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TEENAGE MOTHERS IN THE BRAZILIAN LEGAL AMAZON REGION AND MUNICIPAL INDICATORS OF INCOME EDUCATION AND POSSESSION OF COMPUTERS AND INTERNET ACCESS

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ABSTRACT

Teenage pregnancy is a public health issue due to the prevalence of complications for both the mother and child, and the Brazilian Legal Amazon has a high rate of teenage motherhood compared to other regions of the country. Among the strategies adopted by health managers, information communication technologies, when utilized in sexual education projects, can help in the dissemination of information on the use of contraceptives and other guidance for delaying pregnancy and reducing the chances of second pregnancies. We use the 2010 Brazilian Demographic Census, conducted by the Brazilian Institute of Geography and Statistics, to compile data on (i) households with computers and Internet access and (ii) women classified by age group who had children. These data are analyzed along with municipal indicators on income and education. To understand this phenomenon at the municipality level, we use Bayesian networks to reveal dependencies among the variables studied. First, for municipalities in Brazilian Legal Amazon with the lowest percentage of households with computers and Internet access (<5.58%), there is a probability of 0.751 of finding a high incidence of teenage mothers (≥ 8.24%). The probability is 0.269 for the municipalities in other regions of the country. Second, if a municipality in Amazon has an indicator of municipal income less than 0.500, there is a probability of 0.762 that this municipality will present a high percentage of teenage mothers (≥ 8.24%), while this probability decreases to 0.286 when the municipality is in any other region. Based on the results of Bayesian networks, we discuss the association between teenage motherhood, region (Amazon, other), possession of computer and Internet access, and indicators of income and education in the municipalities. This study reveals the unequal conditions that health workers and managers can address in implementing projects using information communication technology in Amazon municipalities.

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INTRODUCTION

Pregnancy during adolescence (10–19 years) accounts for around 11% of births worldwide (World Health Organization, 2011), and has been considered as a public health issue in several countries.

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Such pregnancies present obstetrician complications, risking both the mother and the child, in addition to psychosocial and economic issues (Yazlle, 2006). Although teenage pregnancy is not restricted to developing nations, 95% of such cases do occur in developing nations (World Health Organization, 2011). Adolescence is a fundamental stage in a person's development, and it includes opportunities in education and skill improvement that promote success in adult life. In Brazil, the phenomenon of pregnancy during adolescence is

associated with social vulnerability in that it occurs frequently in environments with restricted opportunities, few life options, and low indices of education (Martinez *et al.,* 2011). Due to multi-causal features and consequent impacts on life and the health of adolescents and their parents, premature pregnancy is discussed in the literature in relation to low socio-economic level (Martinez *et al.,* 2011; Simões *et al.,* 2003; Goicolea *et al.,* 2009; Berquó *et al.,* 2012), impact on life and health of both adolescents and babies (Ganchimeg *et al.,* 2014), restricted access to health services (Chandra-Mouli *et al.,* 2013), sexual abuse (Madigan *et al.,* 2014), and risky behaviors relating to drug and alcohol use in the family context (Caputo and Bordin, 2008). Indeed, research in public health has long established a link between social factors and health outcomes (Bekalu, 2014). Health knowledge plays an important role in health education and promotion (Chaoguang *et al.,* 2017). Access to health information is a fundamental tool to develop life skills and to encourage girls to delay marriage and childbearing (Baltag, 2009). In this sense, part of the WHO guidelines (World Health Organization, 2011)on preventing early pregnancy are based on information provision, sexuality and health education, life skills building, contraception counselling and service provision, and facilitating access to and use of contraceptive information and services .Studies (Cheng *et al.,* 2008; Chong *et al.,* 2013; Lou *et al.,* 2006; Jones, 2012) have successfully employed in formation and communication technologies (ICTs) that contribute to sexual education of youngsters and adolescents with respect to dissemination of information on using contraceptives and awareness of sexually transmitted diseases. Wesought to analyze the occurrence of teenage motherhood in the municipalities of Brazilian Legal Amazon in comparison to other regions of the country. The analysis relates teenage motherhood to municipal indicators of income, education, and owning a computer with access to the Internet at home.

