Author/s:
Onie, S;Usman, Y;Widyastuti, R;Lusiana, M;Angkasawati, TJ;Musadad, DA;Nilam, J;Vina, A;Kamsurya, R;Batterham, P;Arya, V;Pirkis, J;Larsen, M

Title:
Indonesia's first suicide statistics profile: an analysis of suicide and attempt rates, underreporting, geographic distribution, gender, method, and rurality

Date:
2024-03-01

Citation:
Onie, S., Usman, Y., Widyastuti, R., Lusiana, M., Angkasawati, T. J., Musadad, D. A., Nilam, J., Vina, A., Kamsurya, R., Batterham, P., Arya, V., Pirkis, J. & Larsen, M. (2024). Indonesia's first suicide statistics profile: an analysis of suicide and attempt rates, underreporting, geographic distribution, gender, method, and rurality. The Lancet Regional Health - Southeast Asia, 22, pp.1-10. https://doi.org/10.1016/j.lansea.2024.100368.

Persistent Link:
https://hdl.handle.net/11343/353209

Indonesia's first suicide statistics profile: an analysis of suicide and attempt rates, underreporting, geographic distribution, gender, method, and rurality

Sandersan Onie,[a,b,*] Yuslely Usman,[c] Retno Widyastuti,[c] Merry Lusiana,[c] Tri Juni Angkasawati,[c] Dede Anwar Musadad,[c] Jessica Nilam,[d,e] Ashra Vina,[d,e] Rizal Kamsurya,[f] Philip Batterham,[g] Vikas Arya,[h] Jane Pirkis,[h] and Mark Larsen[a]

[a]Black Dog Institute, University of New South Wales (UNSW Sydney), Sydney, Australia
[b]Universitas Airlangga, Surabaya, Indonesia
[c]Ministry of Health, Indonesia
[d]Wellspring Indonesia, Jakarta, Indonesia
[e]Indonesian Association for Suicide Prevention, Surabaya, Indonesia
[f]Media Nusantara Citra (MNC) University, Jakarta, Indonesia
[g]Australian National University, Canberra, Australia
[h]University of Melbourne, Melbourne, Australia

The Lancet Regional Health - Southeast Asia 2024;22: 100368

Published Online 26 February 2024
https://doi.org/10.1016/j.lansea.2024.100368

Summary

Background Timely and accurate data are critical for effective suicide prevention. Indonesia—the fourth most populous country in the world—has limited data availability and thus, limited data-driven interventions. Through a national government partnership, we obtained critical non-public data for attempts and suicides that could be analysed for the first time in Indonesia's history.

Methods We obtained and analysed data from five sources from 2016 to 2021: police data, death registry data, a provincial survey, a sample registry system, and the WHO's Global Health Observatory (WHO GHO) data. Using these data, we estimated underreporting, identified provinces with the highest suicide and suicide attempt rates, assessed gender ratios, identified methods used, and compared urban and rural suicides.

Findings The analysis yielded an underreporting rate of 859.10% for suicides, while verbal autopsies and increased quality control only increased coverage from 12.80% to 51.40%. Provinces with the highest rates of suicide were Bali, Riau Islands, Special Region of Yogyakarta, Central Java, and Central Kalimantan. Gender analysis revealed a ratio of 1: 2.11 for female to male suicides. Suicide methods analysis revealed that hanging and self-poisoning were the most used method, and rural suicides occurred at a rate 4.47 times higher than urban suicides.

Interpretation The analysis revealed the highest underreporting rate in the literature from a national sample and vast heterogeneity among provinces with high suicide rates—including provinces with strong mystic beliefs, suggesting the need for a culturally sensitive sub-national tailored approach. Through our study, we provide critical information which will allow for data-driven suicide prevention.

Funding The data collection for this was part of a project funded by the Australian Department of Foreign Affairs and Trade, Australian-Indonesian Institute (AII2020322).

Keywords: Suicide; Indonesia; Suicide statistics; Suicide age; Suicide methods; Suicide rurality

Introduction

Suicide is a major global public health issue, with more than 700,000 deaths recorded internationally annually, 77% of which occur in low-income and middle-income countries.[1] Given the considerable social and economic impact, the UN Sustainable Development Goal 3.4.2 has prioritised the reduction of suicide.

Due to the multifaceted nature of suicide, reliable data are essential to inform research, interventions, and policy. For example, means restriction requires

*Corresponding author. Black Dog Institute, University of New South Wales (UNSW Sydney), Sydney, Australia.
E-mail address: s.onie@blackdog.org.au (S. Onie).

