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Clustering Of Suicide In Brazilian Indigenous Children And Youth: Implications For Interventions

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Clustering of Suicide in Brazilian Indigenous Children and Youth: Implications for Interventions

A Thesis Submitted to the
Yale University School of Medicine
in Partial Fulfillment of the Requirements for the
Degree of Doctor of Medicine

by

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2017
Abstract

CLUSTERING OF SUICIDE IN BRAZILIAN INDIGENOUS CHILDREN AND YOUTH: IMPLICATIONS FOR INTERVENTIONS.


Department of Psychiatry, Yale University, School of Medicine, New Haven, CT.

Abstract: The purpose of this study was to conduct a retrospective cohort study as well as a qualitative study to better understand the current context of suicide among the indigenous population living on the reservations surrounding Dourados, Brazil. Critical questions included: What are the most important suicide risk factors? Which communities have the highest rates? What differences exist between higher-risk and lower-risk communities? The Brazilian National Mortality Database (SIM), the Special Indigenous Information System (SIASI), as well as the national census (IBGE) were utilized to estimate an overall suicide rate of 73.4 per 100,000 population per year in the reservation communities. The peak risk for males is during adolescence (15-19) and the peak risk for females is during late childhood (10-14). There was strong evidence for the clustering of suicides by time and geography as well as within extended families among this population. A comparison between two neighboring communities with a 5-fold difference in suicide rate demonstrated that the community with a higher suicide rate suffers from greater poverty and structural barriers to health care. Interventions must focus on children and youth living within the household of suicide victims as well as structural interventions to improve economic opportunities and access to healthcare in highly affected communities.
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Introduction

Suicide is an important and preventable cause of mortality and is the second leading cause of mortality among those aged 15-29 worldwide. The burden of suicide varies significantly across societies and ethnic groups; high suicide mortality rates among indigenous populations is a public health problem that has been documented in many different countries including the United States, Canada, Australia, New Zealand, and Brazil. The discrepancy between indigenous and non-indigenous suicide rates is particularly pronounced among adolescents and young adults. The high rate of indigenous suicide is especially troubling because indigenous ethnic groups play an important role in the heritage of the world’s human societies and contribute to the global diversity of culture and language. Many of the world’s indigenous populations suffer oppression, exploitation, and extreme poverty, leaving their traditions and cultures at risk of extinction. Additionally, indigenous populations tend to have worse health and higher levels of violence than non-indigenous communities. The epidemiology of indigenous suicide was originally explored in an article published by the director of the Indian Health Service Medical Center in New Mexico in 1970, and despite ongoing attention and action over the subsequent decades, suicide among indigenous populations worldwide continues at epidemic proportions.

In Brazil, where the overall suicide rate is relatively low (6.0 per 100,000 population per year), a high rate of indigenous suicide is an enormous burden on an already vulnerable population. Particularly high rates of indigenous suicide have
been reported in the Amazon and South Central regions of the country.\cite{10,15,17,18} In 2006, indigenous suicide rates in Mato Grosso do Sul (MS), a state in South Central Brazil, were reported to 96.2 per 100,000 population per year, ten times greater than the overall state suicide rate and 19 times greater than the national suicide rate. The study attributed the high rate of indigenous suicide to vague cultural and historical factors, including: rapid acculturation, traumatic loss of ancestral lands, overcrowding on reservations, and the introduction of drugs and distilled liquor as important factors precipitating the epidemic of youth suicide.\cite{10} These troubling findings were corroborated by an ecological study comparing indigenous and non-indigenous suicide in Mato Grosso do Sul, which noted the geographic density of suicide cases in indigenous communities.\cite{10,18}

### Indigenous Population in Brazil

There were an estimated 2,000 indigenous ethnic groups in the country when Portuguese colonization began in the 16th century; however, most of the indigenous population died as a result of imported diseases and warfare. As of 2010, the indigenous population in Brazil numbered 817,000 individuals comprising approximately 200 ethnic groups.\cite{19} A 2007 report released by the Brazilian Indigenous Foundation (FUNAI) confirmed the existence of 67 different ethnic groups who have never been contacted by modern society, making Brazil the home of the most such groups on the planet.\cite{20-22} Brazil has a poor track record of protecting the rights of its indigenous population; according to the United Nations High Commissioner for Human Rights, Navi Pillay, indigenous populations in Brazil, “are not benfitting from the country’s impressive economic progress, and are being
held back by discrimination and indifference, chased out of their lands and into forced labor.”

The recent history of Brazilian-Indigenous population relations has been mixed. In 1967, during a federal investigation of the Service for the Protection of Indians (SPI), an organization tasked with protecting the rights and interests of Brazil’s indigenous population, details of abuse including enslavement, sexual abuse, torture, and systematic mass murder were made public. SPI was rapidly shut down and replaced by FUNAI. Then in 1988, when Brazil’s government transitioned from decades of military rule to democracy, the rights of indigenous people were officially recognized in the new Brazilian Constitution. Article 231 of the new document specifically established the right of indigenous people to live on their traditional lands and to use the natural resources required for their cultural way of life. Furthermore, article 67 of the new constitution ordered the demarcation of protected indigenous territories for all of Brazil’s indigenous groups within five years. Five years later, however, the Brazilian federal government had created fewer than half of the promised Terras Indígenas. While the creation of some of the promised Terras Indígenas represented a significant step forward, the protected lands benefit only some of Brazil’s many indigenous ethnic groups. Other indigenous groups, such as the Guarani-Kaiowá in Mato Grosso do Sul, continue to

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*a Terras Indígenas are large areas that are set aside for use solely by Brazil’s indigenous populations and differ from reservations in their size and the level of autonomy. Terras Indígenas are protected to ensure that the indigenous residents live without interference from commercial activities like hunting and logging.*
fight for land while living on overcrowded reservations and roadside acampamentos\textsuperscript{b} despite repeated promises of meaningful land demarcation.

**The Guarani-Kaiowá**

There are approximately 43,000 Guarani-Kaiowá currently living in Brazil, most of whom inhabit South Central Brazil, primarily within the state of Mato Grosso do Sul.\textsuperscript{26} Before the arrival of Europeans, the Guarani ethnic group consisted of about 2 million individuals and occupied a large geographic region that included parts of Argentina, Paraguay, and Brazil. Despite the fact that many indigenous groups were enslaved or converted by Jesuit missionaries, the Guarani-Kaiowá in South Central Brazil continued to live largely undisturbed through the colonial period.\textsuperscript{27} Traditionally, the Guarani-Kaiowá lived in clans consisting of extended family units called guarás\textsuperscript{c} and made their homes in the lush river valleys that crossed the dense forests in the area. They employed communal child-rearing and

\textsuperscript{b} *Acampamentos* are roadside camps that are generally located alongside the ranches and plantations that now occupy traditional Guarani-Kaiowá territory. They generally consist of improvised structures and the residents typically live in extreme poverty. Some families see living in *acampamentos* as a form of protest against the living conditions and quality of land on the reservations as well as a demonstration of their commitment to living on their traditional lands.

