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Incidence of all-cause mortality in prisons: research protocol for a global registry study and systematic literature review with meta-regression analyses

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ABSTRACT

Introduction People in prison experience disproportionate health burdens compared with community-based populations, including elevated rates of infectious and non-communicable diseases, mental illness and substance use disorders. Previous studies have consistently shown increased rates of mortality following release from incarceration, particularly from external (unnatural) causes such as suicide and violence. However, evidence on mortality incidence during imprisonment is scarce, and many deaths may be preventable through targeted health and prevention interventions. This study aims to synthesise worldwide evidence on all-cause mortality incidence in prisons.

Methods and analysis We will conduct a worldwide registry study combined with a systematic literature review and meta-regression analysis. Eligible sources will report deaths among incarcerated people between 2005 and 2025 at the national or, where more appropriate, the subnational jurisdictional level. Mortality data will be retrieved from official reports of prison administrations and direct contact with prison authorities. Also, data from international databases and the scientific literature will be reviewed. Incidence rates of all-cause mortality per 100 000 person-years will be calculated and reported for each jurisdiction, alongside standardised mortality ratios comparing imprisoned populations with general population estimates.

Ethics and dissemination Since the study relies on anonymised routine data registries available from different sources, an exemption certificate was granted by the Ethics Committee of Diego Portales University (UDP) in Santiago, Chile. Findings will be submitted for publication in a peer-reviewed academic journal.

Trial registration number https://osf.io/vkzae.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ This is the first study to systematically collate and synthesise global data on all-cause mortality in prisons worldwide.
⇒ Comprehensive data retrieval from multiple sources (including official prison reports, direct contact/correspondence with prison administrations, international databases and peer-reviewed literature) maximises completeness and comparability.
⇒ A method established for studying cause-specific mortality in prison will guide this research, including meta-regression analyses to identify sources of heterogeneity (region, income group, incarceration rate and prison occupancy).
⇒ Potential under-reporting or misclassification of causes of death and data unavailability may introduce bias, particularly in poorly resourced settings.
⇒ Heterogeneity in definitions and reporting practices across jurisdictions may further limit cross-national comparisons.

INTRODUCTION

Incarcerated people experience health disparities compared with the general population, with higher prevalence of infectious and non-communicable diseases (NCDs).[1 2] They also have high rates of serious mental illness,[3] often with comorbid substance use disorders.[4] Mortality rates are also elevated in people with criminal justice system involvement, especially after release from prison/incarceration.[5] Unnatural causes of death are among the most frequent in the first 2 years after release.[5 6] As time goes on, living in the community, the mortality burden shifts to NCDs, as in the general population.[5 6] Mortality during imprisonment is understudied, and this missing epidemiological knowledge could meaningfully inform prevention efforts. Modifiable causes of death, such as interpersonal violence and suicide, account for a substantial proportion of the all-cause mortality during imprisonment, especially among young men.[7] Potentially lethal infectious diseases, like hepatitis C and B, HIV and tuberculosis, are also common in prison.[1] In a recent umbrella review of mental and physical health morbidity, approximately 18% of the

imprisoned people were estimated to be antibody-positive for hepatitis C.[1] There is a growing body of evidence from interventions detecting, monitoring and treating chronic NCDs in prison, including metabolic disease, cardiovascular disease and cancer.[8] Those interventions have the potential to modify mortality outcomes. In many countries, the prison population is ageing with an increasing need for palliative and end-of-life care.[9] Accordingly, the mortality burden is shifting to NCDs. Addressing mortality during incarceration is an urgent public health priority that needs reliable incidence estimates.

The aim of this study is to systematically review and synthesise the evidence on the incidence of all-cause and cause-specific mortality in prisons worldwide. We will also assess subgroups by sex and regions when data permit such analysis. This study also aims to compare prison mortality incidence rates with mortality data in communities/countries where the prisons are based.