MATERIALS AND METHODS

Study area

The Brazilian Legal Amazon is a political-administrative division corresponding to the entire states of Acre (AC), Amapá (AP), Amazonas (AM), Pará (PA), Rondônia (RO), Roraima (RR), and Tocantins (TO),as well as part of the states of Mato Grosso (MT) and Maranhão (MA). According to the Brazilian Institute of Geography and Statistics (Instituto Brasileiro de Geografia e Estatística; IBGE; http://www.ibge.gov.br), the Brazilian Legal Amazon has an area of approximately 5,217,423 km², which represents approximately 61% of Brazilian territory, and its population corresponds to 12.32% of the inhabitants of Brazil (2010). The term "Brazilian Legal Amazon" will be referred to as simply "Amazon" henceforth.

Study design and population

In this study, we use data from the Household and People Survey of the Demographic Census 2010, performed in all municipalities by the IBGE. The survey collected information about 57,320,474 households whose residents were asked about "owninga personal computer and Internet access," and 16,869,228 women (10–19 years) who answered the census question "Do you have children who were born on or before July 31, 2010?"Our study was conducted in 5,507 municipalities, 756 of which are located in the Amazon, using the administrative division of the country in the year 2000 as a reference. In this study, we also use municipal indicators of education and income.

Data sources

We use the public System of Automatic Recovery of the IBGE (Sistema IBGE de Recuperação Automática; SIDRA; http://www.sidra.ibge.gov.br) to collect information from the Demographic Census 2010 with respect to (i) the number of households with computer and Internet access and (ii) the number of women (10–19 years) in total and those with children bornon or before July 31, 2010, according to the municipality of residence. Our sample comprised 57,320,474 households and 1,044,124 teenage mothers from 16,869,228 girls (10–19 years) who were then divided by age group (10–14 and 15–19 years). Additionally, we collected2010 education and income indicators for each municipality from the platform Atlas of Human Development in Brazil (Atlas do Desenvolvimento Humano no Brasil; ATLASBRASIL; http://www.atlasbrasil.org.br). These indicators are components of the Municipal Human Development Index (MHDI). To support the discussion, we use data from the National Household Sample Survey 2013 (Pesquisa Nacional porAmostra de Domicílios; PNAD), obtained from the IBGE SIDRA system and the Brazilian Communication Ministry (Ministério das Comunicações do Brasil; MiniCom; http://www.mc.gov.br/DSCOM/view/Principal.php) with respect tolow-cost Internet access with a speed of at least 1Mbpsand mobile broadband infrastructure (3G technology) in Brazilian municipalities.

Methods

Five indicators are used to investigate the associations among representative variables of teenage mothers (10–19 years), Internet access, and information on income and education in Amazon municipalities with respect to other municipalities in Brazil. Teenagemothers. This value is obtained by X/Y*100, where X is the total number of women with children in the municipality classified by age group and Y is the total number of women within that age group in the municipality. We consider age groups according to the data available from the IBGE (10–14 and 15–19 years) within the 10–19 age group. MHDI income. Corresponds to the component "income" of the MHDI. This is provided by ATLASBRASIL for each municipality of the country. The Institute for Applied Economic Research (Instituto de Pesquisa Econômica Aplicada; IPEA) (2013) classifies the value of MHDI income between 0 and 1 as follows: very high (above 0.800), high (0.700–0.799), medium (0.600–0.699), low (0.500–0.599), and very low (0.000–0.499). We used the same classification with a minor change. We combined" very high" and "high" ("high," above 0.700) due to the low percentage of municipalities with MHDI income = "very high." MHDI education. Corresponds to the component "education" of the MHDI. This is provided by ATLASB RASIL based on the geometrical average of the frequency sub-index of children and youngsters in school (weight 2/3) and the education sub-index of the adult population (weight 1/3). The IPEA (2013) classifies the value of MHDI education between 0 and 1 as follows: very high (above 0.800), high (0.700–0.799), medium (0.600–0.699), low (0.500–0.599), and very low (0.000–0.499). As with MHDI income, we combined" very high" and "high" ("high," above 0.700) due to the low percentage of municipalities with

Table 1. Variables, Categories, and Descriptions

	Variable	Category	Description
1.	*teenage_mothers*	low	0.00 ≤ Teenage mothers < 4.68
		medium	4.68 ≤ Teenage mothers < 6.34
		high	6.34 ≤ Teenage mothers < 8.24
		very high	Teenage mothers ≥ 8.24
2.	*mhdi_income*	very low	0.000 ≤ MHDI Income ≤ 0.499
		low	0.500 ≤ MHDI Income ≤ 0.599
		medium	0.600 ≤ MHDI Income ≤ 0.699
		high	MHDI Income ≥ 0.700
3.	*mhdi_education*	very low	0.000 ≤ MHDI Education ≤ 0.499
		low	0.500 ≤ MHDI Education ≤ 0.599
		medium	0.600 ≤ MHDI Education ≤ 0.699
		high	MHDI Education ≥ 0.700
4.	*Region*	Amazon	Region = Amazon
		Other	Region = Other
5.	*households_internet*	very low	0.00 ≤ Households with computer and Internet < 5.58
		low	5.58 ≤ Households with computer and Internet < 12.00
		medium	12.00 ≤ Households with computer and Internet < 22.02
		high	Households with computer and Internet ≥ 22.02

