Exploratory analysis based on leprosy epidemiological and operational indicators in the city of Governador Valadares/MG/Brazil

Katiuscia Cardoso Rodrigues[1], Gilvan Ramalho Guedes[2], Pedro Henrique Ferreira Marçal[1], Rafael Silva Gama[1], Ana Clara Siman Andrade[3],Victor de Lima Rodrigues[3],Daisy Cristina Monteiro dos Santos[3],Thais Daiane de Morais Souza[3],Dirce Ribeiro de Oliveira[3], Euzenir Nunes Sarno[4], Milton Ozório Moraes[4],Jessica K Fairley[5], Lucia Alves de Oliveira Fraga[3*]

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[1]Universidade Vale do Rio Doce/UNIVALE-Programa de Mestrado em Ciências Biológicas, Governador Valadares/Minas Gerais, Brazil.
[2]Universidade Federal de Minas Gerais/UFMG, Belo Horizonte/Minas Gerais, Brazil.
[3]Universidade Federal de Juiz de Fora -Campus GV, Programa Multicêntrico de Bioquimica e Biologia Molecular/PMBqBM, Governador Valadares/Minas Gerais, Brazil.
[4]Laboratório de Hansenologia/IOC/FIOCRUZ/RJ, Rio de Janeiro, Brazil.
[5]Emory University-Atlanta/USA

ABSTRACT

Governador Valadares (GV) is a municipality of recognized leprosy hyperendemicity. From 2001 to 2010, the municipal health management invested in a heterogeneous way in the decentralization of control actions to expand access to diagnosis, highlighting the years 2002 and 2004, when training-campaigns took place in the Family's Health Program. It is an epidemiological study, of a descriptive nature, of a longitudinal type, developed in the city of GV/Minas Gerais/Brazil. The variables collected were: Age group, categorized as <15 years and> 15 years; Gender; Year of notification; Operational classification categorized as paucibacillary and multibacillary; Number of registered household and outside contacts, classified by whole numbers starting with zero (no communications), and mode of entry, as new or not. The estimates obtained from the analysis of municipal indicators reveal that the coefficients of general detection and children under 15 years old remained at hyperendemic levels during the ten years of study with an apparent decrease in general detection to the period studied. Furthermore, according to national parameters, it was observed maintenance of a consistent number of diagnoses in children under 15 and insufficient contact examination coverage. Our study points to the importance of continuing leprosy control actions over time. Observing the findings related to some epidemiological and operational leprosy indicators in GV from 2001 to 2010 makes us aware of a high disease burden.

Keywords: **Epidemiological parameters, leprosy, operational indicators**

*Corresponding author. Email: luciaalvesfraga@yahoo.com.br

INTRODUCTION

Leprosy is an infectious disease caused by Mycobacterium leprae. It is a chronic condition, with a long incubation period, of 2-5 years (Goulart et al., 2002). The detection of new leprosy cases has shown progress worldwide. According to WHO (2019), in 2018, including all priority endemic countries, 208,619 new leprosy cases were reported in 127 countries. Brazil recorded 28,660 patients. India, Indonesia, and Brazil together accounted for 79.6% of all new cases detected globally. In Brazil, between 2009 and 2018, 311,384 new cases of leprosy were diagnosed. The country remained in the parameter of high endemicity, except in the South and

Southeast regions (WHO, 2019). According to the State Department of Health (2019), in the State of Minas Gerais, approximately 1,400 new cases have been reported each year for the last eight years. In the municipality of Governador Valadares, the coefficient detection of new cases of leprosy / 100,000 inhabitants was 24.7 in 2016, and in children under 15 years old, the coefficient was 6.1. Even with a decrease in detection over the years, the municipality is classified as "very high" about the endemic disease's strength.

In the State of Minas Gerais is located two of the ten largest national clusters, the four and the nine. Governador Valadares belongs to cluster 4, formed by the south of Bahia, the north of Espírito Santo, and the northeast of Minas Gerais (Penna et al., 2009). The city stands out in the national context as a priority municipality by the Ministry of Health. It has a qualified team at the local reference center at the state level, which is also considered a regional reference. Detection and prevalence coefficients have been decreasing in the State, with 16.4 / 100,000 inhabitants and 3.2 / 10,000 inhabitants in 2000. In 2009, they corresponded to 9.35 / 100,000 inhabitants and 1.3 / 10,000 inhabitants. In the last decade, the State Secretariat of Health of Minas Gerais (SES / MG) has invested in preparing municipal and regional managers and monitors to control actions. In this way, they will be able to act in a qualified way to train professionals, supervision, monitoring, and evaluation, focusing on improving the program and social mobilization (Andrade et al., 2010).