METHODS AND ANALYSIS

Information sources

Websites of prison administrations will be searched for annual reports on mortality data. In federal countries, in which prisons are administered on a subnational level (ie, states and provinces), we will undertake a broader search for institutions and reports that may collate this information nationally. Jurisdictions on the subnational level may be included when collated information at the national level is unavailable. When not publicly available, a second approach, by directly contacting prison administrations to request mortality data, will be used.

When no primary sources are available, we will employ a third approach by retrieving information from international databases. The United Nations Office on Drugs and Crime (UNODC)[10] and the Council of Europe Annual Penal Statistics (SPACE, for Statistiques Pénales Annuelles du Conseil de l'Europe)[11] will be consulted. Finally, this study also includes a systematic review of the scientific literature. We will use data from the scientific literature for countries in which primary and secondary international data sources are unavailable. Automatic translation tools (eg, Google Translate) will be used to search reports in languages not mastered by the multinational research team (figure 1).

In the case of discrepancies between sources for single countries, we will use the official national statistics but flag the differences in the manuscript.

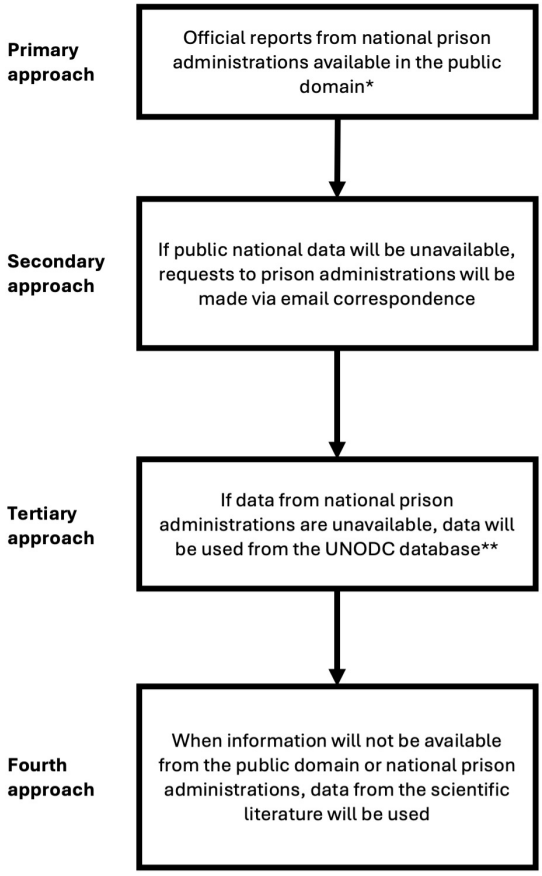

Figure 1 Search strategy to retrieve mortality data in prison populations. Approaches to retrieve mortality data during imprisonment. Note: *There are exceptions in European and Asian countries. In Europe, SPACE data sets will be considered as the primary source since national agencies regularly report data to this organisation. This criterion also applied to some Asian countries affiliated with SPACE (ie, Cyprus). **For European and SPACE-affiliated Asian countries, the UNODC data will be used to complement the reporting periods. SPACE, Council of Europe Annual Penal Statistics; UNODC, United Nations Office on Drugs and Crime.

Search strategy

Both websites and email contacts of the prison administrations will be retrieved through the World Prison Brief,[12] an online database with free access to prison statistics in 223 jurisdictions worldwide, hosted by the Institute for Crime and Justice Policy Research at Birkbeck, University of London. Contact attempts will be made via email in English, but also using automated translation tools for local languages. A maximum of three email contact attempts will be made, with at least 2 weeks between attempts when there is no reply. For the scientific literature review, we will search Medline, EMBASE, Global Health, Global Index Medicus, Scopus, Criminal Justice Database and National Criminal Justice Reference Service databases from 1 January 2005 to the search date, using search terms of (mortality OR death OR dying OR survival) AND (prison* OR inmate OR jail OR offend* OR "criminal justice" OR imprison* OR remand OR detain* OR detention OR probat* OR sentenced OR incarcerat*). The exact syntax for each database is shown in the online supplemental file 1. The 20-year observation period allows for a substantial number of cases to conduct analyses and focus on recent cohorts of imprisonment (ie, ageing prison population). Google Scholar searches will also be undertaken, including country names in the search string for countries in which other data sources are unavailable. In Latin America, we will also request prison