Table 2. Datasets, Variables, andInput File

Dataset	Variable	Input File (lines × columns)
A	*mhdi_income, mhdi_education, region, teenage mothers*	5507 × 4
B	*region, teenage mothers, households_internet*	5507 × 3
C	*mhdi_income, mhdi_education, region, households_internet*	5507 × 4

MHDI education = "very high." Region. Refers to the location of the municipality, i.e., whether it is in the Amazon or not, assuming the values "Amazon" or "other."This is relevant because it identifies characteristics (by means of association with values of other variables) that are common to the municipalities in the Amazon. For us, municipalities located in "other regions"are outside the Amazon region, meaning that they are Brazilian municipalities located in any other region. Households with computer and Internet access. Corresponds to the percentage of households that have a computer with Internet access within a certain municipality. This value is determined by X/Y*100, where X is the number of households in the municipality that answered "Yes" to the 2010 census question on" owning a personal computer and Internet access," and Y is the total number of households in the municipality (also provided by IBGE). Data were integrated into a single database using the identifier of the municipalities that is common across all the data sources as a key (in Brazil, there is a numeric code for each municipality). Then, we compared the average percentage of teenage mothers in the Amazon against the average percentage in other regions. Table 1 summarizes variables, categories, and ranges according to the five indicators considered. Thus, the continuous quantitative variables—teenage_mothers and households_internet—have been discretized based on the frequency method that yielded four groups. Each group represents around 25% of the records. Variables mhdi_education and mhdi_incomewere previously discretized when we adopted the classification based on IPEA (2013). In order to measure the association between variables, we use Bayesian networks. Bayesian networks are models that encode probabilistic relationships among variables representing a certain domain. These models include a qualitative and a quantitative structure. The qualitative structure represents dependencies between nodes (variables), while the quantitative structure represents conditional probabilities of these nodes. The idea is evaluate the nodes in probabilistic terms (Chen *et al.,* 2001) and provide a compact and easy-to-use representation of the probabilistic information from the data.

The network structure is an effective way to communicate dependencies among the domain variables. Once the network is established, the posterior distribution of the parameters is estimated by statistical inference. Inference is computed using a Conditional Probability Distribution (P) using quantitative information of the Bayesian network. We use the Bayesian belief network as a model of probabilistic dependency, where the key feature is the explicit representation of the conditional independence and dependence among events.The joint probability of any particular instantiation of all nvariables Xin a belief network can be calculated as showin Equation (1)(Cooper and Herskovits, 1992).

$$P(X_i,...,X_n) = \prod_{i=1}^{n} [P(X_i \mid \pi_i),] \quad \text{.....(1)}$$

Where $\pi_i$represents the instantiation of the parents of X_i.

We used the Bayesware Discoverer (http://open.bu.edu/handle/2144/1288) programto find the most probable Bayesian network structure within the search space based on the K2 heuristic search algorithm (Cooper and Herskovits, 1992). We also used the program to calculate the conditional probabilities of the selected Bayesian networks. Based on the variables in Table 1, compositions were made among them to create datasets, as seen in Table 2. These datasets were used as input files during the process of Bayesian analysis. We then used ArcGis software version 9.3 (Environmental Systems Research Institute, Redlands, CA, USA) to evaluate the geographic distribution of the percentage of teenage mothers and of households with computers and Internet access in the Brazilian municipalities as the geographical units of analysis.

RESULTS

In the 5507 municipalities that were analyzed, 1,044,124 of teenagers (10–19 years) said that they had children who were born on or before July 31, 2010. Among these adolescents, 37,094 were in the age group of 10–14 years and 1,007,030 were 15–19 years. The average percentage of teenage mothers

(10–19 years) is significantly greater in Amazon municipalities (9.58%) than it is in other regions of Brazil (6.16%). This is true in both the 10–14 and 15–19 age groups (Table 3).

