SUPPLEMENTARY FILE2. Table 2.1 Articles retained for the review

Ref	Author(s)	Country (further specifications, if any)	Study period (year)	Study design §	Unit of analysis §§	Short study description	Type of study §§§	Total size	Age	Study area †	Leprosy cases (No.)	Measure ††	Prevalence/ Incidence in the studied area	Confounders (N or list all, if any)	Factors studied	Categories	No. or mean	% or SD	Incidence or Prevalence (by category)	No. or mean	% or SD	Method #	Type of association measure ##	Unadjusted association measure (95% CI or P-value)	Adjusted association measure (95% CI or P-value)
(14)	Doull JA et al, 1942	Philippines (Talisay and Cordova municipalities)	1936-37 (Talisay), 1933 (Cordova)	CH	Individual	Retrospective study on contact status as a risk to develop leprosy.	PB	13,734 (217,729 PYR) in Talisay; 8,057 (117,287 PYR) in Cordova	<5 to 50+ years	NA	242 (Talisay), 160 (Cordova)	I	1.11 / 1,000 PYR (Talisay), 1.38 / 1,000 PYR (Cordova)	Sex	Household contact	No Yes No (male) (female) Yes (male) (female)	252 (307,663 PYR) 150 (27,353 PYR)		0.82 / 1,000 5.48 / 1,000 1.11 / 1,000 0.55 / 1,000 6.69 / 1,000 3.87 / 1,000			Contingency table	RR‡	 6.70‡ (5.43, 8.23)	

Incidence rate was over six times higher in household contacts (person who had lived under the same roof as a case for at least 1 month) than in non-contacts, and higher in males than females both in contacts and non-contacts

Ref	Author(s)	Country	Study period	Design	Unit	Description	Type	Total	Age	Area	Cases	Meas.	Prev/Inc	Conf.	Factors	Categories	No./mean	%/SD	Inc/Prev	No./mean	%/SD	Method	Type	Unadjusted	Adjusted
(28)	Nigam P et al, 1977	India (Bundelkhand area)	1974-1975	CS	Individual	Cross-sectional study carried out on the total population of three villages.	PB	3,362	All ages	RUR	18	P	5.35 / 1,000	N	Sex Income level	M F ≥Rupees 300 per capita/month Rupees 50-299 per capita/month Rupees 70-149 per capita/month Rupees 30- 69 per capita/month <Rupees 30 per capita/month	13 5 0 0 2 13 3		7.03/ 1,000 3.30/ 1,000 3.34/ 1,000 6.40/ 1,000 4.32/ 1,000	1,835 1,509 0 38 596 2,019 691		Contingency table	OR‡	1.00 2.14 (0.71, 7.68) - 1.00 1.92 (0.43, 8.53) 1.29 (0.22, 7.77) 1.21 (0.750) [1] 0.10 (0.748) [2]	

Risk of leprosy was higher, although non significantly, in males, and in poorer people

Ref	Author(s)	Country	Study period	Design	Unit	Description	Type	Total	Age	Area	Cases	Meas.	Prev/Inc	Conf.	Factors	Categories	No./mean	%/SD	Inc/Prev	No./mean	%/SD	Method	Type	Unadjusted	Adjusted
(29)	Bhavsar BS et al,1980	India (Surat District)	1976-1978	CS	Individual	School survey.	PB	21,412	5-19 years	MX	26	P	12/10,000	N	Age Sex Type of area Social-economic groups Score of socio-sanitary conditions of household	5 to 9 years 10 to 14 years 15 to 19 years Male Female Urban Rural Class I Class II Class III Class IV Class V missing 6 (best condition) 5 4 3 2	12 11 3 22 4 9 17 0 0 7 16 3 0 0 1 1 2 2		14/10,000 9/10,000 81/10,000 17/10,000 4/10,000 6/10,000 28/10,000 0 0 8/10,000 19/10,000 46/10,000 0 0 3/10,000 7/10,000 6/10,000 6/10,000	8,102 11,665 1,645 12,453 8,959 15,350 6,062 450 1,766 9,419 8,595 650 532 647 3,240 1,340 3,331 3,084		Contingency table	Chi square	1.54 (p>0.05) 7.53*(p<0.01) 17.63*(p<0.001) 8.11*(p<0.05) 26.02*(p<0.001)	

[1] test of homogeneity (equal odds): chi square (p-value)
[2] score test for trend of odds: chi square (p-value)

Ref	Author, year	Country	Period	Design	Level	Objective	PB/MB	Sample	Age	Setting	Cases	I/P	Rate	N	Risk factor	Category	n	%	Rate	Population	%	Analysis	Test	Result
																1 0 missing	7 13 0		12/10,000 37/10,000 0	5,678 3,432 660				

Prevalence of leprosy was lower than in other areas in India, but increased with deterioration of socioeconomic and home sanitary conditions.

Ref	Author, year	Country	Period	Design	Level	Objective	PB/MB	Sample	Age	Setting	Cases	I/P	Rate	N	Risk factor	Category	n	%	Rate	Population	%	Analysis	Test	Result
(15)	Dominguez VM et al, 1980	Myanmar (Singu municipality)	1964-76: 1st survey in 1964-68, 2nd survey in 1969-72, annual follow-up of cases and contacts in 1965-76	CH	Individual	Estimation of incidence rates of leprosy in the 2nd mass survey among the individuals free of leprosy during the 1st survey (mean period four years) in 163 villages.	PB	52,026	All ages	NA	1,367	I	9.8/1,000 PYR (among contacts); 5.9/1,000 PYR (among non-contacts)	N	Household contact	No Yes	1,090 277	2.3% 5.1%	5.9‰ / year 12.6‰ / year	45,446 5,203	97.7% 94.9%	Contingency table	RR‡	2.15 (1.89, 2.46)

The mean yearly incidence rate in household contacts was over twice than in non-contacts

Ref	Author, year	Country	Period	Design	Level	Objective	PB/MB	Sample	Age	Setting	Cases	I/P	Rate	N	Risk factor	Category	n	%	Rate	Population	Analysis	Test	Result
(30)	Sommerfelt H et al, 1985	India (North Arcot District)	1978 and 1982	CS + EC	Individual (CS); clusters (EC)	Two house-to-house surveys: one (1978) to assess demographic data and child nutritional status in 35 villages, the other one (1982) to assess leprosy prevalence in the the same villages. Correlation coefficients were used to assess the relationship between socio-demographic factors and leprosy incidence /1,000 inhabitants, among villages aggregated in 12 clusters.	PB	7,428 individuals; 12 clusters	All ages	RUR	131	P	17.9/1,000	N	CS study: Type of area EC study: Poverty (≤ 600 rupees) % Illiteracy of all members of family % Malnutrition in children 1-4 years old (mid-upper-arm circumference-MUAC) % Malnutrition in general population	Village Field area MUAC<12.5 cm MUAC<13.5 cm	97 34		20.2/1000 12.9*/1000	4,702 2,602	Contingency table Pearson correlation	Chi square with Yates correction R squared	NA (p=0.03) 0.099 (p=0.16) 0.025 (p=0.31) 0.318 (p=0.028) 0.410 (p=0.012) 0.0055 (p=0.35)

In villages/field areas and aggregates, lower leprosy prevalence rates was correlated to field areas. Moreover, there was a significant correlation between the occurrence of malnutrition in children 1 to 4 years of age and the prevalence of leprosy. Neither the occurrence of poverty nor illiteracy were correlated to leprosy prevalence.

Ref	Author, year	Country	Period	Design	Level	Objective	PB/MB	Sample	Age	Setting	Cases	I/P	Rate	N	Risk factor	Category	n	%	Rate	Population	%	Analysis	Test	Result
(31)	Chaturvedi RM et al, 1988	India (Bombay)	1979-1983	CS	Individual	Data collected in Malwany suburb from different sources (mass house-to-house survey, school survey, household contact survey, clinical referral cases and self-reported cases) and analyzed all together.	PB	63,321	All ages	URB	691	P	10.91/1,000 (overall)	N	Religion Type of dwelling [3] Income per capita Monthly income (rupees)	Hindu Muslim Christians others Zopadapatti Chawls Individual tenements 0-50 rupees 51-100 101-250 >250 mean	331 318 39 3 463 221 7 327 283 70 11 62	47.90 46.02 5.65 0.44 67.01 31.98 1.01 47.32 40.96 10.13 1.59	9,17/1,000 13,57/1,000 12,57/1,000 4,30/1,000 11,42/1,000 10,11/1,000 7,68/1,000 20,82/1,000 10,16/1,000 4,57/1,000 2,48/1,000	36093 23428 3102 698 40557 21852 912 15704 27861 15323 4433 99.05	57.00 37.0 4.9 1.1 64.05 34.51 1.34 24.8 44.0 24.2 7.0	Difference in proportions	Z test	NA*(p<0.001) NA*(p<0.05) NA (p=NS) NA (p=NS) NA*(p<0.001) NA (p=NS) NA (p=NS) NA (p=NS) NA (p=NS) NA (p=NS) NA (p=NS) NA (p=NS)

Leprosy is more prevalent among low socioeconomic status and overcrowded families. Prevalence is higher among Muslims, possibly because of overcrowding.

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[3] Chawls: public housing buildings constructed between 1920 and 1956 by factory owners and landowners to accommodate migrant workers in India, consisting of one-room apartments with a small cooking space and common toilet facilities on each floor; zopadpattis: informal neighbourhoods created through ad-hoc construction techniques, representing the type of slum in India most commonly depicted by media.

(21) George K et al, 1990	India (Asananbut village)	1983-1984	CC	Individual	Study on 72 cases from a SET[4] Unit and 216 matched controls from a Control Unit of the National Leprosy Eradication Programme.	HS	288	All ages	RUR	72	-	NA	N		Intrahousehold contact	No	53	21.9%	-	189	78.1%	Contingency table	OR	1.00	
																Yes	19	41.3%	-	27	58.7%			2.51*(1.23, 5.11)	