Governador Valadares is a pole municipality in eastern Minas Gerais, which has its history marked by the robustness of leprosy endemic, with innovative investments in controlling the disease (Municipal department of health, 2003; Morais, 2010). It is considered a priority for monitoring leprosy control actions at the regional, state, and national levels. In the last decade, epidemiological studies have addressed the temporal dimension and the characterization of the endemic through the variables related to cases (Lana et al., 2002; Morais, 2010), without, however, insert the space or territory as variables in the analysis.

The use of epidemiological and statistical tools in identifying areas with a high number of detected cases, complemented by the understanding of risk factors linked to the patients' place of residence, can guide the planning, monitoring, and evaluation, enabling the implementation of control programs. Thus, in the present study, an exploratory analysis was carried out between 2001 and 2010, based on epidemiological and operational indicators of leprosy, to present the general epidemiological-operational panorama of the endemic disease in GV municipality.

MATERIALS AND METHODS

This is an epidemiological study, of a descriptive nature, of a longitudinal type, developed in the city of Governador Valadares – MG/Brazil. The data referring to new leprosy cases residing in Governador Valadares, reported between 2001 to 2010, was available by the Governador Valadares Epidemiology Management. Thus, we used the database of the National System and Notifiable Diseases - SINANNet (Brazil, 2007). The variables collected were: Age group, categorized as <15 years and > 15 years; Gender; Year of notification, in the period between the years 2001 to 2010; Operational classification in the diagnosis, categorized as "paucibacillary" and multibacillary"; Number of registered household and outside contacts, classified by whole numbers starting with zero (no communications), and mode of entry, as new or not.

From the data collected, the following epidemiological and operational indicators were constructed for the analysis of the endemic disease (Table 1) as proposed by the Ministry of Health (Brazil, 2010): Annual detection coefficient of new leprosy cases per 100,000 inhabitants; Annual detection coefficient of new cases of leprosy in the population aged 0 to 14 years per 100,000 inhabitants; Proportion of leprosy cure among new patients diagnosed in the years of the cohorts; Proportion of examinees among registered household contacts of new leprosy cases in the year. The internal consistency of the data was checked, with typing and related revision whenever necessary.

RESULTS

Descriptive analysis

Table 2 shows the percentages of new cases of multibacillary leprosy, of affected women, of adults aged 20 to 50 years old and children under 15 years old. Between 2007 and 2010, there was an average of 142 new cases diagnosed with multibacillary leprosy, with 2007 being the year with the highest number of patients (183). The percentage of multibacillary had an average of 37.1%, with the highest rate in 2010 (41.6%). The percentage of women's diagnoses averaged 52.9%, with the lowest percentage in 2010 (48.7%). Regarding the percentage of adults (20 to 59 years old), there was an average of 58.7% of diagnoses. Finally, the rate of children under 15 diagnosed with leprosy averaged 10.5%, with the highest increase in 2009 (15.6%).

2-Coefficient of general detection of new cases of leprosy

Figure 1 shows the coefficient of detection of new leprosy cases from 2001 to 2010. There was a significant growth from 2001 (90.8 \ 100,000 inhabitants) to 2002 (184.3 \ 100,000 inhabitants), and this year there was the highest increase in the period analyzed. In the year 2002 to 2003, there was a reduction from 184.3 \ 100,000 inhabitants to 109 \ 100,000 inhabitants. From 2003 to 2004, the coefficient increased again, reaching 144.6 \ 100,000

Table 1: Epidemiological and operational indicators selected for analysis of leprosy disease.