Table 3. Teenage Mothers by Region and Age Group (%) in 2010

Region	Teenage Mothers (%)		
	10–19 years	10–14 years	15–19 years
Amazon	9.58	0.74	19.52
Other	6.16	0.34	12.09

Of the 756 municipalities of Amazon that were analyzed, 88% (665 municipalities) have a high or very high occurrence of teenage mothers (over 6.34%). In fact, when we observe the 50 municipalities (regardless of region) with the highest percentage of teenage mothers (10–19 years), 38are in the Amazon region. A common characteristic of these municipalities is that they have small populations (less than 50,000 inhabitants). Table 4 presents the 10 municipalities with the highest percentage of teenage mothers in Brazil. Of these, only one does not belong to the Amazon region (AntônioJoão, MS).

Table 4. Municipalities with the Highest Percentage of Teenage Mothers

State	Amazon?	Municipality	Teenage mothers (%)
PA	Yes	Jacareacanga	21.79
AM	Yes	Silves	18.84
MT	Yes	General Carneiro	18.80
MT	Yes	Campinápolis	18.74
TO	Yes	Santa Maria do Tocantins	18.21
MS	No	AntônioJoão	17.97
RR	Yes	Amajari	17.31
AP	Yes	Calçoene	16.93
AM	Yes	Jutaí	16.87
TO	Yes	Tupirama	16.78

With dataset A as input, the Bayesian network structure that was selected presents the target variable teenage_mothersas directly dependent onmhdi_education and region (Fig. 1).

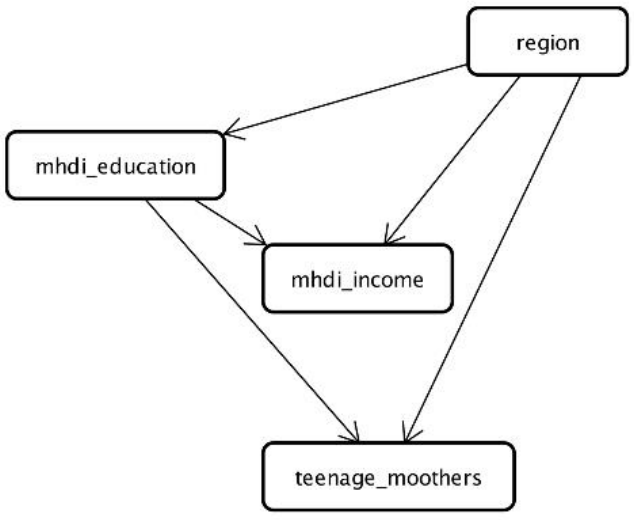

Fig. 1. Bayesian Network Produced from Dataset A

If a municipality in Amazon has a very low or low MHDI education, there is a probability of 0.780 and 0.627, respectively, that this municipality will have a large percentage of teenage mothers. These values fall to 0.296 and 0.207 when the municipality is in any other region. Table 5 shows the conditional probability distribution of teenage_mothers considering values forregion and mhdi_education.

Table 5. Conditional Probabilities for teenage_mothers from region and mhdi_education

Region	*mhdi_education*	*teenage_mothers*			
		low	medium	high	very high
Amazon	Very low	0.009	0.023	0.188	0.780
	low	0.029	0.121	0.223	0.627
	Medium	0.094	0.259	0.353	0.294
	high	0.003	0.272	0.362	0.362
Other	Very low	0.168	0.221	0.316	0.296
	low	0.250	0.265	0.278	0.207
	Medium	0.357	0.319	0.216	0.108
	high	0.564	0.316	0.088	0.032

On the other hand, for a municipality with a high MHDI education that did not belong to Amazon, the probability of a low percentage of teenage mothersis0.564, while the effect of high education is almost non-existent (0.003) when the municipality is within Amazon. The Bayesian network shows that the variable teenage_mothersis directly affected by region and mhdi_education (Fig. 1), although the influence of mhdi_incomeon teenage_mothers is also high, as seen in Table 6. For example, if a municipality in Amazon has a very low MHDI income, there is a probability of 0.762 that this municipality will have a higher percentage of teenage mothers. This probability decreases to 0.286 when the municipality is in any other region. On the other hand, if a municipality that does not belong to Amazon has a high MHDI income, there is a probability of 0.382 that this municipality has a low percentage of teenage mothers. This probability is 0.063 when the municipality belongs to Amazon. Table 6 shows these probability distributions of teenage_mothers with regard toregion and mhdi_income.