Research in context

Evidence before this study

Data on suicide and suicide attempts in Indonesia such as geographic distribution, gender ratios and methods are currently limited, with no systematic data on information critical to data-driven suicide prevention. Epidemiological studies from a national sample are constrained to only measuring suicidality. However, without suicide and attempt data, the effectiveness of suicide prevention efforts are likely limited.

Added value of this study

This study provides the first suicide statistics profile for Indonesia. This includes data on underreporting of suicide, geographic distribution of suicides and attempts, gender ratio, methods used, and rurality.

Implications of all the available evidence

This information allows us to conduct national data-driven suicide prevention efforts for the first time, including efforts to increase coverage of suicide and attempt reporting, culturally and provincially sensitive suicide prevention approaches and means restrictions based on rurality. The data is essential as data-driven approaches maximise effectiveness and the scarce resources for mental health and suicide prevention can be used judiciously.

understanding which methods are used and how they are accessed. Further, data from sub-national administrative areas, such as a state or province, allow for context-specific approaches. For example, different provinces may have different levels of rurality and thus experience different patterns of method access and use.

Indonesia, the fourth most populous country in the world, unfortunately does not have high availability and transparency of suicide data.[2] The World Health Organization (WHO) has classified Indonesia's estimated suicide rate with the lowest possible quality score, indicating poor data quality and reliability.[3] Critical data on method and gender distributions at national and provincial levels are not accessible. Provinces are autonomous regions differing substantially in factors likely relevant to suicide and its prevention, such as industries, socio-economic distributions, appropriate cultural practices, and access to health professionals. As a result of insufficient data, little to no systematic action can be taken. The current suicide prevention guidelines published by the Ministry of Health, Indonesia (*Kementerian Kesehatan Republik Indonesia*) review the existing literature but contain minimal contextual adaptation from international guidelines beyond linguistic translation.[4] This is concerning given Indonesia's history of stigma and maltreatment of individuals with suicidal ideation, who are often considered morally and religiously deficient.[2]

A recent WHO LIVE-LIFE[5] situational analysis for the national suicide prevention strategy[2] conducted alongside the Ministry of Health, Indonesia and WHO Indonesia revealed that consulted stakeholders strongly believed that suicides are likely to be underreported in Indonesia. This is probably due to a combination of poor reporting systems and undesirable social consequences of reporting.[2] Underreporting and thus underestimating suicide may lead to undue deprioritisation of suicide prevention. The situational analysis concluded that while it is publicly recognised that Indonesia has a suicide problem, there is not enough data to understand how to tackle it.

Fortuitously, as part of a national investigation, we obtained non-public data containing mortality counts for each province, method of suicide on a national level, and data from a nationally representative registry study (Sample Registration System; SRS). Collectively, these data allow us to obtain critical information to guide systematic and effective suicide prevention efforts in Indonesia.

This study sought to develop a national profile of suicide for Indonesia, by estimating underreporting of suicide, provincial rates of suicide and suicide attempts, gender ratio for suicide, rurality, methods, and a comparison of two sources of suicide data. This is the first time detailed Indonesian data have been made available for analysis and is an essential step to inform data-driven suicide prevention policy and practice.

Methods

Data sources

The data sources record data at different administrative levels. In Indonesia, the hierarchy of relevant administrative levels is as follows: country, province (*provinsi*), regency (*kabupaten*), city (*kota*), district (*kelurahan*), and subdistrict (*kecamatan*). The Ministry of Health made four non-public datasets available to us for analysis. All these datasets have national coverage, with the fourth dataset (the SRS) sampling from a nationally representative population.

The first source of data is the National Indonesian Police Records,[6] which is traditionally considered the official source of suicide data.[7] Suicide in Indonesia is processed primarily through the criminal justice system as police evaluate and determine whether a suicide has occurred. Thus, if a suicide is suspected, the police must investigate. This dataset reports the total number of suicides per province across the country from January

2017 to July 2021, and 2016 data for national total suicides. More details are reported elsewhere.[7]

The second data source is the death registry from the Directorate of Population and Civil Registration under the Ministry of Home Affairs.[8,9] The death registry is informed when death certificates are issued. While the police records reflect the processes of the police investigation, the death registry reflects the healthcare and hospital reporting system. Thus, the death registry may reflect greater input from the healthcare system than the police report. More details about the recording and pipeline can be found elsewhere.[9] This dataset records the number of suicides (males, females, and total persons) per province and regency for 2020.

The third data source is the Village Potential Survey (*Potensi Desa; Podes*), a triennial survey completed on a sub-provincial level to assess economic, agricultural and population growth.[10,11] Within the survey, question 1307 asks about the total number of suicide attempts, including fatalities. The data are collected in survey form, which is filled in by the administrative head of each region. The administrative head collates the data needed to complete the survey from relevant data sources, such as hospital records. More details about the survey, methodology, and key findings can be found elsewhere.[10,11] This dataset reports the number of suicide attempts per province for 2018 and 2021.

