Study of Health in Pomerode (SHIP-Brazil): aims, methodological issues and descriptive results

Ernani Tiaraju de Santa Helena, Clóvis Arlindo de Sousa, João Luiz Gurgel Calvet da Silveira, Carlos Roberto de Oliveira Nunes, Luciane Coutinho de Azevedo, Luana Gabriele Nilson, Caroline Valente, Rosana Leal do Prado, Caio Mauricio Mendes de Cordova, Keila Zaniboni Siqueira Batista, Tatiani Karini Rensi Botelho, Angela Duebbers Cunha, Siegmar Starke, Sergio Luiz Zimmermann, Nágila Raquel Teixeira Damasceno, Raul Dias Santos, Till Ittermann, Henry Völzke, Marcello Ricardo Paulista Markus

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Estudo Vida e Saúde em Pomerode (SHIP-Brazil): objetivos, aspectos metodológicos e resultados descritivos.

AUTHORS:

Ernani Tiaraju de Santa Helena
Programa de Pós-Graduação em Saúde Coletiva – Universidade Regional de Blumenau, Blumenau, Brasil.
ORCID: https://orcid.org/0000-0002-1337-6723

Clóvis Arlindo de Sousa
Programa de Pós-Graduação em Saúde Coletiva – Universidade Regional de Blumenau, Blumenau, Brasil.
ORCID: https://orcid.org/0000-0001-5049-5345

João Luiz Gurgel Calvet da Silveira
Programa de Pós-Graduação em Saúde Coletiva – Universidade Regional de Blumenau, Blumenau, Brasil.
ORCID: https://orcid.org/0000-0003-0100-3302

Carlos Roberto de Oliveira Nunes
Programa de Pós-Graduação em Saúde Coletiva – Universidade Regional de Blumenau, Blumenau, Brasil.
ORCID: https://orcid.org/0000-0001-6301-4053

Luciane Coutinho de Azevedo
Programa de Pós-Graduação em Saúde Coletiva – Universidade Regional de Blumenau, Blumenau, Brasil.
ORCID: https://orcid.org/0000-0001-5574-9092

Luana Gabriele Nilson
Programa de Pós-Graduação em Saúde Coletiva – Universidade Regional de Blumenau, Blumenau, Brasil.
ORCID: https://orcid.org/0000-0003-3224-6294

Caroline Valente
Programa de Pós-Graduação em Saúde Coletiva – Universidade Regional de Blumenau, Blumenau, Brasil.
ORCID: https://orcid.org/0000-0002-3816-3871

Rosana Leal do Prado
Programa de Pós-Graduação em Saúde Coletiva – Universidade Regional de Blumenau, Blumenau, Brasil.
ORCID: https://orcid.org/0000-0002-5897-2799

Caio Mauricio Mendes de Cordova
Programa de Pós-Graduação Química– Universidade Regional de Blumenau, Blumenau, Brasil.
ORCID: https://orcid.org/0000-0001-6090-0367

Keila Zaniboni Siqueira Batista
Departamento de Ciências Naturais (DCN) e Programa de Pós-Graduação em Ensino de Ciências Naturais e Matemática (PPGECIM) – Universidade Regional de Blumenau, Blumenau, Brasil.
ORCID: https://orcid.org/0000-0001-5644-3650

Tatiani Karini Rensi Botelho
Programa de Pós-Graduação em Biodiversidade – Universidade Regional de Blumenau, Blumenau, Brasil.
ORCID: https://orcid.org/0000-0001-8647-9056

Angela Duebbers Cunha
Departamento de Medicina – Universidade Regional de Blumenau, Blumenau, Brasil.
ORCID: https://orcid.org/0000-0002-3236-3610

Siegmar Starke
Departamento de Medicina – Universidade Regional de Blumenau, Blumenau, Brasil.
ORCID: https://orcid.org/0000-0003-1834-0145

Sergio Luiz Zimmermann
Departamento de Medicina – Universidade Regional de Blumenau, Blumenau, Brasil.r
ORCID: https://orcid.org/0000-0002-9444-9209

Nágila Raquel Teixeira Damasceno
Departamento de Nutrição - Faculdade de Saúde Pública – Universidade de São Paulo, São Paulo, Brasil
ORCID: https://orcid.org/0000-0002-9332-7816

Raul D Santos
Instituto do Coração (InCor) – Faculdade de Medicina – Universidade de São Paulo, São Paulo, Brasil
ORCID: https://orcid.org/0000-0002-9860-6582

Till Ittermann
Institute for Community Medicine, University Medicine Greifswald, Greifswald, Germany
ORCID: https://orcid.org/0000-0002-0154-7353

Henry Völzke
Institute for Community Medicine, University Medicine Greifswald, Greifswald, Germany
ORCID: https://orcid.org/0000-0001-7003-399X

Marcello Ricardo Paulista Markus

Department of Internal Medicine B, University Medicine Greifswald, University of Medicine Greifswald, Greifswald, Germany
ORCID: https://orcid.org/0000-0002-6234-4955

CORRESPONDING AUTHOR:
Ernani Tiaraju de Santa Helena
Universidade Regional de Blumenau – PPG Saúde Coletiva
Rua Antonio da Veiga, 140 – Bairro Victor Konder – Blumenau – CEP: 89010-150
E-mail: erntsh@furb.br

ABSTRACT

Background

Few studies compared populations with similar genetic and culture background on different continents with standardized methods.

Objective

To describe methodological issues of the Study of Health in Pomerode - SHIP-Brazil and some characteristics of the participants of the baseline examination.

Design and Setting

Prospective, population-based cohort study of a representative sample of residents (aged 20 to 79 years) of Pomerode, Santa Catarina, Brazil.

Methods

Data for the baseline survey (from 2014 to 2018) were collected through interviews and medical examinations, including socio-demographic and lifestyle information, clinical and subclinical conditions, oral and mental health, among others. Biosamples (blood, urine, stool, and saliva) were collected and stored. Methods of data collection and quality control are described. Preliminary descriptive statistics were performed.