mortality data from national transparency departments if not otherwise available. In several Asian and African countries that do not provide prison mortality data in the public domain or in published reports,[13] we will involve further collaborators based on previous collaborations and on authorship in scientific literature. Those potential collaborators will request prison mortality data in local languages from their national authorities.

Eligibility criteria

Study selection will be guided by the PEO (population, exposure, outcome) framework, a variant of PECO (population, exposure, comparison, outcome) for prevalence studies. The comparison (ie, prison vs community-based population) will be an original contribution of this study (see below, outcomes and data analysis plan). Observational studies, databases and registries systematically reporting the number of deaths (outcome) during incarceration (exposure) in unselected adults (population) for at least 1 year between 2005 and 2024 for any prison or jail, regardless of the cause of death or location (country or jurisdiction), will be included. Thus, deaths during leave/permit of people who are otherwise in full-time imprisonment or during imprisonment due to a disease or injury inflicted before intake will also be included. We will exclude reports of mortality in preselected prison populations (ie, by age, offence type, health condition or security level).

As this study is based on registry data and a systematic review of all available reports worldwide, no formal sample size calculation is required. All eligible data sources published in any language between 2000 and 2025 will be included to maximise statistical power and ensure representativeness.

Data management

Data will be extracted to a shared Excel file on Google Drive. We will employ the UNODC categories and definitions for causes of deaths during incarceration, which consider deaths due to natural causes and deaths due to external causes in prisons and jails.[10] Those will be subdivided into the categories used by the Global Burden of Disease (GBD) study.[14] When those categories are available, natural causes will be subdivided into communicable, maternal and nutritional causes in one subgroup and NCDs in the other subgroup. External causes correspond to the GBD category of injuries and will include subcategories when available: unintended alcohol and other drug poisoning, suicides, interpersonal violence, accidents and fire. Unknown and undetermined causes of death will also be added to the external causes as they are likely to correspond to one of the included causes. Persons sentenced to death by a competent authority and executed based on a legal ruling while in prison will be included as a separate category. We will also attempt to obtain data relating to individuals who are released early due to likely impending death—usually terminal cancer—otherwise referred to as 'on compassionate grounds'.

Selection and data collection processes

APM will coordinate the data extraction. Online search and email communication with prison administrations and transparency departments in Latin America and Africa will be conducted by AM-R. BIAR, AM-R, ER-S and SA will search reports and communicate with prison administrations in Asia, Europe and Oceania. ER-S, BIAR and AM-R will extract data from national official sources, SPACE and UNODC. SPACE will be the preferred database for European countries. For other countries, data provided directly by prison administrations when available will be preferred over secondary data sources (ie, UNODC). Uncertainties will be resolved between APM, AM-R, BIAR, PAC-G and ER-S. BIAR and ER-S will independently screen titles and abstracts of the literature using Rayyan.[15]

Data items

The mortality incidence rates (all-cause, natural causes and external causes) during the study period (2005–2024) will be the dependent variables. Independent variables will be: country and UN region (Africa, Americas, Asia, Europe and Oceania with the Americas as reference category; categorical); income group (low- and middle-income countries (LMIC) vs high-income countries; dichotomous); prison occupancy (continuous); incarceration rate (continuous); sex (when available); and mortality in the general population aged between 15 and 60 years (continuous).