\textsuperscript{c} Guarás were extended family clans, which served as the most important social unit in traditional Guarani society. Guarás shared resources internally and children born into the guará were raised communally with a strong emphasis on culture and community.
subsisted largely on hunting, fishing, and gathering fruits and vegetative plants within their tekohá.28

Gradual encroachment on the Guarani-Kaiowá territory and way of life began in the early 20th century as soy, sugar cane, and maté plantations as well as cattle ranches became very profitable in the region.10 The government facilitated large-scale migration to the region between 1915 and 1928 by creating eight reservations in the region to provide the indigenous population with an alternative place to live to reduce conflict between the Guarani-Kaiowá and the migrants; the Guarani-Kaiowá were systematically removed from the most valuable agricultural land.29 Despite the creation of the reservations, most of the Guarani-Kaiowá population proceeded to retreat deeper into the thick forests in the area and were largely unaffected by the changes. By the 1960s, however, mechanized agricultural equipment accelerated the transformation of the region’s forests into cattle ranches and plantations, leading to intensifying conflict and ultimately rapid growth of the reservation populations.10 The Guarani-Kaiowá movement demanding the return of their traditional lands through governmental land demarcation began in 1978 in response to increasingly poor conditions for Guarani-Kaiowá families who were suffering on overcrowded reservations.30

Today, the majority of the Guarani-Kaiowá living in Mato Grosso do Sul, reside on the reservations, although some families have moved to roadside acampamentos lining the roads that now lace their traditional lands.14,26 Their

\[d\text{ Tekohá is the Guarani word for the sacred land that belongs to a guará. Tekohá refers to entire landscape including rivers, forests, animals, fish, gardens, and natural resources that are necessary for the Guarani-Kaiowá life.}\]
The situation is one of great uncertainty as Brazilian government promises of land demarcation have not been realized and have been violently opposed by ranchers and plantation owners. Between 2003 and 2011, there were many high profile violent incidents between Guarani-Kaiowá groups trying to re-occupy their traditional lands and the ranchers who currently control the territory, leaving at least 279 Guarani-Kaiowá dead. The Guarani-Kaiowá remain in a desperate battle against the Brazilian government and wealthy ranchers for the right to live in their traditional land and return to their way of life. In his assessment of the situation that has befallen the Guarani-Kaiowá, anthropologist Marcos Homero asserted:

“The Situation of the Guarani-Kaiowá [...] requires an immediate and urgent solution. It is not an exaggeration to speak of genocide, since the series of events and actions committed against this group since the end of the 1990s has contributed to subjecting its members to conditions preventing their physical, cultural, and spiritual existence. Children, young people, adults and the elderly are subjected to degrading experiences, which directly harm their human dignity.

The way of life imposed on the Guarani-Kaiowá reveals how the white people see the Indians. Prejudice, indifference, mistreatment, non-consideration of their rights to the land, to life, to dignity are all evident. They are living in a situation analogous to that of a refugee camp. It is as if they were strangers in their own country. It is as if
the “whites” have gone to war with the Indians and the latter are left with the thin strip of road separating a ranch from the side of a road.”

Outside interest and documentation of Guarani-Kaiowá suicide began with a study produced by the Brazilian Ministry of Health and American Centers for Disease Control and Prevention in 2006. The study reported very high rates of suicide among young adult males in the population and was included in a series of articles published in *Suicide* documenting the crisis of indigenous suicide worldwide. The study was cited by Survival International in a report on the epidemic of Guarani suicide. The epidemic inspired a 2008 film by Marco Bechis called, *Bird Watchers*, which depicts the ongoing territorial conflict between a Guarani-Kaiowá community and the farmer who has taken over their land. All filming took place in Dourados, Mato Grosso do Sul, and Bechis cast Guarani-Kaiowá individuals as all indigenous characters in the film. The story follows a family who leave their reservation to develop a roadside camp next to their traditional family territory (tekohá) in an attempt to take the land back. One of the children defies his father and jumps on an agricultural truck to work for a white rancher for a couple of weeks. When he returns home, he has bought a pair of new tennis shoes in an attempt to fit in with the non-indigenous majority culture. His father is intoxicated when he arrives home and disowns him. Soon after, the boy is depicted hanging from a tree. The film effectively portrays the intersection of cultural trauma,
race, alcoholism, youth growing up without hope for a better future, and the ongoing epidemic of suicide among the Guarani-Kaiowá.

As may be expected, the epidemic of suicide is deeply troubling to the Guarani-Kaiowá community in Mato Grosso do Sul. In 2014, a local Guarani-Kaiowá chief summarized his experience with suicide in his community: “We see people taking their lives, hanging themselves, [...] and we are thinking: ‘What has gotten into the head of that person to do this?’ because it’s really scary.” On the reservations, family members and neighbors are frequently the first people to encounter the body of a suicide victim. When asked about the problem of suicide in his neighborhood, a Guarani-Kaiowá community member, Rosalino Ortiz contributed a poignant commentary on the impact that the loss of traditional land and culture has had on the youth in his community:

“People commit suicide because we have no land. In the old days we were free, we are no longer free. Our young people come around and they think there is nothing and they wonder how they can live. They sit and think, forget, lose themselves and then commit suicide.”

Key Research Questions

The purpose of this study was to develop a better understanding of the current context of suicide in an indigenous population with a high suicide burden. Prior studies investigating indigenous suicide in Brazil looked at large, regional populations without considering the ethnic groups comprising the population being studied. By rigorously investigating the suicide epidemiology in a small area with a well-defined population, real trends and clusters can be uncovered without getting
lost in un-stratified data, with the objective of developing realistic, evidence-based interventions to address the problem.

It has been demonstrated that in this region, suicide occurs more frequently within indigenous communities than outside of them,\textsuperscript{10,18} however, there is not yet an understanding of which indigenous communities have the highest suicide rates and of what differences exist between higher-risk and lower-risk communities. There is also evidence of suicide clustering in indigenous communities\textsuperscript{18} and some indigenous families\textsuperscript{36} in the region. Community-level clustering in this population has never been reported as a comparable index and the only exploration of intra-familial clustering was a case study. There is the need for more information on how common suicide clusters are, which communities are suffering the most suicide clusters, and why they are happening.

Finally, there is a commonly held local belief that belonging to the Guarani-Kaoiwá ethnic group is the most important variable that confers suicide risk in this ethnically heterogeneous indigenous population. Additional risk factors that community members commonly link to suicide include alcoholism, drug abuse, and absentee parenting. These hypotheses have never been scientifically tested, and alternative hypotheses, such as the possibility that exposure to suicide or experiencing structural barriers to economic opportunity may be important mediators of suicide risk, have yet to be explored. These key research questions were addressed systematically through epidemiological analysis as well as through focus group interviews with community members.
Methods

Study Design

The study was a retrospective cohort study, which utilized suicide surveillance and population data to estimate the suicide incidence rate among the indigenous population served by the Dourados Indigenous Health Office (DSEI – Polo Base Dourados) between 2003 and 2013.