Table 6. Conditional Probabilities for *teenage_mothers*Based on*region* and *mhdi_income*

region	*mhdi_income*	*teenage_mothers*			
		low	medium	high	very high
Amazon	very low	0.011	0.035	0.192	0.762
	low	0.018	0.062	0.204	0.717
	medium	0.034	0.121	0.236	0.609
	high	0.063	0.219	0.316	0.402
Other	very low	0.177	0.225	0.312	0.286
	low	0.197	0.236	0.302	0.265
	medium	0.280	0.278	0.259	0.182
	high	0.382	0.309	0.200	0.109

The Bayesian network shown in Fig. 2 results after applying dataset B. Here, the variable teenage_mothersis negatively influenced by househo lds_internet. By querying the network, we can respond to the association between region, house holds_internet, and teenage_mothers. If a municipality in Amazon has a low percentage of households with computer and Internet access (<5.58%), there is a probability of 0.751 that this municipality will have a high percentage of teenage mothers. For municipalities in other regions, this probability is 0.269. Table 7 shows the conditional probabilities of teenage mothers given the effects of region and households_internet. Dataset C was processed to produce the Bayesian network shown in Fig. 3. It suggests that the influence of households with computer and Internet access on percentages of teenage mothers in Brazilian municipalities may be justified based on the association found between households_internet and

mhdi_income, mhdieducat ion, and region. The variable mhdi_education most positively affects households internet and mhdiincome; a municipality with a high MDHI education has a probability of 0.903 and 0.937 of showing a high MHDI income and a high percentage of households with computer and Internet access (over 22.02%), respectively.

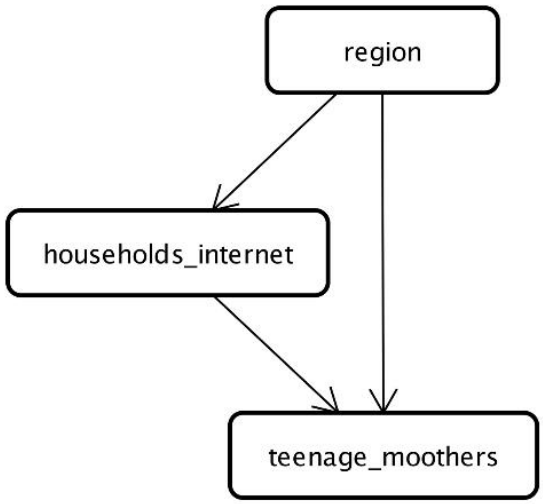

Fig. 2. Bayesian Network Produced from Dataset B

Table 7. Conditional Probabilities for *teenage_mothers* Based on*region* and *households_internet*

region	*households _internet*	*teenage_mothers*			
		low	medium	high	very high
Amazon	very low	0.009	0.043	0.197	0.751
	low	0.031	0.130	0.191	0.648
	medium	0.104	0.151	0.321	0.424
	high	0.001	0.326	0.369	0.304
Other	very low	0.168	0.248	0.315	0.269
	low	0.216	0.244	0.290	0.250
	medium	0.318	0.263	0.239	0.180
	high	0.399	0.331	0.194	0.076

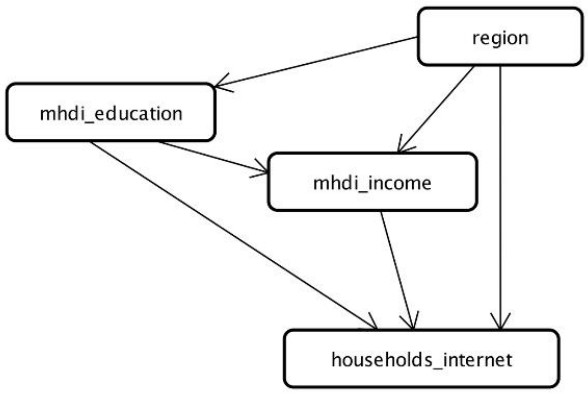

Fig. 3. Bayesian Network Produced from Dataset C

However, this is not a typical scenario in the Amazon region. In fact, the probability that such a municipality is not in Amazon is 0.968. The spatial distribution of the percentage of teenage mothers and percentage of households with computer and Internet access in the Brazilian municipalities contributes to understanding the relationships among these indicators. The thematic map in Fig. 4 shows, for example, municipalities with an elevated rate of teenage mothers in Amazon (over 8.23%). Most of these municipalities also have a low or a very low percentage of households with computer and Internet access (below 5.58%), as can be observed in Fig. 5. These are the characteristics of AM, RR, AP, TO, MA,and AC,all of which belong to Amazon.