Household contacts had a higher risk of leprosy compared to non-contacts

(32) Andrade VLG et al, 1994	Brazil (São Gonçalo municipality)	1988 (85 days)	CS	Domicile	Cross-sectional study to assess the household characteristics, the social and economic factors for leprosy transmission. A random sample, proportional to the number of leprosy cases in each census tract, was selected. Households with leprosy (group 1) were compared with one neighborhood group (group 2) and another random group (group 3).	PB	926	All ages	URB	137	P	NA	Group 1 vs Group 2: Education, age, time of residence in the household, number of rooms.	Type of housing	Aggregation / House or flat	31 / 106	92 / 303	LR	OR	1.841 (0.825, 4.108) / 1.0	
														Size of household	≤ 50m2 / > 50m2	79 / 58	259 / 135			0.888 (0.524, 1.505) / 1.0	
														Household floor	Ground/cement / Carpet, wood, ceramic	64 / 73	182 / 212			1.552 (0.930, 2.591) / 1.0	
														Water supply	No tap water / Tap water	17 / 120	58 / 336			1.176 (0.567, 2.441) / 1.0	
														Number of rooms	≤ 2 / > 2	42 / 95	184 / 210			0.589*(0.356, 0.964) / 1.0	0.757 (0.376, 1.526) / 1.00
														Number of residents	≥ 5 / 1 to 4	63 / 74	127 / 267			1.351 (0.859, 2.126) / 1.0	
														Sweep the house	Once a week / Everyday	5 / 132	14 / 380			1.261 (0.404, 3.934) / 1.0	
														Age (head of the household)	> 40 years-old / ≤ 39 years-old	99 / 38	185 / 209			4.326*(2.546, 7.352) / 1.0	2.660*(1.321, 5.362) / 1.00
														Education (head of the household)	Primary/middle-school / High-school	123 / 14	305 / 89			2.707*(1.212, 6.046) / 1.0	2.543*(1.063, 6.085) / 1.00
														Sex (head of the household)	Female / Male	50 / 87	148 / 246			0.924 (0.593, 1.441) / 1.0	
														Time living in the address (head of the household)	>11 years / ≤ 10 years	76 / 61	167 / 227			2.759*(1.610, 5.208) / 1.0	1474 (0.714, 3.039) / 1.00
														Use of shoes (head of the household)	None or sandals / Shoes	104 / 33	286 / 108			0.949 (0.504, 1.782) / 1.0	
													Group 1 vs Group 3: Education, age, time of residence in the household, type of housing, floor, water supply and number of rooms.	Type of housing	Aggregation / House or flat	31 / 106	27 / 368			4.127*(2.344, 7.267) / 1.0	3.950*(1.790, 8.717) / 1.00
														Size of household	<=50m2 / >50m2	79 / 58	244 / 151			0.879 (0.563, 1.278) / 1.0	
														Household floor	Ground/cement / Carpet, wood, ceramic	64 / 73	226 / 169			0.620*(0.414, 0.923) / 1.0	0.872 (0.491, 1.548) / 1.00
														Water supply	No tap water / Tap water	17 / 120	85 / 310			0.421*(0.226, 0.787) / 1.0	0.372*(0.151, 0.914) / 1.00
														Number of rooms	<= 2 / > 2	42 / 95	156 / 239			0.694 (0.453, 1.061) / 1.0	0.694 (0.453, 1.061) / 1.00
														Number of residents	>= 5 / 1 to 4	63 / 74	161 / 234			1.243 (0.832, 1.856) / 1.0	
														House sweeping	Once a week / Everyday	5 / 132	18 / 377			0.861 (0.313, 2.370) / 1.0	
														Age (head of the household)	> 40 years-old / <=39 years-old	99 / 38	206 / 189			2.527*(1.601, 3.989) / 1.0	2.071*(1.092, 3.927) / 1.00

[4] Survey, Education and Treatment

													Variable	Category	n	Prevalence	Population	Method	Measure	Estimate 1	Estimate 2
													Education (head of the household)	Primary/middle-school	123			313			2.106*(1.023, 4.350)	1.776 (0.788, 4.003)
														High-school	14			82			1.0	1.00
													Sex (head of the household)	Female	50			113			1.497 (0.985, 2.277)	
														Male	87			282			1.0	
													Time living in the address (head of the household)	>11 years	76			141			2.466*(1.510, 4.208)	1.519 (0.868, 2.659)
														<= 10 years	61			254			1.0	1.00
													Use of shoes (head of the household)	None or sandals	104			279			1.204 (0.698, 2.078)	
														Shoes	33			116			1.0	

Households, age and educational level are determinant factors for leprosy morbidity in this area. Comparing domiciles with leprosy (Group I) with their neighbors (Group II) and with domiciles outside the leprosy focus areas (Group III), the chance of a household have the disease when the head of the family have low educational level is 2.5 times higher than those with higher educational level when residing in the same area

Ref	Location	Years	Type	Level	Description	Pop	N	Age	Sex	Cases	Grp	Prevalence	Adj	Variable	Category	n	Prevalence	Population	Method	Measure	Estimate 1	Estimate 2
(16) Ranade MG et al, 1995	India (State of Maharashtra, 27 villages)	1952-1886	CH	Individual	Study on risk of leprosy among healthy contacts, based on annual surveys conducted in the area, covering about 85% of the population.	Contacts	12,489 (in 1952), 22,377 (in 1986), 6,284 healthy contacts (overall)	NA (adult and children)	NA	331 (secondary cases), 1,074 (cases in non-contacts)	I	23.5 / 1,000 (prevalence in 1952); 4.46 / 1,000 PYR	N	Household contact	No	1,074	1.98/1,000	-	Contingency table	RR‡	1.00	
															Yes	331	4.46/1,000	5,953			2.26*(1.99, 2.55)	
														Closeness of contact (parent, child, grand parent, grandchild, spouse)	Not close (overall contacts)	109		2,166			1.00	
															Close	222		3,787			1.05 (0.96, 1.14)	
															Not close (male contacts)	73		1,085			1.00	
															Close	123		1,790			1.01 (0.90, 1.13)	
															Not close (female contacts)	36		1,081			1.00	
															Close	99		1,997			1.13*(1.02, 1.26)	
														Sex of contact	Female	135		3,078			1.00	
															Male	196		2,875			1.52*(1.23, 1.88)	

In the general population, risk of leprosy was over two times higher among household contacts than non-contacts; among contacts, chance of leprosy was higher among males than females, but closeness of contact was a significant risk only in female contacts

Ref	Location	Years	Type	Level	Description	Pop	N	Age	Sex	Cases	Grp	Prevalence	Adj	Variable	Category	n	Prevalence	Population	Method	Measure	Estimate 1	Estimate 2
(33) Kumar A et al, 2001	India (Agra district)	1999-2000	CS	Individual	One year survey in domiciles and schools in each of the 90 villages/urban units from Agra, aiming to study the persistently high case detection remain in the region and the socio-demographic factors related to leprosy prevalence.	PB	17,161 (13,320 rural and 3,841 urban)	<15 to 69+ years	MX	95	P	5.5/1,000; 1.25/1,000 (in <15 year olds)	Age, sex, area	Area[5]	Urban	15	3.9/1,000	13,320	LR	OR (combining data from rural and urban areas)	-	-
															Rural	80	6.0/1,000	3,841			1.00	1.00
														House cleanliness	No	-		-			0.48*(0.32, 0.73)	0.49*(0.33, 0.75)
															Yes	-		-			1.00	1.00
														Formal education	No	-		-			0.95 (0.61, 1.49)	0.56*(0.35, 0.90)
															Yes	-		-			1.00	1.00
														Occupation	Blue collar	-					0.45*(0.29, 0.71)	00.53*(0.28, 1.02)
															Housewifes/students/others	-						
														Rural area:								
														Age	Under 15 years	8	1.3/1,000	6,494				
															15 to 29	11	3.8/1,000	2,915				
															30 to 44	16	8.3/1,000	1,939				
															45 to 59	21	18.6/1,000	1,131				
															59 or more	24	28.5/1,000	841				
														Sex	Male	56	8.9/1,000	6,310				
															Female	24	3.4/1,000	7,010				
														Education	None	53	7.3/1,000	7,270				
															Formal	27	4.5/1,000*	6,050				
															<=5 years	10	3.0/1,000	3,348				
															5-10 years	15	6.7/1,000	2,251				
															>10 years	2	4.4/1,000	451				
														Occupation	Agriculture/blue collar	44	19.7/1,000*	2,230				
															Others	36	3.3/1,000	1,090				
															none	12	3.1/1,000	3,817				
															students	6	1.6/1,000	3,678				
															housewifes	18	5.0/1,000	3,595				
														Religion	Hindu	78	6.7/1,000	11,565				

[5] Rural and urban areas corresponded to different surveys

Variable	Category	n	Rate	Population
House type	Muslin	1	2.5/1,000	404
	Kuccha (mud and straw)	40	7.8/1,000	5,126
	Pucca (cement/briks)/Semi-pucca(mixed)	39	5.4/1,000	7,289
House cleanliness	Clean	37	4.9/1,000	7,505
	Dirty/very dirty	42	9.4/1,000	4,464
Surroundings	Clean	25	5.1/1,000	4,883
	Dirty	54	7.6/1,000	7,086
Urban area:				
Age	Under 15 years	2	1.1/1,000	1,880
	15 to 29	3	3.2/1,000	942
	30 to 44	7	1.2/1,000	584
	45 to 59	2	7.6/1,000	263
	59 or more	1	5.8/1,000	172
Sex	Male	8	4.5/1,000	1,790
	Female	7	3.4/1,000	2,051
Education	None	9	5.1/1,000	1,776
	Formal	6	2.9/1,000	2,065
	<=5 years	2	2.5/1,000	801
	5-10 years	4	3.8/1,000	1,062
	>10 years	0	0.0/1,000	202
Occupation	Agriculture/blue collar	8	13.0/1,000*	614
	Others	7	2.3/1,000	3,227
	none	1	1.1/1,000	918
	students	1	0.8/1,000	1257
	H/W	5	4.8/1,000	1,052
Religion	Hindu	12	3.5/1,000	3,460
	Muslin	3	7.9/1,000	380
House type	Kuccha (mud and straw)	2	7.8/1,000	258
	Pucca (cement/briks) / Semi-pucca (mixed)	13	3.6/1000	3,578
House cleanliness	Clean	6	2.1/1,000	2,833
	Dirty/very dirty	9	8.9/1,000*	1,008
Surroundings	Clean	2	1.8/1,000	1,105
	Dirty	13	4.8/1,000	2,736

The study found a higher prevalence of leprosy in rural areas. Formal education and living in clean housing was associated to lower risk of leprosy. Agricultural/blue collar workers, persons living in dirty surroundings and persons living in houses with insufficient exposure to sunlight also have a higher risk of leprosy.