Recognising potential annual variability in classifications, the UN geographical region[16] and World Bank income group[17] will be assigned according to the median value observed for accessible data. Occupancy of the national prison systems, incarceration rates and pretrial detention rates will be retrieved from the SPACE[11] and UNODC[18] repositories, as appropriate. When these data are unavailable, the World Prison Brief[12] will be used. Those variables will also be used as independent variables in meta-regression analyses to assess outcome heterogeneity. The female incarceration rate will be retrieved from the World Prison Brief[12] and used to calculate sex-standardised mortality rates.

The annual mortality incidence in the general population will be retrieved from the WHO's Global Health Observatory database from 2005 to 2021.[19] If the WHO Global Health Observatory is not updated by the time our study is conducted, mortality data for the general population from 2022 onwards will be retrieved from other mortality databases, such as the World Bank's World Development Indicators.[20] For a range of countries, we will also consider the inclusion of mortality databases with quicker updates (The Organisation for Economic Co-operation and Development[21]; European Statistical Office[22]; Human Mortality Database[23]).

Total population counts for each year will be collected from the UN Population Division database.[24]

Outcomes and prioritisation

We will estimate the all-cause mortality rate per 100 000 person-years of imprisonment over the observation

period (2005–2025) as primary outcome on the country/jurisdiction level, separately for males and females, where data permit such analyses. Secondary outcomes will be natural, external and cause-specific mortality incidence per 100 000 person-years of imprisonment over the observation period (2000–2024), and standardised mortality ratios (SMRs) between the prison and the general populations aged 15–60 years. We will also compare prison mortality incidence during the COVID-19 pandemic with the mortality during other periods.

Data analysis plan

To estimate the all-cause mortality incidence rate per 100 000 person-years of imprisonment for each country, the total number of deaths from all available years during the observation period will be summed in the numerator and the number of incarcerated individuals on an annual reporting day for the same years in the denominator. The resulting proportion will be multiplied by 100 000. The person-years of imprisonment will be estimated based on the annual incarceration rate, which often relies on the occupancy of a single reporting day as a proxy.

The same method will be applied to estimate incidence rates in the general population. Incarceration rates for each country will also be calculated for all available years. The occupancy level for each jurisdiction will be calculated as the sum of the incarcerated individuals in each year in the numerator and the prison capacity in the denominator. The result will be multiplied by 100, a figure that indicates full occupancy. For the USA, deaths in jails and state and federal prisons will be summed. All deaths and corresponding person-years will also be summed globally and by region to estimate crude incidence rates. Summing data from small jurisdictions and those with <1000 person-years of observation into an additional composite jurisdiction on the regional level before data synthesis will be conducted as a sensitivity analysis. Jurisdictions with fewer than 1000 person-years of observation will be excluded from data syntheses since incidence estimates may be unstable, though they will be included in an aggregate form in sensitivity analyses. We will conduct analyses for subgroups of males and females in prison, as well as for the years 2020–2021 of the COVID-19 pandemic versus the other years prepandemic and postpandemic.

The Freeman-Tukey double arcsine transformation will be applied before meta-analysis to stabilise variances in proportions close to zero, approximating a normal distribution before pooling data. We will estimate heterogeneity by using random-effects models fitted through the restricted maximum likelihood method. True variance between jurisdictions will be assessed using the Tau-squared (τ^2) statistic, which is more robust in large sample sizes than the I-squared (I^2) measures.

The median mortality rate and associated IQRs will be calculated for all jurisdictions and by UN region and income group. To explore differences in mortality between sexes, we will estimate the sex-specific median and IQRs for male and female populations in jurisdictions reporting data by sex. We will perform random-effects meta-regression analyses using models fitted via the restricted maximum likelihood method to explore potential sources of heterogeneity. Significant independent variables at the 5% level will be retained for multivariable meta-regression models. In case the outcome variables exhibit extreme variation, they will be stabilised through a log transformation before performing the meta-regression.