Indicator	Construction	Source	Utility	Parameters
Annual detection coefficient of new leprosy cases per 100,000 inhabitants	**Numerator:** new cases residing in a given location and diagnosed in the year of assessment **Denominator:** total population residing in the same place and period. Multiplication factor: 100,000	Numerator: SINANNet Denominator: IBGE	(Indicator of the strength of morbidity, magnitude, and epidemiological profile) Measure endemic morbidity, magnitude, and tendency strength.	**Hyperendemic**: >40.00 / 100,000 inhab. **Very High**: 20.00 to 39.99 / 100,000 inhab. **High:** 10.00 to 19.99 / 100,000 inhab. **Average**: 2.00 to 9.99 / 100,000 inhab. **Low:** <2.00 / 100,000 inhab.
Annual detection coefficient of new leprosy cases in the population aged 0 to 14 years per 100,000 inhabitants	**Numerator:** new cases in children under 15 years of age residing in a given location and diagnosed in the year of assessment **Denominator:** population aged 0 to 14 years in the same place and period. Multiplication factor: 100,000	Numerator: SINANNet Denominator: IBGE	(Indicator of the strength of morbidity, magnitude, and epidemiological profile) Measure the strength of the new endemic transmission and its trend. Integrates the agreement of the Growth Acceleration Program - CAP Mais Saúde [Indicator of the quality of actions and services (operational) Assess the quality of care and follow-up of newly diagnosed cases until treatment is complete.	**Hyperendemic**: >10.00 / 100,000 inhab. **Very High**: 5.00 to 9.99 / 100,000 inhab. **High:** 2.50 to 4.99 / 100,000 inhab. **Average**: 0.50 to 2.49 / 100,000 inhab. **Low**: <0.50 / 100,000 inhab.
Proportion of leprosy cure among new cases diagnosed in the years of the cohorts	**Numerator:** new cases resident in a given location, diagnosed in the years of the cohorts and cured until December 31 of the year of assessment **Denominator:** a total of new cases residing in the same location and diagnosed in the years of the cohorts Multiplication factor: 100	Numerator: SINANNet Denominator: SINANNet	Monitor the Pact for Life (Ordinance No. 325 / GM, of February 21, 2008)	**Good**> 90% **Regular** 75% to 89.9% **Precarious** <75%
The proportion of examinees among registered household contacts of new leprosy cases in the year	**Numerator:** household contacts examined for new cases resident in a given location and diagnosed in the year of assessment **Denominator:** a total of home contacts registered new cases resident in the same location and diagnosed in the year of assessment Multiplication factor: 100	Numerator: SINANNet Denominator: SINANNet	To evaluate the services' capacity to carry out the surveillance of household contacts of new leprosy cases to detect new cases. Monitor the results of PAVS actions.	**Good**:> 75% **Regular**: 50 to 74.9% **Precarious:** <50%

Source: Brazil, 2010.

Table 2. Percentage of new multibacillary leprosy cases, women, and individuals by selected age group, diagnosed in Governador Valadares - MG, 2007 to 2010.

Year	Total of new cases (142±31.5)	Percentage of Multibacillary (37.1±4.1%)	Percentage of women (52.9±3.7%)	Percentage of adults 20 to 59 years (58.7±2,9%)	Percentage of under 15 years (10.5±4.3%)
2007	183	38.8	54.1	58.5	12.6
2008	150	32	57.3	62	6
2009	122	36.1	51.6	54.9	15.6
2010	113	41.6	48.7	59.3	8

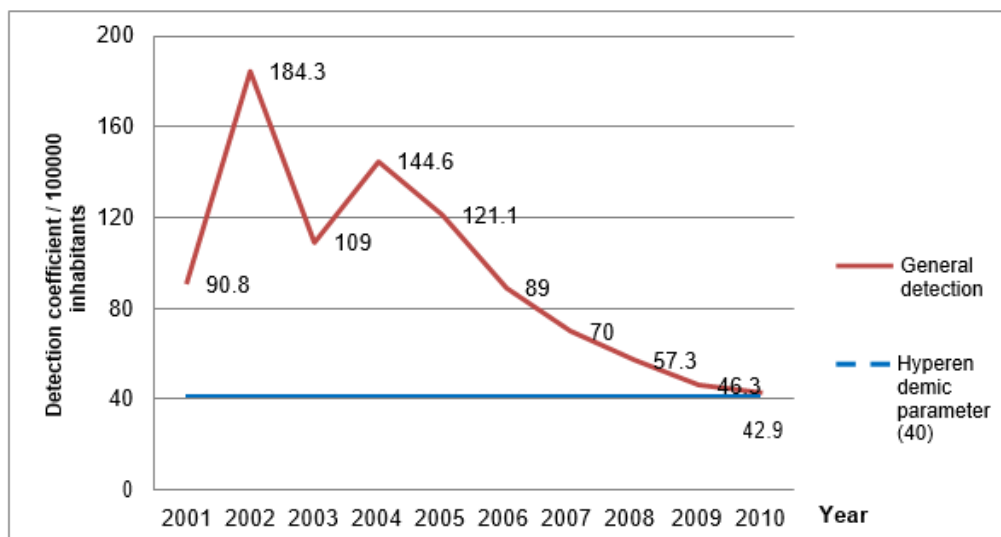**Source:** SINANNet (GOV. VALADARES, 2011).

