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Systematic Review and Meta-analysis of Lyme Disease Data and Seropositivity for *Borrelia burgdorferi*, China, 2005–2020

Appendix

Appendix Table 1. Search strategies and results by database

Database	Search strategy	Results
PubMed	Borreliosis OR lyme OR borrelia Filters: Full text, from 2005/1/1 - 2020/12/31	8,537
EMBASE	(((borrelia AND (2005:2020[pdat])) OR (lyme AND (2005:2020[pdat]))) OR (borreliosis AND (2005:2020[pdat]))) Filters: Date: Publication years 2005 – 2020; Pub. Types: Article, Data Papers, Review	10,445
Global Health (CABI Direct)	((borrelia OR lyme OR borreliosis) AND yr:[2005 TO 2020]) AND (((item-type:(("Journal article")))))	6,348
CNKI	Topic: Lyme disease (vague) OR Topic: Borrelia burgdorferi (vague) OR Topic: Lyme disease AND Serum (vague) Publication time: 1st Jan 2005 - 31st Jan 2020	2,032
Wanfang Data	All (vague): Lyme disease; All (vague): Borrelia burgdorferi; All (vague): Lyme disease AND Serum Publication time: 1st Jan 2005 - 31st Jan 2020	3,658

Appendix Table *2*. Studies included in systematic literature review contributing to seropositivity analyses and associated data points

Study	Year(s) of data collection	Province of data collection	Diagnostic test(s)	Antibody*	Sero-positivity, (%)†	Study Denominator	Exposure category	Study population details
Chen et al. (*1*)	2011	Beijing	ELISA	IgG	4.6%	549	Moderate exposure risk	Mountain residents of randomly selected survey sites in Miyun, Beijing, with history of defined field activities within one year. No specific forestry exposure mentioned.
Cui et al. (*2*)	2003–2006	Zhejiang	IFA	IgG	11.9%	932	High exposure risk	Forestry (forest farms) workers and mountain residents in three districts of Hangzhou, Zhejiang.
Dong et al. (*3*)	2004	Neimenggu (Inner Mongolia)	IFA	IgG	1. 10.4% 2. 33.3%	1. 671 2. 84	1. High exposure risk 2. Clinical suspicion	1. Forestry residents from forest farms of Greater Khingan, Neimenggu 2. Hospitalized psychiatric patients in the forestry area of Greater Khingan, Neimenggu
Dou et al. (*4*)	2013	Beijing	ELISA + WB	IgG	5.1%	801	Moderate exposure risk	Mountain residents lived near Miyun Reservoir in the northern suburb of Beijing. No specific forestry exposure mentioned.
Du et al. (*5*)	2010	Henan	IFA	IgG	10.3%	126	High exposure risk	Local residents in the mountain regions of Henan with high vegetation coverage and high risk of tick exposure during animal contact.