A qualitative study was also conducted and consisted of semi-structured focus group interviews with three critical community groups: community leaders, community health agents, and youth (aged 16-22). The interviews explored central themes: culture and community, conception of suicide, risk and protective factors, and recommendations for solutions. The interviews were conducted in Portuguese and Guarani by a Guarani-Brazilian psychologist who works regularly in the community and is included as an author on this study.

Collaborating Partners

The study was developed as a collaboration between the department of Public Health at Universidade Federal da Grande Dourados and Yale University. The researchers at Universidade Federal da Grande Dourados had ongoing research projects investigating tuberculosis among the indigenous population living on the reservations surrounding Dourados, and through that extensive contact, they saw firsthand the magnitude and devastation of the local indigenous suicide epidemic. A psychiatrist from Yale School of Medicine was recruited to serve as the principal investigator on the project. Finally, the local indigenous healthcare office was
invited to participate because they work most closely with the indigenous population and are best positioned to transform compelling findings into intervention programs. The director of the local indigenous health care office as well as their psychologist are listed as co-authors for their many contributions to the design and execution of this project.

**Role of the Thesis Author**

This thesis contains the many and varied contributions of each of the collaborating clinicians and scientists acknowledged as authors in the abstract; however, the thesis author, TL, was solely responsible for writing this thesis and was the primary contributor and lead author on the manuscript that corresponds to this document. TL was responsible for designing this project *de novo* under the guidance of their Yale School of Medicine faculty mentor, RR, with input from the collaborating institutions. The thesis author spent a total of ten weeks in Mato Grosso do Sul, Brazil in the summer of 2014, during which time they accessed the electronic databases and all focus group interviews were conducted. TL worked closely with Brazilian contributor CG to develop the semi-structured focus group interview scripts used and personally attended but did not facilitate the focus group interviews. The thesis author worked directly with anthropology graduate student, KM, to conduct the qualitative data analysis. TL was also responsible for all of the quantitative data analysis as well as each of the figures and tables contained in this thesis, with the exception of Figure 1. (a map of the region), which was contributed by CG.
**Population and Study Site**

The study population included the 14,606 individuals living in the five reservation communities or *aldeias* (Bororo, Jaguapiru, Panambizinho, Panambi, and Sucuri) that comprise the service area for the organization charged with providing health care to the local indigenous population, DSEI – Polo Base Dourados in Mato Grosso do Sul, Brazil (Figure1; Table1).

*Figure 1.* Map of study area in Mato Grosso do Sul, Brazil. 1. Bororo, 2. Jaguapiru, 3. Panambizinho, 4. Panambi, 5. Sucuri.

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*Aldeia* is a term that literally translates to “village”; however, in Brazil, it is used interchangeably with indigenous reservation.
Table 1. Characteristics of the study reservations.

<table>
<thead>
<tr>
<th>Aldeia</th>
<th>Populationa</th>
<th>Number of Householdsb</th>
<th>Distance from Douradosc</th>
<th>Ethnictiest</th>
<th>Maled</th>
<th>Less than % Minimum Salary per capitae</th>
<th>Have a private bathroomf</th>
<th>Have electricityg</th>
<th>Social Conditionsh</th>
<th>Structural Conditionsį</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bororo</td>
<td>6,091</td>
<td>1183</td>
<td>12km</td>
<td>-Guarani-Kaiowá (88.1%) -Guarani-Randeua (9.0%) -Terena (2.3%)</td>
<td>53.1%</td>
<td>57.7%</td>
<td>31.6%</td>
<td>71.0%</td>
<td>-Significant youth gang involvement -Prevalent drug and alcohol abuse</td>
<td>-Roads inaccessible in rain -Elementary-aged children without access to school -Over-crowded; no land for family farms</td>
</tr>
<tr>
<td>Jauguapiru</td>
<td>6,495</td>
<td>1280</td>
<td>5km</td>
<td>-Guarani-Kaiowá (29.3%) -Guarani-Randeua (27.9%) -Terena (42.8%)</td>
<td>63.9%</td>
<td>47.9%</td>
<td>41.1%</td>
<td>89.7%</td>
<td>-Significant youth gang involvement -Prevalent drug and alcohol abuse</td>
<td>-Major highway with municipal bus stop bisects village bisects village -Has Missionary Hospital -Over-crowded; no land for family farms</td>
</tr>
<tr>
<td>Panambi</td>
<td>547</td>
<td>267</td>
<td>39km</td>
<td>-Guarani-Kaiowá (91.8%) -Guarani-Randeua (7.3%)</td>
<td>61.7%</td>
<td>52.5%</td>
<td>52.3%</td>
<td>80.5%</td>
<td>-Prevalent drug and alcohol abuse</td>
<td>-Rural and far from city -Farming possible</td>
</tr>
<tr>
<td>Panambitinho</td>
<td>334</td>
<td>81</td>
<td>19km</td>
<td>-Guarani-Kaiowá (95.6%) -Guarani-Randeua (4.4%)</td>
<td>80.3%</td>
<td>49.4%</td>
<td>14.8%</td>
<td>65.4%</td>
<td>-Prevalent drug and alcohol abuse</td>
<td>-Rural and far from city -Farming possible</td>
</tr>
<tr>
<td>Sucuri</td>
<td>315</td>
<td>49</td>
<td>90km</td>
<td>-Guarani-Kaiowá (90.8%) -Guarani-Randeua (7.6%) -Terena (1.6%)</td>
<td>97.9%</td>
<td>83.7%</td>
<td>6.1%</td>
<td>18.4%</td>
<td>-Prevalent drug and alcohol abuse</td>
<td>-Rural and far from city -Farming possible</td>
</tr>
<tr>
<td>Others</td>
<td>824</td>
<td>-</td>
<td>-</td>
<td>-Guarani-Kaiowá (90.5%) -Guarani-Randeua (7.5%) -Terena (1.9%)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-Prevalent drug and alcohol abuse</td>
<td>-Spread out geographically into small camps -Improvised housing</td>
</tr>
<tr>
<td>Total</td>
<td>14,606</td>
<td>1708</td>
<td>-</td>
<td>-Guarani-Kaiowá (62.5%) -Guarani-Randeua (17.4%) -Terena (20.2%)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

*Population and ethnicity data from SIASI – FUNASA/MS 2015
*Aldeia-level household data from 2015 SENAI household-level census
*Distance from Dourados from 2014 SENAI report
*Male HHI. Salary data, household data from 2010 IBGE national census for sectors that are 100% indigenous and located within the indicated reservation aldeias
*Social, economic, and structural information drawn from discussions with community leadership and community health workers in July-August 2014.
There are three indigenous ethnic groups living together on the reservations included in this study; they are: Guarani, Guarani-Kaiowá, and Terena. The Guarani ethnic group is a large group, from which several distinct sub-groups with their own languages and customs, including the Guarani-Kaiowá, branched. The Guarani and Guarani-Kaiowá have lived in the region for centuries and the majority of the families living on the reservations were displaced from their traditional lands in the 1960s. The Terena ethnic group historically lived farther north in Mato Grosso do Sul and in the state of Mato Grosso.