The fourth data source is the SRS study developed by the National Research and Development Center, which was conducted in 128 selected subdistricts in Indonesia to represent the population.[8,12] The SRS covered 4.84 million individuals (approximately 1.84% of the population) distributed across rural and urban areas with a 1: 1.22 ratio, approximating the country's population rurality distribution.[13] The SRS is the country's bid to improve the birth and death registry. Data collection was completed by project officers who were local community members trained to build rapport and to collect comprehensive data through verbal autopsies. A verbal autopsy is an interview conducted within three months of death, by a trained professional with an individual familiar with the deceased with the goal of understanding the circumstances surrounding the individual's death, including identifying probable cause of death. Critically, confidentiality was promised by project officers. The interview results are handed to a doctor at the local health centre and recorded in a standardised International Classification of Diseases Version 10 (ICD-10) format following rigorous quality control. This process is separate and parallel to the typical data recording process, such as police recording of suicides. More details about the SRS are reported elsewhere.[12] Data on suicide deaths and total deaths in the regions covered by the SRS between 2016 and 2018 and the distribution of method used based on ICD-10 codes were provided. The 2018 data available to us has more detail, providing gender breakdown by province and ICD-10 death code by rural and urban settings.

The fifth source of data is WHO Global Health Observatory (GHO).[14] The GHO derives its values from the Global Health Estimates (GHE), which uses a range of different data sources, including the WHO mortality database, household surveys, verbal autopsies, or special studies to provide the most accurate estimation of suicide rates. Modelling is applied to adjust for estimated underreporting. More information can be found elsewhere.[14] In addition to the above sources, we accessed the national and provincial populations from census data reported on the Federal Bureau of Statistics website.[13,15]

Analysis plan

Estimating underreporting of suicides and coverage

To quantify underreporting, we first obtained crude suicide rates for the relevant data sources. We divided the number of suicides from the police data by the national population, and the number of suicides from the SRS by 4.8 million (the total population in the SRS study catchment). The published WHO GHO rate was used.[14] The police and GHO data were analysed for 2016–2021, while the analyses including SRS data were only conducted for 2016–2018. An overall underreporting rate was calculated over the relevant period, and the range of rates for individual years are also reported.

The police (official data) and GHO rates were compared by calculating an underreporting rate by using a rate ratio calculation.[16] We then used Bayesian one-sample t-test modelling to estimate the credible interval of the underreporting estimates. Underreporting rates were similarly calculated for SRS versus GHO data, and police (official) versus SRS data.

To complement the underreporting rates, we also estimated the coverage associated each dataset, i.e. the proportion of suicides counted in the police and SRS sources relative to the GHO data. The coverages of the police and SRS data were calculated for 2016–2021 and 2016–2018 respectively. The difference in coverage of the police and SRS data was also calculated. Given that applying a singular underreporting adjustment to data from various sources may not be appropriate, all subsequent analyses use raw values.

Suicide and attempt rate (nationally and in each province)

We calculated crude suicide rates per 100,000 population (nationally and in each province) by dividing the number of deaths for each year (from the police data) by the relevant population multiplied by 100,000. When fewer than 5 suicide deaths were recorded in a year, the rate was not calculated to prevent unreliable rate estimates. To identify priority provinces, we then entered the yearly crude suicide rates for each province from 2017 to 2021 into a Bayesian linear model to obtain an estimate of the mean and the 95% credible intervals,

from which we identified the five provinces with the highest rates.

Crude attempt rates were calculated in a similar manner to crude suicide rates, replacing suicide counts with suicide attempt counts from the Village Potential Survey. Attempt data from the Village Potential Survey and death data from the police dataset were used to calculate the ratio of suicide attempts to suicide deaths.

Gender analysis

We calculated the ratio between male and female suicides using the 2020 death registry data and the 2018 SRS data.

Age analysis

The mean and range of ages at the time of death by suicide was calculated from the 2016–2018 SRS data. The distribution of deaths across five-year age ranges was also derived and combined with population age data from the census to calculate age-specific suicide rates.

Method reporting

Data on suicide methods (as recorded using ICD-10 codes) were extracted from the 2016–2018 SRS data and are reported as a proportion of recorded suicides.