Results

The response rate was 67.6% (n=2,488 individuals). The Kappa test-retest of some variables varied from 0.54 to 1.0. German culture participants are older (46.5 vs 38.7 years), self-declared white (97.3% vs 82.1%), more frequently never smokers (71.4% vs 66.9%) but had higher risk of consuming alcohol (16.9% vs 13.4%) compared to participants with non-German background. Germans were taller (169 cm vs 166 cm), had greater abdominal circumference among men (101.9 cm vs 97.3 cm). Furthermore, they reported more multimorbidity (56.7% vs 43.6%) , had more arterial hypertension (30.7% vs 18.5%), but less depression (15.4% vs 19,1%) than non-Germans.

Conclusions

The interaction of genetic and social/environmental issues should be examined to understand the role of risk factors on clinical conditions observed.

Key-words: Epidemiological Methods; Data Collection; Epidemiologic studies; Cohort; Health of Ethnic Minorities.

RESUMO

Introdução

Poucos estudos compararam populações com histórico genético e cultural semelhante em diferentes continentes com métodos padronizados.

Objetivos

Descrever questões metodológicas do estudo de "Vida e Saúde em Pomerode - SHIP-Brazil" e algumas características dos participantes do exame inicial do estudo.

Desenho de estudo e local

Estudo de coorte prospectivo de base populacional em amostra representativa de moradores (20 a 79 anos) de Pomerode, Santa Catarina.

Métodos

As informações para a linha de base (de 2014 a 2018) foram coletadas por meio de entrevistas e exames médicos, incluindo dados sociodemográficos, de estilo de vida, condições clínicas e subclínicas, saúde bucal e mental, entre outros. Amostras biológicas (sangue, urina, fezes e saliva) foram coletadas e armazenadas. A coleta de dados e o controle de qualidade foram descritos. Foram realizadas análises descritivas preliminares.

Resultados

A taxa de resposta foi de 67,6% (n=2.488 indivíduos). O Kappa teste-reteste de algumas variáveis variou de 0,54 a 1,0. Os participantes de cultura alemã são mais velhos (46,5 vs 38,7 anos), autodeclarados brancos (97,3% vs 82,1%), com menor número de fumantes (71,4% vs 66,9%), mas tiveram maior risco de consumir álcool (16,9% vs 13,4%), eram mais altos (169 cm vs 166 cm), tinham maior circunferência abdominal entre os homens (101,9 cm vs 97,3 cm) em comparação com participantes "não-alemães". Pessoas de cultura alemã relataram mais multimorbidade (56,7% vs 43,6%), apresentavam mais hipertensão arterial (30,7% vs 18,5%), mas menos depressão (15,4% vs 19,1%).

Conclusões

A interação genética e social/ambiental devem ser examinadas para melhor entender o papel desses fatores de risco nas condições clínicas observadas.

Palavras-chaves: Métodos epidemiológicos; Coleta de dados; estudos epidemiológicos; coorte; Condições de saúde dos grupos étnicos.

INTRODUCTION

During the recent decades, Brazil has produced a growing number of publications of epidemiological studies[1,2] that covers a broad spectrum of relevant themes for the formulation of health policy.[3] Despite the expansion of epidemiological cohort studies in a broad range of life periods and different sites[4–7], few studies compared populations with similar genetic and culture background on different continents.[8,9] For that, an important challenge is to ensure high-quality data collection and processing to improve comparability between sites.

The Study of Health in Pomerania (SHIP) is a population study project conducted by researchers of the German University Medicine Greifswald. Since 1997, three cohorts have been established and partly follow-up several times. It was designed to describe the prevalence and incidence of a broad range of diseases, as well as environmental and behavioural risk factors in the region of the West Pomerania in Northeast Germany.[10]

Pomerode, a small city in Southern Brazil (26° 44' 27" S 49° 10' 37" W), was one of the migration destinies of German-Pomeranians in the 19th century. Known as "the most German city in Brazil", the city has around 30,000 inhabitants, a high Human Development Index,[11] and preserves ancient Pomeranian culture, including folk festivals and language.[12]

In 2013, the University of Blumenau in partnership with the University Medicine Greifswald started a sister study of the original SHIP; the Study of Health in Pomerode – SHIP-Brazil. SHIP-Brazil aimed to know the living and health conditions of the population of Pomerode with standardized methods and quality assurance designed to allow comparability with the original data collected by SHIP in Germany.[13]

Many national[4,14–16] and international[17,18] studies have discussed the challenges for recruiting and data collection in population-based studies. These challenges seem more evident in small cities and rural areas.[19,20] Moreover, in our study, due to the amount and diversity of measures, effective standardized mechanisms for recruiting, training, certification, and quality control were required.

This study aims to describe the sampling and recruiting process, procedures for data collection and quality assurance, their practical challenges, coping strategies adopted, and preliminaries results of SHIP-Brazil.

METHODS

The SHIP-Brazil was planned as a population-based cohort study of 20 to 79 years old residents of the city of Pomerode, state of Santa Catarina, Southern Brazil.

Sampling procedures

The participants were selected from a list of residents between 20 and 79 years old (n=21,796) from the Health Secretary database submitted to a previous quality control study. A simple random sampling of 12 strata of sex and age of 20 to 79 years old with 10-year intervals was performed. The sample size calculation considered the population in each stratum, with a prevalence of 50% events, an accuracy of 6% and a range of 95% confidence interval. The study sample comprised 3,678 subjects. Those who lived at least 6 months in Pomerode were eligible for the study. The exclusion criteria were: 1) people with a physical or cognitive impairment or mental illness that did not allow to answer the questionnaires or to move to the Examination Centre in the Hospital of the University of Blumenau (EC-HUB); 2) those who did not speak Portuguese.

