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ORIGINAL ARTICLE

Investigation of the COVID-19 outbreak in a prison unit: health surveillance actions

Investigação de surto de COVID-19 em unidade prisional: ações de vigilância em saúde

Investigación del brote de COVID-19 en una unidad penitenciaria: acciones de vigilancia

Carlos Alves Pessoa[1] ORCID 0000-0002-0819-9697
João Paulo Cola[2] ORCID 0000-0003-4972-4686
Thiago Nascimento do Prado[2] ORCID 0000-0001-8132-6288
Letícya Dos Santos Almeida Negri[1] ORCID 0000-0002-0056-4506
Heleticia Scabelo Galavote[1] ORCID 0000-0003-4490-6763

[1]Federal University of Espirito Santo, São Mateus, Espírito Santo, Brazil.
[2]Federal University of Espirito Santo, Vitória, Espírito Santo, Brazil.

Address: Oswaldo Manoel Pimenta Ramos Street, Guriri Sul, São Mateus, Espírito Santo, Brazil.
Email: carlos.pessoa.2025@gmail.com

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ABSTRACT

Background and Objectives: the population deprived of liberty is classified as vulnerable to contagion by COVID-19, living in environments susceptible to the spread of infections. Given this, it was proposed to describe the COVID-19 outbreak in a prison unit and analyze health surveillance actions to control it. **Methods:** this is a mixed, quantitative and qualitative study of a COVID-19 outbreak that occurred between July and September 2020 in a Remand Center. Secondary data from suspected cases of COVID-19 were used, and in the qualitative analysis, interviews were carried out with five healthcare professionals. **Results:** 640 suspected cases of COVID-19 were registered; 477 (74.5%) cases were confirmed for COVID-19; and only 91 (14.2%) of cases showed characteristic symptoms. They all evolved into healing. Screening symptomatic people, isolation cells, suspension of visits and mass testing were strategies listed to control the outbreak. **Conclusion:** the population deprived of liberty is vulnerable to respiratory diseases due to the overcrowded context in which they live.

Keywords: *Disease Outbreaks. Prisons. Prisoners. Coronavirus Infections.*

RESUMO

Justificativa e Objetivos: a população privada de liberdade é classificada como vulnerável à infecção pela COVID-19, pois vive em ambientes suscetíveis à disseminação de infecções. Diante disso, propôs-se descrever o surto de COVID-19 em unidade prisional e analisar as ações de vigilância em saúde para o seu controle. **Métodos:** trata-se de estudo misto, de caráter quantitativo e qualitativo, de surto de COVID-19 ocorrido entre julho e setembro de 2020 em Centro de Detenção Provisória. Utilizaram-se dados secundários de casos suspeitos da COVID-19, e na análise qualitativa, foram realizadas entrevistas com cinco profissionais de saúde. **Resultados:** foram registrados 640 casos suspeitos de COVID-19; 477 (74,5%) casos foram confirmados para COVID-19; e somente 91 (14,2%) dos casos apresentaram sintomas

característicos. Todos evoluíram para cura. Rastreio de sintomáticos, celas de isolamento, suspensão de visitas e testagem em massa foram estratégias elencadas para o controle do surto. **Conclusão:** a população privada de liberdade é vulnerável a doenças respiratórias devido ao contexto de superlotação em que vivem.

Descritores: *Surto de Doenças. Prisões. Prisioneiros. Infecções por Coronavírus.*

RESUMEN

Justificación y Objetivo: la población privada de libertad se clasifica como vulnerable al contagio por COVID-19, al vivir en ambientes susceptibles a la propagación de infecciones. Ante esto, se propuso describir el brote de COVID-19 en una unidad penitenciaria y analizar acciones de vigilancia sanitaria para controlarlo. **Métodos:** se trata de un estudio mixto, cuantitativo y cualitativo de un brote de COVID-19 ocurrido entre julio y septiembre de 2020 en un Centro de Detención Provisional. Se utilizaron datos secundarios de casos sospechosos de COVID-19, y en el análisis cualitativo, se realizaron entrevistas a cinco profesionales de la salud. **Resultados:** se registraron 640 casos sospechosos de COVID-19; 477 (74,5%) casos fueron confirmados para COVID-19; y sólo 91 (14,2%) de los casos presentaron síntomas característicos. Todos ellos evolucionaron hacia la curación. El cribado de personas sintomáticas, el aislamiento en celdas, la suspensión de visitas y los test masivos fueron estrategias enumeradas para controlar el brote. **Conclusión:** la población privada de la libertad es vulnerable a padecer enfermedades respiratorias debido al contexto de hacinamiento en el que vive.