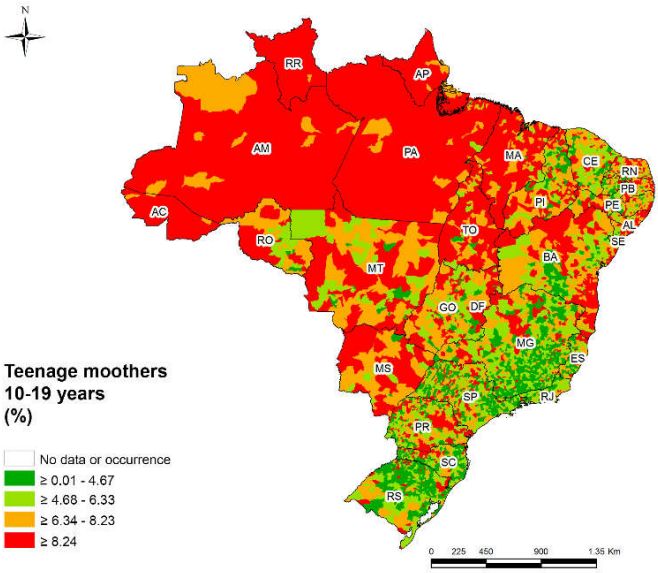

Fig. 4. Spatial Distribution of Teenage Mothers

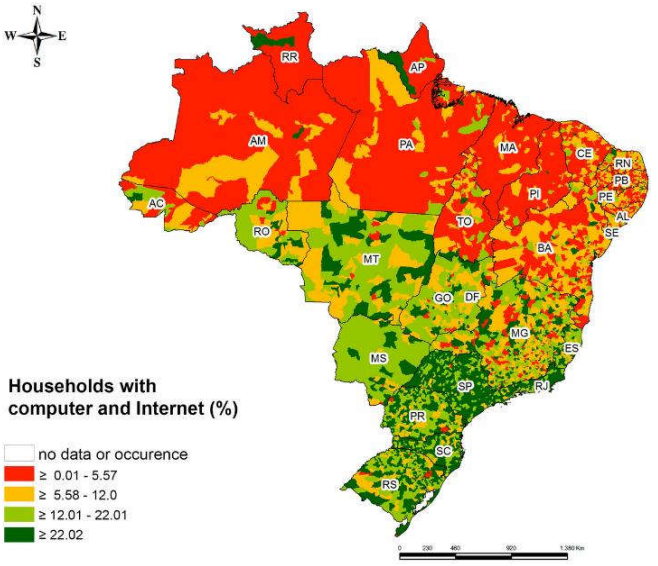

Fig. 5. Spatial Distribution of Households with Computer and Internet Access

DISCUSSION

This study reveals a high occurrence of teenage mothers in the municipalities of Amazon, drawing from the total number of teenagers (10–19 years) and the number of those who had children born on or before July 31, 2010. The association between teenage motherhood and the representative variables of income, education, and computer and Internet access is analyzed using Bayesian networks. These networks pointed to the region as the influential variable on the high percentages of teenage mothers and households with computer and Internet access. The Bayesian networks show an association between teenage motherhood and low education and income indicators, an association already confirmed in previous studies (Martinez *et al.,* 2011; Simões *et al.,* 2003; Goicolea *et al.,* 2009; Berquó *et al.,* 2012). In Brazil, based on the IBGE Demographic Census of 2010, it has been demonstrated that those with