SMRs will be estimated by dividing the mortality incidence rate in imprisoned populations by the sex-standardised rate in the general population in each country.[13] This procedure takes into account an uneven proportion of typically about 93% males and 7% females in the prison population.[12] SMRs during COVID-19 (2020–2021) will also be compared with the SMRs during other years.

Risk of bias

We will assess risk of bias and data quality at the jurisdiction level. A modified risk-of-bias tool used in a previous systematic review on suicide mortality in prison[13] will be used. The instrument comprises eight items, with one point assigned to each and was based on a tool to assess bias in prevalence studies.[25] Higher scores indicate lower risk of bias. Publication bias will be assessed using funnel plots, which display each country's incidence rate against its corresponding SE, and indicate country rates' asymmetry, assessed through Egger's test. The assessment of the strength of evidence will be guided by GRADE (Grading of Recommendations Assessment, Development and Evaluation).[26]

Patient and public involvement

Planning, design and execution of the study will be advised by a person whose son died in a prison fire.

DISCUSSION

This study will provide an overview of the all-cause mortality in prison populations across jurisdictions with national, regional and worldwide incidence estimates, addressing an important global health research gap in a vulnerable population. Examining mortality from all rather than specific causes and groups of causes will provide a broader understanding of the health risks during incarceration and their implications for prevention and policy.

This study applies a comprehensive and systematic data retrieval strategy. Drawing on official prison reports, direct communication with correctional authorities, international repositories such as UNODC and SPACE, and peer-reviewed literature enhances both completeness and comparability of mortality data across settings. This multimodal approach also facilitates the inclusion of information from jurisdictions with limited reporting systems.

The analytical plan, including random-effects meta-analysis, will allow reporting pooled estimates. If the heterogeneity between jurisdictions limits conclusions derived from pooled values, data synthesis will focus on descriptive analyses of the medians and IQRs. Exploring heterogeneity between jurisdictions with meta-regression can help to identify ecological, country-level or prison system-level factors associated with the mortality. These analyses have the potential to enable more context-specific policy recommendations. These methods, including data retrieval strategies, were established by investigating cause-specific mortality, which allows some knowledge about what to expect from the different data sources and in terms of data availability.[13]

While health needs and risks among women experiencing incarceration are often overlooked,[27] this study will make every possible effort to identify sex-specific patterns for the different mortality outcomes.

Limitations must be considered. Under-reporting and misclassification of causes of death can bias estimates. This requires particular attention in LMICs, where resources for investigations, classifying causes and maintaining accurate registries and reporting standards are limited. Due to the political nature of the research topic, some governments may exhibit lower data transparency and may intentionally under-report data.[28] Additionally, heterogeneity in definitions and reporting practices across jurisdictions may further restrict cross-national comparability.

Despite these challenges, the study is expected to generate the most comprehensive evidence to date on mortality incidence in prisons worldwide. Our findings will provide a foundation for targeted interventions and improve international standards in reducing prison-associated mortality.

Ethics and dissemination

An exemption certificate was obtained from the Ethics Committee of Diego Portales University (UDP) in Santiago, Chile. The committee determined that this research poses no risk to human or sentient subjects. The data to be collected are public and anonymous, as no elements that imply the identification of individual subjects will be incorporated.

A manuscript with the results of this study will be published in a peer-reviewed journal.

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Contributors APM conceived the study and is guarantor of the statement. APM, ER-S and BIAR were involved in the study design. ER-S, BIAR, AM-R and PAC-G conducted exploratory searches to inform the most appropriate approach alternatives to the data sources and are responsible for the data collection. APM and ER-S prepared the first draft of the manuscript. All authors critically reviewed the article for important intellectual content. All authors approved the final version of the article.

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Competing interests None declared.

Patient and public involvement Patients and/or the public were involved in the design, or conduct, or reporting, or dissemination plans of this research. Refer to the Methods section for further details.

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