Palabras Clave: *Brotes de Enfermidades. Prisiones. Prisoneros. Infecciones por Coronavírus.*

INTRODUCTION

Coronavirus infection (COVID-19), caused by the SARS-CoV-2 virus, declared a pandemic by the World Health Organization (WHO), continues to be a major health concern. Around 676 million cases and 6.8 million deaths have been reported as of August 2023.[1] The population deprived of liberty (PDL) is classified as vulnerable to COVID-19 infection, as they live in environments susceptible to the spread of infection.[2,3]

Preventing COVID-19 in prison units (PUs) is a challenge due to population density, difficulties in accessing facilities and hygiene supplies as well as limited space for isolation and quarantine to ensure the PDL safety.[4,5] In an attempt to control the spread of infection in the PDL, Brazil adopted measures recommended by the WHO.[6]

Due to the complex situation of COVID-19, PDL presented a high burden of the disease.[7] In a systematic review carried out in 2022, a prevalence of 24% was reported in PDL.[8] In a prevalence study carried out in the state of Espírito Santo, 31.6% of COVID-19 cases were reported in PDL.[9] In this context, prison health and security teams had to reorganize work processes to deal with the disease as well as carry out actions in conjunction with the health surveillance service to minimize the impact of COVID-19 transmission among the PDL.

Intersectoral collaboration between prison teams and health surveillance are essential for early detection and control of disease transmission in prisons. Understanding the aspects of COVID-19 in prisons and its real impact on healthcare services' routine and prison security is essential to predict improvements in the disease prevention process and propose appropriate actions. Therefore, this study aimed to describe the COVID-19 outbreak in prisons and analyze health surveillance actions for its control.

METHOD

This is a mixed study of a quantitative and qualitative nature to address the aspects of the COVID-19 outbreak that occurred between July and September 2020 in a Remand Center (RC) located in the municipality of São Mateus, in the north of the state of Espírito Santo.

The study was divided into two stages. In the first stage, a descriptive study of the COVID-19 outbreak in the RC was carried out using secondary data from the compulsory notification information system for diseases in the municipality of São Mateus. All notification forms that were made between July and September 2020 and had the RC of São Mateus as the notifying health facility were included.

To describe the outbreak, we used the variables from the COVID-19 suspected case notification form, which were: age; race/skin color (black, yellow, white, indigenous, and unknown); clinical signs and symptoms (fever, difficulty breathing, cough, nasal congestion, runny nose, sore throat, diarrhea, headache, weakness, loss of smell, loss of taste); comorbidities and risk factors (chronic lung disease, chronic cardiovascular disease, diabetes mellitus, and HIV infection); results of specific tests for COVID-19 (positive and negative for rapid serological immunochromatographic test (RT) and reverse transcription-polymerase chain reaction (RT-PCRT); and outcome of suspected case and evolution (cure, death, discarded).

For the second stage, a qualitative study was carried out with professionals who worked in health surveillance at the Superintendence of the Northern Region of Health and professionals from epidemiological surveillance in the municipality of São Mateus. To participate in the study, workers had to have worked on actions during the COVID-19 outbreak at RC. The interviews were audio-recorded with a voice recorder and deleted after data transcription, which were stored in a Microsoft Word® ".doc" file.

A semi-structured interview script was used, consisting of two parts: the first contained sociodemographic information, and the second was represented by guiding questions organized into chunks, namely: understanding of the process of requesting to act within the RC;

understanding of the process of acting within the RC; coping, control and prevention actions; intervening factors for acting within the RC.

The interviews were conducted individually in a private room and lasted a maximum of 45 minutes. No criteria were established for closing the interviews. Participant anonymity and confidentiality were preserved by coding statements, using the letters "HP" for healthcare professionals, followed by a sequential Arabic number for each interview. All health workers interviewed signed the Informed Consent Form.

