chronic gastritis	199	4.9	J42.x	Unspecified chronic bronchitis	88	8.7
5	J03.9	Acute tonsillitis, unspecified* <sup>#</sup>	96	4.9	I67.9	Cerebrovascular disease, unspecified	180	4.5	I00.x	Rheumatic fever without heart involvement <sup>#</sup>	52	5.1
6	J18.0	Bronchopneumonia, unspecified* organism	96	4.9	A09.9	Gastroenteritis and colitis, unspecified causes*	134	3.3	K29.7	Gastritis, unspecified	42	4.1
7	N39.0	Urinary tract infection, site not specified	71	3.7	N73.9	Female pelvic inflammatory disease, unspecified <sup>#</sup>	82	2.0	J18.9	Pneumonia, unspecified* <sup>#</sup>	37	3.7
8	M51.9	Intervertebral disc disorder, unspecified	66	3.4	J03.9	Acute tonsillitis, unspecified* <sup>#</sup>	70	1.7	K29.5	Unspecified chronic gastritis*	35	3.5
9	M48.9	Spondylopathy, unspecified	33	1.7	I10.x	Essential (primary) hypertension <sup>#</sup>	61	1.5	A09.9	Gastroenteritis and colitis, unspecified causes*	33	3.3
10	R42.x	Dizziness and giddiness	27	1.4	I25.1	Atherosclerotic heart disease of native coronary artery*	58	1.4	J03.9	Acute tonsillitis, unspecified* <sup>#</sup>	14	1.4
11	G45.0	Vertebro-basilar artery syndrome*	27	1.4	K29.7	Gastritis, unspecified	57	1.4	N73.0	Acute parametritis and pelvic cellulitis <sup>#</sup>	11	1.1
12	K29.1	Unspecified chronic gastritis	26	1.3	O80.0	Encounter for full-term uncomplicated delivery*	55	1.4	K52.9	Noninfective gastroenteritis and colitis, unspecified*	9	0.9
13	N71.0	Acute inflammatory disease of uterus	25	1.3	K29.1	other acute gastritis	51	1.3	A02.0	Salmonella enteritis	6	0.6
14	A09.9	Gastroenteritis and colitis of unspecified origin	24	1.2	I67.2	Cerebral atherosclerosis	48	1.2	K29.1	Other acute gastritis	6	0.6

Rank	Longquanyi				Fushun				Ganluo			
	ICD-10	Disease	n	%	ICD-10	Disease	n	%	ICD-10	Disease	n	%
15	J44.9	Chronic obstructive pulmonary disease, unspecified <sup>#</sup>	23	1.2	J18.9	Pneumonia, unspecified* <sup>#</sup>	46	1.1	J02.9	Acute pharyngitis, unspecified* <sup>#</sup>	6	0.6
16	N20.0	Calculus of kidney	21	1.1	G45.0	Vertebro-basilar artery syndrome*	39	1.0	M06.9	Rheumatoid arthritis, unspecified	5	0.5
17	I67.8	Other specified cerebrovascular diseases*	17	0.9	J44.8	Other chronic obstructive pulmonary disease <sup>#</sup>	35	0.9	N94.8	Other specified conditions with female genital organs and menstrual cycle	5	0.5
18	M51.2	Other specified intervertebral disc displacement	15	0.8	G45.9	Transient cerebral ischemic attack, unspecified	33	0.8	J40.x	Bronchitis, not specified as acute or chronic	5	0.5
19	K29.5	Chronic gastritis, unspecified	15	0.8	J44.1	Chronic obstructive pulmonary disease with (acute) exacerbation* <sup>#</sup>	33	0.8	R42.x	Dizziness and giddiness	4	0.4
20	N73.9	Female pelvic inflammatory disease, unspecified <sup>#</sup>	14	0.7	H81.0	Meniere's disease	32	0.8	M75.0	Adhesive capsulitis of shoulder	4	0.1
		Top 20 total	1572	81.0			2684	66.4			896	88.1

ICD-10: international classifications of diseases 10<sup>th</sup> edition, \*overlapped diseases between township health centres and county hospitals, <sup>#</sup> potentially avoidable hospitalization