Rurality and method analysis

To investigate whether suicides differed as a function of rurality, we calculated the ratio of the number of suicides that occurred in urban settings relative to those in rural settings, using the 2018 SRS data. We then derived a second ratio, adjusted by population, by first dividing the urban suicide count by 1.22, given that 22% more individuals lived in urban areas. We then investigated whether the pattern of method used differed as a function of rurality using 2018 SRS data. We calculated the percentage of suicides for each ICD-10 code as a proportion of total suicides for rural and urban settings separately. We then calculated the ratio of these percentages to investigate whether there was a difference in the proportion of suicides due to one method over another.

Role of the funding source

The funding agency had no role in study design, data collection, data analysis, interpretation, or writing of the manuscript.

Results

Underreporting of suicides and coverage

The suicide rates derived from each of the three data sources are reported in Table 1. When comparing GHO and police data, an underreporting rate of 859.10% (95% CI [736.20%–981.90%]; range: 718.22–1028.18%) was found. When comparing GHO and SRS data, an underreporting rate of 197.40% (95% CI [129.60%–265.30%]; range: 165.97%–215.05%) was found. When comparing SRS and police data, an underreporting rate of 399.90% (95% CI [328.90%–470.80%]; range = 386.07%–432.73%) was found.

Year	WHO GHO	SRS	Police
2016	2.4	1.45	0.33
2017	2.4	1.14	0.30
2018	2.4	1.12	0.29
2019	2.4		0.30
2020	2.4		0.25
2021	2.4		0.23

Note: WHO GHO estimates use age-adjusted suicide rate, while the SRS and police estimates use crude suicide rates. These rates are rounded to two significant figures; differences from rates in the table, and underreporting and coverage analyses are due to rounding. Given that the SRS study was complete in 2018, data for 2019 and onwards is not available.

Table 1: **Yearly suicide rate per 100,000 population, as calculated from each data source.**

Coverage associated with the police and SRS data were 12.80% (95% CI [10.30%–15.30%]) and 51.40% (95% CI [32.20%–70.50%]), respectively, relative to an assumed 100% coverage in the GHO data. The SRS data therefore has 38.60% (95% CI [21.80%–55.30%]) increased coverage above the police data. The estimated suicide coverage across time for each data source is shown in Fig. 1.

Suicide and attempt rate nationally and by province

Provincial analyses reveal that the highest suicide rates occurred in Bali (1.821/100,000, 95% CI [1.611–2.03]), Riau Islands (1.175/100,000, 95% CI [0.688–1.661]), Special Region Yogyakarta (0.951/100,000, 95% CI [0.711–1.191]), Central Java (0.806/100,000, 95% CI [0.647–0.966]) and Central Kalimantan (0.416/100,000, 95% CI [0.294–0.538]) highlighting these five provinces for intervention and further analyses.

The national suicide attempt rate was 2.25 attempts per 100,000 individuals. Further, the five provinces with the highest crude suicide attempt rates were West Sulawesi (20.07 per 100,000), Gorontalo (9.09 per 100,000), Bengkulu (8.72 per 100,000), North Sulawesi (7.11 per 100,000), and Riau Islands (6.62 per 100,000). In 2018, there were 6013 suicide attempts from the Village Potential Survey data and 772 suicides from the police data, suggesting that for every suicide death, there were 7.78 attempts.

Gender analysis

The death registry in 2020 recorded a ratio of 2.11:1 for male-to-female suicides, while the SRS recorded a ratio of 1.69:1 for male-to-female suicides.

Age analysis

The 2016–2018 SRS data revealed that the mean age of death by suicide was 43 years, with a range of 12–90

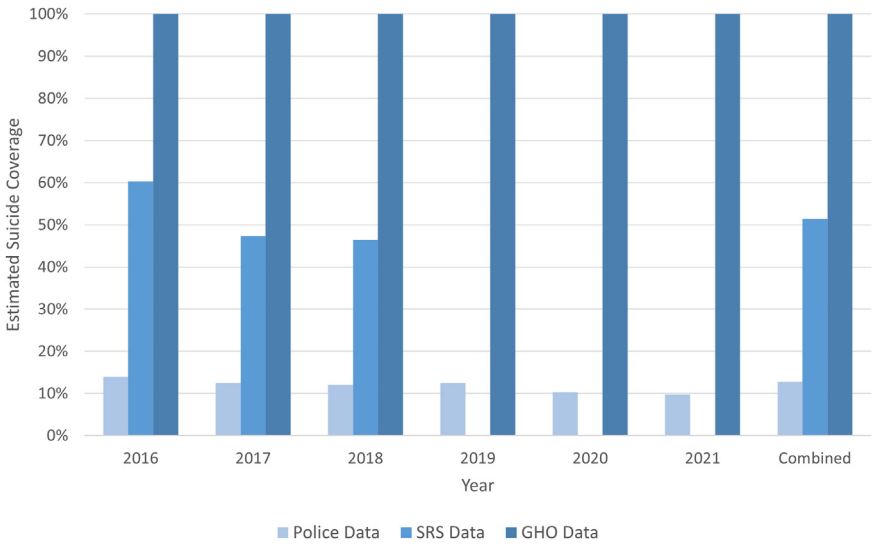

Fig. 1: Estimated coverage of data sources.

years. The distribution of suicides across age groups is shown in Fig. 2.

