

Strategies for control and surveillance of leprosy contacts: integrative review

Estratégias de controle e vigilância de contatos de hanseníase: revisão integrativa

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ABSTRACT The objective of this research was to analyze the available scientific evidence on control and epidemiological surveillance of leprosy contacts. This is an integrative review guided by the question: what is the scientific production on control and epidemiological surveillance of leprosy contacts? Primary studies published in English, Portuguese, or Spanish in the PubMed, Lilacs, and Cinahl databases from 2008 to 2018, available in full, were included. The sample consisted of 19 studies. Three thematic categories were identified: risk factors for infection and illness among leprosy contacts, active surveillance of leprosy contacts, and new strategies for control and surveillance of leprosy contacts. The results showed studies focused on the prevention and control of leprosy among contacts, however, the evidence points to new strategies that may be incorporated into clinical practice aiming at the elimination of leprosy as a public health problem in the Country.

KEYWORDS Leprosy. Epidemiological monitoring. Contact tracing.

RESUMO A pesquisa objetivou analisar as evidências científicas disponíveis sobre controle e vigilância epidemiológica de contatos de hanseníase. Trata-se de uma revisão integrativa norteada pela pergunta: qual a produção científica sobre controle e vigilância epidemiológica de contatos de hanseníase? Incluíram-se estudos primários, publicados em inglês, português ou espanhol nas bases de dados PubMed, Lilacs e Cinahl, entre 2008 e 2018, disponíveis na íntegra. A amostra foi composta por 19 estudos. Identificaram-se três categorias temáticas: fatores de risco para infecção e adoecimento entre os contatos de hanseníase, vigilância ativa de contatos de hanseníase e novas estratégias de controle e vigilância de contatos de hanseníase. Os resultados mostraram estudos voltados à prevenção e controle da hanseníase entre os contatos, entretanto, as evidências apontam novas estratégias que podem ser incorporadas à prática clínica visando à eliminação da hanseníase como problema de saúde pública no País.

PALAVRAS-CHAVE Hanseníase. Monitoramento epidemiológico. Busca de comunicante.

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Introduction

Leprosy is an infectious, transmissible disease caused by *Mycobacterium leprae*, which manifests itself through dermatoneurological signs and symptoms. Predilection of the bacillus for peripheral nerves is responsible for neurological disorders that may result in physical disabilities and deformities¹.

In Brazil, the classification of leprosy cases is based on that of Madrid (1953), which considers as clinical forms the Indeterminate (I), Tuberculoid (T), Dimorphic (D) and Virchowian (V). These, for treatment purposes, are grouped in Paucibacillary – PB (I and T) and Multibacillary – MB (D and V)^{2,3}.

Transmission occurs directly, through the upper respiratory tract (mucous membranes and oropharynx), in which a sick person and in its MB forms infects other people by eliminating the bacillus in the external environment. The incubation period lasts from two to seven years⁴. The most susceptible population includes the MB family case contacts, followed by extra domiciliary contacts and PB⁵ cases.

The magnitude and the high incapacitating power keep the disease as a public health problem in different countries, including Brazil, which, despite establishing strategies that favor its elimination, continues to present trends that are still far from control⁶. In 2016, there were 25,218 new cases reported in the Country, which is equivalent to a detection rate of 12.2/100 thousand inhabitants⁷. In 2008, there was a general prevalence of 2.06 cases/10 thousand inhabitants, and in 2015, prevalence went down to 1.01 cases/10,000 inhabitants⁸. However, despite these efforts, these parameters still classify the Country in terms of high burden for the disease, being the second with the largest number of new cases registered in the world and the first in the Americas, only behind India^{4,6}.

With the aim of reducing the leprosy burden at the global and local levels, it has been developed, by the World Health Organization (WHO), the Global Leprosy Strategy

2016-2020, to accelerate action towards a world without leprosy. The current strategy is focused, mainly, on countries that have not yet reached the elimination of leprosy as a public health problem at the subnational level and is based on three pillars: strengthening government control, coordination and partnership; combating leprosy and its complications; combating discrimination and promoting inclusion make up the third pillar⁹.

To reach the leprosy control goal of the WHO and the Ministry of Health (MH), it is necessary to obtain a prevalence of less than 1 case/10 thousand inhabitants. Therefore, it is necessary to invest in effective actions for the early diagnosis and control of the disease^{1,9}.