Supplementary Table 5 Top 20 diseases in county hospitals

Rank	Longquanyi				Fushun				Ganluo			
	ICD-10	Disease	n	%	ICD-10	Disease	n	%	ICD-10	Disease	n	%
1	I84.2	Internal haemorrhoids without complication	300	3.6	J44.1	Chronic obstructive pulmonary disease with acute exacerbation, unspecified*#	676	6.7	A09.9	Gastroenteritis and colitis of unspecified origin*	720	11.0
2	J44.1	Chronic obstructive pulmonary disease with acute exacerbation, unspecified*#	287	3.5	J03.9	Acute tonsillitis, unspecified*#	541	5.4	O80.0	Spontaneous vertex delivery	579	8.8
3	J20.9	Acute bronchitis, unspecified*	247	3.0	J20.9	Acute bronchitis, unspecified	435	4.3	J18.0	Bronchopneumonia, unspecified	525	8.0
4	E11.7	Non-insulin-dependent diabetes mellitus: With multiple complications#	226	2.7	G45.0	Vertebro-basilar artery syndrome	393	3.9	J06.9	Acute upper respiratory infection, unspecified*#	297	4.5
5	J18.9	Pneumonia, unspecified*#	224	2.7	I25.1	Atherosclerotic heart disease*#	332	3.3	J18.9	Pneumonia, unspecified*#	295	4.5
6	J15.9	Bacterial pneumonia, unspecified#	204	2.5	J18.0	Bronchopneumonia, unspecified	282	2.8	J20.9	Acute bronchitis, unspecified*	283	4.3
7	J03.9	Acute tonsillitis, unspecified*#	199	2.4	J18.9	Pneumonia, unspecified*#	252	2.5	J03.9	Acute tonsillitis, unspecified*#	194	3.0
8	K80.0	Calculus of gallbladder with acute cholecystitis	182	2.2	O82.0	Delivery by elective caesarean section	220	2.2	K29.5	Chronic gastritis, unspecified*	161	2.5
9	I10.x	Essential (primary) hypertension	155	1.9	I63.9	Cerebral infarction, unspecified	181	1.8	K35.9	Acute appendicitis, unspecified	120	1.8
10	K35.9	Acute appendicitis, unspecified	155	1.9	H25.9	Senile cataract, unspecified	164	1.6	K52.9	Non-infective gastroenteritis and colitis, unspecified*	120	1.8
11	J18.0	Bronchopneumonia, unspecified*	152	1.8	M51.2	Other specified intervertebral disc displacement	155	1.5	A16.2	Tuberculosis of lung, without mention of bacteriological or histological confirmation	106	1.6
12	I63.9	Cerebral infarction, unspecified	146	1.8	O80.9	Single spontaneous delivery, unspecified	152	1.5	T00.9	Multiple superficial injuries, unspecified	104	1.6
13	Z51.1	Chemotherapy session for neoplasm	145	1.7	A09.9	Gastroenteritis and colitis of unspecified origin	134	1.3	O82.0	Delivery by elective caesarean section	96	1.5

Rank	Longquanyi			Fushun			Ganluo		
	ICD-10 Disease	n	%	ICD-10 Disease	n	%	ICD-10 Disease	n	%
14	N13.2 Hydronephrosis with renal and ureteral calculous obstruction	133	1.6	K35.9 Acute appendicitis, unspecified	124	1.2	I67.8 Other specified cerebrovascular diseases	85	1.3
15	E11.4 Non-insulin-dependent diabetes mellitus: With neurological complications	123	1.5	A16.2 Tuberculosis of lung, without mention of bacteriological or histological confirmation	118	1.2	K80.1 Calculus of gallbladder with other cholecystitis	70	1.1
16	H25.9 Senile cataract, unspecified	116	1.4	S06.0 Concussion	112	1.1	J62.8 Pneumoconiosis due to other dust containing silica	61	0.9
17	G45.0 Vertebro-basilar artery syndrome*	110	1.3	J06.9 Acute upper respiratory infection, unspecified	108	1.1	O47.1 False labour at or after 37 completed weeks of gestation	58	0.9
18	J06.9 Acute upper respiratory infection, unspecified	110	1.3	C34.9 Malignant neoplasm: Bronchus or lung, unspecified	107	1.1	I25.1 Atherosclerotic heart disease	55	0.8
19	Z43.6 Attention to other artificial openings of urinary tract	98	1.2	K80.0 Calculus of gallbladder with acute cholecystitis	106	1.1	J44.1 Chronic obstructive pulmonary disease with acute exacerbation, unspecified <sup>#</sup>	49	0.8
20	I67.8 Other specified cerebrovascular diseases*	95	1.1	N20.1 Calculus of ureter	89	0.9	N13.2 Hydronephrosis with renal and ureteral calculous obstruction	47	0.7
Top 20	Total	3407	41.0		4681	46.5		4025	61.2