	Author	Country	Year	Design	Level	Objective	Pop. type	N	Age	Setting	Cases	I/P	Prevalence/Incidence		Variable	Category	n	%	Rate	Pop.	%	Test	Measure	Value (p/CI)
(22)	Bakker MI et al, 2002	Indonesia (Tampaang, Pelokang, Kembanglemari, Sailus and Sapuka)	June/July 2000 (1st survey) and Nov 2000 (2nd survey)	CC	Individual	Case-control study on the clustering of leprosy cases by type of contact in five islands.	Contacts	4,140	6 to 73 years	NA	96 (85 new cases, 11 old cases)	I / P[6]	205 (95% CI 162, 248) /10,000 / 195 ((95% CI 156, 234)/10,000	N	Type of clustering of patients and controls	House / House+N1 (N1, direct neighbors) / House+N1+N2 (N2, next neighbors)	NA	32% 52% 64%	NA	NA	16% 30% 47%	Chi square	Patients/ controls rate	2.07 (0.007) 1.75 (0.002) 1.34 (0.029)

For all three types of clusters (with at least another patient), the proportion of patients clustered was higher than the proportion caused by chance, and the effect diminished when widening the cluster

| (34) | Hegazy AA et al, 2002 | Egypt (Kafr-Tambul village) | 1999-2001 | CS | Individual | Household survey | PB | 9,643 | All ages | RUR | 24 (5 new cases,19 old cases) | P | 24.9 (95% CI 16.3, 37.6) / 10,000 | N | Age | <20 years 20-30 30-40 | 4 5 5 | 0.1% 0.3% 0.3% | 0.99/1,000 3.11/1,000 3.30/1,000 | 4,005 1,600 1,510 | 99.9% 99.7% 99.7% | LR | OR | 1.00 3.13 (0.73, 1.74) 3.32 (0.78, 1.54) |

[6] cases registered for therapy at the end of the 2nd survey

													Variable	Category	n	%	rate	population	%			result	OR
														40+	10	0.4%	3.97/1,000	2,504	99.7%				4.00 (1.16, 1.54)
													Sex	Female	11	0.2%	2.33/1,000	4,714	99.8%			1.00
														Male	13	0.3%	2.64/1,000	4,905	99.7%			1.14 (0.48, 2.41)
													Education	Secondary and higher	2	0.1%	1.01/1,000	1,982	99.9%			1.00
														Primary and preparatory	4	0.1%	1.43/1,000	2,802	99.9%			1.41 (0.22,11.09)
														Illiterate/reads and writes	18	0.4%	3.71/1,000	4,835	99.6%			3.69 (0.83,23.02)
													Crowding	<4 persons/room	17	0.2%	2.32/1,000	7,308	99.8%			1.00
														≥4 persons/room	7	0.3%	3.02/1,000	2,311	99.7%			1.30 (0.49, 3.33)
													Water supply	Piped water	8	0.2%	2.02/1,000	3,946	99.8%			1.00
														Hand pump	16	0.3%	2.81/1,000	5,673	99.7%			1.39 (0.56, 3.54)
													Social economic positionscore	Moderate to high	5	0.1%	1.33/1,000	3,756	99.9%			1.00
														Low	19	0.3%	3.23/1,000	5,863	99.7%			2.43 (0.86, 7.44)

Risk of leprosy was significantly higher in individuals older than 40 years; the association of leprosy with male sex, low degree of education, crowding, unhealthy source of water and low social score was not significant

(35) Kumar A et al, 2003	India (Agra district)	2000-2001	CS	Individual	Door-to door survey conducted during one year in the whole urban area in Agra district.	PB	60,179	All ages	URB	204	P	33.9 (95% CI 9.7-40.7) /10,000	Type of housing, sex, age.	Age	<15 years	12		4.4/10,000	27,566		Contingency table/ LR	Chi square / OR	
															> 15 years	192		58.9/10,000	32,409				
														Sex (among >15 years old)	Men > 15 years			92.0/10,000*					
															Woman > 15 years			41.6/10,000*					
														Cleanliness of the house	Slovenly houses/dirty surroundings			64.3/10,000*				10.9*(p<0,0001)	1.00
															Clean houses/clean surroundings			31.9/10,000*					0.56*(0.36, 0.86)
														Work	Manual workers			94.9/10,000*				137.5*(p<0,0001)	1.00
															Others			21.3/10,000*					0.63*(0.43, 0.95)
														Toilet in the household	No			39.1/10,000*				5.6*(p = 0,015)	1.00
															Yes			25.5/10,000*					0.72*(0.53, 0.97)

Higher leprosy prevalence was observe among adults and males. Living in bad sanitary conditions was also associated to increased risk of having leprosy.

(41) Kerr-Pontes LRS et al, 2004	Brazil (State of Ceara, 165 municipalities)	1991-1999	EC	Municipality	Ecological study on the association of leprosy incidence rate with selected socioeconomic and environmental factors.	PB	165	<15 years	NA	NA	I[7]	0.06 to 14.68 / 10,000 (municipalities yearly average rates over 1991-1999)	Level of inequality[8] Mean years of study among aged ≥25yrs % population growth in 1991-1996 % children 7-14 years old not going to school Presence of railroad (Y)	Level of inequality						LN	Pearson correlation (univariate) and β coefficients (95% CI)	0.24 (p<0.05)	1.67 (0.389, 2.944)
														Mean years of study among aged ≥25yrs								0.32 (p<0.01)	1.35 (0.620, 2.081)
														% population growth in 1991-96								0.16 (p<0.05)	0.02 (0.006, 0.038)
														% children 7-14 years old not going to school								-0.09 (p=NSs)	0.02 (0.003, 0.045)
														Presence of railroad (Y)								NA	0.45 (0.025, 0.871)
														% households with public water supply								0.13 (p=NS)	
														Infant mortality rate								0.09 (p=NS)	
														Public Health Services per 1000 inhabitants								0.13 (p=NS)	
														Physicians per 1000 inhabitants								0.32 (p<0.01)	
														% households with density >2 people per room								0.01 (p=NS)	
														% head of family with monthly income ≤ half the minimum wage								-0.14 (p=NS)	

Average incidence rate of leprosy was positively associated with a higher degree of inequality and a higher % of children 7–14 years old not going to school. The presence of railroad, a higher population growth in 1991-1996 and more years of study among 25 year-old people, which are collectively interpreted as indicators of a rapid and uncontrolled urbanization, were also associated with leprosy.

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[7] Yearly average incidence rate 1991-99 (cases/ 10,000)

[8] Theil's L Index

Study (17)

Ref	Country	Year	Type	Level	Description	Class	Sample size	Age		N		Incidence	Analysis
(17) Bakker MI et al, 2006	Indonesia (five islands: Tampaang, Pelokang, Kembanglemari, Sailus and Sapuka)	2000-2004 (6 surveys)	CH	Individual	Cohort study on factors associated with leprosy incidence, as part of a study on the impact of rifampicin prophylaxis on the disease incidence.	PB	4,903 (177,569 person-months)	All ages	NA	44	I	2.98 (95% CI 2.2, 4.0) / 1,000 PYR	(A): sex, household size, serological status in 2000 and contact status by classification of index patient, adjusted for each other + intervention (rifampicin chemoprophylaxis)

Variable	Category	n	%	Estimate (CI)	n	%	Method	Measure	Estimate (CI)	Adjusted
Sex	Female	17	0.7%	2.04 (1.27, 3.29)	2,594	99.3%	CX	HR	1.0	1.0 [12]
	Male	27	1.2%	4.17 (2.86, 6.08)	2,265	98.8%			2.01 (1.10, 3.70)	2.21 (1.20, 4.09)
Age	0–5	1		0.47 (0·07, 3.33)					0.13* (0.02, 0.95)	
	6–14	14		3.70 (2.19, 6·24)					1·0	
	15–29	14		3.53 (2.09, 5·95)					0.92 (0·44, 1.94)	
	30–44	10		3.81 (2.05, 7·08)					1.01 (0·45, 2.28)	
	45–59	3		2.16 (0.70, 6·70)					0.55 (0·16, 1.92)	
	>60	2		2.24 (0.56, 8·96)					0.57 (0·13, 2.52)	
Household members	1-4	11	0.6%	1.88 (1.04, 3.40)	1,917	99.4%			1.0 [11]	1.0 [12]
	5-7	21	0.9%	3.09 (2.02, 4.74)	2,229	99.1%			1.71 (0.82, 3.56)	1.61 (0.77, 3.37)
	8-16	12	1.7%	5.61 (3.19, 9.88)	713	98.3%			3.47 (1.51, 7.98)	3.12 (1.34, 7.27)
Contact status 1	No contact [9]	29		2.88 (2.00, 4.15)					1.0 [11]	
	N2 contact	6	0.7%	3.31 (1.49, 7.38)	4,581	99.3%			1.52 (0.50, 4.59)	
	N1 contact	3		1.48 (0.48, 4.60)					0.72 (0.19, 2.75)	
	Household contact	6	2.1%	6.67 (3.00, 14.9)	278	97.9%			3.29 (1.11, 9.77)	
Contact status 2	No contact (>100m) [10]	15		2.69 (1.62, 4.46)					1.0 [11]	
	Buffer contact 75-100 m	3		1.75 (0.56, 5.43)					0.62 (0.18, 2.15)	
	Buffer contact 50-75 m	8		4.01 (2.00, 8.01)					1.51 (0.64, 3.56)	
	Buffer contact 25-50 m	7		3.15 (1.50, 6.60)					1.33 (0.52, 3.42)	
	Buffer contact 1-25 m	5		2.10 (0.87, 5.04)					1.15 (1.36, 3.62)	
	Household contact	6		6.67 (3.00, 14.2)					3.57 (1.18, 10.7)	

The risk among males to develop leprosy was over twice higher than among females. The risk among household contacts was over three times higher in households with more than 7 members compared to 1-4 member households.

Study (23)

Ref	Country	Year	Type	Level	Description	Class	Sample size	Age		N			Analysis
(23) Kerr-Pontes LRS et al, 2006	Brazil (State of Ceará)	2002	CC	Individual	Study in four municipalities aimed to identify socioeconomic, environmental, and behavioral factors associated with leprosy occurrence in individuals with no contact with leprosy patients. For each case, four age and sex frequency matched individuals, presenting for reasons other than skin problems to the health unit where the case was diagnosed and living in the same municipality as the case, were selected as controls. For multivariate analysis, a hierarchical framework in five blocks (block 1: socio economic factors; block 2: environmental factors; block	PB	1,083	>18 years	NA	222	-	NA	Bivariate analysis was done accounting for cluster effect of municipalities; multivariate analyses were done in each block, adjusting for all variables in the block (first step), and then, adjusting the socioeconomic block by the statistically significant variables of the four blocks left (second step, shown here)

Variable	Category	n	%	n	%	Method	Measure	Estimate (CI)	Adjusted
Block 1:						LR	OR		
Schooling	High	40	18	244	28			1.00	1.00
	Middle	56	25	226	26			1.51 (0.93, 2.47)	1.50 (0.91, 2.50)
	Low	130	58	387	45			2.05*(1.29, 3.27)	1.87*(1.29, 2.74)
Food shortage at any time in life	Never experienced	161	72	687	81			1.00	1.00
	Experienced	63	28	163	19			1.65*(1.11, 2.42)	1.54*(1.45, 1.63)
Access to safe drinking water in the past 10 years	Yes	133	59	546	65			1.00	
	No	91	41	298	35			1.17 (0.96, 1.43)	
Sewage disposal in the past 10 years	Yes	180	81	741	87			1.00	
	No	41	19	111	13			1.44 (0.95, 2.80)	
Sand/mud in the floor in the past 10 years	No	182	81	737	86			1.00	
	Yes	44	20	119	14			1.46*(1.04, 2.06)	
Block 2:									
Household crowding (currently)	0–3 persons per room	200	89	782	92			1.00	
	4 or more persons per room	26	12	71	8			1.43 (0.64, 3.20)	
Has/had animals in the house/yard in the past 10 years	No	39	17	203	24			1.00	
	Yes	184	83	649	77			1.48 (0.77, 2.86)	
Works/worked in forest in the past 10 years	No	148	69	647	76			1.00	
	Yes	68	31	200	24			1.43 (0.90, 2.29)	
Works/worked in agricultural field in the past 10 years	No	81	36	392	46			1.00	
	Yes	144	64	463	54			1.48 (0.79, 2.77)	
Block 3:									

[9] reference category for contacts in household, N1 (direct neighbours) and N2 (next neighbours)
[10] reference category for contact classification by spatially defined buffers
[11] adjusted by intervention
[12] adjusted by (A) (see list of confounders)