Contacts surveillance is considered one of the most effective measures for the diagnosis and control of leprosy, ensuring adequate coverage and quality^{7,10,11}. Its purpose is the discovery of new cases among those living or who have lived, in a prolonged way, with the new case of leprosy diagnosed^{4,10}.

In this context, the MH defines as household contact any person who lives or has lived with the leprosy patient, regardless of the operational classification and living time; and as social contact, any person who lives or has lived in family relationships or not, in a close and prolonged way, including neighbors, work and school colleagues, among others, who must also be investigated according to the level and type of coexistence¹.

Thus, contact tracing not only results in the detection of additional cases, but also has indirect advantages, such as early diagnosis and reduced risk of transmission. For this reason, for each newly diagnosed case, it is essential that the contacts be examined, this way it will be possible to interrupt the chain of transmission^{12,13}.

In light of this, the following question has arisen: what is the scientific production on control and epidemiological surveillance of leprosy contacts? Thus, the objective was to analyze the available scientific evidence on control and epidemiological surveillance of leprosy contacts.

Methodology

It is an integrative review of the literature which included the following steps: identification of the research question; definition of the inclusion and exclusion criteria; categorization and assessment of studies, extraction and interpretation of results and synthesis of knowledge¹⁴.

Data collection was carried out in April 2018. The PICO¹⁵ acronym was used to

elaborate the search strategies in the PubMed (National Library of Medicine and the National Institutes of Health), Lilacs (Latin American and Caribbean Health Sciences Literature) and Cinahl (Cumulative Index to Nursing and Allied Health Literature) database, as described in *chart 1*. These databases were chosen because they contain the main journals in the health and nursing area which deal with the subject of interest for the present study.

Chart 1. Search strategy used. São Luís (MA) Brazil, 2018

Acronym	PubMed	Lilacs	Cinahl
P (problem)	"leprosy" (mesh terms) or "leprosy" (text word)	mh: "leprosy" or tw: "leprosy"	MH "leprosy" or "leprosy"
I (interest phenomenon)	"epidemiological monitoring" (mesh terms) or "surveillance" (text word)	mh: "epidemiological monitoring" or tw: "surveillance"	"epidemiological monitoring" or MH "epidemiological research" or MH "disease surveillance" or "surveillance"
Co (context)	"contact tracing" (mesh terms) or "household contact" (text word)	mh: "contact tracing" or tw: "household contact"	MH "contact tracing" or "contact tracing" or "household contact"

Source: Own elaboration.

The descriptors and keywords used in the search were applied according to particularities of each database and obtained by consultation in the Health Sciences Descriptors (DeCS), Medical Subject Headings (MeSH) and Cinahl Titles. Combinations of terms were performed using Boolean operators 'or' and 'and', in which the first one was used to combine the descriptors and keywords common to each component of the PICO strategy, and the second one, to finalize the search strategy, a combination of the three terms was carried out: (P) and (I) and (Co). The date filter (2008 to 2018) was used for all searches. The descriptors were inserted in the English language, since all journals indexed in these databases present in their articles descriptors in English.

After the search stage, original articles were

selected, from the review of the titles and abstracts, according to the following criteria for inclusion: 1) primary articles available in full; 2) in open online access; 3) in Portuguese, English or Spanish; 4) covering epidemiological surveillance of leprosy contacts; and 5) published in the period from 2008 to 2018.

Subsequently, the reading of complete texts was carried out, searching for the studies which answered to the question of research. Publications that: 1) addressed a topic other than that of interest in this work were excluded; 2) were duplicated; 3) secondary studies, letters, editorials, reports of experience, case studies, theses, dissertations and book chapters.

For the organization of the data, an instrument adapted from Ursi¹⁶ was used containing the following items: bibliographic reference

(title, authorship and year of publication), language, country of origin, database, research objectives, study design, main results, conclusions, limitations and level of evidence.

For the categorization of the Level of Evidence (LE), seven levels of classification were considered: level 1, systematic review or meta-analysis of controlled clinical trials; level 2, well-delineated randomized controlled clinical trial; level 3, controlled clinical trial without randomization; level 4, well-delineated cohort or case-control studies; level 5, systematic review of qualitative and descriptive studies; level 6, descriptive or qualitative studies; and level 7, opinion of authorities or experts¹⁷.