Social Media and Communication

Posters and folders were distributed to the potential participants in community events, workplaces, and commerce. We also used formal media (radiobroadcasts) and internet social media to present the study and for dialogue with the local community.

Recruitment

We had the support of the Community Health Workers from Family Health Teams to improve receptivity and reduce possible mistrust. Those eligible who could not be contacted after at least three times by phone or in-person were considered lost. Refusals were considered after three missing answers. The interviewers scheduled home visits to those who agreed to participate, where the research was explained. After obtaining the signed informed consent, the questionnaire was applied. In the end, the participant received guidance for collecting stool samples and made an appointment for exams in the EC-HUB.

Questionnaires

The general health questionnaire had questions about identification, demographic[21], and socioeconomic[22] and cultural variables. German culture was considered if participant spoke German language at home and participated in German folk's groups.[23] Lifestyle was estimated including tobacco use,[24] alcohol consumption risk,[25] and physical activity.[26] Some clinical and sub-clinical conditions were evaluated, such as cardiovascular diseases,[27] arterial claudication,[28] diabetes, lung diseases,[29] pain, gastrointestinal symptoms,[30] occupational risks,[31] sleep disorders,[32] accidents and injuries, women's health, and other self-reported chronic diseases. A validated food frequency questionnaire (FFQ) was applied.[33] Questions about use of medications and health services were adapted from IBGE Census.

Six instruments were used in a random sequence to assess mental health and quality of life: 1. Child Trauma Questionnaire (CTQ);[34] 2. Medical Outcomes Study 36 – Item Short-Form Health Survey- SF-36;[35] 3. Mini-Mental State Examination (Mini-Mental;[36] 4. Temperament Evaluation of Memphis, Pisa, Paris and San Diego – auto questionnaire version (TEMPS-A);[37] 5. Patient Health Questionnaire 9 (PHQ-9);[38] 6. Self-Reporting Questionnaire-SRQ-20. [39]

Interviews were also conducted about use of oral health services and quality of life (Oral Health Impact Profile - OHIP-14)[40].

Clinical Exams

The arrival of the volunteers in the EC-HUB was at 7 AM daily. The biosamples (except stool) were collected after reading and signing the informed consent form. The EC-HUB had eight rooms and the full clinical examination schedule took, approximately, 6 hours.

Anthropometric measurements included body weight and height based on recommendations of the World Health Organization[41] using the electronic scale W300® (Welmy, Santa Barbara do Oeste, Brazil). The circumferences of neck, waist, and hip were measured by the anthropometric inelastic tape (Cescorf Equipamentos Antropométricos, Porto Alegre, Brazil). Skinfolds of triceps, subscapular, suprailiac, abdominal and calf were measured by the adipometer Cescorf™.

Physical activity was directly determined by accelerometry using the GT3X+ device (ActiGraph Co, Pensacola, USA). The handgrip strength was measure by Dynamometer Jamar™ Plus Digital (Patterson Medical, Sammons Preston, Bolingbrook,

USA. Participants were instructed to perform a maximal isometric contraction and the test was performed three times for each hand. The timed up & go test was performed by volunteers with 60 years or older. Time recording was performed by digital timer CD2800™ (Instrutherm Instrumentos de Medição Ltda, São Paulo, Brazil).

The spirometry was performed after the anthropometric examination and the screening eligibility questionnaire. Subjects performed repeated attempts until three acceptable measurements were achieved according to the American Thoracic Society Guidelines (Miller et al, 2005). The device and software used were EasyOne Spirometer™ (ndd Medizintechnik AG, Zurich, Switzerland).

The OMROM™ 705IT (Omron Healthcare Europe BV, Hoofddorp, The Netherlands) automatic blood pressure device was used to measure the systolic and diastolic blood pressure as well as the cardiac frequency according to Brazilian Guidelines[42]. Electrocardiograms were performed using the Cardio Perfect Workstation™ (Welch Allyn Inc, Skaneateles Falls, USA). Values for pulse wave analyses were determined using the branded device Mobil-O-graph™ (IEM, Aachen, Germany). Part of our sample performed the same exams also using Enverdis IEM™ device (Enverdis GmbH, Dusseldorf, Germany) to check comparability among methods.

Three ultrasound examinations were performed: 1. Carotid: intima-media thickness, presence of plaques and stenosis; 2. Thyroid: volume size, presence of nodules and echogenicity; 3. Liver: size, echogenicity and presence of gallstones. The Vivid-i™brand equipment (GE Healthcare, Chicago, USA) was used for all ultrasound examinations.

Estimation of body fat and lean body mass was performed using bioelectrical impedance analysis (BIA) on the MDD 1500™ device (Bodystat Ltd, Isle of Man, UK) according to procedures defined in a specific SOP.

In women, a Pap smear examination was performed according to the guidelines of the Brazilian National Institute of Cancer.[43]

The dental examinations were performed in a dental chair by previously trained and certificated dentists. The functional analysis of the temporomandibular joint included joint sensitivity, muscle findings, jaw mobility and mouth opening. Examination of the oral mucosa verified the presence of premalignant or malignant lesions and were documented photographically. The dental examination was performed in all quadrants, assessing the entire surface of the teeth checking prosthetic materials. A partial-mouth periodontal examination carried out according to random sequence

probing assessments at only four sites per tooth (the disto-lingual and mesio-lingual sites were not assessed). The assessment of probe depth used direct measurements.[44] The occlusal, distal, buccal, mesial, lingual/palatal faces were examined for the superficial exam of decayed, missing and filled teeth (DMFT).[45]

Biosamples

Biological samples were collected in accordance with the Clinical Laboratory Standards Institute (CLSI)[46] and their respective standard operating procedures (SOPs). Fasting blood collection: three whole blood / plasma tubes, with sodium citrate additive, for evaluation of Time Prothrombin Activity (TPA); four whole blood / plasma tubes with Ethylene-diamine-tetraaceticacid (EDTA) additive for complete blood count; four fasting serum tubes to perform biochemical tests. For volunteers who agreed to participate in the Oral Glucose Tolerance Test (OGTT), 75g of dextrose were offered and after 2 hours, a fasting serum tube and a tube for OGTT serum tube were collected. Partial urine tests were performed by collecting 40ml of the intermediate flow; saliva sample collections for pH and volume test; shaved tongue; MRSA screening by nasal swab; oropharyngeal swab; gingival sulcus; parasitological stool; and collection of mycoplasma culture through cytopathology in the case of women and urine in the case of men.