Ref	Country	Year	Type	Level	Study description	Pop	N	Age	Setting	n	Design	Incidence/Prevalence	Confounders	Variable	Category	Cases	%	Total	%	Measure	Estimate (crude)	Estimate (adj)
					3: behavioral factors; block 4: demographic factors and block 5: vaccination) was defined.									Frequency of changing bed linen (current)	Biweekly	132	58	609	72		1.00	1.00
															>Biweekly	94	42	242	28		1.79* (1.32, 2.43)	1.81* (1.30, 2.52)
														Sharing its own bed/hammock with others (current)	Yes	100	44	428	50		1.00	
															No	125	56	426	50		1.29 (0.93, 1.61)	
														Sharing others bed/hammock with others (current)	Yes	131	58	526	62		1.00	
															No	95	42	322	38		1.17 (0.60, 2.30)	
														Weekly regular bath in open water bodies (creek, river or lake) in the past 10 years	No	188	83	770	90		1.00	1.00
															Yes	38	17	87	10		1.79*(1.18, 2.70)	1.77* (1.12, 2.81)
														Block 4:								
														Sex	Male	108	48	348	41		1.00	1.00
															Female	118	52	509	59		0.84 (0.68, 1.04)	0.97 (0.70, 1.34)
														Age (years) - continuous in the multivariable analysis	< 30	44	20	228	27		1.00	1.00
															30–39	33	15	167	19		1.02 (0.72, 1.45)	1.01 (1.00, 1.02)
															>40	149	66	462	54		1.67 (0.77, 3.64)	
														Skin colour	White	76	34	404	47		1.00	
															Brown/black	148	66	450	53		1.88 (0.99, 3.56)	
														Marital status	Not married	78	35	298	35		1.00	
															Married	144	65	552	65		0.95 (0.84, 1.06)	

Crowding or sharing the bed or hammock with other household members did not show a significant association with leprosy. Low education level, ever having experienced food shortage, bathing weekly in open water bodies (creek, river and/or lake) 10 years previously, and a low frequency of changing bed linen or hammock (>biweekly) currently were all associated with leprosy.

Ref	Country	Year	Type	Level	Study description	Pop	N	Age	Setting	n	Design	Incidence/Prevalence	Confounders	Variable	Category	Cases	Incidence	Total		Measure	Estimate (crude)	Estimate (adj)
(36) Moet FJ et al, 2006	Bangladesh (Districts of Nilphamari and Rangpur)	2002-2003	CS	Individual	Study on prevalence of leprosy among contacts of leprosy patients and its association with different characteristics in contacts and patients (part of COLEP project)	Contacts	21,870 contacts	5 to 50+ years	RUR	159	P	7.3 (95% CI 6.2,8.5) / 1,000	Age, type of leprosy, physical distance, genetic distance	Sex	Female	NA	-	NA	NA	LR / OR	1.00	
															Male		-				1.26 (0.92, 1.72)	
														Age, years	5- 9		3.3 (1.7, 5.9)[14]				1.00	1.00
															10-14		6.5 (4.1, 9.7)[14]				1.97 (0.96, 4.04)	2.02 (0.98, 4.15)
															15-19		9.8 (6.3,14.5)[14]				2.98 (1.46, 6.09)	3.08 (1.49, 6.34)
															20-29		5.0 (3.0, 7.9)[14]				1.53 (0.73, 3.22)	1.72 (0.81, 3.63)
															>30		9.3 (7.4,11.6)[14]				2.84 (1.51, 5.34)	2.94 (1.56, 5.54)
														Physical distance[13]	N2+S		4.9 (3.8, 6.3)[14]				1.00	1.00
															R+N1		8.7 (6.5,11.5)[14]				1.79 (1.23, 2.60)	1.69 (1.16, 2.47)
															K		7.5 (3.9,13.1)[14]				1.54 (0.83, 2.87)	1.05 (0.52, 2.13)
															KR		15.6 (10.6,22.0)[14]				3.21 (2.08, 4.96)	2.44 (1.44, 4.12)

In this study, the contacts living under the same roof as patients and sharing the same kitchen had a higher risk than other contacts living under the same roof and next door neighbors, who, again, had a higher risk than neighbors of neighbors.

Ref	Country	Year	Type	Level	Study description	Pop	N	Age	Setting	n	Design	Incidence/Prevalence	Confounders	Variable	Category	Cases	Incidence	Total		Measure	Estimate	
(18) Kumar A et al, 2007	India	1999-2005	CH	Individual	Study on the leprosy-free population (in a survey conducted in 1999 to 2001), resurveyed from 2 to over 4 years after the initial survey.	PB	42,113 / 123,951.2 PYR	<15 to 44+ years	MX	77	I	6.2/10,000 overall; 4.5/10,000 in <15years old	No	Contact with leprosy patient	non-familial contacts	56	4.6/10,000	41,119		RR	NA (p<0.01)	
															familial contacts	21	67.6/10,000	994				
														Age	< 15	25	4.5/10,000	18,745			NA (p<0.005)	
															15 to 29	15	5.2/10,000	9,857				
															30 to 44	17	7.8/10,000	7,446				
															44 or more	20	11.2/10,000	6,065				
														Sex	Males	29	6.6/10,000	14,806				
															Females	48	6.0/10,000	27,307				
														Follow-up time among non-familial contacts	1 year					Survival analysis	Survival probability (SE)	0.9997 (0.0001)
															2 years							0.9991 (0.0001)
															3 years							0.9986 (0.002)
														Follow-up time among familial contacts	1 year							0.9948 (0.002)
															2 years							0.9842 (0.004)

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[13] KR, contact sharing roof and kitchen ("household") with the index case; K, contact sharing the kitchen; N1, next-door neighbor, not sharing kitchen or roof; N2, neighbor of neighbor

[14] new cases / 1,000 contacts (95% CI)

Ref	Author	Place	Years	Design	Level	Description	PB/MB	Population	Age	URB/MX	Cases	I/P	Rate	Exposure	Exposure (detail)	Categories	n	%	n	%	Method	Measure	Estimate 1	Estimate 2
						Higher incidence of leprosy was found among familial contacts (FC), than among non-familial contacts, and risk increased with age.							3 years										0.9792 (0.005)	
(19)	Fischer EAJ et al, 2008	Bangladesh (District of Nilphamari)	1989-2003	CH	Individual	Retrospective cohort study to identify spatial distribution of leprosy patients detected in 1989-2003 and environmental risk factors associated with leprosy.	PB	1,500,000 approximately	NA	MX	11,060	I	0.49 / 1,000 PYR	Distance to road, distance to river, distance to clinic, distance to town	Distance to road (linear) Distance to road (squared) Distance to river (linear) Distance to river (squared) Distance to clinic (linear) Distance to clinic (squared) Distance to town (linear) Distance to town (squared)		NA	NA	NA	NA	NA	PR	RR	0.911 (0.894, 0.929) 0.995 (0.993, 0.996) 1.028 (0.988, 1.070) 0.998 (0.990, 1.005) 0.963 (0.939, 0.987) 0.997 (0.995, 0.999) 0.890 (0.866, 0.914) 0.990 (0.988, 0.993)	0.934 (0.915, 0.953) 0.996 (0.999, 1.002) 1.033 (0.992, 1.075) 0.998 (0.996, 1.012) 1.006 (0.981, 1.033) 1.000 (0.999, 1.004) 0.922 (0.895, 0.950) 0.993 (0.990, 0.995)
						The study shows association of new leprosy cases rate with proximity to towns, especially in the first kilometers, and proximity to roads; no relationship was found with the proximity to a clinic or to rivers																		
(42)	Lana FCF et al, 2009	Brazil/Minas Gerais	2003-2006	EC	Municipality	The study aims to analyze the association between leprosy detection rates and Human Development Index (HDI).	PB	853	All ages	MX	NA	I[15]	NA	No	HDI	Low (0.694) Median (0.694-0.750) High (>0.750)						Contingency table	Chi square test Bonferroni correction: for total population (8df) and only high versus low HDI (4df)	21,51 (8df; p=0.008) 16,53 (4df; p=0.017)	
						Municipalities with high IDH had lower leprosy detection rates than municipalities with low IDH, which suggest that cities with worst socio-economic conditions have less control of the endemy.																		
(43)	Imbiriba EB et al, 2009	Brazil (city of Manaus)	1998-2004	EC	Census tract	Ecological study on geographical distribution of leprosy and associated factors, based on 1,536 census tracts in the city of Manaus. The dependent variable was the smoothed average detection rate, categorized as 0, for < 4 cases/10,000, or 1, for ≥ 4 cases/10,000 cases.	PB	1,451,958 (population in 2001); 1,536 census tracts	All ages	URB	4,104	I	4.21 / 10,000	Cases in <15 year old children, life conditions index	Cases in <15 year old children Life Conditions Index	0 1 2+ Fair Middle Middle-low Low		NA	NA	NA	NA	NA	LR	OR		1.00 1.76* (1.31, 2.36) 2.44* (1.41, 4.20) 1.00 1.67* (1.14, 2.44) 3.05* (2.15, 4.32) 4.43* (3.14, 6.24)
						Higher risk of leprosy was independently associated with higher occurrence of cases in <15 year old children and worse conditions of life																		
(37)	Durães SMB et al, 2010	Brazil (Duque de Caxias municipality)	2004-2007	CS	Individual	Cross-sectional study on contacts of 107 index cases	Contacts	1,040	All ages	URB	211 coprevalent cases	P		Degree of kinship, type of contact	Degree of kinship Type of contact	Other (including non-relatives) 1st degree (parents, children, siblings) Peridomiciliary Domiciliary	87 124 48 163	14.3% 28.8% 12.2% 23.3%	522 307 347 482	85.7% 71.2% 87.8% 74.7%	LR	OR	1.00 2.42* (1.75, 3.35) 1.00 2.44* (1.69, 3.40)	1.00 2.05 (NA) 1.00 2.00 (NA)
						Household contacts showed higher risk of leprosy, independent on kinship																		
(44)	Queiroz JW et al, 2010	Brazil (Mossoró municipality)	1995-2006	EC	Census tract	Study conducted on 170 census tracts, where 808 leprosy cases were selected out of 1,293 cases diagnosed between 1995 and 2006, and the dwellings were geocoded. Spatial linear regression	PB	213,841 (2000 Census); 170 census tracts	All ages	URB	808	I[16]	0,0 to 31.7 / 10,000 (average yearly detection rate, across 170 census tracts)	NA	Factors extracted by principal components analysis of ten socioeconomic variables; the higher the factor score, the better the socio-economic conditions	First factor, correlated with presence of basic sanitation (existence of piped water, presence of toilets in the house and trash collection) Second factor, expressing the level of literacy and income (mean family		NA	NA	NA	NA	NA	SAR (spatial autoregressive lag model)	RR	β = -0.0978 (0.0331) NA	

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[15] Leprosy detection rates were categorized in low (<0.2/10000), median (0.2-0.99/10000), high (1-1.99/10000), very high (2-3.99/10000) and hyperendemic (>4/10000).