Evidences from a systematic review or meta-analysis and evidence originating from the opinion of authorities and/or expert committee reports were not classified, because

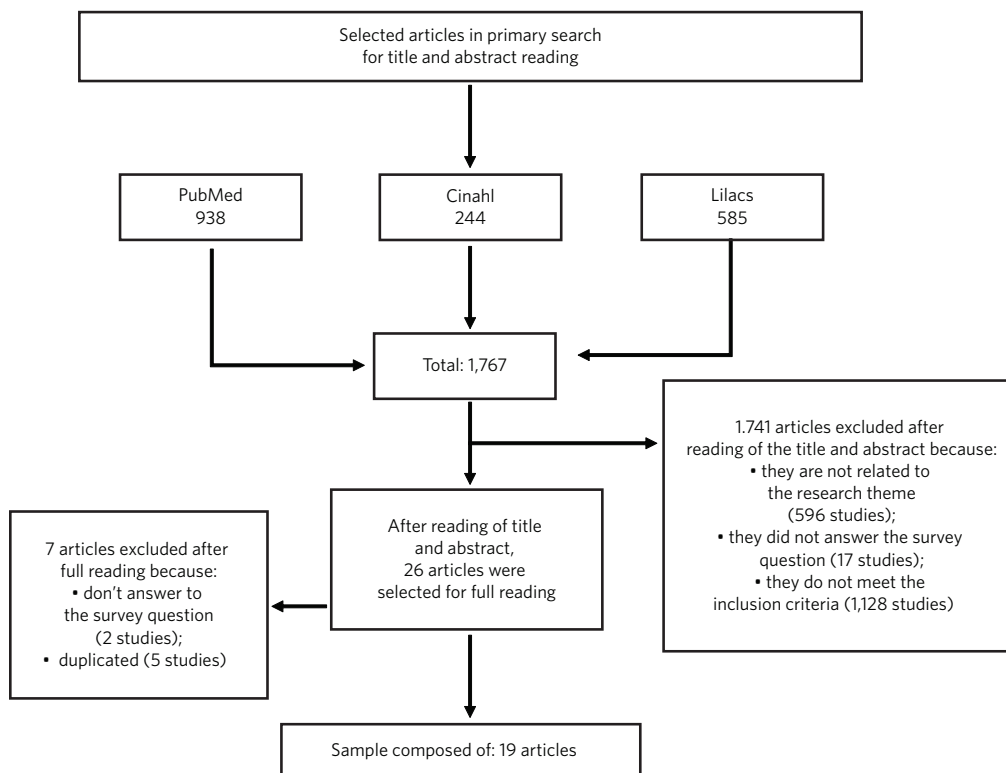
they were excluded at the data collection stage. The results were analyzed and presented in a descriptive way.

The critical analysis of the selected articles was carried out independently by exploratory and analytical reading to evaluate the content of each study. For the treatment of the data, it was used the classification by thematic area, allowing a panoramic view, contemplating the main information and relevant points of the developed researches.

Results

The synthesis of the results obtained in the search stages of the articles is presented in *figure 1*. The articles included were listed from A1 to A19 for didactic purposes.

Figure 1. Primary studies included in the integrative review according to the databases. São Luís (MA) Brazil, 2018



Source: Own elaboration.

Regarding the characterization of primary studies, 14 were developed in Brazil, 1 in China, 2 in Bangladesh, 1 in Colombia, and 1 multicenter which encompassed the following countries: India, Indonesia, Myanmar, Nepal, Sri Lanka, Tanzania, Brazil and Cambodia, with 11 surveys published in English; and 8, in Portuguese.

Related to the year of publication, the year 2008 stands out with four articles. As for LE, 16 articles covered analytical or descriptive observational studies (LE 6), 1 was a case-control study (LE 4) and 2 were randomized clinical trials (LE 2).

The primary studies were grouped into three categories of analysis, due to thematic similarity. In *charts 2, 3 and 4*, the characteristics of the primary studies included in the review are presented, according to each delimited category.

Risk factors for infection and illness among leprosy contacts

Of the seven studies classified in this category, all evidenced that the home contacts of patients with leprosy presented a higher risk of illness¹⁸⁻²⁴. Study A2 emphasizes that the contacts of patients with MB leprosy in V Form presented a 3.8 times higher risk of developing leprosy than the contacts of patients with other clinical forms¹⁸.

The degree of relatedness and inbreeding were also identified as risk factors for the disease, being higher in the first-degree relatives. Among the other risk factors associated with infection and illness are: no scar of *Bacillus Calmette-Guérin* (BCG), Mitsuda negative test or smaller than 5mm, positive ML-Flow test, young age (<20 years), and socioeconomic factors such as low schooling and income, as shown in *chart 2*.