The samples were aliquoted in 2 mL cryotubes and disposed for cryopreservation, properly identified, in ultra-freezers at -80 ^{o}C, on the same day of its collection (for most of the samples), or in 24 h maximum (for serum after OGTT and stool samples in modified Merthiolate-Iodo-Formol), or as soon as possible (for nose swab after MRSA screening).

Training and Pilot Study

All personal (interviewers and examiners) were trained according to SOPs. SHIP-Brazil SOPs were based on the original SOPs used in the SHIP-TREND examination performed in Germany by the University Medicine Greifswald.

For interviews, the SOPs topics included: recruiting subjects process, general procedures, interviews guidelines on completing the questionnaire and operational procedures after interviews (scheduling exams and biological samples). For clinical exams, SOPs contents included logistics (collection location, consumables, software); inclusion and exclusion criteria for each exam; attendance flow chart (detailed

description of all stages of the exam, including descriptive images); and calibration and training. After reading the SOPs, interviewers and examiners participated in twenty hours training that consisted in simulated interviews or exams under supervision that checks for protocol deviations. Examiners must be approved on a quantitative and qualitative evaluation before examine research subjects.[47]

Ultrasonographic exams were performed by nurses. They were trained by an expert from SHIP (Germany). They were certificated when Bland-Altman plots showed that the mean bias for intra- and inter-observer variability have not exceed 5%, and two standard deviations of the bias have not exceeded 25%.

Two pilot studies were performed. The first one aimed to organize the flow, sequence, and time spent in each exam. In the second one, 40 volunteers (health professionals from Pomerode) were examined. This pilot aimed to evaluate the quality and reliability of the collected data.

Quality Assurance

Regular monthly meetings were held to exchange information, and experiences on recruiting, interviewing, and examining. Besides that, supervisors monitored, in each place, interviews and the examinations to check the quality and conform to established protocol.[47] The questionnaire test-retest reliability was checked using some random questions. A phone call interview was performed by an independent examiner around 10 to 20 days after the research interview. The phone call interview lasted around five minutes.

Both questionnaires and exams were checked for potential filling errors as leap errors, missing fields, or inconsistent values. Reliability intra and inter-examiner was check using kappa or intraclass correlation. Regular reports were produced comparing interviewers/examiners. All team members received feedback about their performance and strategies to improve the results were discussed. They were re-trained and certificated. Those who presented 2 periods with repeated errors were set aside.

The SOPs, data dictionary with all variables and a step-by-step to access our data are available in our website www.furb.br/vspomerode.

Ethical Aspects, Comfort, and Feedback to the Participants

All participants must have read and signed the informed consent. SHIP-Brazil is in accordance with the Helsinki Declaration and was submitted (CAAE

99559118.0.0000.5370) and approved (Protocol 2.969.842) by the University of Blumenau Ethics Committee.

The prefecture of the city of Pomerode offered transportation to the EC-HUB and back home to the volunteers. After biosample collection, we offered breakfast to all participants prescribed by nutritionists and considering food restrictions.

At the end, a nurse provided brief feedback about exams to the participants. A written report was sent to their family doctor. If any questionnaire or exam results suggest any immediate risk to the participant's life, they were informed, and the study coordination was contacted.

Statistical Analysis

In this paper, we applied two-steps inverse probability weighting technique to minimized possible selection bias. In short, the probability of participating in the study was calculated for each participant. Then the weight, which is the inverse of the probability of selection, was computed and included into the analysis. Thus, each selected participant would be accounted not only for its value to itself but also for those with characteristics that were not selected.[48,49]

The frequencies and means of some sociodemographic characteristics, lifestyle and clinical conditions in the baseline project were described. Qui-Square and t Student or Wilcoxon tests were used to compare these variables among random and convenience sample participants.

Statistical significance was assumed at $p<0.05$.

RESULTS

The response rate was 67.2% (2488 participants). We had 2,104 (57.2%) of lost and refusal in our random sample. The main causes of lost and refusal were “never at home or incorrect phone number” (n=1,049, 49.9%) and “problems in workplace” (n=150, 7.3%) respectively. Details of sampling process are shown in the Figure 1.

FIGURE 1

We adopted some measures to increase the participation of subjects. First, the interviewers and supervisors contacted the public health services to update the phone number of the participants. The contact of community health workers with the participants improved their confidence in the interviewers and helped them to understand the aims of the study and its importance and the benefits of participation.

Second, we had some meetings with religious and community leaders to explain the potential study benefits for the community. After that, we observed a decrease in refusal among participants from whom these leaders had influence.

The interviews were previously scheduled and carried out at the participant's home. Trained interviewers applied a comprehensive questionnaire about health issues. Some questionnaires on specific topics such as “oral health”, “mental health” and the FFQ were applied in the EC-HUB.

Household interviews presented some infrastructure and process challenges. First, the distances to be covered between households hampered doing more than one interview on the same day. Some interviewers reported the presence of family members during the interview, with loss of privacy and, sometimes, interference in the responses, leading to partial or total interruption of the interview. Furthermore, the turnover of interviewers demanded new selection, training, and certification processes.

These situations demanded direct supervision during the interviews and more meetings with the interviewers to ensure the quantity and quality of the procedures. Besides that, we asked for support from the city company leaders because many participants (especially men 20 to 40 years) mentioned they could not leave their workplace to participate. Finally, local newspapers, radios, and social media helped us to inform and contact the participants.