[16] average yearly detection rate, across 170 census tracts

					models were adjusted to assess the association between socio-economic factors and risk of leprosy .										income, years of schooling and number of toilets in the house) Third factor, expressing the level of poverty (lack of access to bank loaning and number of residents in the household)							β = -0.1027 (0.0240)	

Using spatial linear models, a significant inverse relationship was observed between the geographic distribution of leprosy and factors expressing socioecono mic conditions (the higher the factor score, the better the conditions

Study	Country	Year	Design	Level	Description	Type	N	Age	Setting	Cases		Outcome	Variable	Category	Cases		Controls	Method	Measure	Estimate 1	Estimate 2
(24) Feenstra SG et al, 2011	Bangladesh (Districts of Nilphamari and Rangpur)	2009	CC	Individual	Study on 90 cases and 199 controls (part of the COLEP project), on the association of selected socio-economic factors with leprosy	PB	289	5 to 40+ years	RUR	90	-	NA	Age, food shortage in the last year					LR	OR		
													Sex	Female	41		116			1.00	
														Male	49		83			1.67 (1.01, 2.76)	
													Age (years)	<10	6		22			1.00	1.00
														10-19	20		65			1.13 (0.40, 3.17)	1.17 (0.41, 3.32)
														20-29	21		27			2.85 (0.98, 8.30)	3.22 (1.09, 9.51)
														30-39	15		32			1.72 (0.58, 5.12)	1.84 (0.61, 5.55)
														40-49	11		35			1.15 (0.37, 3.56)	1.28 (0.38, 3.67)
														≥50	17		18			3.46 (1.13,10.61)	3.56 (1.15,11.02)
													Wealth quintile (score)	1	25		40			1.00	
														2	20		40			0.80 (0.38, 1.67)	
														3	16		40			0.64 (0.30, 1.38)	
														4	17		40			0.68 (0.32, 1.45)	
														5	12		39			0.49 (0.22, 1.12)	
																				0.85 (0.71, 1.02) [17]	
													Educational level (highest level of schooling ≥6 years)	High	49		113			1.00	
														Low	41		86			1.10 (0.67, 1.81)	
													Crowding (>3 people per sleeping room)	No	55		129			1.00	
														Yes	35		70			1.17 (0.70, 1.96)	
													Ever food shortage	No	30		76			1.00	
														Yes	60		123			1.24 (0.73, 2.09)	
													Food shortage in the last year	No	47		128			1.00	1.00
														Yes	43		71			1.65 (1.00, 2.74)	1.79 (1.06, 3.02)

In multivariate analysis, including sex, age, wealth quintiles, educat ional level, crowding, food shortage ever and food shortage in the last year, leprosy was associ ated with food shortage in the last year, but not with food shortage ever, and with the age groups of 20-29 years and 50+ years

Study	Country	Year	Design	Level	Description	Type	N	Age	Setting	Cases		Outcome	Variable	Category	N	Method	Measure	Estimate 1	Estimate 2
(20) Sales AM et al, 2011	Brazil (city of Rio de Janeiro)	1987-2007	CH	Individual	Study on contacts of 1,201 new leprosy cases, diagnosed in a national reference Centre, followed-up for 16.9 years on average. A multilevel logistic analysis was performed, with contacts variables placed at the 1st level in the model, and index cases variables at the 2nd level.	Contacts	6,158	All ages	NA	319 co-prevalent cases and 133 incident cases, diagnosed among the contacts	-	-	Age, sex, educational level and income level (in contact and index cases); blood relationship, type of association, years of association, BCG scar and BCG vaccine (in contacts); family size, bacillary index and disability grade (in index cases).	Among co-prevalent cases [18]:		LR	OR		
													Age (contacts)	≥15 years	236			1.00	1.00
														<15 years	83			0.65 (0.50, 0.84)	0.86 (0.62, 1.18)
													Sex (contacts)	Female	177			1.00	1.00
														Male	142			1.07 (0.85, 1.34)	1.12 (0.88, 1.43)
													Educational level (contacts)	>10 years	39 / 1,073			1.00	1.00
														4 to 10 years	25 / 693			0.93 (0.53, 1.65)	1.08 (0.61, 1.94)
														<4 years	255 / 4,072			1.50 (1.03, 2.19)	1.43 (0.96, 2.15)
													Income level (contacts)	>3 minimum wages	87 / 2,475			1.00	
														2 to 3 minimum wages	150 / 2,285			1.85 (1.35, 2.54)	
														<2 minimum wages	82 / 1,080			2.18 (1.50, 3.17)	
													Type of close association with index cases	Non-household	2,378			1.00	1.00
														Household	99 / 3,461			1.44 (1.11, 1.86)	1.33 (1.02, 1.73)
													Years of close association	<5 years	220 / 1,057			1.00	
														≥5 years	26 / 4,782			2.64 (1.75, 3.98)	
													Age (index cases)	≥15 years	293			1.00	

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[17] OR for linear trend

[18] Considered as a cross-sectional analysis

Variable	Category	Cases (n)	Non-cases (n)	Crude OR (95% CI)	Adjusted OR (95% CI)
	<15 years			0.96 (0.53, 1.72)	
Sex (index cases)	Female			1.00	1.00
	Male			1.47 (1.07, 1.01)	1.05 (0.76, 1.45)
Educational level (index cases)	>10 years		833	1.00	1.00
	4 to 10 years	17	1,459	2.53 (1.37, 4.64)	2.40 (1.30, 4.42)
	<4 years	20	3,597	3.31 (1.87, 5.58)	2.72 (1.54, 4.79)
Income level (index cases)	>3 minimum wages	232	1,451	1.00	
	2 to 3 minimum wages	40	1,344	2.31 (1.44, 3.70)	
	<2 minimum wages	84	1,181	2.17 (1.34, 3.52)	
Family size (index cases)	< 5 persons	73	2,264	1.00	
	≥ 5 persons	149	3,566	0.71 (0.53, 0.95)	
		179			
Among incident cases:					
Age (contacts)	≥15 years			1.00	1.00
	<15 years			0.85 (0.58, 1.24)	1.06 (0.66, 1.70)
Sex (contacts)	Female			1.00	1.00
	Male			0.78 (0.55, 1.13)	0.79 (0.54, 1.17)
Educational level (contacts)	>10 years		1,046		1.00
	4 to 10 years	27	686		0.40 (0.16, 1.01)
	<4 years	7	3,974		0.82 (0.49, 1.36)
Income level (contacts)	>3 minimum wages	98	2,436		
	2 to 3 minimum wages	39	2,216		
	<2 minimum wages	69	1,055		
		25			
Type of close association with index cases	Non-household		2,343		1.00
	Household	35	3,336		1.96 (1.29, 2.98)
Years of close association	<5 years	98	1,039		
	≥5 years	18	4,667		
Age (index cases)	≥15 years	115			
	<15 years			1.00	
Sex (index cases)	Female			8.37 (1.12, 62.4)	1.00
	Male			1.00	1.22 (0.70, 1.76)
Educational level (index cases)	>10 years		809	1.61 (1.03, 2.53)	1.00
	4 to 10 years	24	1,428		0.70 (0.37, 1.32)
	<4 years	31	3,519		0.60 (0.34, 1.06)
Income level (index cases)	>3 minimum wages	78	1,427		
	2 to 3 minimum wages	24	1,311		
	<2 minimum wages	33	1,154		
Family size (index cases)	< 5 persons	27	2,218		
	≥ 5 persons	46	3,479		
		87			

The multilevel analysis in this study showed that lower educational level among both contacts and index cases was associated with leprosy among co-prevalent cases but not among incident cases. The study also showed that close association with index cases was associated with leprosy both in co-prevalent and incident cases.

(45) Cury MRCO et al, 2012	Brazil (São Jose do Rio Preto city)	1998-2007	EC	Census tract	Territory-based study to analyze the association between leprosy incidence (as a categorical variable in quintiles) and socio-	PB	419,633 (population); 432 census tracts	All ages	URB	379	I	10.4/100,000 (cumulative incidence)	NA	Socio-economic factor[19] (obtained by principal component analysis of socio economic variables - the greater the factor value, the better the	442.8 - 835.6					Contingency table	Chi square	180.7 (p<0.001)
															835.6 - 1,195.8
															1,195.8 - 1,686.8
															1,686.8 - 2,799.9
															2,799.9 - 8,790.9

[19] Socio-economic factor (SF), based on: average years of education of the breadwinner, average years of education of the female breadwinner, average income of the breadwinner, average income of the female breadwinner, percentage of illiterate people (E), percentage of illiterate women, and percentage of residences with five or more inhabitants.

Ref	Author, Year	Country (location)	Study year	Design	Level	Study description	Setting	Sample size	Age	Setting type	No. of cases	P	Incidence	Adjustment variables	Variable	Category	Value	Cases n	Cases %	Controls/Non-cases n	Controls %	Analysis	Measure	Crude estimate	Adjusted estimate
						demographic categorical variables.								socio economic level) in quintiles		0.0015 - 0.0037								
													Demographic density (inhabitants per km2) in sextiles		0.0038 - 0.0054								
															0.0055 - 0.0068								NA (p=NS)
															0.0069 - 0.0084								
															0.0085 - 0.0104								
															0.0105 - 0.0144								

High leprosy incidence was associated with lower socioeconomic levels. There is no association between leprosy incidence and demographic density.

Ref	Author, Year	Country (location)	Study year	Design	Level	Study description	Setting	Sample size	Age	Setting type	No. of cases	P	Incidence	Adjustment variables	Variable	Category	Cases n	Cases %	Controls n	Controls %	Analysis	Measure	Crude	Adjusted
(25)	Feenstra SG et al, 2013	Bangladesh (Districts of Nilphamari and Rangpur)	2009	CC	Individual	Study on 90 cases and 199 controls (part of COLEP project), on the association of social contact patterns and other factors with leprosy.	PB	289	5 to 40+ years	RUR	90	-	NA	Age, social contact score, food shortage in the last year	Sex — Female		41	26.1%	116	73.9%	LR	OR	1.00	
															Male		49	37.1%	83	62.9%			1.67 (1.01, 2.76)	
															Age (years) — <10		6	21.4%	22	78.6%			1.00	1.00
															10-19		20	23.5%	65	76.5%			1.13 (0.40, 3.17)	1.38 (0.48, 4.00)
															20-29		21	43.8%	27	56.3%			2.85 (0.98, 8.30)	4.07 (1.33,12.47)
															30-39		15	31.9%	32	68.1%			1.72 (0.58, 5.12)	2.41 (0.77, 7.57)
															40-49		11	23.9%	35	76.1%			1.15 (0.37, 3.56)	1.50 (0.47, 4.87)
															≥50		17	48.6%	18	51.4%			3.46 (1.13,10.61)	5.17 (1.56,17.11)
															Social contact score[20] level 1								1.09 (1.01, 1.18)	1.09 (1.00, 1.19)
															Social contact score level 2								1.07 (1.03, 1.11)	1.07 (1.03, 1.11)
															Social contact score level 3								1.05 (0.97, 1.14)	
															Household size								0.93 (0.82, 1.05)	
															Wealth quintile — 1		25	38.5%	40	61.5%			1.00	
															2		20	33.3%	40	66.7%			0.80 (0.38, 1.67)	
															3		16	28.6%	40	71.4%			0.64 (0.30, 1.38)	
															4		17	29.8%	40	70.2%			0.68 (0.32, 1.45)	
															5		12	23.5%	39	76.5%			0.49 (0.22, 1.12)	
															Wealth score (continuous)								0.75 (0.57, 0.97)	
															Educational level (highest level of schooling ≥6 years) — High		49	30.2%	113	69.8%			1.00	
															Low		41	32.3%	86	67.7%			1.10 (0.67, 1.81)	
															Food shortage in the last year — No		47	26.9%	128	73.1%			1.00	1.00
															Yes		43	37.7%	71	62.3%			1.65 (1.00, 2.73)	2.03 (1.17, 3.52)