Study	Year(s) of data collection	Province of data collection	Diagnostic test(s)	Antibody*	Sero-positivity, (%)†	Study Denominator	Exposure category	Study population details
Geng et al. (*6*)	2001–2006	Multiple Provinces	IFA + ELISA	IgG & IgM	16.3%	827	Clinical suspicion	Serum samples from healthcare-seeking patients with clinical suspicion of Lyme disease (unclear forestry exposure)
Geng et al. (*7*)	2007	Jilin	IFA	IgG	10.8%	545	High exposure risk	Forestry residents from the forest region of Changbai and Tonghua counties, Jilin.
Geng et al. (*8*)	2007–2008	Multiple Provinces	IFA + ELISA	IgG & IgM	15.2%	105	Clinical suspicion	Serum samples from healthcare-seeking patients with clinical suspicion of Lyme disease (unclear forestry exposure)
Geng et al. (*9*)	2009	Heilongjiang	IFA	IgG	17.0%	342	Clinical suspicion	Healthcare seeking patients identified from Mudanjiang Forestry Central Hospital.
Gong et al. (*10*)	2002–2004	Zhejiang	1. IFA 2. IFA 3. ELISA 4. ELISA	IgG	1. 0.1% 2. 0.0% 3. 4.7% 4. 9.8%	1. 958 2. 162 3. 86 4. 430	1. High exposure risk 2. Clinical suspicion 3. Low exposure risk 4. High exposure risk	1. Forestry workers, mountain farmers, and other residents in the forestry area of Kaihua county and Tiantai county, Zhejiang 2. Suspected Lyme disease cases identified from community health centers. All surveyed individuals were local farmers. No specific forestry exposure mentioned. 3. Urban or suburb residents from Lishui, Zhejiang 4. Forestry (forest farms) workers and farmers from Lishui, Zhejiang
Gu et al. (*11*)	NA	Heilongjiang	ELISA	IgG	33.9%	498	High exposure risk	Forestry residents from multiple forest farms of Xiao Hinggan Mountains, Heilongjiang
Hao et el (*12*).	NA	Multiple Provinces	IFA	IgG	10.3%	3,669	High exposure risk	Human population in forest areas of 8 provinces in China, covering a wide area of the country from north to south. Investigation sites were chosen based on clear evidence of ticks in the environments. Study population had lived in the forest areas and often worked in the fields.
Ji (*13*)	1. 2013 2. 2014	Neimenggu (Inner Mongolia)	1. IFA 2. ELISA	IgG	1. 16.9% 2. 4.1%	1. 136 2. 98	1. High exposure risk 2. Low exposure risk	1. Individuals from mountain region, forestry area 2. Individuals from plains area
Li et al. (*14*)	2008	Yunnan	ELISA	IgG	2.4%	42	Low exposure risk	University students. A convenient sample taken from health checks in a university in Yunnan. No forestry exposure mentioned.
Li et al. (*15*)	2008–2009	Shaanxi	IFA	IgG & IgM	6.7%	194	High exposure risk	Forestry workers, mountain farmers, and other local residents with long-term residency (greater than 5 years) in three forestry areas of Shaanxi.

Study	Year(s) of data collection	Province of data collection	Diagnostic test(s)	Antibody*	Sero-positivity, (%)†	Study Denominator	Exposure category	Study population details
Li et al. (*16*)	2013	Hainan	1. IFA 2. IFA + WB	IgG	1. 12.4% 2. 2.8%	1. 251 2. 251	Clinical suspicion	Healthcare-seeking patients identified from a hospital in Hainan. Suspected cases were defined as patients with clinical diagnosis of neurological symptoms.
Li et al. (*17*)	2015	Hainan	1. IFA 2. IFA + WB	IgG	1. 3.3% 2. 1.5%	1. 1,334 2. 1,334	Clinical suspicion	Healthcare-seeking patients identified from multiple hospitals in Hainan. Suspected cases were defined as patients with clinical diagnosis of arthritis and/or neurological disease suspected of Lyme disease (excluding rheumatoid arthritis and other related diseases).
Lin (*18*)	NA	Jilin	ELISA	IgG	8.3%	218	High exposure risk	Forestry residents from multiple forest farms of Changbai mountain, Jilin
Lin et al. (*18*)	2007	Fujian	IFA	IgG	17.1%	269	High exposure risk	Forestry workers, mountain farmers, and other local residents of the north forest area (Wuyi Mountain) in Fujian.
Liu et al. (*19*)	2006	Hunan	IFA	IgG	10.2%	914	High exposure risk	Forestry workers, mountain farmers, and other local residents in the mountain forestry areas of Shandong
Liu et al. (*20*)	2010–2011	Heilongjiang	IFA	IgG	18.3%	180	Clinical suspicion	Healthcare-seeking patients with recent tick bite in the past 2 months identified from Mudanjiang Forestry Central Hospital, Heilongjiang. The participants usually presented with tick-borne disease related clinical symptoms.
Long et al. (*21*)	2013–2014	Xinjiang	IFA	IgG	5.7%	637	Low exposure risk	Voluntary blood donors (urban residents) in People's Hospital of Xinjiang Uygur Autonomous Region. Most of the urban residents were not exposed to forestry or pastoral environments.
Song et al. (*22*)	2000–2003	Tianjin	IFA	IgG	1. 6.9% 2. 1.8%	1. 735 2. 170	1. High exposure risk 2. Low exposure risk	1. Local residents from mountain regions or mid-levels of Tianjin 2. Local residents from plains areas of Tianjin
Sun et al. (*23*)	1998–2003	Xinjiang	IFA or ELISA	IgG & IgM	13.0%	7,956	Moderate exposure risk	Workers and other local residents of Xinjiang prospecting bureau of Henan oil field, in natural foci of Lyme disease in Xinjiang.
Sun et al. (*24*)	2002–2004	Gansu	IFA	IgG	12.9%	240	High exposure risk	Forestry (forest farms) workers in both protected natural forests and nursey forests.
Tan et al. (*25*)	1999–2004	Xinjiang	1. IFA 2. IFA + WB	IgG	1. 12.1% 2. 3.1%	1. 223 2. 223	High exposure risk	Natural population (including residents and forestry workers) in natural foci of Lyme disease in Southern Mountainous Area of Urumqi, Xinjiang. The survey sites are exposed to high level of forests, pastures, wild animals and plants.