Quantitative data analyses were performed using the software Epi Info™ statistical version 7.4.2. Relative and absolute frequencies were calculated for qualitative variables, and mean and standard deviation were calculated for quantitative variables. A histogram graph was created based on the date of onset of symptoms or the date of test collection for asymptomatic cases. The graph was created using Microsoft Office Excel® 2019.

For qualitative data analysis, the software *Interface de R pour les Analyses Multidimensionnelles de Textes et de Questionnaires* (IRAMUTEQ) version 0.7 alpha 2.3.3.1 was used. This software performs analysis on text *corpora* through the Descending Hierarchical Classification (DHC) method, which grouped the segments of workers' speeches into classes by similar excerpts.[10] Based on the DHC, thematic content analysis was performed, including material exploration, which aims to transform the raw data to reach the core of understanding of the text, and treatment of results, in which the author makes inferences and interpretations.

The study was approved by the ethics committee of *Centro Universitário Norte do Espírito Santo, Universidade Federal do Espírito Santo*, under Opinion 5.738.429/2022.

RESULTS

Characterization of the COVID-19 outbreak in the prison unit

Between June and September 2020, 640 reports of suspected cases of COVID-19 were made among the RC PDL. Figure 1 shows the distribution of confirmed cases of COVID-19 based on the date of onset of symptoms or the date of collection of specific tests for COVID-19 in the asymptomatic PDL. After the first confirmed case on July 18, 2020, confirmed cases began to increase, with a peak of confirmed cases on August 8, 2020, registering 378 confirmed cases. Soon after, there was a decline in cases, with the last one on September 1, 2020.

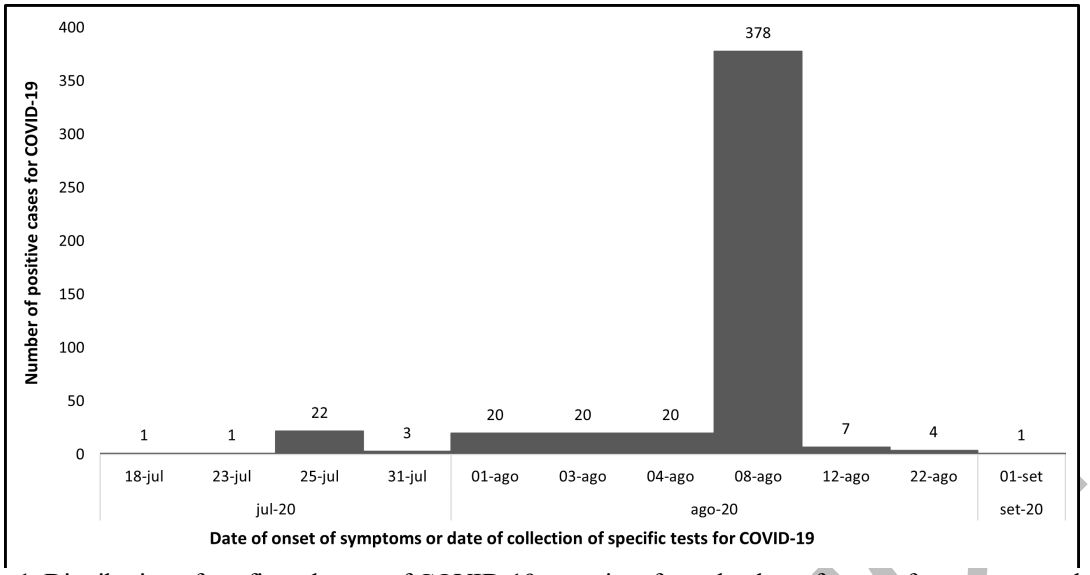

Figure 1. Distribution of confirmed cases of COVID-19 over time from the date of onset of symptoms or the date of collection of specific tests for COVID-19 in the prison population. São Mateus, ES, Brazil, 2020 (N=477)

The sociodemographic profile and distribution of comorbidities and risk factors among the PDL of the RC show that, in relation to race, 267 (41.7%) declared themselves as black (black and brown). The mean age was 28.2 (±8.7) years. Among the comorbidities, 32 people had chronic cardiovascular disease; five had a diagnosis of HIV; five had a diagnosis of chronic lung disease; and two had diabetes mellitus (Table 1).