Figure 1: Coefficient of general detection of new cases of leprosy. Governador Valadares - MG, 2001 to 2010. **Source**: Based on Morais (2010); SINANNet (GOV. VALADARES, 2011).
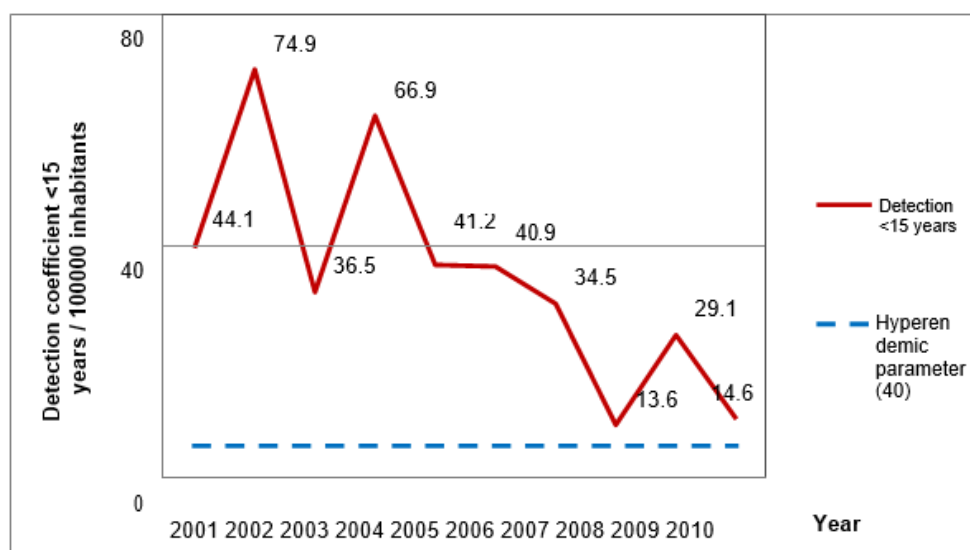

Figure 2: Coefficient of annual detection of new cases of leprosy in children under 15 years old per 100,000 inhabitants, Governor 2001 to 2010. **Source:** Based on Morais (2010); SINANNet (GOV. VALADARES, 2011).

inhabitants. 2004 to 2010, the coefficient decreased in all years, reaching 46.3 \ 100,000 inhabitants in 2010. The general detection coefficient exceeded the parameter for a region to be considered hyperendemic throughout the period.

3-Coefficient of annual detection of new cases of leprosy in children under 15 years old

Figure 2 shows that in the period from 2001 to 2010 there was a significant change in the annual detection rate of new cases of leprosy in children under 15 years old, with the highest detection occurring in 2002 (74.9 \ 100,000

inhabitants) the lowest value in the year 2010 (14.6 \ 100,000 inhabitants. However, in all years, the detection coefficient exceeded the minimum parameters considering the municipality with a hyper-endemic region.

4- Proportion of leprosy cure among new cases diagnosed in the years of the cohorts