Aldeias Bororo and Jaguapiru have a combined population that represents approximately 85% of the overall study population; these adjacent aldeias jointly comprise the Dourados Indigenous Reservation, a peri-urban reservation that is the largest single indigenous reservation in Brazil. The majority of the population in Bororo is Guarani-Kaiowá (88·1%) and a small minority identify as Terena (9·6%). Bororo has many serious social issues including significant youth gang violence, prevalent alcohol and drug abuse, and a lack of youth education; a recent newspaper article reported that there were 800 children that were not enrolled in elementary school in Bororo in 2014.³⁷ Jaguapiru has a Terena plurality (42·8%) but also has significant Guarani-Kaiowá (29·3%) and Guarani (27·9%) minorities. Like Bororo, Jaguapiru also suffers from youth gang violence as well as drug and alcohol abuse. The major highway that leads out of Dourados passes directly through the town and there is a municipal bus stop located at the entrance to Jaguapiru alongside the highway. Also, the well-established missionary hospital that was established to take care of the indigenous population in the region is situated in Jaguapiru.
Panambi, Panambizinho, and Sucuri are much smaller reservations that are located in the countryside farther from Dourados. Despite being more rural, the populations living on the three remote reservations still suffer from overcrowding on land that is poorly suited for agriculture and impossible to hunt on. Panambizinho has a population of just 334 individuals living in 81 households and is located 19km from the city. Panambizinho is 95.6% Guarani-Kaiowá and 4.5% Guarani. Panambi, which is slightly larger at 547 individuals, is located to the north of Dourados, about 39km away from the city. Panambi is 91.8% Guarani-Kaiowá and 7.3% Guarani. Sucuri, which is the smallest aldeia with a population of just 315 individuals, is located 90km from Dourados. Sucuri has a population that is 90.8% Guarani-Kaiowá, 7.6% Guarani, and 1.6% Terena. The de-centralization of the indigenous population leads to difficulties in providing adequate medical and social services.

Dourados is a rapidly growing municipality with a population of 210,000 in South Central Brazil, near the Paraguay border. The city has experienced rapid economic growth over the last several decades, as it has become a regional center for agriculture, specializing in soy, maté, corn, and beef. The development of the agricultural sector has been at the expense of the indigenous population, who have seen their territory seized and lush forests converted into plantations and ranches for the profit of European Brazilian settlers.
Ethics statement

This study was approved by the ethics committee at Universidade Federal da Grande Dourados, the Brazilian National Research Ethics Committee, and the Brazilian Indigenous Research Ethics Committee (CAAE: 35421914.7.0000.0021). The study was also reviewed and approved by the Yale University Institutional Review Board. The chief of each of the indigenous communities included in the study met with the research team and provided the research team with a formal letter granting permission to conduct the study within their community. Each participant in the focus group interviews provided written consent according to a protocol and form approved by the ethics committee at Universidade Federal da Grande Dourados. Minors were required to sign approved assent forms and the signature of at least one consenting parent was required for a minor to participate.

Data sources

Quantitative Data

Population and demographic data (age, gender, ethnicity, and address) were obtained electronically from the 2015 Special Indigenous Information System (SIASI) census and socioeconomic data (literacy rate, per capita income, and household data) were accessed electronically from the 2010 Brazilian National Census (IBGE). 2015 SIASI population data were used for the study because earlier data sets did not differentiate between indigenous ethnic groups, a distinction that is critical for understanding suicide epidemiology in the region. Indigenous suicide cases that occurred during the study period were drawn from The Brazilian National Mortality Database (SIM) and the SIASI suicide surveillance database.
SIM maintains demographic information (age, gender, marital status, ethnicity, and address) and ICD-10 codes for deaths in Brazil. Deaths with the suspicion of suicide undergo forensic autopsy at the local Medical Legal Institute before being ascribed an ICD-10 code corresponding to “intentional self-harm” (X60-X84) in SIM. To avoid underreporting indigenous suicide, SIASI utilizes community health agents to investigate the circumstances of potential suicides by interviewing family members and other key informants knowledgeable about the deceased individual. SIASI includes the individual’s name, age, gender, ethnicity, suicide method, and address. Suicides occurring between 2003 and 2013 were extracted from each database. In the case of discrepancies, the names, birth dates, and dates of death of the cases were compared with one another to ensure that each was distinct.

**Qualitative Data**

Qualitative data were acquired in recorded focus group interviews. The participants were asked a series of open-ended questions to stimulate discussion of participant experiences and opinions. Co-Authors, CG and WB, conducted the focus group interviews primarily in Portuguese; Guarani was used occasionally to clarify questions and responses. Volunteers were solicited using snowball sampling with the help of community leaders and DSEI Polo Base Dourados staff. In order to obtain an in-depth understanding of suicide in the community, focus group interviews were conducted with community leaders, community health agents, and the highest risk group – youth aged sixteen to twenty-two.
Throughout the study, preliminary analysis of the focus groups was conducted until no new themes appeared to be emerging in each of the three participant cohorts. Youth who were enrolled in local schools were purposefully included as well as those who had terminated their studies. Similarly, cultural as well as political leaders were included to ensure that a variety of experiences and perspectives were represented. The interview transcripts were transcribed in Portuguese by a professional, local transcription service; Guarani content was translated and transcribed by WB. The transcripts were translated into English by TL and an independent, professional Portuguese-English translation service. Two transcripts were translated by both TL as well as the outside service to confirm consistency in the translation content and meaning.

**Statistical analysis**

**Quantitative Data Analysis**

The suicide rate in this population was calculated as suicides per 100,000 population per year. Suicide cases were extracted from SIM and SIASI, and population estimates were from the SIASI census. Rate ratios with 95% confidence intervals were calculated to compare suicide rates by gender, age group, ethnicity, and aldeia. Comparisons of stratified suicide rates were assessed statistically using Pearson’s Chi-squared test. Statistical significance was defined as a relationship with a p-value of less than or equal to 0.05.

The clustering of suicide events was assessed in two ways. First, spatial-temporal clustering was assessed utilizing an operational definition proposed by Larkin and Beautrais\(^{38}\) and endorsed in a recent review\(^{39}\): “a series of three or more
closely grouped deaths within 3 months that can be linked by space or social relationships.” For the analysis, suicides occurring in the same aldeia were considered spatially linked. Detailed information on social relationships was unavailable for most cases and therefore could not be considered in the analysis. The second method used to assess suicide clustering was to calculate the number and proportion of suicides occurring within neighboring households during the study period. In the aldeias, large families typically occupy a single home and extended relatives occupy neighboring houses, so suicides occurring within two household numbers of another suicide case were considered to likely represent an extended family cluster.