Table 1 – Characterization of the sociodemographic profile and distribution of comorbidities/risk factors presented by the population deprived of liberty participating in the study. São Mateus, ES, Brazil, 2020 (N=640)

Variable	**N (%)**
Race	
Black*	267 (41.72)
Yellow	187 (29.22)
White	60 (9.38)
Indigenous	1 (0.16)
Ignored	125 (19.53)
Mean age (SD)	28.2 (±8.7)
Chronic lung disease	10 (1.56)
Chronic cardiovascular disease	32 (5.0)
Diabetes mellitus	2 (0.31)
HIV infection	5 (0.78)

Legend: SD - standard deviation; *considers the values reported for the black and brown population deprived of liberty according to the IBGE classification.

In relation to the distribution of signs and symptoms of COVID-19 presented by the RC PDL and the results of specific tests, it was observed that 91 (14.2%) presented symptoms suggestive of COVID-19 in the last 14 days referring to the date of notification. The most

frequent symptoms were fever (13.28%), headache (10.94%), runny nose (7.81%) and cough (7.34%). On the other hand, 549 (85.7%) of the PDL did not present signs and symptoms suggestive of COVID-19 (Table 2).

Table 2 – Distribution of COVID-19 symptoms and distribution of laboratory data of the prison population participating in the study. São Mateus, ES, Brazil, 2020 (n=640)

Variable	N (%)
Presence of signs and symptoms in the last 14 days	
Yes	91 (14.22)
No	549 (85.78)
Fever	85 (13.28)
Difficulty breathing	5 (0.78)
Cough	47 (7.34)
Nasal or conjunctival congestion	14 (2.19)
Runny nose	50 (7.81)
Sore throat	37 (5.78)
Diarrhea	14 (2.19)
Nausea/vomiting	1 (0.16)
Headache	70 (10.94)
Weakness	33 (5.16)
Loss of smell	8 (1.25)
Loss of taste	3 (0.47)
Rapid test sample collected*	534 (83.44)
Rapid test result*	
Positive	58 (10.86)
Negative	476 (89.14)
Collected RT-PCR sample	582 (90.94)
RT-PCR result	
Positive	419 (71.99)
Negative	159 (27.32)
Inconclusive	4 (0.69)
Confirmed for COVID-19	477 (74.53)
Evolution	
Cure	477 (74.53)
Discarded cases	163 (25.47)

Legend: RT-PCR - reverse transcription polymerase chain reaction test; *rapid immunochromatographic serological test.

When analyzing laboratory data, it was identified that 534 (83.4%) underwent RT, of which 58 (10.8%) had a positive result. A total of 582 (90.9%) RT-PCR sample collections were performed in the PDL with negative RT, of which 419 (71.9%) had a positive result for COVID-19. There was confirmation of 477 (74.5%) cases of COVID-19 in the PU and, of these, all evolved to the clinical outcome of cure (Table 2).

Health surveillance actions to control COVID-19 in the prison unit

Five healthcare professionals participated in the interview. Regarding the characterization of classes, four categories were identified, described below:

Class 1. Establish an action plan and interprofessional relationship between teams for COVID-19 contingency

The lack of protocols and contingency plans for the spread of the SARS-CoV-2 virus was evident in healthcare professionals' statements. It was expected that, at the beginning of a pandemic scenario, there would still be gaps in the construction of protocols for the conduct to be taken.

> *"During the outbreak, there was no contingency plan... until now, there was no contingency plan for prison health with COVID". HP3*

However, efforts by professionals to build solutions to the problem to be faced were observed with the meetings held, in order to build an action plan for the control of COVID-19 in the PU that involved all security professionals and health surveillance professionals.

> *"We held meetings with the responsible parties, and we drew up a work plan of what was going to be done in relation to the outbreak". HP4*

Class 2. Changes in the prison system routine to monitor and organize disease prevention

It was possible to observe, in professionals' speeches, the need for changes in the institutional routine, as well as the performance of tasks and processes to be able to monitor new cases of the disease among the PDL and prevent the proliferation of the virus.

> *"We implemented a new routine; if a new inmate arrived, he would be kept in an isolated cell and would only enter his own cell if he took the test." HP3*
>
> *"We suggested that sunbathing be separate, that all areas be disinfected." HP4*
>
> *"And also measures for entering the RC. So, we implemented a barrier at the RC door". HP3*

It is possible to verify that, based on the signs of COVID-19 infection, the PU drew up strategic plans to separate the PDL, considering spaces, such as cells and wings, in order to promote the necessary isolation.