The proportion of leprosy cure considering new cases diagnosed in the years of the cohorts showed changes in the rate between 2001 to 2010, as shown in figure 3. It appears that in the years 2005, 2006, and 2010 the
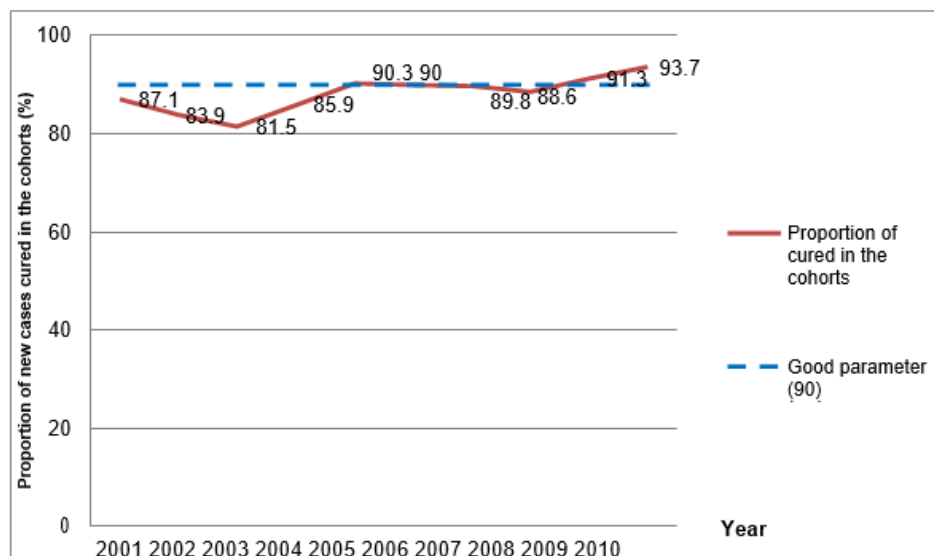
Figure 3: Proportion of leprosy cure among new cases diagnosed in the years of the cohorts, Governador Valadares, 2006 to 2010. Source: Based on Morais (2010); SINANNet (GOV. VALADARES, 2011).
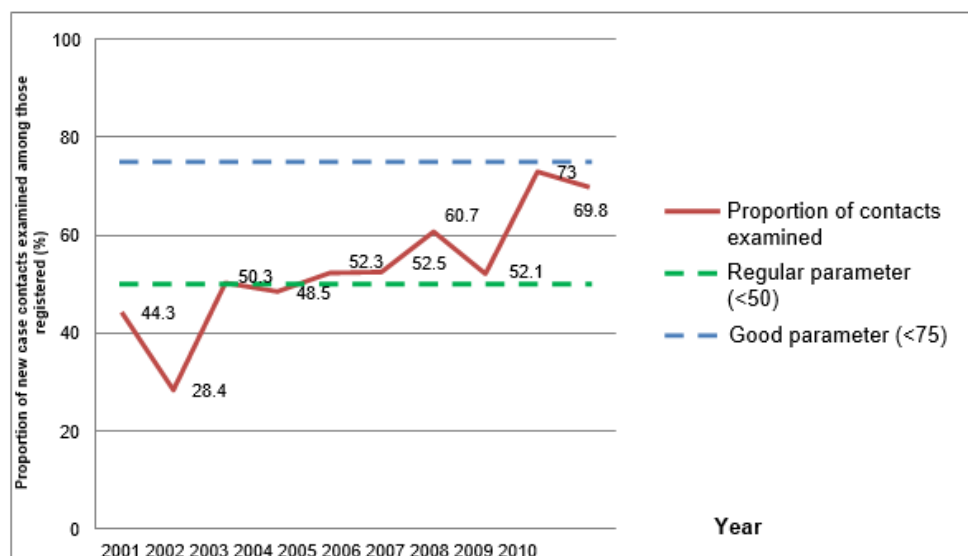

Figure 4: Proportion of examinees among the registered household contacts of new leprosy cases in the year, Governador Valadares, 2006 to 2010. Source: Based on Morais (2010); SINANNet (GOV. VALADARES, 2011).

proportion of cure had results above the recommended. In the other years, the results were below this parameter. In 2003 the cure rate was the lowest (81.5%).

5-Proportion of examinees among registered household contacts of new leprosy cases

The proportion of those examined among the registered household contacts of new leprosy cases between 2001 and 2010 is shown in figure 4. There are good and regular parameters (>75% and <50% of household contacts examined, respectively) as indicators for

monitoring contacts. In 2001 (44.3%), 2002 (28.4%) and 2004 (48.5%) the proportion of contacts examined was below the regular parameter. The proportion was above the regular parameter in the other years, but below the good parameter, presenting the best result in 2009 (73%).

DISCUSSION

To understand the global behavior of leprosy in the municipality of Governador Valadares, we present the

indicators for monitoring and evaluating the disease between 2007 and 2010, complementing the data published by Morais (2010) from 2001-2006.