During the recruitment process, we faced losses and refusal that could bias our sample and reduce the statistical power. So, we decided to open a convenience sample. Random sample participants could suggest a person according to 3 criteria: 1. could not live in the same home; 2. must not be a relative, and; 3. the sex and age group must be defined by the study coordination. In the end, the final sample had 2,488 participants.

Figure 2 presents a density map of the Pomerode population and participants (random plus convenience) by quintiles.

FIGURE 2

The participants were more similar (considering age and sex) to the random calculated sample than randomly recruited, or convenience samples isolated (see supplemental material). Table 1 compares the frequencies of some selected variables among random and convenience sample participants.

TABLE 1

The reproducibility was performed among 5% of the final sample. Kappa’s test-retest of some variables vary from 1,0 (self-reported cancer) to 0.54 (self-reported

depression). Two hundred and thirty-five respondents (9.5%) did not attend the EC-HUB for examination. Regarding socio-demographic characteristics, there were no differences regarding sex, marital status, race/colour, and socioeconomic status. Those who did not attend were younger (39.1 vs 44.3 years; $p<0.001$), non-Germanic culture (84.1% vs 95.1%; $p<0.001$); non-Lutherans (63.7% vs 52.8%; $p<0.001$). These differences should be considered in future analysis.

Table 2 shows the frequencies of some selected variables among those categorized as German culture and other background.

TABLE 2

Table 3 presents mean (and standard error) of continuous variables from Germans and non-German culture participants.

TABLE 3

Results comparing the effect of raw and weighted data and the corresponding standard errors are presented in Table 4.

TABLE 4

DISCUSSION

To the best of our knowledge, SHIP-Brazil is the first comprehensive population-based study to analyse health conditions and risk factors of Pomeranian descendants living in Brazil as part of an international initiative. Despite the difficulties faced during the recruitment, the solutions adopted in the data collection and quality assurance seem to have produced satisfactory results. Preliminary results suggest a higher frequency of some clinical conditions and cardiovascular risk factors among individuals with German culture background.

In order to minimize possible bias on point and variance estimates,[50] the choice of a random sampling stratified by sex and age resulted in access to participants being more difficult and expensive, compared to cluster sampling used in most national population studies.[15,19,51] Difficulties in recruiting participants have been reported among population surveys in small and medium-sized cities in national[6,52] and international scenario.[17,53] The transfer of the Examination Centre from the University Hospital in Blumenau to Pomerode, expansion of schedules and standardization of examinations by sex and age should be considered for a future follow-up examination to improve the adherence of participants and have a better logistic in data collection.

The inclusion of a convenience sample increased the statistical power which is important for estimating the association between clinical and subclinical conditions and exposure variables. Figure 2 suggests similar socioeconomic spatial pattern among the population and random plus convenience sample. Table 1 shows a few differences regarding socio-demographic variables, lifestyle, and clinical conditions between the random recruited sample and the convenience one(except sex and age, whose proportion in the convenience sample could contribute to reducing selection bias). However, we recommend caution when assuming observed frequencies assuming as prevalence.

One option to partially minimize a possible sample bias is to apply two-step inverse probability weighting technique as presented in this paper. [48,49] Results comparing weighted and crude data suggest the first option reduced standard errors (Table 4). A deep discussion of this approach is beyond the scope of this paper, but theoretical and empirical approaches should be analysed.

Another challenge of this study was to identify German descendants. Ancestry and genotyping tests are the best options, but the high cost limit their use. Pomeranian immigration occurred in the mid-19th century, so questions about ancestry were subject to recall bias. Thus, we adopted the practice of the German language regularly at home as a marker of German ethnic/cultural identity.[23] A study to check the accuracy of this approach is being performed.[54]

The participants were 92% white, 62% with German culture and 88% in high/middle SES. The frequencies of alcohol abuse (21%), overweight/obesity (69%), hypertension (26.4%), depression (16.7%) and poor/very poor self-perception of health (6.35) are similar or higher than those presented in national surveys.[55–60] On the other hand, the frequency of alcohol consumption, overweight/obesity and depression was similar to studies carried out in Germany.[61–63] Such comparisons must be taken with caution due to the great conceptual and operational variety between those studies.

German culture participants are mostly older, self-declared white, never smokers but consumed higher amounts of alcohol compared to participants with non-German background. They were taller and stronger, had both higher cardiovascular risk (abdominal and neck circumference) and arterial hypertension, but reported less depression, better quality of oral health, and better self-perception of health than non-Germans. A more detailed comparison of these and other health characteristics available in our databases might contribute to the formulation of hypotheses about the process of gene-environment interaction in the generation of diseases.

One of the strengths of our study is the standardization of data collection to ensure an appropriate comparison with data from SHIP in Germany. Besides the publication of scientific papers, we have presented the results of SHIP-Brazil to the health authorities and professionals, as well as to the community members in the Municipal Health Council that stimulated debates and law changes.[64] We also used our website and social media to communicate our results to the participants and community.[65]

However, this study has some limitations. Firstly, the high number of losses and refusals during recruitment may have contributed to selection bias. Despite the use of weights to adjust for non-response, we cannot rule out the possibility of bias due to unmeasured risk factors. Another limitation is the fact that much of the information was self-reported. This problem could be minimised by comparing these data with existing personal health databases in the public health system.

CONCLUSIONS

In addition to the theoretical aspects and results, it is essential to discuss the logistic of population-based studies like recruiting, possible sample bias as well as quality assurance. Debating the alternatives to overcome these challenges is fundamental to help scientific guidance for researchers and produce high-quality information to support public health policies.