> *"We made a technical visit to understand and be able to guide the entire process". HP2*
>
> *"In one of the meetings with the technical team, we even discussed the structure of the cells, the number of cells to be able to move them". HP2*

"The PDL was constantly monitoring them. To prevent the situation from getting worse, everyone who tested positive was kept in one cell". HP2

Class 3. Strategies applied in the prison unit to contain the virus

Concern for the PDL's health was the driving force that led professionals to outline strategies to contain the virus, such as dividing the PDL into blocks and separate times for sunbathing.

"We considered the dirty area and the clean area. So, in the dirty area, which would be block A or B, were the positive PDL. In the clean area, were those who were not positive. And we also had cell freezing [...] if there was a positive person in that cell, that person was isolated and that cell was frozen. No one could enter and no one could leave." HP1

"It was also recommended that all those who were not infected should take their daily sunbath before those who were infected. So, we had to separate two sunbath times so that they would not be together". HP3

Class 4. COVID-19 screening strategy for the prison population

In their statements, healthcare professionals report the testing process for everyone at the PDL. The statements highlight the process of reporting those tested for COVID-19 in e-SUS Health Surveillance during the pandemic. The difficulty of reporting quickly was also clear, given the high occurrence of cases of the disease.

"The epidemiological surveillance team was the one who made [the notification] during the outbreak." HP3

"When you collect an RT-PCR sample, I also need to enter it into the LACEN laboratory management system. While we were there collecting, here in the epidemiological surveillance, there were people notifying and entering these tests into the GAL". HP3

The statements also provide an insight into the emergence of the first people who presented suspected COVID-19, and highlight the importance of the process of monitoring suspected cases carried out by health surveillance to carry out a rapid response to public health events.

"I realized that we tested positive for one person, one inmate, and then I realized that from one, the next week we already had five, two days later we already had ten, I don't remember the exact numbers. I was

alerted, because in less than a week, we were testing positive very quickly...". HP3

Professionals highlight the organization and process of carrying out tests to screen for COVID-19. As a limitation, they highlight the adaptation to the collection environment, how to ensure everyone's safety in this process, as well as the limitations of the tests used, being the serological ones and only later the RT-PCR ones.

"We used the yard itself. Five people would come down from a cell, an entire cell would be opened, and then the entire cell, which had around five to seven people, would sit on plastic chairs. The security chiefs and prison officers would position the PDL, and after that, we would collect it and bring it to storage, because it was placed in the technical box. [...] we would collect it and release it to return to the cell [...] and while they were going through the other staircase at the end of the wing, there was already another cell going down at the beginning of the wing. So, we always created this flow so that they wouldn't cross paths either". HP3

"What we did first was the rapid serological test [...] at that time, we didn't have a vaccine, we didn't have antibody production yet, so we could use the rapid serological test and that's what we had. [...] for the negative ones, we did the RT-PCR". HP4

DISCUSSION

We found a high rate of SARS-CoV-2 infection among PDL with rapid transmission of the virus within the prison system. In Brazil, a cross-sectional study conducted in four prisons found a seroprevalence for SARS-CoV-2 of 81.1%.[11] In the state of Espírito Santo, the prevalence among PDL was 31.64%, with emphasis on the North region, which presented 43.7% prevalence.[9] The differences found in the studies may be related to the structure of the PU healthcare services in the different regions, which may affect the early detection of symptoms and delay in diagnosis, affecting the spread of the disease.

Monitoring people with respiratory symptoms is essential in the health surveillance process at the PU. Early identification of symptomatic people triggers preventive actions, such as the use of masks and isolation in specific cells. It was from monitoring notifications of suspected cases of COVID-19 that the epidemiological surveillance service raised the hypothesis of a possible outbreak among the PDL, triggering actions to control the disease. The

PDL presented several symptoms, the most prevalent being fever, headache, runny nose, cough and sore throat. The symptoms are inherent to the fact that the respiratory system is the most commonly affected by COVID-19.[12-15] However, a quantity of PDL greater than the PU's capacity may provide incipient monitoring, creating a favorable scenario for the spread of COVID-19.