Comparing the number of cases diagnosed between 2007 to 2010 with the data from Morais (2010). There was a decrease over the years, since, between 2001 and 2006, the number of cases was higher (Table 2).

However, the proportions observed between these periods are similar: women predominate in a higher percentage, except in 2010 (Table 2); the rate of multibacillary remains close to 40%, as in the period studied by Morais (2010), but diverging from the studies by Lana et al. (2002) for the period from 1990 to 2000, in which the percentage of MB was 60%.

The proportional distribution in the selected age groups (adult) and (under 15 years old), was done by the most considerable epidemiological importance in the years studied by Morais (2010), which are similar to those of this period. In this context, this endemic disease's socioeconomic relevance mainly affects people of economically active age and the concern about children's involvement is highlighted. Indeed, this last fact is attributed to large community bacillary loads and the weakness of control actions (Chen et al., 2000; Norman et al., 2004).

Figure 1 shows that the municipality remains categorized as hyper-endemic throughout the period, with an apparent decline in the number of diagnosed cases. Morais (2010) highlighted the high detection in 2002 and 2004 when there were intense efforts to decentralize leprosy control actions for the Family's Heath Program teams.

Table 2 and figures 1 and 2 show the detection coefficients of new cases in children under 15 years old in the same place and period, reinforcing that the endemic disease still has a large magnitude. In all the years studied, detection in this age group remains at "hyper-endemic" or "very high" levels, pointing to active transmission in the communities.

Figure 3 shows the proportion of cases cured in the cohorts, an indicator of the Pact for Life (Brazil, 2010), had results close to those recommended as good (90%). This indicator gives leprosy visibility as a health priority since the diagnosed cases are expected to be managed appropriately for the desired outcome (bacteriological cure).

Finally, figure 4 shows the indicator's findings for monitoring contacts, the proportion of contacts examined among the cured. Such a panorama is worrying since it remained below the recommended (Brazil, 2010). This finding may indicate the need for decentralization, problems in the registration of the exam, and even the lack of completeness of the actual surveillance. It is expected that the services are organized for the active search for cases among household contacts, who probably have a higher risk of becoming ill (Fine et al., 1997; Matos et al., 1999; Jain et al., 2002).

Finally, our study points to the importance of continuing leprosy control actions over time. Observing the findings related to some epidemiological and operational leprosy indicators in Governador Valadares from 2001 to 2010 makes us aware of a high disease burden. Also, despite the apparent drop in available detection, there is the maintenance of diagnoses in children under 15 years of age, which serves as a warning for new active transmission.

The most relevant findings were: (1) The coefficients of general detection and children under 15 years old remained at hyper-endemic levels during the ten years of study, with an apparent decrease in general detection compared to the period studied by Morais (2010) with the maintenance of a consistent number of diagnoses in children under 15, (2) Peaks of detection in 2002 and 2004, coinciding with training for family health teams in loco and (3) Insufficient coverage of contact examination, according to national parameters (Brazil, 2010).

Notably, the operational indicators point, for the most part, to consistent performance, except in the examination of contacts. This situation is expected once the Reference Center for Leprosy diagnoses is located in the central part of the city, and it may be a possible explanation for the proportion of contacts examined below the recommended: the farther from the service the patient and his family are, the more difficult it is to capture and bond. In 2003, there was no structured training; however, in 2004, a joint effort was made in the same way as the 2002 training (in loco), with the difference that, after the theoretical approach, the practice was directed towards examining contacts from previous years. From 2005 to 2008, the Credenpes, a Reference Center for endemic diseases, conducted training, focusing primarily on doctors and nurses. In 2007, the action was taken with community agents and in some communities with the active search. In 2009 there was no training for the teams, and, in 2010, only in the last quarter, some groups were trained traditionally. Professional turnover, especially for doctors, is an ordinary reality in the family health environment. It is described as detrimental to the sustainability of the performance of Leprosy control actions (Pimentel et al., 2004; Barbosa et al., 2008; Moreno et al., 2008). Thus, professionals who were trained, a few months later, we're no longer working in the municipality. Finally, at the central level, implementing activities to the Primary Care Master Plan in 2009 and 2010, making the family health training agenda incompatible, also contributed to this discontinuity.

Acknowledgments

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