Chart 2. Characteristics of the studies presented in the category 'Risk factors for infection and illness among leprosy contacts'. São Luís (MA) Brazil, 2018

N	Country/ Year	Design	Objective	Main results	Level of Evidence
A2 ¹⁸	Brazil 2008	Case-control	To characterize important risk factors associated with the incidence of leprosy in household contacts	The contacts of patients with lepromatous leprosy were 3.8 times more likely to develop leprosy. All unfavorable combinations of the two and three tests generated significant risk values ranging from 5.76 to 24.47, with the highest risk given by the combination of no BCG scar, negative Mitsuda test and positive ML-Flow test. The positive ML-Flow test indicated a six times higher relative risk for the occurrence of the disease.	4
A4 ¹⁹	Brazil 2008	Descriptive, retrospective, quantitative	To analyze variables related to the intra-domiciliary contacts of patients with leprosy treated in the municipality of Londrina in a period of ten years	There were 3,394 contacts registered, with an average of 3.2 per case. 71.5% aged up to 40 years, children (40.6%) and spouse (17.8%). Of the 1,731 contacts examined (51.0%), 183 had any signs of leprosy: 16 confirmed cases. 51.6% were exposed to multibacillary forms and 10.1% evidenced two doses of BCG.	6
A6 ²⁰	Brazil 2010	Analytical, observational, cross-sectional, quantitative	To analyze the clinical-epidemiological profile of co-prevalent cases and to identify risk factors for illness among leprosy contacts	The controlled analysis of the type of contact and degree of relatedness variables revealed that home contact and first-degree relatedness are independently associated with a higher probability of becoming ill.	6

Chart 2. (cont.)

A10 ²¹	Brazil 2012	Analytical, observational, retrospective, quantitative	To review data of the cohort of contacts over the past 25 years on the major risk factors leading to the infectious phase of the disease, estimate the incidence rates of leprosy in the cohort and to characterize the risk factors for the disease among contacts under surveillance	The factors associated with the acquisition of the disease were: not receiving the BCG vaccine, a negative reaction of Mitsuda and contact with patients with multibacillary clinical form. The factors associated with the infection defined as a seropositivity for IgM anti-phenolic-glycolipid-1: young age (<20 years old), low measured Mitsuda reaction (<5 mm) and contact with an indexed patient with high bacilloscopic index.	6
A14 ²²	Brazil 2014	Descriptive, retrospective, quantitative	To characterize the communicators of leprosy patients in a public hospital	It was observed influence of the consanguinity factor in the transmission, besides deficiency in the dermatoneurological evaluation of the communicants people.	6
A17 ²³	Brazil 2016	Descriptive, retrospective, quantitative	To evaluate the actions of the surveillance of household contacts of patients with leprosy in the Municipality of Igarapé-Açu, State of Pará, Brazil, from 2004 to 2008	Of the 133 contacts identified, 52.63% were male; 42.10%, incomplete elementary school; 42.85%, singles; 55.63%, unemployed; 60.15%, family income less than 1 minimum wage; and 67.67%, a BCG scar. The rate of not assessed contacts was 84 (63.16%), and of these, 56 (66.70%) were contacts of multibacillary cases.	6
A18 ²⁴	Colombia 2017	Analytical, observational, prospective, quantitative	To evaluate the transmission of leprosy in family groups of leprosy patients from four Colombian departments: Antioquia, Bolivar, Cordoba and Sucre	159 Family Groups (FG) formed by 543 household contacts (HHCs) were evaluated. Twenty-two (4.1%) of the 543 HHCs had positive anti-PGL-I IgM antibody titers, indicating infection. The genotype of the two strains (HHCs and index case) was in agreement with 9 markers, showing individuals infected by the same strain, indicating family transmission.	6

Source: Own elaboration.

Active surveillance of leprosy contacts

Six articles which evidenced contact surveillance were identified as the main epidemiological surveillance strategy for early diagnosis and contact tracing of patients with leprosy, highlighting the active search of household contacts as an important measure of disease control²⁵⁻³⁰, as highlighted in *chart 3*.

Study A9 compared contact surveillance and passive case detection, identifying that cases diagnosed by contact surveillance were found at the earliest stage, resulting in less severe clinical presentations, lower levels of disability, lower bacterial rates, and lower prevalence of disease reaction, indicating that active surveillance is especially important in areas of high endemicity, such as Brazil²⁹.