A mass testing strategy used in 16 PUs in the United States reported a prevalence of 86.8% of SARS-CoV-2 among the PDL, with a reduction in the emergence of new cases in the PU.[4] We observed that the strategy of testing all PDL patients rapidly increased the positivity rate, but then presented a decrease in positive cases, remaining at zero, suggesting a good strategy for controlling the disease. Considering that one of the main objectives of health surveillance is disease control actions, this action was effective in identifying new cases and acting to contain the spread of COVID-19 in the PU.

Not only testing everyone, but also testing the PDL made it possible to reduce cases and control the outbreak in the PU. Measures such as screening for respiratory symptoms, dividing the PDL into symptomatic or asymptomatic blocks, isolation cells, suspension of visits, among others, were essential for controlling COVID-19. The pandemic required changes to PU's routine.[16,17] The pandemic scenario was challenging for PU professionals, given the need to deal with something new, with the creation of new protocols without compromising the PDL safety and health,[16] with interprofessional interaction between safety professionals and health surveillance professionals being the key point for controlling COVID-19 in the PU.[18]

Prison conditions are conducive to the spread of SARS-CoV-2. [19] Although these conditions are favorable for the introduction and spread of respiratory diseases, there are few reports on the transmission dynamics and impact of COVID-19 in prisons. [20-21] In an investigation of a COVID-19 outbreak in a prison in the Brazilian capital, no statistical association was found between overcrowding or sleeping location and the presence of SARS-CoV-2 antibodies.[11]

There are several possibilities for SARS-CoV-2 to enter the PU.[22,23] One of the ways of entering is through the external environment, through visitors and professionals who work inside the PU.[23-24] With the introduction of SARS-CoV-2 inside the PU, its transmission is extremely fast, which responds to a peak in cases.[25] A systematic approach study assessed the risk of SARS-CoV-2 transmission in different environments, describing that a detainee infected with SARS-CoV-2 has a 60% chance of infecting another within the same cell, which may justify the speed of COVID-19 transmission in the PU.[26]

Professionals were concerned about the worsening of PDL with a diagnosis of COVID-19, which may require hospitalization and risk of death. At the beginning of the COVID-19 pandemic, little was known about clinical management and factors associated with death and hospitalization, so there was greater concern for the most vulnerable populations. Studies have already described a higher risk of hospitalization and death from COVID-19 in PDL when compared to the general population.[27-29] However, in our study, no people were found in the PDL who required hospitalization and had a fatal outcome, which may be a result of early management and monitoring, and interprofessional partnership with health surveillance.

This study highlights the interprofessional actions listed to contain a COVID-19 outbreak in a public health unit that contribute to the process of preventing the disease and proposing appropriate actions for possible new outbreaks and pandemics. However, it is necessary to highlight its limitations. Since this is a secondary data analysis, the lack of complete information in the notification forms or incorrect filling of information in the information system may have influenced the results. However, since this was a major COVID-19 outbreak, the data were revisited by the health surveillance team, validating the information.

In conclusion, the data led to the understanding that the PDL is vulnerable to rapid transmission of respiratory diseases due to the context in which these people live. Health surveillance strategies for the rapid identification of introduction of pathogens into the PU and blocking transmission are essential factors to prevent the massive spread of the communicable disease. Structuring health surveillance services and qualifying their organizational process is essential for the prevention and control of future outbreaks.

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Carlos Alves Pessoa contributed to bibliographic research, abstract writing, introduction, methodology, discussion, interpretation and description of results, preparation of tables, conclusions, review and statistics. **João Paulo Cola** contributed to bibliographic research, abstract writing, introduction, methodology, discussion, interpretation and description of results, preparation of tables, conclusions, review and statistics. **Thiago Nascimento do Prado** contributed to bibliographic research, abstract writing, introduction, methodology, discussion, interpretation and description of results, preparation of tables, conclusions, review and statistics. **Letícya Dos Santos Almeida Negri** contributed to bibliographic research, abstract writing, introduction, methodology, discussion, interpretation and description of results, preparation of tables, conclusions, review and statistics. **Heleticia Scabelo Galavote** contributed to bibliographic research, abstract writing, introduction, methodology, discussion, interpretation and description of results, preparation of tables, conclusions, review and statistics.

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