**Qualitative Data Analysis**

The content of the focus group interview transcripts was assessed by TL and KM through inductive thematic analysis. A transcript from each focus group cohort (leaders, community health agents, and youth) was read independently by TL and KM, after which, emerging themes were discussed and transformed into an iterative coding scheme. The process was repeated for a second transcript from each cohort, after which the codebook was subsequently refined and applied to the six transcripts. TL then applied the iterative coding scheme to the remaining transcripts. This process enabled the extraction of a code list with relevant quotes, linking the iteratively developed themes with the study participants’ own words.
Role of Funding Sources

Neither of my generous sponsors, the Bertram Roberts Memorial Fund nor the Wilbur Downs Fellowship, had a role in designing the study, analyzing the data, or writing this report.

Results

Results of Quantitative Analysis

A total of 119 suicide cases were identified in the aldeias between 2003 and 2013 with 84 suicide cases extracted from both SIM and SIASI, 22 suicide cases extracted only from SIASI, and 13 cases from SIM only. The overall and aldeia-stratified suicide mortality rates are displayed in Table 2. The overall suicide rate for the study population was 73.4 per 100,000 population per year. The majority of suicide cases (93%; 111/119) were reported as hanging deaths and the remaining 7% of cases (8/119) were reported as intentional agrochemical ingestion.

Age and Gender-Stratified Results

There was a significant discrepancy in the suicide rate by gender. The male suicide rate was more than twice the female rate (Figure 2). The highest rates of suicide among males were observed for those aged 15-19 and 20-24 with rates of 289.3 per 100,000 population per year (95% CI: 187.5-391.2) and 275.9 per 100,000 population per year (95% CI: 155.0-396.8), respectively. These rates were significantly higher than all other male cohorts except for males aged 50-59, for
whom the confidence interval spans a wide range (95% CI: 21·1-320·7) due to the small population in the demographic.

**Figure 2.** Crude suicide rate according to age and sex

The highest suicide mortality rate among females was seen for girls aged 10-14, whose rate was 85·3 per 100,000 population per year (95% CI: 34·9-135·7), which was not significantly greater than any other female cohort in the statistical analysis. The rate of suicide among male children aged 10-14 was 92·5 per 100,000 population per year (95% CI: 40·2-144·9). Overall, 32·3% (11/34) of female suicides and 19·3% (23/119) of all suicides occurred among individuals under age 15. More than half (50·4%; 60/119) of all suicide victims were under the age of 20.
Aldeia-Stratified Results

Aldeia-stratified suicide rates are shown in Table 2; Bororo, Panambi, Panambizinho, and Sucuri had significantly higher suicide rates than Jaguapiru. These aldeia-level trends in suicide rate were also seen when the Guarani-Kaiowá suicide rates were compared between the aldeias.

Table 2. Crude suicide rate according to aldeia of residence for the study period (2003-2013.)

<table>
<thead>
<tr>
<th>Aldeia</th>
<th>No. cases(^a) (PY)(^b)</th>
<th>Rate</th>
<th>95% CI</th>
<th>RR(^c)</th>
<th>95% CI</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bororo</td>
<td>77 (67,001)</td>
<td>114.9</td>
<td>89.3 - 140.6</td>
<td><strong>4.83</strong></td>
<td><strong>2.85 - 8.16</strong></td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Jaguapiru</td>
<td>17 (71,445)</td>
<td>23.8</td>
<td>12.5 - 35.1</td>
<td>1.00</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Panambi</td>
<td>10 (6,017)</td>
<td>166.2</td>
<td>63.2 - 269.2</td>
<td><strong>6.97</strong></td>
<td><strong>3.20 - 15.2</strong></td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Panambizinho</td>
<td>8 (3,674)</td>
<td>217.7</td>
<td>66.9 - 368.6</td>
<td><strong>9.13</strong></td>
<td><strong>3.94 - 21.2</strong></td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Sucuri</td>
<td>3 (3,465)</td>
<td>86.6</td>
<td>0.0 - 184.6</td>
<td><strong>3.64</strong></td>
<td><strong>1.07 - 12.4</strong></td>
<td>0.027</td>
</tr>
<tr>
<td>Others</td>
<td>3 (9,064)</td>
<td>33.1</td>
<td>0.0 - 70.6</td>
<td>1.39</td>
<td>0.41 - 4.75</td>
<td>0.60</td>
</tr>
</tbody>
</table>

PY: Person-years in denominator; Rate: expressed as suicides per 100,000 person-years; CI: Confidence intervals; RR: Relative risk; Bold values indicate statistical significance.

\(^a\)Number of cases from SIASI and SIM databases (2003-2013) with reported aldeia of residence

\(^b\)People-years of follow-up calculated using population data from SIASI – FUNASA/MS 2015

\(^c\)Relative risk was calculated for Jaguapiru versus other aldeias

There were significantly higher rates of Guarani-Kaiowá suicide in Bororo (Rate: 105·0 per 100,000 population per year; RR: 5·50; p=0·002), Panambi (Rate: 163·0 per 100,000 population per year; RR: 8·53; p<0·001), and Panambizinho (Rate: 199·5 per 100,000 population per year; RR: 10·43; p<0·001) than in Jaguapiru (Rate: 19·1 per 100,000 population per year). The Guarani-Kaiowá suicide rate was also higher in Sucuri (Rate: 63·6 per 100,000 population per year; RR: 3·33; p=0·141) than in Jaguapiru but the result was not statistically significant.
Suicide Clustering

Clustering of suicide cases by time and geography was observed; 61.3% (73/119) of all suicide cases occurred in clusters of three or more suicides occurring within three months of one another in the same aldeia. This was especially pronounced in Bororo, where 83.1% (64/77) of all suicide cases occurred in such clusters and 27.3% (21/77) of suicide cases occurred in clusters of six or more cases within three months. Out of the 104 suicide cases that were linked to a household number, 50.0% (52/104) occurred within two household numbers of another case during the study period. In Bororo, 56.7% (38/67) of cases met this definition. These clustering data are presented in Figure 3., in which each cluster is represented by a row in the chart.
Each row represents a cluster of 2 or more cases within 2 household numbers (neighboring homes) in the same aldeia during the study period. The letter in the code represents the aldeia: “B” is for Bororo, “J” is for Jaguapiru, “P” is for Panambi, “Pz” is for Panambizinho, and “O” is for the acampamentos (roadside camps). The number in the code distinguishes each cluster from other clusters within the same aldeia but do not specify geographic zones within the aldeia. The numbers and letters on the chart refer to the age and sex of the victims. A diamond represents one suicide and each circle is a pie chart representing multiple suicides occurring within 365 days of one another within the same cluster.
**Variation of Suicide by Month of Year and Day of Week**

Analysis was performed to determine if suicides took place more frequently during certain times of the year or on certain days of the week. There was variation in the number of suicides occurring in different months; twenty-two suicides took place in August, eight more than in any other month during the time period. The fewest suicides occurred during April, when only four suicides were reported. Overall, there was a pattern in which more suicides took place in spring and summer months (October thru February in the southern hemisphere) than in fall and winter months (March thru September in the southern hemisphere).