In multivariate analysis, including sex, age, social contact scores, wealth quintiles, educational level and food shortage in the last year, leprosy was associated with a higher score for social contacts at home (level 1) and in the nearby neighborhood (level 2), with food shortage in the last year, and with the age groups of 20-29 years and 50+ years

Ref	Author, Year	Country (location)	Study year	Design	Level	Study description	Setting	Sample size	Age	Setting type	No. of cases	P	Incidence	Adjustment variables	Variable	Category	n	Rate	Population	Analysis	Measure	Estimate
(38)	Kumar A et al, 2013	India (States of Uttar-Pradesh and Haryana)	2009-2010	CS	Individual	Population survey carried out in Primary Health Care subcentres in two States (Uttar-Pradesh:UP and Haryana:H), identified through multistage random selection sampling.	HS	631,618 (rural) 172,918 (urban)	All ages	MX	355 new cases (276 in UP and 79 in H)	P	4.41/10,000 (6.91/10,000 in UP and 1.95/10,000 in H)	Age, sex	Area — Urban	153	8.85/10,000	172,765	Contingency table	Chi square	98.3 (p<0.0001)
															Rural	202	3.20/10,000	631,416			
															Age — 0- 9	20		203 276			
															10-19	64		203 591			
															20-29	48		137 172			
															30-39	66		98 795			
															40-49	58		69,648			
															50-59	38		38,457			
															60+	61		53,242			
															Sex — Male	183		411,910			
															Female	172		392,271			

In the surveyed area, the new case detection rate was significantly higher in urban areas compared to rural areas

Ref	Author, Year	Country (location)	Study year	Design	Level	Study description	Setting	Sample size	Age	Setting type	No. of cases	P	Incidence	Adjustment variables	Variable	Category	n	Rate	Population	Analysis	Measure	Estimate
(39)	Moura ML et al, 2013	Brazil (Mossoró city)	2006	CS	Individual and family	Survey among household contacts and neighboring contacts of leprosy patients in	Contacts	637	All ages	URB	15	P	2.4/100	N	Type of contact — Household	6	2.9/100	203	NA	NA	NA (p=0.555)
															Neighbour	9	2.1/100	419			

[20] Social contact score: level 1, in the home; level 2, within the neighbourhood; level 3, outside the neighbourhood

two neighborhoods with the highest concentration of leprosy cases in the study municipality.

There was no difference in leprosy detection rate among household contacts and individuals living in neighboring residences.

(26) Murto C et al, 2013	Brazil (Maranhão State)	2009-2010	CC	Individual	A matched case-control study in endemic municipalities to examine if migration in the past five years is a risk factor for leprosy and to assess the social determinants associated with leprosy among past 5-year migrants. Cases were individuals >15 years old from national registry of leprosy and controls were selected from a national primary heath care program (Family Health Program).	HS	680 (340 cases and controls)	>15 years	MX	340	-	NA	Age, sex and clinic of diagnosis (matching variables), family (parent/child/sibling) and household contact with leprosy patient	Past 5 years migration	Yes	80		55	LR	OR	1.59*(1.17, 2.38)	1.51*(1.0, 2.28)
														No	260		285			1.00	
														Among migrants in the past 5 years:								
														Age	15–29	35		28				
															30–44	21		14				
															45–59	15		9				
															60 or more	9		4				
															Male	40		35				
															Female	40		20				
														Education	Literate	54		45				
															Illiterate	26		10				
														Type of migration	In-state (Maranhao)	45		25				
															From outside Maranhao	35		30				
														Number of times the individual migrated in the past 5 years	1	61		47				
															2	19		8				
														Zone of migration in the past 5 years	Urban	47		38				
															Rural	26		13				
															Rural/urban	6		3				
														Migration for work in past 5-yrs	Yes	46		30				
															No	34		25				
														Social network prior to migration	Always	63		39				
															Sometimes	5		1				
															Never	11		15				
														Who lived with during migration	Family	64		41				
															Co-workers	14		12				
															Other	1		2				
														Mean people who lived with during migration		8.61		6.7				
														Mean years of migration		6.25		4.8				
														Alcohol consumption	Never drank	15		14				1.00
															drinks currently	15		28				0.50 (0.17, 1.45)
															drank in the past 5 years	43		9				4.46*(1.43, 14.15)
															use to drink more than 5 years ago	7		4				1.63 (0.32, 9.25)
														Familial and non-familial contact	No leprosy contact	33		43				1.00
															parent/sibling/child with leprosy	24		4				7.82*(2.32, 33.38)
															others with leprosy (regardless of consanguinity)	23		6				4.99*(1.70, 16.51)
														Household contact with leprosy in the past 5 years	Yes	20		3				5.54*(1.49, 30.46)
															No	59		49				1.00
														Income	≤ R$ 510	38		17				2.12*(0.97, 4.71)
															≥ R$ 510	39		37				1.00
														Public waste service	Yes	58		49				1.00
															No	22		6				3.10*(1.10, 10.02)
														Family illiteracy	Yes							

| | | | | | | | | | | | | | | | | | No | | 32 39 | | 12 39 | | | 2.67*(1.13, 6.51) 1.00 | |

Leprosy was associated with migration in the past five years. Among migrants, having a leprosy contact, lower income, poor public waste services, alcohol consumption and illiteracy in the family were associated with leprosy. However, education, zone of residence and lifestyle stressors were not associated with leprosy.

| *(46)* Barreto JC el at, 2014 | Brazil (Castanhal municipality) | 2004-2010 | EC | Census tract | Spatial analysis techniques were used to determine the spatio-temporal pattern of leprosy cases in eleven districts from a hyperendemic municipality in the Brazilian Amazon region. | PB | 114 census tracts | All ages | URB | 499 | I | 25.1-97.0 / 100,000 | | Mean number of people per household (household density) | | 5.0 | 2.6 | | 3.8 | 3.2 | Mann-Withney test | U | NA (p<0.001) | |

A positive correlation was found between household density and leprosy incidence. Spatial clusters of high and low detection rates were also found, as well as a spatial autocorrelation of individual cases at fine spatio-temporal scales.

| *(47)* Cabral-Miranda W et al, 2014 | Brazil (State of Bahia), the all of 417 municipalities) | 2005-2011 | EC | Municipality | Study of new cases of leprosy that occurred between 2005 and 2011in the all of 417 municipalities in the State, in children under 15 years old. A hierarchical conceptual model in three levels was used. | PB | 417 | <15 years | MX | 1,674 | I | 0.88/10,000 (2005), 0.52/10,000 (2011) | 'Caatinga', % of water bodies, Gini Index, average No. of dwellers p/ residence, % of urban population, % of residents born in Bahia | OLS regression 'Caatinga' (No vs Yes) Percent of water bodies Gini Index Average No. of dwellers /residence Percent of urban population Percent of resident born in Bahia

Spatial regression 'Caatinga' (No vs Yes) Percent of water bodies Gini Index Average No. of dwellers /residence Percent of urban population Percent of resident born in Bahia

Spatial components in spatial regression Lag of 'caatinga' (No vs Yes) Lag of % of water bodies Lag of Gini Index

Lag of average No. of dwellers / residence Lag of % of urban populatio Lag of % of resident born in Bahia | | NA | NA | NA | NA | NA | LR (OLS regression and spatial regression) | RR | | -0.00 (0.41) [21] 0.04 (0.02) [21] 3.84 (0.00) [21] 0.43 (0.04) [21]

0.02 (<0.00) [21] -0.04 (0.00) [21]

-1.11e-03 (0.32) [22] 3.85e-02 (0.05) [22] 3.36e+00 (0.00) [22] 1.22e-01 (0.63) [22]

1.71e-02 (0.00) [22] -2.28e-05 (0.99) [22]

1.29e-03 (0.41) [23]

-2.24e-02 (0.52) [23] 1.47e+00 (0.40) [23]

8.63e-01 (0.04) [23]

3.13e-03 (0.51) [23] 5.94e-02 (0.00) [23] |

In the regression model, after allowing for spatial dependence, relative risk of leprosy in children less than 15 years old was associated with higher percentage of area occupied by water bodies, greater Gini index and higher percentage of urban population; additional explanation was given, considering the spatial components, by a larger average number of dwellers by permanent residence and a lower percentage of residents born in Bahia.

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[21] OLS (ordinary least squares) regression estimate (Pr(|z|)

[22] Spatial regression estimate (Pr(|z|)

[23] Spatial component estimate (Pr(|z|)

(48)	Freitas LRS et al, 2014	Brazil	2009-2011	EC	Municipality	Study on the association between demographic and socio-economic characteristics of all of the 5,565 municipalities and the average smoothed incidence rate / 100,000 of leprosy, using a hierarchical log-linear negative binomial regression analysis.	PB	190,755,799 (Brazilian population according to 2010 Census); 5,565 municipalities	All ages	MX	NA	I	9.1 (3.3, 22.8)/100,000 [24]	Region, size of the municipalities, illiteracy rate (%), urbanization rate (%), Gini index, households with inadequate sanitation (%), average of dwellers/ room, contacts investigated (%), coverage of Family Health Program (FHP) (%), cases with grade 2 disability (%)					NB	RR		