Method analysis

The numbers and percentages of deaths accounted for by each method from the SRS data from 2016 to 2018 are reported in Table 2. Hanging (X70 [ICD-10 Code]) accounted for the majority (60%) of recorded suicides, followed by self-poisoning (X60–X69, <26%). Most self-poisoning deaths occurring from pesticides (X68; 13% of all suicides).

Rurality and means analysis

Majority of deaths documented in the 2018 SRS data occurred in rural areas (55/70), yielding a ratio of 1: 3.67: between urban and rural incidents. Adjustment for the relative populations in urban and rural areas results in a ratio of 1: 4.47.

Hanging accounted for 53% of the reported suicide deaths in rural areas, and 67% of those in urban areas, yielding a rate ratio of 1:1.26 for hanging deaths in urban to rural areas. Self-poisoning deaths occurred at ratio of 1:1.54 with higher rates in rural areas. Due to

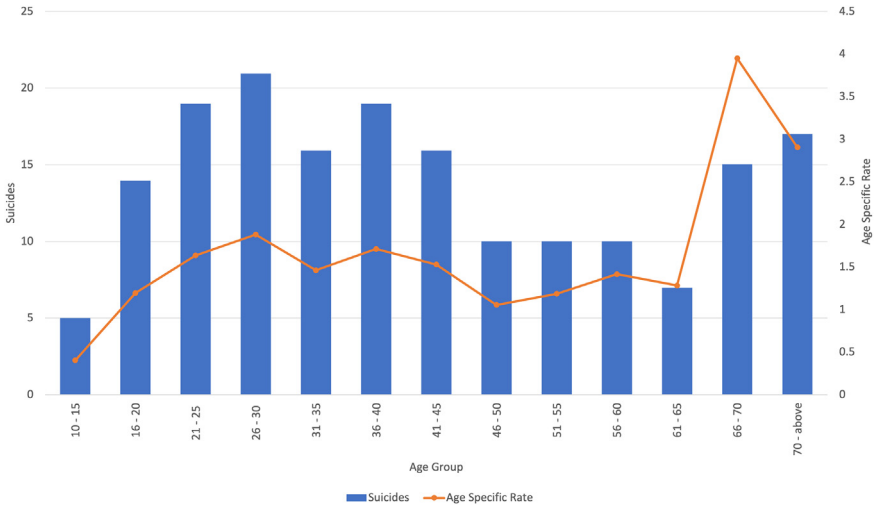

Fig. 2: Age distribution of suicides from the 2016–2018 SRS data.

ICD-10 Code	Description	Suicides	Percentage
X62	Intentional self-poisoning by and exposure to narcotics and psycholeptics [hallucinogens] not elsewhere classified	<5	<3%
X65	Intentional self-poisoning by and exposure to alcohol	5	3%
X68	Intentional self-poisoning by and exposure to pesticides	24	13%
X69	Intentional self-poisoning by and exposure to other and unspecified chemicals and noxious substances	12	7%
X70	Intentional self-harm by hanging, strangulation and suffocation	107	60%
X71	Intentional self-harm by drowning and submersion	<5	<3%
X76	Intentional self-harm by smoke, fire, and flames	<5	<3%
X77	Intentional self-harm by steam, hot vapours and hot objects	<5	<3%
X78	Intentional self-harm by a sharp object	5	3%
X79	Intentional self-harm by a blunt object	<5	<3%
X80	Intentional self-harm by jumping from a high place	<5	<3%
X81	Intentional self-harm by jumping or lying before moving object	<5	<3%
X84	Intentional self-harm by unspecified means	<5	<3%

Note: Counts fewer than 5 and their corresponding percentages have been obfuscated to preserve anonymity.

Table 2: **Suicide means from the 2016–2018 SRS data.**

low count data, rates for other methods could not be reported.

Discussion

This study investigated the epidemiology of suicides and suicide attempts in Indonesia, providing data on underreporting, geographical distribution, the proportion of fatal suicide attempts, age, gender, and rurality distribution as well as methods used. It is the first study to have done this at scale in Indonesia. Below we discuss the findings in each subsection.