Chart 3. Characteristics of the studies presented in the category 'Active surveillance of leprosy contacts'. São Luís (MA) Brazil, 2018

N	Country/ Year	Design	Objective	Main results	Level of Evidence
A3 ²⁵	Brazil 2008	Descriptive-exploratory, quantitative, cross-sectional	To carry out the active search of the intra-domiciliary contacts lacking in the control of leprosy in a Regional Ambulatory of Specialties of Vale do Paraíba	92 contacts were identified, 64.1% were absent, and 25% between 20-29 years and 58.5% were female. 66.6% reported nonadherence to the control due to forgetfulness and lack of time (11.1%); 4 contacts had leprosy symptoms, and 1 was confirmed (Dimorphic form).	6
A5 ²⁶	China 2009	Descriptive, cross-sectional, quantitative	To evaluate the value of household contact research in the detection of cases of leprosy in a situation of low endemicity in China	The number of index cases was responsible for 22.0 and 14.1% of patients newly registered in Southwest and East China. The household contact survey (36.1%) and the skin diagnosis (62.0%) ranked first in the methods of cases detection in Southwest and East China, respectively.	6
A7 ²⁷	Brazil 2011	Descriptive, retrospective, quantitative	To describe the situation of leprosy contacts and evaluate the implementation of leprosy contact surveillance by Sanitary district in the municipality of São Luís (MA)	1,520 contacts were identified, 50.3% female, aged > 14 years old (66.5%) and consanguineous relationships of 1st Degree (59.1%) with the index case. Of the 583 contacts examined, 6.5% had a diagnosis of leprosy (dimorph). The evaluation of the execution of contact surveillance actions was considered precarious in most districts.	6
A8 ²⁸	Brazil 2012	Descriptive, cross-sectional, qualitative	To evaluate the perception on the control actions of leprosy contacts developed by the Family Health Teams (EqSF) of the II Sanitary District of Recife	The actions of control of the contacts have importance recognized by the professionals of the EqSF, however, these actions have been facing some obstacles, such as the non-attendance of the users to the health unit, difficulties to carry out educational and organizational activities.	6
A9 ²⁹	Brazil 2012	Analytical, observational, cross-sectional, quantitative	To compare the epidemiological characteristics of cases diagnosed by contact surveillance with the characteristics of passively detected cases	Through contact surveillance, cases were diagnosed earlier, with less severe clinical presentations, lower initial and final levels of disability, lower bacillary load and prevalence of reaction. The strategy was shown to be effective in tertiary prevention, with active surveillance being important in areas of high endemicity, such as Brazil.	6
A19 ³⁰	Brazil 2018	Descriptive, cross-sectional, quantitative	To characterize patterns of approach of Intra-domiciliary Contacts (Cid) of leprosy cases residing in the North of Brazil, from 2001-2012	There were 459 Cid included. The non-execution of the dermatological examination was reported by 191 people (41.6%), and the neurological examination by 252 (54.9%); 138 (30.1%) did not have indication for BCG, and 122 (26.6%) received no guidelines; 257 (56.0%) were not advised to return to a new evaluation/follow-up, and 186 (40.5%) were not geared towards the mobilization of other contacts.	6

Source: Own elaboration.

New strategies for control and surveillance of leprosy contacts

Of the six studies classified in this category, two were randomized clinical trials; four, observational; and one, descriptive. The studies have brought innovative strategies for contact surveillance used in other countries and developed in Brazil based on single dose rifampicin chemoprophylaxis³¹; Single Dose Rifampicin

(SDR) chemoprophylaxis associated with immunoprophylaxis with BCG³²; dosage of serum anti-PGL1 IgG/IgM and salivary anti-PGL1 IgA/IgM and detection of nasal carriage by *M. leprae*³³; mapping as a tool to identify areas at high risk for leprosy³⁴; use of the Self-Image Form (SIF) and surveillance of extra domiciliary contacts³⁵; and the implementation of the Leprosy Post Exposure Prophylaxis (LPEP) program to evaluate the contact tracing,

viability, efficacy and impact of Post-Exposure Prophylaxis (PEP) with SDR in pilot areas located in several endemic leprosy countries, including Brazil³⁶, as shown in *chart 4*.