higher levels of education and income also tend to have computers with Internet access (Neri *et al.,* 2012). Our approach relates teenage mothers, income, and education to computers and Internet access, identifying common features in the municipalities of Amazon. Just like in Martinez *et al.* (2011), our study investigates the social phenomenon of teenage motherhood in its collective occurrence (municipalities), rather than on the individual level. That is, an association observed for the municipality does not necessarily occur on the individual level. The results corroborate those of other studies on small groups of women that relate teenage motherhood with the environment in which they live (Martinez *et al.,* 2011; Simões *et al.,* 2003; Berquó *et al.,* 2012). Although the determinants of teenage pregnancy involve social elements that are extremely complex and difficult to address, it is fundamentally important to provide information and guide youngsters on adequate use of contraceptive methods towards the prevention of early pregnancy (World Health Organization, 2011). According to Chandra-Mouli *et al.* (2013), efforts to provide adolescents with accurate information about contraceptives must be carried out in combination with sexuality education. Online sexual education may be an alternative method towards providing such education. For instance, Simon and Dan eback (Simon and Daneback, 2013) pointed out that youngsters rely on the Internet as a resource for health information. In schools in Shanghai, Internet sexual education increased students' knowledge of reproductive health and contributed to attitude changes with respect to sex-related questions (Lou *et al.,* 2006). For Jones (Jones, 2012), in online sex education, demonstrations of the appropriate use of contraceptives might promote adequate utilization among sexually active young people. In this sense, lack of access is a barrier to the use of the Internet for promoting sexual education in these municipalities. A limitation of our study is related to the impossibility of conducting a time series (historical) analysis of the association between variables. This is because the variable studied (households with computers and Internet access) was only included in the Demographic Census in 2010, when the last census was conducted. Despite this limitation, we observed data from the National Household Sample Survey 2013 (PNAD), which is a sample survey that provides indicators at the state level—it is not performedon municipalities. According to the analysis of these data, all the states of Amazon presented a high percentage of girls between 15 and 19 years with children as follows: AM (2.86%), AP (2.7%), AC (2.42%), RO (2.33%), TO (2.14%), and PA (2.01%). States within Amazon also have a low representation of households with computers and Internet access compared to the average of Brazil (42.41%):MA (15.96%), PA (19.87), TO (24.8%), AC (25.25%), RO (25.27%), AP (25.57%), AM (28.36%), RO (29.92%), andMT (35.73%).In short, for states, there were no significant changes in 2013 from the 2010 scenario.

Even when we observe the most recent data from the Ministry for Communications on infrastructure investments for accessing Internet in the municipalities (MiniCom, http://www.mc.gov.br/DSCOM/view/Principal.php), such as mobile broadband (3G Technology) coverage and the National Plan of Broadband, as of November 2014, several municipalities are not included for these services. This is the case for Pracuúba (AP) and Cachoeira Grande (MA),which have 14.29% and 9.56% rates of teenage mothers, respectively. In the 2010 Census, these municipalities did not have households with computer and Internet access. Our analysis suggests the need to conduct local studies on an individual basis to understand the relationship between teenage motherhood and other variables in a social context linked to the environment in which the teenagers live in the Amazon region. Finally, we are not suggesting that poor Internet access is the main cause of teenage pregnancy. In fact, studies indicate that many factors determine the high rates of teenage pregnancy, including low socio-economic level (Martinez *et al.,* 2011; Berquó *et al.,* 2012), restricted access to health services (Chandra-Mouli *et al.,* 2013), sexual abuse (Madigan *et al.,* 2014), and environment in which the teenage girls live (Martinez *et al.,* 2011; Goicolea *et al.,* 2009; Berquó *et al.,* 2012). However, with the expansion of Internet access and use of social networks, a growing number of works have proposed and positive evaluated the use of ICTs to support sex education (e.g. online sex education) (Lou *et al.,* 2006; Jones, 2012; Simon and Daneback, 2013) and to improve the public health (Bekalu, 2014). The implementation and improvement of Internet access infrastructure and its use will not prevent the teenage pregnancy, but in this study, we show that the planning and execution of Internet-based information dissemination projects remain largely unfeasible for health workers and managers working in many localities of the Amazon.

REFERENCES

Baltag, V. 2009. Adolescent pregnancy: a culturally complex issue. Bull World Health Organ. 87: 410-11. doi: 10.1590/S0042-96862009000600005.

Bekalu, MA. 2014. Communication inequalities and health disparities. Information Development, 30(2), 189-191.

Berquó, E., Garcia, S. and Lima, L. 2012. Youth and reproduction: demographic, behavioral and reproductive profiles in the PNDS-2006. Rev Saúde Pública. 46(4):685-93.

Caputo, VG. and Bordin, IA. 2008. Teenage pregnancy and frequent use of alcohol and drugs in the home environment. RevSaúdePública. 2008;42(3): 402-10. doi: 10.1590/S0034-89102008000300003.

Chandra-Mouli, V., Camacho, AV. and Michaud, P-A. 2013. WHO guidelines on preventing early pregnancy and poor reproductive outcomes among adolescents in developing countries. *J Adolesc Health.,* 2013;52(5): 517-22. doi: 10.1016/j.jadohealth.2013.03.002.