Variable	Category	Value	RR (1)	RR (2)
Size of the municipalities [25]	Small 1	8.4 (3.0, 21.2)	1.00	1.00
	Small 2	11.7 (4.3, 27.7)	1.21 (1.13, 1.30)	1.19 (1.11, 1.29)
	Medium-sized	10.0 (4.1, 31.0)	1.29 (1.15, 1.45)	1.41 (1.24, 1.60)
	Large	8.1 (3.4, 23.8)	1.05 (0.93, 1.19)	1.67 (1.44, 1.95)
	Metropolis	11.4 (4.4, 26.0)	1.07 (0.66, 1.74)	1.92 (1.15, 3.18)
Illiteracy rate (%)	<8	3.8 (1.5, 8.3)	1.00	1.00
	≥8 to <13	8.8 (3.5, 21.2)	2.54 (2.35, 2.74)	1.51 (1.37, 1.66)
	≥13 to <24	17.6 (7.0, 44.3)	3.76 (3.49, 4.06)	2.41 (2.12, 2.74)
	≥24	12.1 (5.2, 24.3)	2.38 (2.20, 2.57)	2.15 (1.83, 2.53)
Urbanization rate (%)	<47	8.4 (2.6, 21.0)	1.00	1.00
	≥47 to <65	10.6 (3.7, 26.6)	1.30 (1.21, 1.41)	1.27 (1.17, 1.37)
	≥65	8.7 (3.5, 22.2)	2.21 (1.13, 1.29)	2.53 (1.40, 1.67)
Gini index	0.50	5.8 (2.3, 14.1)	1.00	1.00
	≥0.50 to <0.55	10.2 (3.9, 25.1)	1.51 (1.42, 1.61)	1.10 (1.02, 1.18)
	≥0.55	17.6 (7.1, 40.0)	2.17 (2.03, 2.32)	1.26 (1.16, 1.37)
Households with inadequate sanitation (%)	<6	4.3 (2.0, 10.1)	1.00	1.00
	≥6 to <16	8.6 (3.2, 20.9)	2.06 (1.91, 2.23)	1.42 (1.30, 1.56)
	≥16	13.5 (5.4, 31.3)	2.64 (2.46, 2.82)	1.34 (1.47, 1.81)
Average number of dwellers / room	<0.51	4.9 (1.4, 12.4)	1.00	1.00
	≥0.51 to <0.57	7.1 (2.9, 16.9)	1.42 (1.31, 1.53)	1.14 (1.05, 1.24)
	≥0.57 to <0.65	10.6 (4.4, 25.1)	2.03 (1.88, 2.19)	1.25 (1.14, 1.37)
	≥0.65	17.6 (7.5, 39.7)	2.49 (2.30, 2.68)	1.41 (1.26, 1.58)
Coverage of FHP (%)	<50	5.1 (2.4, 14.5)	1.00	1.00
	≥50 to <80	11.0 (4.3, 24.2)	1.58 (1.44, 1.74)	1.19 (1.07, 1.32)
	≥80	9.9 (3.6, 24.2)	1.43 (1.32, 1.54)	1.29 (1.17, 1.41)
Sex ratio (male to females)	<1.0	7.7 (3.0, 17.6)		
	≥1.0 to <1.1	9.1 (3.3, 23.0)		
	≥1.1	23.9 (7.5, 64.7)		
Average number of dwellers in permanent private households	<3.1	6.1 (1.7, 15.7)		
	≥3.1 to <3.3	9.8 (3.8, 24.2)		
Poverty rate (%)	≥3.3	10.9 (3.9, 25.8)		
	<25	4.4 (1.7, 9.8)		
	≥25 to <43	7.7 (3.0, 21.5)		
	≥43 to <66	14.4 (4.8, 37.0)		
Percentage of the population living in extreme poverty	≥66	13.6 (6.4, 27.8)		
	<3	4.6 (2.0, 9.7)		
	≥3 to <8	8.2 (2.9, 23.2)		
	≥8 to <20	14.3 (4.7, 35.2)		
Average monthly household income per capita	≥20	14.6 (6.5, 30.2)		
	<R$ 260	12.7 (6.0, 25.3)		
	≥R$ 260 to <R$ 421	14.1 (4.9, 34.7)		
	≥R$ 421 to <R$ 571	8.0 (3.1, 21.6)		
Unemployment rate (%)	≥R$ 571	4.5 (1.7, 11.1)		
	<4	4.9 (1.4, 12.7)		
	≥4 to <6	9.8 (3.9, 24.0)		
	≥6 to <8	10.6 (4.2, 28.3)		

[24] median (Q1, Q3) of SIR (smoothed incidence rate) / 100,000 inhabitants in Brazil in 2009-2011

[25] small 1 (municipality with up to 20,000 inhabitants), small 2 (municipality with 20,001 to 50,000 inhabitants), medium-sized (municipality with 50,001 to100,000 inhabitants), large (municipality with 100,001 to 900,000 inhabitants), metropolis (municipality with > 900,000 inhabitants).

Exposure	Category	Value
(20–20) income ratio	≥8	12.9 (5.4, 28.6)
	<12	5.2 (2.1, 11.5)
	≥12 to <17	7.0 (2.8, 17.6)
	≥17 to <27	11.0 (3.9, 27.2)
	≥27	17.0 (7.7, 39.5)
Percentage of coverage of the Family Allowance Programme (PBF)	<16	4.1 (1.6, 9.5)
	≥16 to <30	8.2 (3.2, 22.8)
	≥30	14.2 (5.8, 31.4)

Significantly higher adjusted RRs were identified for municipalities with higher illiteracy rates, more urbanized municipalities, large municipalities compared to small ones, municipalities with higher social inequality as per the Gini index, with high percentage of households with inadequate sanitation, with greater average number of dwellers per room and with higher FHP coverage

(49) Nery J et al, 2014 — Brazil — 2004-2011 — EC — Municipality

Ecological mixed design study conducted on 1,358 municipalities, all belonging to high risk clusters for leprosy detection, on the impact of the Brazilian cash transfer program Bolsa Família (BFP) and the primary health care program (FHP) on leprosy new case detection rate. Negative binomial regressions on panel data were performed.

PB — 1,358 — All ages — MX — 200,966 — I — 74.8 /100,000 (2004) to 45.6 /100,000 (2011)

Bolsa Familia Program (BFP) coverage (a), Family Health Program (FHP) coverage (a), illiteracy rate (b), Gini Index (b), unemployement rate (b), urbanization rate (b), average No. of residents/ household (b), % of < 15 years old people (b), % of poor people (b); variable categorization at tertiles (a) or at median value (b)

NA — NA — NA — NA — NA — NB — RR

Exposure	Category	RR	RR
BFP coverage	Low (0.0–27.75%)	1.00	1.00 [26]
	Intermediate (27.76–48.10%)	0.86 (0.84, 0.88)	0.89 (0.86, 0.91)
	High (≥48.11%)	0.83 (0.80, 0.87)	0.85 (0.81, 0.88)
	Consolidated (>48.11% + target population coverage 100% for at least 4 years)	0.73 (0.69, 0.77)	0.79 (0.74, 0.83)
FHP coverage	1st tertile (0, 72.02%)	1.00	1.00 [26]
	2nd tertile (72.03, 95.06%)	0.99 (0.96, 1.02)	1.05 (1.02, 1.09)
	3rd tertile (> 95.06%)	1.04 (0.99, 1.08)	1.12 (1.08, 1.17)
Illiteracy % ≥ 20.42			1.12 (1.07, 1.18) [26]
Gini Index ≥ 0.54			1.07 (1.04, 1.11) [26]
Unemployement % ≥ 7.47			1.20 (1.16, 1.23) [26]
Urbanization % ≥ 59.8			0.99 (0.93, 1.06) [26]
Average No. of residents / household ≥ 3.6			1.04 (1.01, 1.08) [26]
% of < 15 years old people ≥ 31.1			1.12 (1.08, 1.15) [26]
% of poor people ≥ 27.42			1.13 (1.08, 1.18) [26]
Only for BFP:			
BFP coverage	Low (0.0, 27.75%)		1.00 [27]
	Intermediate (27.76, 48.10%)		0.90 (0.87–0.92) [27]
	High (≥48.11%)		0.87 (0.83, 0.90) [27]
	Consolidated (>48.11% + target population coverage 100% for at least 4 years)		0.81 (0.77, 0.85) [27]
Illiteracy % ≥ 20.42			1.12 (1.07, 1.18) [27]
Gini Index ≥ 0.54			1.07 (1.03, 1.11) [27]
Unemployement % ≥ 7.47			1.19 (1.16, 1.23) [27]
Urbanization % ≥ 59.8			0.99 (0.93, 1.06) [27]
Average No. of residents / household ≥ 3.6			1.04 (1.01, 1.07) [27]
% of < 15 years old people ≥ 31.1			1.11 (1.07, 1.14) [27]
% of poor people ≥ 27.42			1.13 (1.09, 1.18) [27]
Only for FHP:			
FHP coverage	1st tertile (0, 72.02%)		1.00 [28]

[26] model with BFP coverage, FHP coverage and the other municipality variables
[27] model with BFP coverage and the other municipality variables
[28] model with FHP coverage and the other municipality variables

													2nd tertile (72.03, 95.06%) [28]									
													3rd tertile (> 95.06%)									
											Illiteracy % ≥ 20.42										1.02 (0.99, 1.05) [28]
											Gini Index ≥ 0.54										1.09 (1.05, 1.13) [28]
											Unemployment % ≥ 7.47										1.14 (1.08 ,1.20) [28]
											Urbanization % ≥ 59.8										1.07 (1.03, 1.11) [28]
											Average No. of residents / household ≥ 3.6										1.20 (1.16 ,1.23) [28]
											% of < 15 years old people ≥ 31.1										1.01 (0.94, 1.07) [28]
											% of poor people ≥ 27.4										1.05 (1.02, 1.09) [28]
																						1.13 (1.10, 1.17) [28]
																						1.14 (1.09, 1.19) [28]

In multivariate analysis, leprosy new case detection rate was significantly lower in municipalities with consolidated BFP coverage, perhaps reflecting a reduction in leprosy incidence, and independently and significantly higher in municipalities with a better coverage of FHP. Also, higher rate of leprosy was significantly associated with greater percentage of illiteracy and unemployment, higher number of residents per household, larger percentage of young people and larger percentage of poors.

| (50) Duarte-Cunha M et al, 2015 | Brazil (Duque de Caxias municipality) | 1998-2006 | EC | Neighbourhood | Ecological study, using neighborhoods as units of analysis, on the association of new case detection rate with selected socio- economic and health services variables. | PB | 855,042 (2010 population); 40 neighbourhoods | All ages | NA | 2,572 | I | 3.70 /10,000 | Proportion of households running water; number of reference health care units with assistance by the Leprosy Program; ratio of cases with indeterminate form / sum of cases with tuberculoid, dimorphous and Virchowian forms; ratio of multibacillary cases / paucibacillary cases; number of local case-tracking campaigns performed. | Proportion of households with running water / Proportion of households whose head is unemployed / Proportion of households with 7+ residents / Proportion of households whose head earns up to 1 minimum wage / Proportion of households with running water in at least one room / Proportion of households connected to general sewage network / Log (population density) / Proportion of households disposing of waste in vacant lot / Proportion of households whose head is illiterate / Proportion of households without bathroom / Number of local case-tracking campaigns performed / No. of basic health care units with assistance by the Leprosy Program / No. of reference health care units with assistance by the Leprosy Program | | | | | | | PR (log-normal model) | RR (expressed as β coefficient (95% CI)) | -2.011 (-3.514 ,-0.532) / 1.155 (-0.187, 2.491) / 0.789 (-0.252, 1.809) / -0.341 (-1.145, 0.472) / 1.223 (-3.331, 5.823) / 0.736 (-2.273, 3.752) / -0.028 (-0.183, 0.131) / 8.299 (-49.391, 65.924) / 0.475 (-4.907, 5.669) / -0.015 (-12.872, 12.618) / 0.043 (-0.020, 0.107) / 0.014 (-0.419, 0.451) / 0.419 (-0.013, 0.857) | -2.334 (-3.831, -0.851) / / / / / / / / / / 0.019 (-0.042, 0.081) / / 0.524 (0.092, 0.963) |

Multivariate analysis shows a significant association of a higher proportion of households with piped water and a larger number of reference health care units with, respectively, a reduction and an increase of leprosy detection rate. No relevant modifications of the regression coefficients were found after allowing for spatial dependence.