Study	Year(s) of data collection	Province of data collection	Diagnostic test(s)	Antibody[*]	Sero-positivity, (%)[†]	Study Denominator	Exposure category	Study population details
Tan et al. (*26*)	2000–2004	Xinjiang	IFA + WB	IgG	NA[‡]	NA[‡]	1. High exposure risk 2. Moderate Exposure Risk	1. Natural population in natural foci of Lyme disease in six districts of Xinjiang, including forestry workers, pastoral workers, and border soldiers. Individuals with no clinical suspicion of Lyme disease were randomly surveyed from hospitals and out-patient clinics of Xinjiang as comparison group. No specific forestry exposure mentioned but noted this region in Xinjiang is endemic to Lyme disease.
Tan et al. (*27*)	1. 2002 2. 2006	Xinjiang	WB	IgG	1. 0.3% 2. 37.0%	1. 1,406 2. 119	1. Moderate exposure risk 2. Moderate exposure risk	1. Human population in natural foci of Lyme disease in Xinjiang were selected. 2. Individuals in natural foci of Lyme disease in Xinjiang with negative test results in the previous epidemiologic study in 2002.
Wang et al. (*28*)	1990	Shandong	IFA	IgG	6.3%	1,934	High exposure risk	Forestry (forest farms) workers and local residents of multiple regions in Shandong.
Wang et al. (*28*)	1990–2003	Guizhou	IFA	IgG	5.0%	139	Moderate exposure risk	Workers and other residents (including mostly agrarian population and selective forestry workers) living in agricultural county.
Wang et al. (*29*)	2005	Beijing	IFA	IgG	1. 9.5% 2. 3.0% 3. 8.5%	1. 370 2. 331 3. 47	1. Moderate exposure risk 2. Low exposure risk 3. Clinical suspicion	1. Local residents and pastoral workers in the natural foci of Lyme disease in Miyun district, Beijing. No forestry exposure mentioned. 2. Local residents engaged in tourism reception work at home. Had low or minimal risk of tick exposure. 3. Local residents with neurologic disorders identified from local mental health care facility.
Wang et al. (*30*)	2006	Jilin	IFA	IgG	6.6%	617	Moderate exposure risk	The mountainous area and the border area in conjunction with North Korea. Survey sites in Tonghua, Ji'an, and Changbai counties of Jilin are selected, which are representative of Lyme disease-endemic area in Jilin. No specific forestry exposure mentioned.
Wang et al. (*31*)	2003–2008	Jilin	IFA	IgG	5.0%	909	Low exposure risk	Local residents from the plains regions of five districts in Jilin
Wang et al. (*31*)	NA	Jilin	ELISA	IgG	7.0%	1,002	High exposure risk	Local residents from the mountainous forest region of Jilin county and Yanbian county, Jilin. These regions have high forestry coverage