Chart 4. Characteristics of studies presented in the category 'New strategies for control and surveillance of leprosy contacts'. São Luís, MA, Brazil, 2018

N	Country/Year	Design	Objective	Main results	Level of Evidence
A13 ³¹	Bangladesh 2008	Randomized clinical trial	To determine the efficacy of chemoprophylaxis using a single dose of rifampicin to prevent leprosy in close contacts	91 of the 9,452 contacts in the placebo group and 59 of 9,417 in the rifampicin group developed leprosy. There was a 57% reduction in overall incidence among leprosy contacts using a single dose of rifampicin in the first two years.	2
A11 ³²	Bangladesh 2013	Randomized clinical trial	To examine the combined effect of chemoprophylaxis with Single Dose Rifampicin (SDR) and immunoprophylaxis with <i>Bacillus Calmette-Guérin</i> (BCG), in contacts of new cases of leprosy	Primary outcome: number of new patients with leprosy emerging from the contact groups	2
A12 ³³	Brazil 2013	Analytical, observational, cross-sectional, quantitative	To evaluate levels of serum anti-PGL1 IgG/IgM and salivary anti-PGL1 IgA/IgM in addition to the detection of nasal carriage by <i>M. leprae</i> in household contacts of leprosy and its cases index	Salivary anti-PGL1 IgA/IgM and serum anti-PGL1 IgG showed good correlation comparing contacts and index cases. A high frequency of anti-PGL1 IgM positivity was found in IgG-negative samples. Serum anti-PGL1 IgG/IgM and salivary anti-PGL1 IgA/IgM measurements are strongly suggested for monitoring household contacts of leprosy.	6
A13 ³⁴	Brazil 2013	Analytical, ecological, cross-sectional, quantitative	To evaluate the mapping as a tool to identify high risk areas of leprosy and the usefulness of the dermatoneurological exam during home visits in high prevalence neighborhoods to identify new cases of leprosy	719 subjects were examined, of them, 82 had previous history of leprosy, 209 were household contacts and 428 lived in neighboring residences. Fifteen new cases were confirmed, detection rate of 2.0% of the persons examined. Spatial analysis showed the grouping of newly diagnosed cases and the association with residential coordinates of previously diagnosed multibacillary cases.	6
A15 ³⁵	Brazil 2015	Analytical, observational, prospective, quantitative	To determine if the surveillance of extra domiciliary contacts (neighbors) and the use of SIF increase the notification of cases of leprosy	The search for cases among the neighbors of leprosy patients using the Self-Image Form (SIF) increases the notification of new leprosy cases, in this case, in 17.5% (7/40).	6
A16 ³⁶	India, Indonesia, Myanmar, Nepal, Sri Lanka, Tanzania, Brazil, Cambodia 2016	Descriptive	To evaluate contact tracking and feasibility, efficacy and impact of PEP with SDR in pilot areas located in several countries endemic for leprosy	Feasibility will be assessed in terms of coverage (proportion of contacts tracked, selected and receiving PEP, if eligible), required resources and coordination efforts. Efficacy will be measured as the impact of the LPEP program on the National Cardiovascular Data Registry (NCDR) of pilot areas	6

Source: Own elaboration.

Discussions

Even after 30 years of the creation of the Unified Health System (SUS) and 27 years after the official implantation of the Polychemotherapy in Brazil, leprosy still constitutes a serious public health problem, since Brazil was unable to fulfill its commitment forged with WHO, neither in 1991, in 2005 nor in 2011, to eliminate it as a public health problem by 2015, that is, to reach the goal and reduce the prevalence to less than 1 case/10 thousand inhabitants in all Brazilian municipalities^{9,37}.

It is known that social inequities determine the persistence and difficulties of controlling Neglected Tropical Diseases (NTDs), causing greater vulnerability and risk of these diseases. With regard to leprosy, poverty is a determining factor for its occurrence and transmission. Variables as bad housing conditions; lack of access to public services, such as sanitation, garbage collection and piped water; and lack of hygiene were significantly associated with leprosy³⁸.

The high endemicity of leprosy allows multiple exposures of the population to the bacillus, even in the first years of life³⁹. The detection of new cases in young contacts, and, especially, in children under 15 years of age is directly related to the focus of active transmission²³. Low schooling directly interferes with the difficulty of understanding the information disclosed about leprosy, reflecting even a large number of unemployed and self-employed workers, implying low monthly income, which are factors associated with the lack and abandonment of polychemotherapy^{40,41}.