| (51) Nobre ML et al, 2015 | Brazil (State of Rio Grande do Norte) | 2001-2013 | EC | Municipality | Study to assess the risk of leprosy associated with socio-economic factors and the presence in the municipality of | PB | 167 | All ages | MX | 3,927 | I | Approximate average yearly incidence 9 / 100,000 | Presence of a train station in the municipality (Y/N); illiter cy rate (a), per | Presence of railway station / Illiteracy rate / Per capita household income | N Y | NA | NA | NA | NA | NA | LR | OR | 1.00 / 6.00 (2.55,13.98) / 1.04 (0.97, 1.11) / 0.99 (0.99, 1.00) | 1.00 / 7.92 (2.93,21.41) / 1.10 (0.98, 1.24) / 0.99 (0.98, 1.01) |

														Exposure description	Variable	Category	Cases		Controls				OR (crude)	OR (adjusted)
						a railway station, a marker of old railways, active in the early 20th century. The dependent variable was the average yearly new case detection rate / 100,000 between 2001 to 2013, categorized in ≤10/100,000 and >10/ 100,000.								capita household income (a), % of people living on ≤ 70 US$/ month per capita (a), unemployment rate (a), % of houses without sanitary facilities (2000), % of houses without trash collection (2000), infant mortality (2001 to 2013) (b), vaccination coverage (2001 to 2013) (b), malnutrition of children < 1 year old (2001 to 2013) (b); arithmetic means calculated from 2000 and 2010 national censuses data (a), or from yearly measurements (b)	% of people with income ≤US$ 70/month Unemployment rate % of houses without sanitary facilities % of houses without trash collection Infant Mortality per 1,000 % of Vaccination coverage % of malnourished children < 1year old									0.99 (0.99, 1.00) 1.05 (0.95, 1.15) 0.99 (0.94, 1.02) 0.97 (0.94, 1.02) 1.04 (0.96, 1.13) 1.02 (0.97, 1.09) 0.98 (0.67, 1.43)	0.94 (0.86, 1.03) 1.03 (0.93, 1.14) 0.99 (0.95, 1.02) 0.97 (0.92, 1.02) 1.04 (0.96, 1.13) 1.02 (0.95, 1.09) 0.95 (0.62, 1.48)

At municipality level, no association of high leprosy rate with socio-economic or public health indicators was found. However, a strong association was found with the presence in the municipality of a railway station: the intense migratory drought-related movements that occurred in the past between this state and leprosy endemic areas may explain this finding.

| (27) Wagenaar I et al, 2015 | Bangladesh (Nilphamari and Rangpur districts) | 2013 | CC | Individual | Study in an endemic area aimed to identify differences in dietary intake between recently diagnosed leprosy patients and controls. Cases were selected from Rural Health Program database and controls from a random cluster sample of the population. Cases and controls were balanced for age, sex, and only one individual per household was enrolled. Social, demographic, biological and food consumption data were assessed using questionnaires, measures and a 24h food consumption recall. Analyses were conducted following a framework constituted of four | PB | 152 | 18-50 years | RUR | 52 | P | NA | Age (continuous) and sex in univariate and all multivariate analyses; in multivariate analyses by block: Block 1: age, sex, religion and household size; Block 2: age, sex, food expenditure and self-classification; Block 3: age, sex, disease other than leprosy, BCG vaccination, Body Mass Index (BMI); Block 4: age, sex, Dietary Diversity | | | | | | | | LR | OR | | |

Variable	Category	Cases (value)	Cases (SD)	Controls (value)	Controls (SD)	OR (crude)	OR (adjusted)
Age (continuous) [29]	mean	35.0	(9.5)	33.3	(10.4)	1.02 (0.99, 1.05)	A. 1.00 (0.97, 1.05) B. 1.02 (0.98, 1.05)
Age (categorical)	15-29	25.0%		37.0%			
	30-44	32.7%		27.0%			
	45-60	42.3%		36.0%			
Sex [29]	Male	29		48		1.00	1.00
	Female	23		52		0.69 (0.35, 1.37)	A. 0.45 (0.20, 1.00) B. 0.52 (0.25, 1.10)
Religion [29]	Muslim	40		88		1.00	1.00
	Hindu	12		12		2.21 (0.90, 5.38)	2.23 (0.92, 5.46)
Household size [29]	mean No. of people eating in the house	4.6	(1.4)	5.2	(2.1)	0.83 (0.67, 1.02)	A. 1.41 (0.52, 3.88) B. 0.82 (0.66, 1.02)
Income (BDT [30])	Household mean	5,115	(3,621)	8,177	(6,398)		A. 0.76 (0.55, 1.04) B. 0.68 (0.52, 0.89)
	Per capita mean	1,180	(886)	1,766	(2,011)		
Income (log [31])	Per capita mean	2.96	(0.27)	3.12	(0.30)	0.10* (0.03, 0.44)	
Income variation (BDT)	mean	3,827	(2,852)	5,234	(5,719)		
Food expenditure (BDT)	Household mean	4,545	(2,323)	6,540	(3,435)		
	Per capita mean	1,046	(530)	1,340	(841)		

[29] included in the 1st block (demographic factors)
[30] BDT (Bangladesh Thaka), 100 BDT ≅ US$ 1.28 (2013)
[31] included in the 2nd block (socioeconomic factors)

						Description	Pub	N	Age				Incidence		Variable	Category	Value	(SD)		Value	(SD)		Stat	Measure	Result	Result
						blocks: 1.demographic factors, 2.socioeconomic factors, 3.health factors, and 4.diet-related factors. A. multivariate analysis including all significant variables in analyses by block: age, sex, religion, household size, food expenditure, occupation, BMI, DDS and household food stocks; B. multivariate analysis including the significant variables in analysis A: age, sex, household size and food expenditure.							Score (DDS) and household food stocks;	Food expenditure (log)[31]	Per capita mean	2.98	(0.17)		3.08	(0.18)				0.02* (0.00, 0.22)	0.03* (0.00, 0.36) A. 0.02 (0.00, 0.45) B. 0.005 (0.00, 0.08)
															Land ownership[31]	Landless Land leaser Landowner	41 3 8			58 8 34					1.00 0.49 (0.12, 1.99) 0.34* (0.14, 0.81)	
															Land size	mean size (m^2)	387	(1,214)		3,161	(6,820)					
															Self-classification[31]	Very poor Poor Low/middle Middle Rich	17 21 11 3 0			14 29 35 22 0					1.00 0.61* (0.24, 1.50) 0.26* (0.10, 0.69) 0.11* (0.03, 0.47) -	
															Occupation of the income generator[31]	Laborer Shopkeeper Other Farmer Business	26 10 8 5 3			28 13 25 19 15					1.00 0.84* (0.31, 2.27) 0.32* (0.12, 0.86) 0.28* (0.09, 0.86) 0.19* (0.05, 0.76)	1.00 1.28 (0.44, 3.80) A. 2.08 (0.62, 6.98) 0.44 (0.16, 1.22) A. 0.59 (0.20, 1.72) 0.24 (0.07, 0.83) A. 0.47 (0.12, 1.89) 0.31 (0.07,1.34) A. 0.66 (0.13, 3.25)
															HFIAS[32] (score 0-27)[33]		10.2	(7.4)		6.4	(7.0)				1.08* (1.03, 1.13)	
															DDS (score 0-9)[33]	No	3.2	(1.1)		3.8	(1.4)				0.67* (0.50, 0.89)	0.71* (0.52, 0.96) A. 0.83 (0.58, 1.18)
															Recent food shortage (past year)[33]	Yes No	10 42			36 64					1.00 2.42* (1.07, 5.47)	
															Ever food shortage[33]	Yes No	2 50			16 84					1.00 4.30* (0.93, 19.77)	
															Household food stocks[33]	Yes	25 27			26 74					1.00 0.38* (0.19, 0.78)	1.00 0.45* (0.22, 0.95) A. 0.66 (0.29, 1.50)

DDS and household food stocks were the most important diet-related factors negatively associated with leprosy. Food expenditure per capita was also negatively associated with leprosy.

(52) Castro SS et al, 2016	Brazil	2010	EC	State		The study analyzed the 27 Brazilian States, to estimate the incidence of leprosy and assess the correlation between overall incidence and social and demographic variables from Census.	PB	27	All ages	MX	NA	I	22.2/100,000	N	Mean residents per household Water supply Presence of bathroom in the house Sex					Male Female			25.67/100000 18.85/100000	Pearson correlation	R^2/p-value	0.46*(p=0.0148) -0.69*(p<0.001) -0.52*(p=0.0052)

Leprosy incidence is positively associated with higher household density, and negatively associated with presence of water supply and of bathroom in the house.

| (40) Dabrera TME et al, 2016 | Sri Lanka (Puttlam district) | 2012 | CS | Individual | | Comprehensive household survey in the all of 166 households from a small village. | PB | 753 | All ages | NA | 39 | P | 511/10,000 (overall); 183.24/10,000 (in <15 year-old) | N | Sex

Age (dummy) | Female
Male
0 to 5
6 to 15
16 to 30
31 to 45 | 25
14
3
11
14
6 | | | 396
438
109
185
165
133 | | LR | OR | 1.43 (0.73, 2.80)
1.00
0.46 (0.14, 1.50)
1.12 (0.54, 2.20)
1.86 (0.94, 3.66)
0.79 (0.32, 1.93) | |

[32] Household Food Insecurity Access Scale
[33] included in the 4th block (diet-related factors)

																≥46	5			122			0.71 (0.27, 1.86)	
															Education	Primary or lower	10			120			1.73 (0.74, 4.07)	
																Secondary and tertiary	13			271			1.00	
															Occupation (dummy)	Unemployed/retired/housewifes	13			218			1.43 (0.55, 3.66)	
																Laborers (factory/ agricultural/construction)	5			61			1.77 (0.62, 5.06)	
																Merchant/office workers	2			56			0.65 (0.14, 2.90)	
																Others	0			51			1.06 (1.03, 1.08)	
															Number of occupants in household (dummy)	1-4 members	7			167			0.71 (0.31, 1.65)	
																5-8 members	31			487			1.80 (0.81, 3.92)	
																9-12 members	1			60			0.28 (0.03, 2.12)	
															Household contact	household member with leprosy	18			81			6.69*(3.42, 13.09)	
																household member without leprosy	18			633			1.00	

The study showed that pockets of high endemicity remain present at the subnational level despite national rates below the elimination target. The study showed that having a person with leprosy in the household increased the chance of having leprosy.

§ CC case-control, CS cross-sectional, CH cohort, EC ecological
§§ individual, family/domicile, administrative/geographic unit, spatial/temporal cluster
§§§ PB (population based), HS (Health structure based), contacts of leprosy patients, other (specify)
† RUR (mainly rural), URB (mainly urban), MX (mixed)
†† I (incidence, new cases detection rate), P (prevalence)
††† control group, cohort baseline - cases, general population
# LN (linear regression), LR (logistic regression), CX (Cox regression), PR (Poisson regression), NB (negative binomial regression), ANOVA (Analysis of variance), other (specify)
RR, OR, PR, HR, other (specify)
*statistically significant at α ≤ 0.05
‡ calculated by the review's Authors
PYR person-years at risk
NA (not, or unclearly, described)
NS non significant