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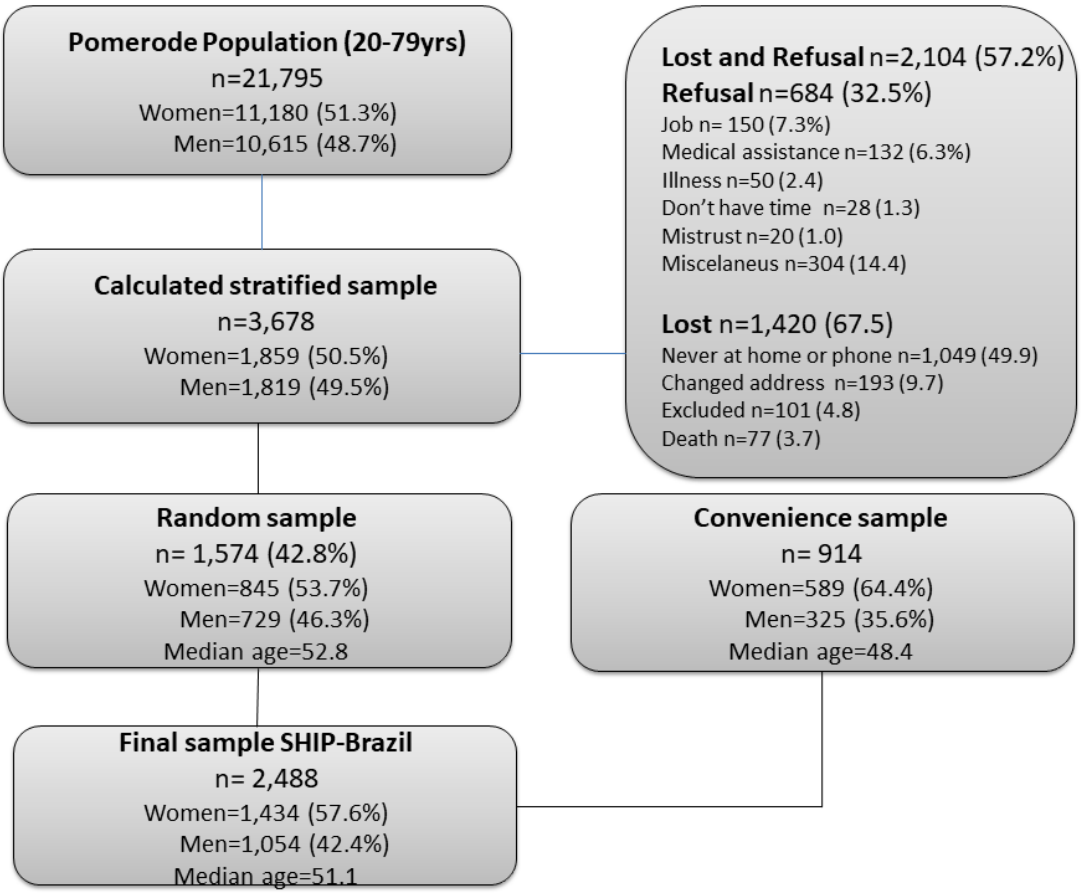

Figure 1 - Flowchart of sampling process in SHIP-Brazil, 2014-2018.
*Results without weightings