Underreporting and coverage of suicide

Across 2016–2018, the analysis yielded an estimated underreporting rate of 859.10%. Techniques employed in the SRS were associated with a higher coverage of suicides compared with official police sources. To our knowledge, the underreporting rate of 859.10% is the highest to be identified in a nationally representative sample.[16–19] This was likely to reflect underreporting across several layers of infrastructure, where not only do families often ask that a suicide is not reported, but field workers have found that police often do not pursue suicide-related investigations.[2] Further, we predict that Indonesia's underreporting rate may be higher than suggested in this analysis, given we have not used other methods of assessing underreporting, such as reanalysing deaths due to unidentified means.[17]

The difference in suicide rates derived from the SRS and police data may have been due to the data collection methods. In the SRS, project officers were local community members trained to build rapport and collect comprehensive data through verbal autopsies. Critically, confidentiality was explicitly guaranteed. Furthermore, SRS data collection may have occurred up to three months after the death, allowing the bereaved sometime after the initial period of grief. These factors may have led to a greater willingness of interviewees to disclose suicide-related information. However, our analyses also suggested that implementation of suicide recording capacity building, verbal autopsies, guaranteed confidentiality, as well as greater quality control systems may only capture approximately half (51.4%, 95% CI [32.20%–70.50%]) of all suicides; this still leaves a substantial number of cases underreported, and thus further work is needed to understand what other barriers exist and how to overcome them.

Research in other countries in the WHO southeast Asia region has similarly reported differences in suicide rates between sources. For example, a recent study on suicide rates in India compared police and the Global Burden of Disease (GBD) study data (2005–2015).[16] The GBD estimates were drawn from SRS studies and are assumed to have more coverage. The study found that GBD-recorded suicides counts were 1.27 times greater than police-recorded suicides and recommended that social stigma towards suicide and improved data collection pipelines be addressed to reduce underreporting. In Bangladesh, estimates of national and regional suicide rates also suggest that there may be underreporting.[20] Further research may seek to understand how common data reporting and cultural factors among countries contribute to underreporting of suicide. For example, in all three countries, religion is a core pillar of society, and a recent report has found that religious law is a common thread among countries that criminalise suicide.[21] Thus, religious based destigmatisation may be a fruitful approach for suicide prevention in many countries in the southeast Asia region.[22,23]

We recommend that in countries like Indonesia, where there is substantial stigma, relevant investigative parties are trained in communication given the sensitivity of the topic and the potential of severe social repercussions of disclosure. Moreover, policy should aim to reduce underreporting as much as possible.

Underreporting underestimates the true cost and impact of suicide leading to under-resourcing of suicide prevention activities, while selective underreporting may lead to misallocation of services. Future work should investigate the factors affecting family member and local community's willingness to report a suicide and the willingness to record a death as a suicide by officials. Initial findings from the Indonesian Suicide Prevention Strategy have led to the recommendation of a single governing body to have access to and to analyse the data under the auspices of the Ministry of Health. Such an approach may lead to improved quality and coverage of data collection.[2]

Provincial differences

A provincial analysis identified five key provinces: Bali, Riau Islands, Special Region Yogyakarta, Central Java, and Central Kalimantan. Apart from Central Java and adjacent Yogyakarta, the other provinces are all culturally and ethnically distinct. For example, despite being a predominantly Muslim country, Bali is a single island with a predominantly Hindu population and an economy that relies heavily on tourism. Riau Islands are a collection of 1796 individual islands off Sumatra Island, heavily influenced by Malaysian culture. Central Kalimantan consists of a predominantly Muslim population from the Dayak ethnic group, unique to the region. Central Java and DKI Yogyakarta are located on the large Java Island and are primarily Muslim in religion from the Javanese ethnic group.

Further investigation is needed to identify underlying patterns in these priority provinces. For example, different cultural and religious aspects may influence perceptions on self-harm and death. For example, Bali, the province with the highest suicide rate, is also Indonesia's only predominantly Hindu province.[24] Hinduism has been previously linked with higher rates of suicide, which may can be linked with the religion's perspectives on the finality of death—or lack thereof.[25] By understanding these perspectives, stakeholders' efforts can engage the population more effectively, to reduce stigma, increase help-seeking, and gather community support for suicide prevention activities. Given the heterogeneity of factors across the priority provinces, national strategies and efforts need to be complemented by local approaches and implementation.