Chaoguang, H., Feicheng, M., Yifei, Q. and Yuchao, W. 2017. Exploring the determinants of health knowledge adoption in social media: An intention-behavior-gap perspective. *Information Development*, 0266666917700231.

Chen, Z. 2001. Data mining and uncertain reasoning: an integrated approach. New York: John Wiley & Sons. 392 p.

Cheng, Y., Lou, C-H., Mueller, LM., Zhao, S-L., Yang, J-H., Tu, X-W. and Gao, E-S. 2008. Effectiveness of a school-based AIDS education program among rural students in HIV high epidemic area of China. *J Adolesc Health.,* 42(2): 184-91. doi: 10.1016/j.jadohealth.2007.07.016.

Chong, AM., Gonzalez-Navarro, M., Karlan, D. and Valdivia, M. 2013. Effectiveness and spillovers of online sex education: evidence from a randomized evaluation in Colombian public schools. *National Bureau of Economic Research*, w18776:1-26.

Cooper, GF. and Herskovits, E. 1991. A Bayesian method for the induction of probabilistic networks from data. Mach Learning. 9(4): 309-47. doi: 10.1007/BF00994110

Ganchimeg, T., Ota, E., Morisaki, N., Laopaiboon, M., Lumbiganon, P., Zhang, J., Yamdamsuren, B., Temmerman, M., Say, L., Tunçalp, Ö., Vogel, JP., Souza, JP. and Mori, R. 2014. WHO Multicountry Survey on Maternal Newborn Health Research Network. Pregnancy and childbirth outcomes among adolescent mothers: a World Health Organization multicountry study. BJOG: *Int J ObstetGy.,* 121(s1): 40-8.

Goicolea, I., Marianne, W., Ohman, A. and San Sebastian, M. 2009. Risk factors for pregnancy among adolescent girls in Ecuador's Amazon basin: a case-control study. Rev PanamSaludPublica. 2009;26(3): 221-8. doi: 10.1590/S1020-49892009000900006.

IPEA, 2013. Índice de Desenvolvimento Humano Municipal Brasileiro. Brasília: Programa das NaçõesUnidas para o Desenvolvimento - PNUD. 96p. Portuguese.

Jones, A. 2012. Computer-based sex education for high school students. Evidence-Based Practice Project Reports. Paper 14. Available from:http://scholar.valpo.edu/ebpr/14.

Lou, C-H., Zhao, Q., Gao, E-S. and Shah, IH. 2006. Can the Internet be used effectively to provide sex education to young people in China? *J Adolesc Health*., 39(5): 720-8. doi: 10.1016/j.jadohealth.2006.04.003.

Madigan, S., Wade, M., Tarabulsy, G., Jenkins, JM. and Shouldice M. 2014. Association between abuse history and adolescent pregnancy: ameta-analysis. *J Adoles Health.,* 2014; 55(2): 151-9. doi: 10.1016/j.jadohealth.2014.05.002.

Martinez, EZ., Roza, DLD., Caccia-Bava, MCGG., Achcar, JA. and Dal-Fabbro, AL. 2011. Teenage pregnancy rates and socioeconomic characteristics of municipalities in São Paulo State, Southeast Brazil: a spatial analysis. Cad Saude Publica. 27(5): 855-67.

Neri, MC., Melo, LCC., Sacramento, SR., Gomes, RW., Lipkin, P., Cavalcante, T., et al., 2012. Mapa da inclusão digital. Neri MC, editor. Rio de Janeiro: FundaçãoGetúlio Vargas. Portuguese.

Simões, VMF., Silva, AAM., Bettiol, H., Lamy-Filho, F., Tonial, SR. and Mochel, EG. 2003. Características da gravidez na adolescência em São Luís, Maranhão. Rev SaúdePública. 37(5): 559-65. Portuguese.doi: 10.1590/S0034-89102003000500003.

Simon, L. and Daneback, K. 2013. Adolescents'use of the Internet for sex education: a thematic and critical review of the literature. *Int J Sex Health.,* 25(4): 305-19. doi: 10.1080/19317611.2013.823899

World Health Organization, 2011. WHO guidelines on preventing early pregnancy and poor reproductive health outcomes among adolescents in developing countries: Geneva: World Health Organization.

Yazlle MEHD, 2006. Gravidez na adolescência. Rev Bras Ginecol Obstet. 28(8): 443-5. Portuguese.doi: 10.1590/S0100-72032006000800001.

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