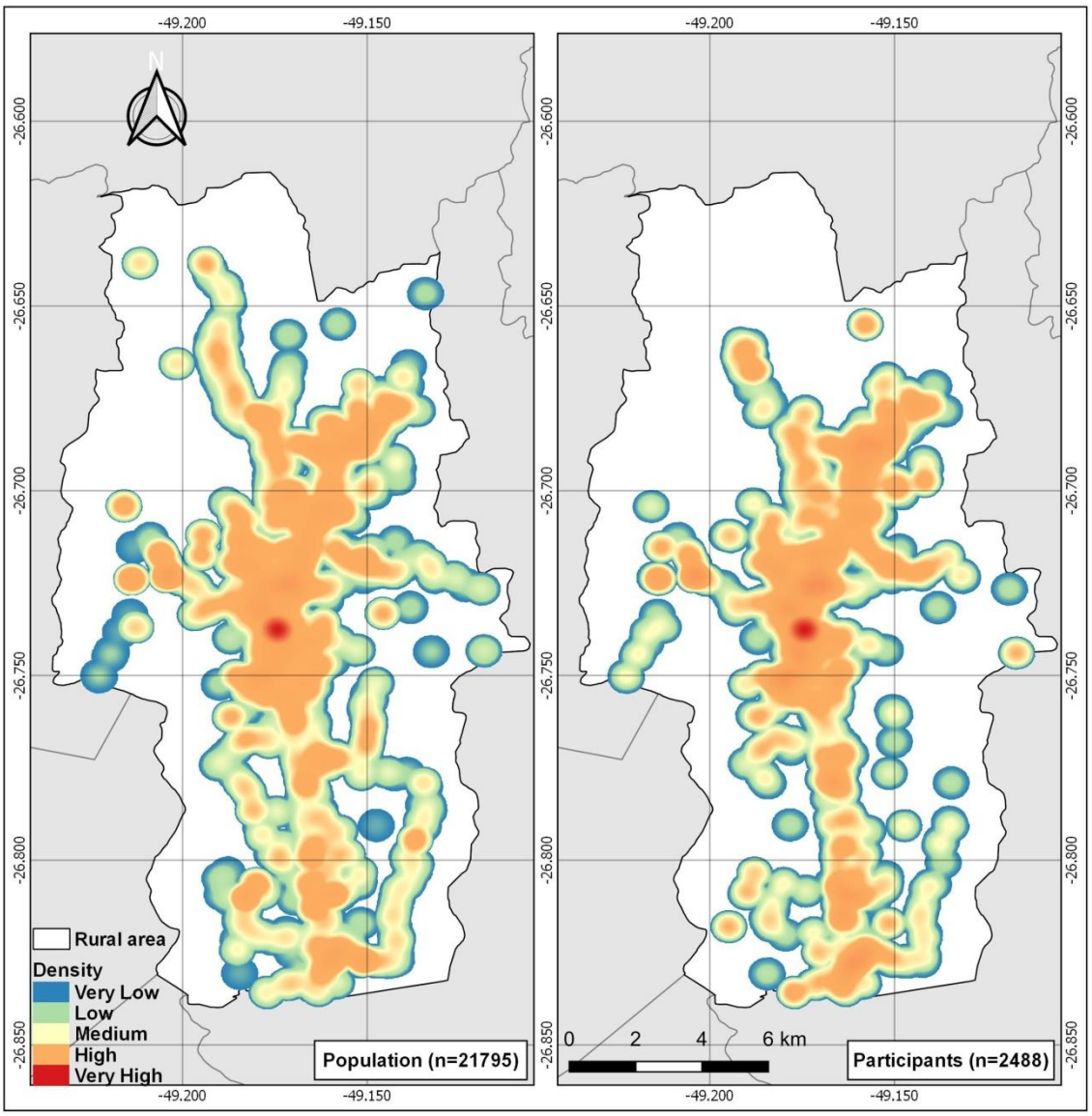

Figure 2: Kernel density of Pomerode city population and participants by quintiles.

Table 1 – Comparison of some sample characteristics in the random and convenience samples, SHIP-Brazil, 2014-2018. (n=2,488)

Variables	Total (n=2,488)	Random (n=1,574)	Convenience (n=914)	p
Age* (mean)	43.7	44.9	41.7	**<0.001**
Sex				
Man	48.7	52.4	42.6	
Women	51.3	47.6	57.4	**<0.001**
Marital status				
Married	71.6	70.6	73.1	
Single/Divorced/Widow	28.4	29.4	26.9	0.273
Race/colour self-report				
Non-white	8.4	8.5	8.3	
White	91.6	91.5	91.7	0.861
German culture				
Yes	62.2	62.4	61.9	
No	37.8	37.6	38.1	0.829
Socioeconomic Status*				
High	22.9	24.0	21.2	
Middle	65.5	65.1	66.2	
Low	11.6	10.9	12.6	0.243
Tobacco use				
Never smoke	69.7	68.9	70.9	
Former smoker	19.6	20.5	18.2	
Current smoker	10.7	10.6	10.9	0.454
Alcohol consumption risk				
Low/Moderate	84.3	85.1	83.1	
High/Severe	15.7	14.9	16.9	0.281
Daily Fruits/vegetables consumption				
Five and more portions	42.5	43.7	40.6	
Less than five portions	57.5	56.3	59.4	0.226
Daily red meat consumption				
Less than 70 grams	34.6	33.4	36.5	
70 grams and more	65.4	66.6	63.5	0.191
Height* (mean)	168	168	167	0.350

Weight* (mean)	80.2	80.1	80.4	0.723
BMI*	28.6	28.5	28.7	0.364
Muscle strength* (mean)				
Men	44.5	44.4	44.7	0.697
Women	25.5	25.3	25.7	0.207
Abdominal Circumference* (mean)	98.9	99.0	98.9	0.917
Waist/Height Ratio (mean)	53.9	53.9	53.8	0.772
Thyroid volume* (mean)	14.8	15.1	14.4	0.05
Hypertension	26.4	26.9	25.5	0.499
Overweight/Obesity*	69.2	69.6	68.6	0.687
Multimorbidity*	51.9	50.7	53.8	0.240
Health condition (self-report)				
Very good/good	61.4	62.3	59.9	
Regular	32,3	31.9	32.8	
Bad/very bad	6.3	5.7	7.2	0.297

Source: SHIP-Brazil, 2014-2018

* Age in years; SES: high: class A1/A2 and schooling of 9 years or more or the class was B1/B2 but with schooling of 12 years or more; low: C1/C2 or D/E and education 0 to 4 years of study. All others were considered in middle. Height and circumferences in centimetres. Weight in kilograms. Muscle Strength in kilogram. Body mass index (BMI): weight/height^2. Overweight/Obesity: BMI 25 and over for those until 65 years and BMI 27 and over for those 65 years and older. Multimorbidity: 2 and more chronic conditions.

Table 2 – Proportion of some characters of participants according to German culture, SHIP-Brazil, 2014-2018

	German Culture	
Variables	**No**	**Yes**
Sex		
Men	46.8	50.0
Women	53.2	50.0
Age*		
20 – 64	95.8	86.5
65 -79	4.2	13.5
Marital status		
Married	71.6	71.7
Single/Divorced/Widow	28.4	28.3
Race/colour self-report		
Non-white	17.9	2.7
White	82.1	97.3
Socioeconomic Status (SES)*		
High/Middle	90.8	86.9
Low	9.2	13.1
Tobacco use		
Never smoke	66.9	71.4
Former or Current smoker	33.2	28.6
Alcohol consumption risk		
Low/Moderate	86.6	83.1
High/Severe	13.4	16.9
Moderate to vigorous physical activity		
Less than 150min/week	34.8	32.2
150 min/week and more	65.2	67.8
Daily Fruits/vegetables consumption		
Five and more portions	39.6	44.1
Less than five portions	60.4	55.9
Daily red meat consumption		
Less than 70 grams	35.1	34.4
70 grams and more	64.9	65.6

Hypertension		
No	81.5	69.3
Yes	18.5	30.7
Overweight/Obesity*		
No	34.5	28.8
Yes	65.6	71.2
Depression (PHQ-9)*		
No	80.9	84.6
Yes	19.1	15.4
Multimorbidity*		
None/One	56.4	43.3
Two and more	43.6	56.7
Health Perception (self-report)		
Very good/good/Regular	92.4	94.5
Bad/very bad	7.6	5.5

Source: SHIP-Brazil, 2014-2018

* Age in years; SES: high: class A1/A2 and schooling of 9 years or more or the class was B1/B2 but with schooling of 12 years or more; low: C1/C2 or D/E and education 0 to 4 years of study. All others were considered in middle. Overweight/Obesity: BMI 25 and over for those until 65 years and BMI 27 and over for those 65 years and older. PHQ-9: Patient Health Questionnaire. Multimorbidity: 2 and more chronic conditions.