Study	Year(s) of data collection	Province of data collection	Diagnostic test(s)	Antibody*	Sero-positivity, (%)†	Study Denominator	Exposure category	Study population details
								and Lyme disease-endemic area.
Wu et al. (*32*)	2016	Xinjiang	ELISA	IgG	4.1%	1,500	Low exposure risk	Individuals participated in health checks in the urban region of southern Xinjiang. No forestry exposure mentioned.
Xia et al. (*33*)	NA	Jilin	ELISA	IgG	6.8%	281	High exposure risk	Forestry residents from multiple forest farms of Tonghua county, Jilin.
Xie et al. (*34*)	NA	Guangdong	IFA or ELISA	IgG	1. 10.3% 2. 10.3%	1. 1,191 2. 993	1. High exposure risk 2. Moderate exposure risk	1. Natural population in living in forestry area (forest farms) of Meizhou, Guangdong (natural foci of Lyme disease). 2. Natural population living in non-forestry area of Meizhou, Guangdong (natural foci of Lyme disease).
Yang et al. (*35*)	2016	Beijing	ELISA + WB	IgG	9.3%	140	Clinical suspicion	Healthcare-seeking patients identified from 10 community health centers in Lyme disease natural foci of Miyun, Beijing. Suspected cases were defined as patients with clinical diagnosis of arthritis (excluding rheumatoid arthritis and other related diseases).
Ye et al. (*36*)	2005	Fujian	IFA	IgG	2.1%	239	Low exposure risk	Individuals participated in health checks (including pregnant women and drug users) in the urban region of Xiamen, Fujian. No specific forestry exposure mentioned.
Yu et al. (*37*)	2006	Gansu	IFA	IgG	10.9%	522	High exposure risk	Forestry (forest farms) workers and local residents of Diebu county, Gansu.
Yue & Shi (*38*)	NA	Qinghai	IFA	IgG	15.1%	1,108	High exposure risk	Forestry workers, farmers, and other forestry residents in agricultural or pastoral county.
Zhang et al. (*39*)	2005	Shanxi	IFA	IgG	6.2%	227	High exposure risk	Forestry workers and mountain residents in Shanxi
Zhang et al. (*40*)	2009	Multiple Provinces	IFA	IgG	7.0%	725	High exposure risk	Forestry residents of four provinces in northern China, including Xinjiang, Gansu, Ningxia, and Shaanxi
Zhang et al. (*41*)	2013	Hainan	1. IFA 2. IFA+ WB	1. IgG & IgM 2. IgG & IgM	1. 16.6% 2. 2.3%	1. 259 2. 259	Clinical suspicion	Healthcare-seeking patients identified from a hospital in Hainan. Suspected cases were defined as patients with clinical diagnosis of arthritis or neurological disease suspected of Lyme disease.
Zhao et al. (*42*)	2012	Xinjiang	ELISA	IgG	1. 5.9% 2. 2.9%	1. 101 2. 34	1. High exposure risk 2. Moderate exposure risk	1. Border guard soldiers stationed in mountain/forest habitats in northern Xinjiang. 2. Border guard soldiers stationed in the Gobi/desert habitats in northern Xinjiang. Indicated occupational risk of tick exposure.
Zhu et al. (*41*)	2013	Hainan	1. IFA 2. IFA+ WB	IgG	1. 7.7% 2. 1.3%	1. 542 2. 542	Clinical suspicion	Healthcare-seeking patients identified from a hospital in Hainan. Suspected cases were defined as patients with

Study	Year(s) of data collection	Province of data collection	Diagnostic test(s)	Antibody*	Sero-positivity, (%)†	Study Denominator	Exposure category	Study population details
								clinical diagnosis of arthritis or neurological disease suspected with B. burgdorferi infection (excluding related diseases).
Zhu et al. (*43*)	2015	Hainan	1. IFA 2. IFA+ WB	IgG	1. 3.4% 2. 1.4%	1. 900 2. 900	Clinical suspicion	Healthcare-seeking patients identified from two hospitals in western region, Hainan. Suspected cases were defined as patients with clinical diagnosis of arthritis or neurological disease suspected of Lyme disease (excluding rheumatoid arthritis and other related diseases).
Zhuang et al. (*44*)	2006	Guizhou	1. IFA 2. IFA+ WB	IgG	1. 5.3% 2. 1.1%	1. 1,233 2. 1,233	Low exposure risk	Rural population of 8 counties in Guizhou (alpine, mainly plains area). No specific forestry exposure mentioned.

*Antibody measured reflects data used for analysis. For IgG and IgM, results were presented collectively without separation. ELISA, enzyme-linked immunosorbent assay; IFA, immunofluorescence assay; IgG, immunoglobulin G; IgM, immunoglobulin M; WB, Western immunoblot.

†Multiple estimates from same source presented as the total estimate.

‡Multiple data points available in Supplementary Table 1.

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