**Figure 4.** Number of Suicides occurring in each calendar month during the study period (2003-2013).
A trend was also seen when assessing the number of suicides that occurred on different days of the week. More suicides took place on weekend days than on weekdays, with the largest number of suicides occurring on Sundays (26/119; 21.8%) followed by Saturdays (22/119; 18.4%). For this analysis, weekend days were considered to include Friday, Saturday, and Sunday; more than half of the total suicide cases (64/119; 53.8%) took place on one of the three weekend days. Fewer suicides occurred on weekdays with the number of cases ranging from eleven on Mondays to fifteen on Wednesdays and Thursdays during the study period.

**Figure 5.** Number of Suicides occurring on each day of the week during the study period (2003-2013).
**Socioeconomic Analysis of Bororo and Jaguapiru**

Markers of socioeconomic status and educational opportunities are presented in Table 1. Households in Bororo were significantly more disadvantaged in both socioeconomic status and education than those in Jaguapiru. On measures of socioeconomic status, residents of Bororo were less likely to have private bathrooms (31.6% vs. 41.1%; p<0.0001), electricity (71.0% vs. 89.7%; p<0.001), and were more likely to make less than ¼ of the minimum wage per household resident (57.7% vs. 47.9%; p<0.001) than households in Jaguapiru. On measures of education, the over-age-five literacy rate was significantly lower in Bororo than in Jaguapiru (55.2% vs. 63.2%; p<0.001), as was the likelihood of having a literate head of household (66.8% vs. 84.9%; p<0.001).

**Results of Qualitative Analysis**

A total of fourteen focus group interviews were conducted with between seven and fourteen participants each. Of the fourteen interviews, three included community leaders, three included community health agents, and eight included youth (aged 16-22). During the focus groups, several important themes were discussed, including reasons a person might commit suicide, risk factors for suicide, protective factors against suicide, exposure to suicide clusters, and reasons one indigenous community might have more suicide than another. The focus group interviews are identified in Table 3.
The focus group interview transcripts contain rich narrative-based qualitative data representing the opinions and lived experiences of the focus group participants. For the purposes of this thesis, two specific themes that interface with questions both answered and raised by the quantitative data will be presented:

1) The local perception that belonging to the Guarani-Kaiowá ethnic group is the most important risk factor for committing suicide in this population.

2) The belief that those who commit suicide are most commonly alcoholics, addicted to drugs and/or come from dysfunctional families.

Theories linking suicide and potentially related factors abound in the communities; however, the most pervasive connection encountered in the focus groups was the belief that belonging to Guarani-Kaiowá ethnic group is the most important suicide risk factor in this ethnically heterogeneous indigenous
population. When the topic was discussed in the focus group interviews, most but not all of the participants agreed that suicide was a problem primarily afflicting the Guarani-Kaiowá rather than the indigenous community as a whole. Various explanations were offered, including the specific propensity of Guarani-Kaiowá individuals to be emotionally reserved and to struggle with verbalizing their emotional difficulties. A community health agent utilized the metaphor of a bursting balloon to help explain suicide as an emotional release for the Guarani-Kaiowá:

“He [the Guarani-Kaiowá] doesn’t speak, he holds, then when he holds, the balloon fills up, and cannot stand it, and the balloon bursts, and when you see him, he is already hanging, the Kaiowá people think many things but do not express them (FG 3, Participant 3).”

Another frequent suggestion was that most Guarani-Kaiowá believe in feitiço and that feitiço can lead people to kill themselves. A Guarani-Kaiowá health worker described the role that the Guarani-Kaiowá believe feitiço plays in suicide:

“The community [...] believes in feitiço, that it made him [the suicide victim] hang himself, it made him take poison, it made him kill himself (FG 3, Participant 9).”

Other potential suicide risk factors that were commonly mentioned in the focus group interviews include alcoholism, drug addiction, belonging to a dysfunctional family, and poverty. In every focus group, these same factors were

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Feitiço is the word that is used to describe a form of traditional Guarani-Kaiowá witchcraft. It is frequently believed that if an individual angers another person, the angered neighbor might cast macumba, or a magical curse, that can cause a person to hallucinate and even to climb a tree with a rope and hang themselves.
linked to suicide and were often explained as overlapping. A leader in Bororo clearly defined the interconnectedness of alcohol abuse, dysfunctional family life, and suicide in her description of a recent suicide in her neighborhood:

“The father and mother are alcoholics. […] She hung herself because her mother was fighting a lot with her father, and it was that way, living like that in their house, right, so one day she went to school, and later when she went home, her mother was fighting and she ran away, they found her the next day and she was dead (FG 14, P 5).”

Another community leader from Bororo described the family life of two brothers who had committed suicide:

“Two brothers died by hanging, from the same house. […] I went inside the house, they don’t have anything in the house, they have no beds, […] the father drinks, the mother drinks, the parents leave the children at home (FG 14, P 3).”

Discussion

An important finding in this study is the historically high rate of suicide in this population. Two limitations may render the high suicide rates presented in this study underestimations of the true burden of suicide in this population. Unreported or mischaracterized suicide deaths would not have been detected for analysis. To maximize case detection two separate databases were used. According to capture-recapture analysis of the two databases, it is estimated that only 2.99
suicide cases occurring in the study population during the study period were missed in the analysis. Another limitation is that 2015 population data were used in the calculations of the suicide rate during the time period of 2003 to 2013. These population data were used because they are the earliest data that delineate between specific ethnic groups, a variable that is crucial to understanding the population's suicide epidemiology. Prior data had a single designation for indigenous individuals and therefore determining the ethnic composition of the indigenous population would not have been possible. Unofficial population estimates and 2010 census figures suggest that the population has grown significantly over the past two decades; therefore utilizing 2015 population data to calculate suicide rates resulted in lower reported rates.

There are significant gender differences in the suicide risk of different age groups in this population, and one of the most critical findings in this study is the high rate of suicide among girls. In late childhood (age 10-14), girls commit suicide twice as often as women overall and as often as boys of the same age, a trend which diverges after age 15, when young men are at far greater risk than young women. With a suicide rate of 85.3 per 100,000 population per year, girls in this population are committing suicide at a rate far greater than indigenous girls in the state as a whole (38.3 per 100,000 population per year). In fact, I believe that this is the highest suicide rate ever reported for female children. Girls in this population face many challenges including high rates of sexual violence as well as childhood and teen pregnancy; however, further investigation is needed to understand the role that these known stressors play in mediating the suicide risk of female children in
this population, as well as to identify additional potential suicide risk factors for girls.