Household contacts of leprosy patients presented a higher risk for infection and illness, and factors, such as genetic susceptibility and the clinical form of the index case, are directly related to a higher incidence of the disease, results already widely documented in the literature^{2,4,7,42}.

The occurrence of new cases among

consanguineous household contacts of the index case, mainly, first-degree relatives, presented a probability 2.05 times higher in relation to other types of parentage, evidencing the importance of genetic susceptibility in the chain of transmission of the disease^{19,20,22,24}. As to the clinical form of the disease, it was found that the contacts of patients with MB leprosy in its V form presented a 3.8 times higher risk of leprosy development than the contacts of patients with the other clinical forms^{18,23}. The data reinforce the need for an early diagnosis and an appropriate treatment institution, which contributes to a decrease in the period of exposure of contacts to cases, mainly to MB¹⁹.

Home contacts with no BCG scar were 3.7 times more likely to develop leprosy when compared to contacts with one or more scars. Regarding the Mitsuda test, the household contacts that obtained a ≤ 7 mm Mitsuda score had an estimated 6.25 times higher risk of disease when compared to positive contacts (8 to ≥ 10 mm)¹⁸. The ML-Flow test identified that positive results with 10.4% titration between affected contacts compared to healthy contacts represent a nearly six-fold increased relative risk for disease onset²¹. It was observed that all unfavorable combinations of two and three tests generated significant risk values ranging from 5.76 to 24.47, with the highest risk represented by the combination of no BCG scars, a negative Mitsuda test and one ML-Flow^{18,21} positive test.

It is emphasized that BCG vaccination is important in clinical and epidemiological practice and that maintaining the additional dose of BCG in contacts is an important strategy for leprosy control programs, aiming to protect contacts, especially against MB^{23,30} forms. The Mitsuda test was not standardized by the WHO for clinical classification or epidemiological studies, since the WHO leprosy classification system was based on the number of lesions in PB

and MB⁴³. However, studies have shown that the application of the Mitsuda test in endemic regions may be an important epidemiological approach to monitor household contacts^{18,21}. The ML-Flow test, which is an alternative method to Elisa for the detection of IgM anti-PGL-1 antibodies, does not constitute a diagnostic test but rather an examination for the classification of patients in PB and MB and to aid in the therapeutic decision⁴⁴.

Studies show that the main strategy to reduce the burden of leprosy and the extent of disease control as a public health problem at the national level is necessarily due to the surveillance and qualified approach of leprosy case contacts^{4,20,22,45-47}. However, contact surveillance has been undervalued and even neglected in the public health services that develop the actions of the National Leprosy Eradication Programme (NLEP); since it privileges the space for disease and patient control, re-electing the control actions of the contacts to a secondary plan³⁷.

Contact surveillance is the main strategy for the active detection of cases of leprosy^{4,13}, with the purpose of discovering new cases among those who live or have lived together, in a prolonged way, with the index case and also aims to discover their possible sources of infection in the domicile or outside it (social), regardless of the patient's operational classification – PB or MB1.

In China, in regions with low leprosy endemicity, it was identified that the active search through the contact survey and the dermatoneurological examination ranked first among the methods of leprosy detection among the contacts²⁶. A comparison made between the epidemiological characteristics of the cases diagnosed by contact surveillance and the passively detected cases in Brazil showed that the contacts diagnosed through contact surveillance presented less severe clinical forms, lower levels of

disability, lower bacillary load and reaction prevalence¹³.

However, when assessing the proportion of contacts examined among those registered over the years 2002 to 2011 in Brazil, it was verified that this proportion did not exceed 60%; and that, between the years 2012 and 2014, there was a slight increase to 74%, still not reaching satisfactory rates⁴⁸.

It should be emphasized that, for active surveillance, measures to evaluate and control contacts and integration of these actions at different levels of attention should be intensified, seeking to promote the access of the population to health services, facilitating early diagnosis, contributing to the interruption of the transmission and, consequently, reducing the deficiencies and incapacities, which, ultimately, represent a strong social, economic and psychological impact for the patients^{4,28-30}.

Regarding strategies, this review made it possible to identify new strategies for control and surveillance of leprosy contacts through the implementation of innovative tools and methodologies that favor the interruption of transmission of *M. leprae* and early detection of new cases among contacts.

A randomized clinical trial carried out in Bangladesh with 21,711 contacts has found a 57% reduction in the overall incidence of leprosy among the contacts of patients newly diagnosed with the administration of SDR after two years of treatment, with, therefore, SDR being 57% effective in prevention of the development of clinical leprosy. The use of SDR is a promising, preventive, cheap and practical intervention for contacts of patients with leprosy in leprosy control programs³¹.