Among the provinces of priority, one notable province is DKI Yogyakarta. DKI Yogyakarta includes Gunung Kidul Regency, a mountainous region of Yogyakarta known for high suicide rates[26]; it is often attributed to a mystic cultural element to suicide called *pulong gantung*[26]. *Pulong gantung* is a phenomenon where a fire spirit is observed hovering above the house indicating that someone in that household will die by hanging. Another version of the story states that the household will experience great loss, and a sacrifice must be made to avoid this loss. Indeed, several case studies document individuals reporting seeing the fireball and dying by hanging shortly afterwards. Interviews with individuals who have attempted suicide at Gunung Kidul regency reveal that many report losing consciousness before attempting suicide.[26] DKI Yogyakarta's suicide statistics suggest that these cultural elements cannot be neglected, but suicide prevention programs must address them directly. Bali and Central Java also have strong mystic beliefs, suggesting that addressing mystic beliefs needs to be a core element in suicide prevention messaging and approaches in Indonesia.

Attempted suicide and suicide rates

The estimated ratio between suicide attempts and suicide deaths of 7.78 is lower than that reported elsewhere in the literature, as other studies have found that suicide attempts may exceed 30 times the number of deaths.[27] Similarly, low ratios have been found in other countries with nascent mental health systems. For example, suicide fatality in rural India is much higher compared to high-income countries due to a lack of mental health services, infrastructure and resources,[28] leading to attempts being more fatal. Another possibility is that underreporting of suicide attempts is greater than the underreporting of suicides. For example, the situational analysis for the national suicide prevention strategy revealed that treatment following a suicide attempt is not covered by insurance, therefore doctors will often not record that an incident was a suicide attempt to allow patients to receive insurance coverage.[2] Future efforts should seek to understand what factors lead to the potentially high fatality rate of suicide attempts and seek to rectify them, as well as how to measure and address underreporting of suicide attempts.

Moreover, we expect suicide attempt counts to be underreported to an even greater degree than suicides, given that universal healthcare does not cover treatment following a suicide attempt, and thus, doctors will mask a suicide attempt to allow the patient access to universal healthcare.[2] Furthermore, many more attempts may occur in the community without individuals seeking healthcare.

Gender analysis

The ratio between female to male suicides is 1:1.69 and 1:2.11, according to the 2018 SRS and 2020 death registry data, respectively, indicating a higher proportion of male suicide deaths. As has been found in other countries, suicides recorded in Indonesia predominantly occurred in men. For example, past findings suggested that in southeast Asia, the ratio between male to female suicide deaths was 1.57:1.[29] However, due to a lack of existing data, we cannot conclude whether, like in other settings, there is a higher incidence of suicide attempts and self-harm in women. We currently do not have data

outlining differences in means selection for men and women—information essential to gender-based approaches in means restriction. Furthermore, many findings outside Indonesia reveal gender differences in cognition, experiences, help-seeking behaviour, and therapy protocols.[30] More research is needed to understand how these differences manifest in the Indonesian population and whether this interacts with the heterogeneity of each province.

Age analysis

The age analysis reveals that suicide counts rise from 10 to 16 years, peaking at 26–30 years, and decreasing between 46 and 50, with a sharp increase from the 61–65 to the 66–70-year groups. However, examining the age-specific rate reveals that while there is a peak in the curve prior to 46–50, following the counts, the rate increases dramatically in the 66–70 age group. This pattern of findings is not unique to Indonesia; for example, 2021 data for Australia suggests that despite the greatest numbers of suicides occurring around the 30–34 age group, the highest age-specific rates occur above 80 years old.[31]

The elderly experience higher rates of chronic illness, loneliness, and in Indonesia's case, poverty due to the lack of social support—known risk factors for suicide.[32] Thus, further investigation is needed to understand factors in suicide as well as suicide prevention across the lifespan, not just in one age group.

An additional contribution to the high rate among the elderly may be the high count of suicides among the elderly in Gunung Kidul regency, within DI Yogyakarta province, an identified province of concern. In one study, the authors found that 50% of suicides in the regency over the 2012–2019 period occurred in people over 60 years of age.[33] This may be partly due to *pulong gantung*, in which the elderly will often take their own life to prevent another family member having to die by suicide. Given that DI Yogyakarta contributes substantially to national suicides, this may play a contributing factor. However, further investigation is needed.