ICD-10: international classifications of diseases 10<sup>th</sup> edition, \*overlapped diseases between township health centres and county hospitals, <sup>#</sup> potentially avoidable hospitalization



Supplementary Table 6 Number of admissions with surgery or procedure by disease system

ICD-9-CM	System	THs			CHs		
		Fushun	%	Rank	N	%	Rank
00	Procedures and interventions, NEC	/	/	/	0	0	18
01~05	Nervous	/	/	/	129	2.5	9
06~07	Endocrine	/	/	/	26	0.5	16
08~16	Eye	/	/	/	429	8.2	5
17	Others	/	/	/	18	0.3	17
18-20	Ear	/	/	/	140	2.7	8
21-29	Nose, mouth and pharynx	/	/	/	94	1.8	12
30-34	Respiratory	1	1.0	4	36	0.7	14
35-39	Cardiovascular	/	/	/	28	0.5	15
40-41	Haemic and lymphatic	/	/	/	1,701	32.6	1
42-54	Digestive	13	12.4	2	315	6	6
55-59	Urinary	/	/	/	109	2.1	11
60-64	Male genital organs	1	1.0	4	441	8.4	4
65-71	Female genital organs	6	5.7	3	803	15.4	2
72-75	Obstetrical procedures	82	78.1	1	601	11.5	3
76-84	Musculoskeletal system	1	1.0	4	312	6	7
85-86	Integumentary system	1	1.0	4	37	0.7	13
87-99	Miscellaneous	/	/	/	129	2.5	10
Total		105			5348		

THCs: township hospitals, CHs: county hospitals

Supplementary Table 7 Number of surgery types by disease system

ICD-9-CM	System	THs	CHs		
		FS	LQY	FS	GL
00	Procedures and interventions, NEC	/	0	0	0
01~05	nervous system	/	11	5	2
06~07	endocrine system	/	3	3	2
08~16	eye	/	17	12	0
18~20	Ear	/	3	1	0
21~29	Nose, mouth and pharynx	/	12	10	0
30~34	Respiratory system	1	12	7	1
35~39	Cardiovascular system	/	4	2	1
40~41	Haemic and lymphatic system	/	3	2	2
42~54	Digestive system	3	44	25	13
55~59	Urinary system	/	21	16	4
60~64	Male genital organs	1	9	10	2
65~71	Female genital organs	4	22	25	4
72~75	Obstetrical procedures	2	10	5	1
76~84	Musculoskeletal system	1	26	19	20
85~86	Integumentary system	1	8	12	6
87~99	Miscellaneous	/	5	2	0
Total		13	210	156	58

THs: township hospitals, CHs: county hospitals, LQ: Longquanyi county, GL: Ganluo county,

FS: Fushun county

Supplementary Table 8 Top 10 surgeries in township hospitals and county hospitals

Fushun township health centres					All county hospitals			
Rank	ICD-9-CM	Operation name	N	%	ICD-9-CM	Operation name	N	%
1	75.9	Other obstetric operations	47	43.5	74.1	Caesarean section	587	11.3
2	74.1	Cesarean section	36	33.3	49.4	Procedures on haemorrhoids	413	7.9
3	49.4	Procedures on haemorrhoids	8	7.4	51.2	Cholecystectomy	407	7.8
4	53.0	Repair of hernia	4	3.7	47.0	Appendectomy	324	6.2
5	71.7	Repair of vulva and perineum	2	1.9	13.7	Cataract surgery	265	5.1
6	86.0	Incision of skin and subcutaneous tissue	2	1.9	79.3	Open reduction of fracture with internal fixation	258	5.0
7	34.0	Incision of chest wall and pleura	1	0.9	53.0	Repair of hernia	161	3.1
8	49.1	Incision or excision of anal fistula	1	0.9	73.6	Episiotomy	150	2.9
9	64.0	Circumcision	1	0.9	78.6	Removal of implanted devices from bone	139	2.7
10	67.3	Other excision or destruction of lesion or tissue of cervix	1	0.9	69.0	Dilation and curettage of uterus	136	2.6
Top 10	Total		103	95.3	Top 10	Total	2840	54.6