Another study developed in Bangladesh with approximately 20 thousand contacts examined the combined effect of chemoprophylaxis with SDR and immunoprophylaxis with BCG to prevent leprosy in contacts of newly diagnosed cases. The combination of these measures is potentially a very

effective and innovative tool for the contacts of leprosy patients, which can significantly reduce the transmission of *M. leprae*³².

In view of the evidence, as unprecedented intervention, LPEP is being implemented in pilot areas located in several countries endemic for leprosy: India, Indonesia, Myanmar, Nepal, Sri Lanka, Tanzania, Cambodia and Brazil in order to evaluate the viability, efficacy and the impact of the PEP with SDR with a view to speeding the acceptance of this intervention and the introduction of the PEP in national leprosy programs³⁶.

The 'PEP-Hans' project coming from this initiative is under development in Brazil and explores the administration of chemoprophylaxis and immunoprophylaxis (SDR and BCG) to about 20 contacts per index patient. The project is being implemented in 16 municipalities in the states of Mato Grosso, Pernambuco and Tocantins and covers patients diagnosed from 2015 to 2017. It is estimated that 850 patients with 17,000 contacts will be included each year. The LPEP program will help translate existing evidence on SDR PEP to reduce the risk of developing leprosy between contacts of leprosy patients in routine actions, providing solid data from a range of settings and conditions established by the national programs themselves for the control of leprosy³⁶.

Still in Brazil, 30 patients with leprosy and 135 household contacts were evaluated for and salivary anti-PGL1 IgA/IgM and detection of nasal carriage by *M. leprae*. Salivary anti-PGL1 IgA/IgM and serum anti-PGL1 IgG antibodies showed a good correlation comparing contacts and index cases ($p < 0.01$, $p < 0.005$ and $p < 0.0001$, respectively). High frequency of positive IgM anti-PGL1 was found in negative samples for IgG. The results of the study pointed out that both isotypes should always be measured. Serum anti-PGL1 IgG/IgM and salivary anti-PGL1 IgA/IgM measurements

are strongly suggested for follow-up of household contacts of leprosy³³.

The grouping/mapping was evaluated as a tool to identify high risk areas of leprosy and the usefulness of the dermatoneurological examination during home visits. The spatial analysis identified a group of newly diagnosed cases and an association with the residential coordinates of previously diagnosed MB cases, showing that in hyperendemic areas the risk of the disease is high in social contacts. The distribution of PB cases was not random and depended on the presence of MB cases. The mapping associated with the dermatoneurological examination of extra domiciliary contacts has been shown to be effective for detecting new cases among leprosy contacts, especially those living close to a MB³⁴ case.

In the Amazon region, it was verified that the search of cases among neighbors with leprosy using SIF increases the notification of new cases of leprosy in 17.5%. The active search for leprosy cases among contacts, including widening the scope of research to neighbors in at least a 200 meters radius of residence of the index case, combined with the use of a modified SIF (inclusion of a question about the presence of anesthetic areas) is a simple, low-cost, efficient and feasible implementation within the context of Primary Health Care (PHC)³⁵.

Final considerations

This review has updated knowledge about control and epidemiological surveillance of leprosy contacts. The analysis of the literature indicates that there is a concentration of studies aimed at prevention and control of the disease among the contacts, mainly, focusing on the identification of risk factors and implementation of surveillance actions through the active search of new cases. However, the evidences indicate new strategies and effective tools that can be incorporated into clinical

practice in health services or associated with existing ones, aiming at the early detection and interruption of transmission of *M. leprae* for the elimination of leprosy as a public health problem in the Country.

Collaborators

Santos KCB (0000-0001-6290-2796)* contributed to the design and planning, analysis and interpretation of data, elaboration of the draft, critical review of content and approval

of the final version of the manuscript. Corrêa RGCF (0000-0002-6451-5156)* contributed to the elaboration of the manuscript, critical review of content and approval of the final version of the manuscript. Rolim ILTP (0000-0002-8453-2543)* and Pascoal LM (0000-0003-0876-3996)* also contributed to the elaboration of the manuscript. Ferreira AGN (0000-0003-3705-3918)* contributed to the design and planning, analysis and interpretation of the data, elaboration of the draft, critical revision of the content and approval of the final version of the manuscript. ■

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