There was seasonal variation of suicide cases in the study population during the study period. More suicides took place during the South American spring and summer (October to January) than in the fall and winter (March to September). The overall trend is consistent with previously published reports data the Brazilian states of Rio Grande do Sul, Paraná, and Santa Catarina that suggest that suicide is more common during the spring and summer in Brazil. The outlier in this trend was the preponderance of August suicides, which warrants further investigation. An initial theory posited by my Brazilian colleagues is that the Brazilian academic calendar includes a winter recess during the month of July and the emotional and psychological stress of returning to school after a prolonged holiday may play a role.

There was also variation in the number of suicides that occurred on different days of the week. The three most common days of the week for committing suicide during the study period were Sunday, Saturday, and Friday. This observed trend is consistent with prior data collected by Souza et al., which demonstrated that more than half of Brazilian indigenous suicides occur over the weekend as opposed to just over forty percent of non-indigenous suicides. An explanation proposed elsewhere is that alcohol and drug use commonly play a role in suicides that take place on indigenous reservations in Brazil and that the consumption of large quantities of alcohol is both more common and more socially acceptable over the weekend. The available data did not provide insight into a possible link between drug and alcohol consumption and suicide.
There is dramatic evidence for the clustering of suicide cases in this population. During the study period, 61.3% of all suicide cases met the operational definition for a suicide cluster and more than four out of five cases in Bororo were clustered. These data are reported in a manner proposed by Larkin and Beautrais so as to provide a readily comparable metric for the degree of clustering occurring in this population. It was not possible to assess which of the suicide cases were socially connected, which limits the depth of the analysis; however, the aldeias are small and suicide cases are reported on the radio and by word-of-mouth, so news of suicides spreads quickly.

The number of suicide cases occurring within neighboring homes over the study period was assessed to estimate intra-familial clustering. Over half of all suicide cases occurred within two neighboring household numbers of another suicide case during the study period. Detailed social information was unavailable for most of the suicide cases; however, there were several cases for whom relatedness was known, such as a grandmother who hung herself upon discovering that her grandchild had done so the day prior and a pair of brothers who hung themselves from the same tree within a week of one other. There is further published evidence of families with as many as seven cases of suicide and stories of related individuals committing suicide were frequently shared in the focus group interview transcripts. Additionally, some individuals move in with in-laws when they marry and many families occupy more than two neighboring households, so the estimate of the amount of intra-familial clustering may in fact be low. These
data suggest that the experience of witnessing or grieving a suicide impacts an individual’s subsequent risk of committing suicide in this population.

The qualitative analysis revealed the compelling shared belief, expressed by many focus group participants, that belonging to the Guarani-Kaiowá ethnic group is the most important suicide risk factor in their neighborhoods. This idea was raised frequently when the focus groups discussed the demographic and structural differences between high-risk and low-risk communities. Popular explanations for the validity of the shared belief included the perception that Guarani-Kaiowá individuals are emotionally reserved and dwell with their troubles until they build up and burst like balloons as well as the important role that feitiço, or witchcraft, plays in causing the Guarani-Kaiowá victims of curses to end their lives.

The findings of the quantitative analysis, however, suggests that poverty and socioeconomic disadvantage play a more important role in mediating suicide risk in the study population. The neighboring aldeias of Bororo and Jaguapiru jointly comprise the Dourados Indigenous Reservation and represent 85% of the study population. The two aldeias share many commonalities in terms of size, location, a popularly held belief that indigenous culture has been “lost”, and prevalent alcoholism and drug abuse. However, the suicide mortality rate in Bororo is four to five times the rate in Jaguapiru. As mentioned above, the shared local belief is that demographic differences, namely the percentage of the population belonging to the Guarani-Kaiowá ethnic group, explain the difference in suicide rate. Bororo is almost 90% Guarani-Kaiowá while Jaguapiru is only 30% Guarani-Kaiowá; however, the ethnicity-specific suicide rates calculated in this study do not support this
hypothesis. A large, statistically significant difference in suicide rates between the two aldeias persists even when looking only at the Guarani-Kaiowá suicide rate in each.

The comparison between Bororo and Jaguapiru raises important questions regarding the interrelatedness of structural barriers, like the dearth of educational opportunities and the challenges of accessing employment opportunities in the city, with indicators of poor well being, such as disintegration of families and suicide. Individuals living in Bororo experience higher structural barriers to economic success compared to their neighbors in Jaguapiru. Bororo is farther from Dourados, is not connected to any major highways, lacks access to public transportation, does not have its own hospital, and has many hilly dirt roads that flood during the rainy season. It should be noted that Jaguapiru is not affluent; comparing Jaguapiru to the general population in Dourados demonstrates far greater inequalities than comparisons with its poorer neighbor. However, perhaps as a result of the higher structural barriers to accessing economic and educational opportunities in Bororo, available data demonstrate that there are significant differences in the socioeconomic conditions and education level between Bororo and Jaguapiru. The implication is that youth without an education and without job prospects feel hopeless and that this hopelessness is connected with the phenomenon of suicide in these communities. These findings corroborate evidence presented elsewhere that poverty and socioeconomic disadvantage as well as historical and cultural factors increase an individual’s risk of committing suicide.43-47
Implications for Interventions

The findings of this study suggest pathways for addressing this public health emergency in Mato Grosso do Sul that may also be applicable more broadly to other indigenous communities. I believe that there are five critical components to a successful suicide prevention intervention. First and foremost, due to the complex and diverse cultural contexts in which indigenous suicides occur, interventions must be culturally tailored to and accepted by the population of interest. Second, planning must involve those best positioned to design and implement the program.12 Third, evidence regarding effective program design must be considered. Fourth, indigenous suicide typically occurs within communities with limited resources, so programs must be designed to be efficient and sustainable. Finally, through rigorous epidemiological analysis, high-risk groups must be identified so that programs are designed to match the specific needs of the community.12 The following paragraphs and table will attempt to outline how the findings of the thesis can be used in conjunction with the five-pronged approach to design an indigenous suicide prevention program specifically tailored to the needs of this population.

The results of the qualitative study as well as conversations with indigenous community leaders and community health agents provide insights into the cultural issues that must be considered when designing an intervention for this population. Several critical cultural values were expressed as important to the local indigenous cultural identity, including the importance of family, education, and the perpetuation of indigenous culture. Therefore, any program should reflect these cornerstone cultural values to resonate with the community and inspire confidence
in local stakeholders. Additional considerations include the sensitive treatment of popular cultural beliefs including the belief in witchcraft among others. Finally, a successful intervention must be accessible to all community members and therefore must be moderated by individuals who are fluent in Guarani as well as Portuguese.