Table 3 – Mean and standard error among German culture and selected variables, SHIP-Brazil, 2014-2018

Variables	German Culture	
	No Mean (SE)	**Yes** Mean (SE)
Height (mean)**	166 (0.005)	169 (0.002)
Weight (mean)**	77.2 (0.80)	81.9 (0.52)
BMI**	28.2 (0.28)	28.8 (0.16)
Neck circumference**	36.7 (0.16)	37.5 (0.11)
Abdominal circumference**		
Men	97.3 (0.91)	101.9 (0.60)
Women	94.9 (0.84)	99.2 (0.55)
Waist/Hip Ratio		
Men	0.91 (0.004)	0.80 (0.004)
Women	0.94 (0.003)	0.82 (0.003)
Waist/Height Ratio	0.53 (0.004)	0.54 (0.002)
Muscle strength**		
Men	44.2 (0.72)	44.7 (0.43)
Women	24.8 (0.37)	25.9 (0.21)
Intima-media thickness	0.62 (0.005)	0.69 (0.004)
OHIP-14 **(median)	3.3 (0.18)	2.4 (0.10)

Source: SHIP-Brazil, 2014-2018

**SE: standard error. Height and circumferences in centimetres. Weight in kilograms. Muscle Strength in kilogram/force. Body mass index (BMI): weight/height^2. OHIP-14: Oral Health Impact Profile.

Table 4: Description of some study variables (crude and weighted), SHIP-Brazil, 2014-2018 (n=2488).

Variable	Crude n (%)			Weighted		
	%	SE	IC 95%	%	SE	IC 95%
Age (mean)	50.7	0.2980	50.1-51.3	43.7	0.6103	43.6-43.8
Sex						
Female	57.4	0.0099	55.4 - 59.3	51.3	2.5e-15	51.3-51.3
Marital status						
Married	75.3	0.0087	73.6 - 77.0	71.5	0.0101	69.5-73.4
Religion						
Protestant	63.5	0.0097	61.5 - 65.4	60.3	0.0113	58.1 - 62.6
Colour						
White	92.8	0.0052	91.7 - 93.8	91.4	0.0068	90.0 - 92.6
German culture	67.9	0.0094	66.0 - 69.8	62.2	0.0111	60.0 - 64.4
Education						
None	1.5	0.0024	1.1 - 2.0	0.9	0.0014	0.6 - 1.2
Elementary (1 - 8 yrs)	58.7	0.0099	56.8 - 60.7	45.9	0.0095	44.0 - 47.7
High (9 -11 yrs)	23.7	0.0085	22.1 - 25.5	32.0	0.0107	29.9 - 34.1
University (12 yrs and more)	16.0	0.0074	14.6 - 17.5	21.3	0.0098	19.4 - 23.3
Current smoker	11.1	0.0063	9.8 - 12.4	10.7	0.0071	9.4 - 12.2
Self-report chronic disease						
Hypertension	33.8	0.0102	31.8 - 35.9	24.8	0.0083	23.2 - 26.5
Diabetes	9.2	0.0061	8.0 - 10.5	6.2	0.0043	5.4 - 7.1
Dyslipidemia	31.8	0.0094	29.9 - 33.7	24.4	0.0084	22.8 - 26.1
Varicose veins	17.9	0.0078	16.4 - 19.5	13.8	0.0066	12.6 - 15.2
Cancer (all types)	4.2	0.0041	3.4 - 5.1	2.7	0.0028	2.2 - 3.3
BMI (mean)						
Adults	28.8	0.1522	28.5 - 29.1	28.3	0.1641	28.0 - 28.6
Elderly	29.7	0.2092	29.9 - 30.1	29.8	0.2068	29.4 - 30.2
Waist/Height (mean)	55.4	0.1788	55.0 - 55.7	53.9	0.1876	53.5 - 54.2
Fatty liver*	30.8	0.0105	28.8 - 33.0	26.7	0.0105	24.7 - 28.9
Open mouth (mm)	47.6	0.1625	47.3 - 47.9	48.2	.01894	47.8 - 48.5
Common Mental Disorders (SRQ-20)	26.9	0.0098	25.0 - 28.9	24.5	0.0101	22.6 - 26.6
Depression (PHQ-9)	9.4	0.0064	8.1 - 10.7	7.4	0.0056	6.3 - 8.5

*IMT =carotid intima media thickness in mm. Fatty liver detected by hepatic ultrasound

AUTHORS CONTRIBUTION:

ETSH: conceptualization, project administration, funding acquisition, methods and data collection, formal analysis, writing (original draft and critical review), final approval; CAS: conceptualization, funding acquisition, methods and data collection, formal analysis, writing (original draft and critical review), final approval; JLGCS: conceptualization, funding acquisition, methods and data collection, writing (original draft and critical review), final approval; CRON: conceptualization, methods and data collection, writing original draft and critical review, final approval; LCA: conceptualization, methods and data collection, critical text revision, final approval; CMMC: conceptualization, methods and data collection, critical text revision, final approval; RLP: conceptualization, methods, critical text revision, final approval; KZSB: conceptualization, methods, critical text revision, final approval; TKRB: conceptualization, methods and data collection, critical text revision, final approval; SS: conceptualization, methods, critical text revision, final approval; SLZ: conceptualization, critical text revision, final approval; ADC: conceptualization, methods, critical text revision, final approval; LGN: conceptualization, methods, critical text revision, final approval; NRDT: conceptualization, critical text review and final approval; RDS: conceptualization, critical text review and final approval; TI: conceptualization, methods, critical text revision, final approval; HV: conceptualization, methods, critical text revision, final approval; MRPM: conceptualization, methods, formal analysis, writing (original draft and critical review), supervision, final approval.

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