Table 4. Application of the study results and study population’s cultural values to the proposed 5-pronged approach to suicide prevention intervention design

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. Cultural Tailoring</td>
<td>The program should emphasize and be respectful of local cultural values including the importance of family, education, and indigenous customs. In this population, it is critical that programs be available in Guarani as well as Portuguese so that they are accessible to all.</td>
</tr>
<tr>
<td>II. Inclusion of Appropriate Partners</td>
<td>Aldeia leaders including educators, healthcare providers, and cultural officials should be involved from the early planning stages and consulted prior to the introduction of an intervention. DSEI Polo Base Dourados and the School of Public Health at UFGD are excellent local institutional partners whose expertise in preventative healthcare and program implementation are invaluable. Yale represents an effective research institution partner, which has abundant human and technological resources that are helpful in addressing specific questions and gaps in knowledge.</td>
</tr>
<tr>
<td>III. Consideration of Evidence Base</td>
<td>Interventions should be informed by all available efficacy data from similar interventions in other communities. In this case, gatekeeper training, education interventions for students, and community-wide programs emphasizing resilience have been shown to be effective in other indigenous communities with similar suicide epidemiology.</td>
</tr>
<tr>
<td>IV. Resource Stewardship</td>
<td>The program must draw on and leverage existing human resources, including critical community stakeholders whenever possible. Such individuals identified by community leaders include indigenous educators, community health agents, and cultural leaders in the community in order to be maximally effective under resource constraints. Large-scale screening is prohibitively expensive, so programs must be as targeted as possible to ensure efficiency.</td>
</tr>
<tr>
<td>V. Identification of High-Risk Groups</td>
<td>This study contributes significantly in identifying critical groups who should be specifically included in any suicide prevention intervention in this population. The epidemiological data identified two high-risk groups of individuals (children and youth, the friends and relatives of suicide victims) and one high-risk community (aldeia Bororo). Interventions must be designed to address the stresses and circumstances experienced by these groups.</td>
</tr>
</tbody>
</table>
As far as the inclusion of the appropriate community and institutional partners, this thesis project effectively galvanized relevant interested parties, which each bring essential and diversified expertise. The community stakeholders possess an intricate understanding of the fabric of their community and are best positioned to identify and recruit the appropriate individuals to organize and moderate interventions in the aldeias. Despite the involvement of many outside organizations, the best individuals to directly present the program to the population are recognizable, trusted community figures including indigenous educators, community health agents, and cultural leaders, most of whom were included in the focus group interviews and expressed interest in being involved in prevention programming. DSEI Polo Base Dourados has an expertise in preventative health program implementation in this setting and is ultimately responsible for allocating and providing healthcare resources. Collaborators at the School of Public Health at UFGD are uniquely positioned to offer local academic support in terms of developing an evidence-based preventative health program that incorporates as much efficacy data as possible into the final design. Finally, the most distant partners, those at Yale School of Medicine, are in a position to offer insight into specific research questions and gaps in knowledge through rigorous scientific methods. The close partnership between the indigenous communities, the indigenous health-care agency, and local and international research institutions in this study could be a model for an academic-local community global partnership.

The data on the efficacy of different indigenous suicide prevention program models is very limited. In general, such programs are developed and implemented
in settings with limited financial resources, and as may be expected, the resources are reserved for program design and implementation rather than efficacy analysis. Clifford, Doran, and Tsey performed the only available high-quality systemic review of suicide prevention interventions for indigenous people.\textsuperscript{12} They performed a comprehensive assessment of the types of programs that have been developed and importantly the types of programs that have been successful in indigenous settings. Although limited by the number of published studies, this meta-analysis described several types of programs that have been effective, including gatekeeper training,\textsuperscript{48,49} education interventions for students,\textsuperscript{50} and community-wide programs.\textsuperscript{51-53} Systematic screening is another intervention which has been effective in non-indigenous populations\textsuperscript{54} and could identify those at-risk of suicide as well as determine the prevalence of other behaviors such as substance abuse, self-harm, and suicidal ideation. Incorporating suicide prevention strategies that have demonstrated efficacy into a suicide prevention program in the study communities is critical to maximizing the likelihood of success.

The epidemiology of suicide that was elucidated in this study identified two high-risk groups of individuals (children and youth, the friends and relatives of suicide victims) and one high-risk community (aldeia Bororo, which has a large population and a high suicide burden). Given the young age at which suicides occur in the aldeias, a community-wide intervention aimed at increasing knowledge of suicide and increasing protective behaviors such as awareness about alcohol consumption and the importance of directed adult mentorship of children could be effective.\textsuperscript{51} Such a program could draw on the existing talents of community
members such as, educators, leaders, health care providers and community health agents to minimize costs and maximize impact. Despite its prevalence, suicide may represent the tip of the iceberg of child psychosocial distress in this population. For this reason, community-wide screening for suicidal behaviors, including prior suicide attempts and suicidal ideation would be tremendously informative. Large-scale screening is prohibitively expensive, but the potential benefit is great if screening is targeted at children in Bororo. A final possibility, and one that has already been implemented, is timely intervention with friends and relatives of suicide victims. Currently, the DSEI Polo Base Dourados psychologist meets with those affected by a suicide to reconstruct the circumstances that preceded the suicide and assess proximate individuals' need for counseling.

Finally, by investigating aldeia-level and ethnic group differences in suicide epidemiology, this study was able to raise important questions regarding commonly held beliefs about the causes of suicide and to highlight the important role that structural barriers to educational and economic opportunities play in exposing whole communities to known suicide risk factors. Lack of access to education and employment results in decreased socioeconomic opportunities, which results in poverty and contributes to community and family disintegration. At the individual-level this lack of economic opportunity may predispose individuals to substance abuse, hopelessness, and ultimately suicide. Therefore, I strongly recommend interventions that decrease the structural barriers to economic success, specifically improving access to educational opportunities, job training, affordable childcare and improving public transportation to Dourados.
Acknowledgements

I would like to thank the tireless support of my faculty mentor, Dr. Robert Rohrbaugh, who began advising me on this project during the fall of my first year of medical school when I successfully applied for a Downs International Travel Fellowship. I am grateful for Dr. Rohrbaugh’s willingness to take on a totally new project and for his support during the project’s planning stages, while I was in Brazil, and for the past several years in New Haven as I developed a manuscript and eventually a thesis from the project. Although I will not be going into Psychiatry, I greatly look forward to working with Dr. Rohrbaugh in my future pursuits, whether it is organizing an international elective for Yale Medical Students or seeking his advice on how to compassionately and responsibly improve the delivery of medical care in different international settings. In Dr. Rohrbaugh, I have found a cherished career-long mentor and a dear, lifelong friend.

I would like to thank Dr. Julio Croda and Dr. Christolne Gonçalves for their hospitality during my time in Brazil and for the immense amount of time and energy that they put into mentoring me and ensuring the success of this project. I would likewise like to thank Dr. Albert Ko for his support and mentorship from the earliest planning stages of this project.

I would also like to thank my wife, Melissa, for accompanying me to Brazil for the summer of 2014 during which we made countless trips to the reservation communities that made up the study population. Her thoughtful consideration of the devastating situation and nuanced insights are certainly reflected in this thesis.
This thesis research was made possible through the generous financial support of the Wilbur Downs International Health Student Travel Fellowship and the Bertram H. Roberts Memorial Fund.

**Conflicts of Interest**

The author has no conflicts of interest to disclose.
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