Methods analysis

Method analysis from the 2016–2018 SRS data reveals that hanging was the primary method of suicide, followed by self-poisoning by pesticides. The use of hanging and pesticide self-poisoning as means is consistent with a predominantly agricultural country.[34] In addition, pesticides are commonly used and available in Indonesia due to the prevalence of insect-borne diseases common in tropical countries.[35] Furthermore, ligature material is extremely accessible given that construction often uses rudimentary techniques involving high rope and bamboo.[36] Furthermore, homes in rural areas are still often constructed with bamboo and rope, making ligatures and ropes extremely accessible.[36] Means restriction should focus on how these means are obtained and whether suicide prevention efforts can be inserted into the purchasing and access process. Studies investigating the types of pesticides used and their lethality are needed to introduce policies that substitute less lethal pesticides that provide similar crop yields.[37]

Rurality

Consistent with findings from other studies,[38] our study showed that suicides in Indonesia occurred disproportionately in rural areas with an adjusted rate ratio of 1:4.47. This may be due to several factors, such as increased religiosity leading to higher stigma and lower help-seeking[39] and greater availability of means given the high use of rope and pesticides, which form the bulk of the means used in suicide cases in Indonesia.

Another potential factor is the lack of access to mental health services; however, Indonesia suffers from a vast shortage of psychologists and psychiatrists, with an estimated ratio of one provider for every 60,666 individuals and most professionals practicing in urban areas.[40] Thus, while most of the workforce is in metropolitan areas, even individuals in urban areas have difficulty accessing psychological help—suggesting the need for a greater workforce and evidenced-based, scalable interventions to substitute the demand for professional services to reduce suicidality and manage crises.

Further research is needed to understand what factors lead to higher suicides in rural areas in Indonesia, including unique cultural factors such as those occurring in Gunung Kidul. Indeed, it may be that these unique cultural factors may be more prevalent in rural areas compared to urban areas. For example, in rural areas, mental ill-health is often associated with the presence of non-human entities such as the *djinn* (genie) or *hantu* (ghosts)[41] and is often treated with religious approaches.[41]

Mental health stigma may be more pronounced in rural areas in Indonesia; for example, the practice of *pasung*, in which individuals with mental ill-health may be chained in makeshift prisons and inhumane conditions, leading to malnourishment and even death.[40] These beliefs and behaviours towards individuals with mental ill-health may affect factors pertaining to suicide and warrant further study.

All datasets, including those analysed in this study, have data quality limitations–although the SRS/WHO GHO data was considered the most reliable due to the rigorous recording process. Thus, we caution against any strong inference, particularly using data with low counts. The WHO GHO data used in calculating underreporting is also an estimate using modelling techniques; and thus may not be completely accurate as well. Thus, it is important to use the range of estimates as a guideline. However, this further highlights the need to develop systems for accurate recording of suicides.

We could not calculate underreporting per province, which may differ as a function of reporting pipelines, infrastructure, and cultural stigma; underreporting rates are likely to be different for suicide deaths and attempts, and for different suicide methods. We have calculated a best estimate in the absence of other underreporting data, but we urge rapid action to quantify underreporting across these different reporting pipelines. Nevertheless, this study is just the first step to a data-driven approach to suicide prevention in Indonesia, and as more data emerge, we expect these estimates to be refined.

The current study investigates key statistics for effective, data-driven suicide prevention in Indonesia. The data reveal a picture of a country suffering from vast underreporting and heterogeneity among its suicide and suicide attempt rates on a provincial level. Nevertheless, these data provide essential information which can allow for critical steps in suicide prevention, such as means restriction and allocation of resources between rural and urban areas, as well as certain geographic regions. Given the scarcity of resources for suicide prevention and mental health, resources must be used judiciously and use data-driven approaches to maximise effectiveness.

Contributors

SO led the conceptualisation, obtaining funding, investigation, formal analysis, visualisation, data interpretation, writing and revising. YU, RW, M Lusiana, TJA, and DAM led data collection for the SRS. JN and AV led project management and administration. PB supported data analysis and revising. VA, RK and JP supported revising. ML supervised, supported conceptualisation, visualisation, data analysis, and revising.

Data sharing statement

This publication relies on government agency data which is shared in the open form that is provided in the manuscript. For additional information, correspondence should be directed to Dr. Sandersan Onie at s.onie@blackdog.org.au or sandy.onie@gmail.com.

Declaration of interests

YU, RW, M Lusiana, TJA, and AM were part of the team to lead the SRS; YU is currently part of the Ministry of Health. SO led the qualitative study for the national situational analysis; JN and AV were respondents as part of that study. SO has received funding from Suicide Prevention Australia and the Department of Foreign Affairs and Trade and holds a role as the President of the Indonesian Association for Suicide Prevention. PB has received funding from the National Health and Medical Research Council, Medical Research Future Fund, and the Australian Department of Veteran Affairs to the institution, but not directly relevant to the manuscript. ML has received payments to the institution for broader suicide prevention research, but not directly relevant to this manuscript. The authors declare no other conflicts of interest.

Acknowledgements

We thank the Indonesian government agencies, various departments of the Ministry of Health, and WHO Indonesia for their collaboration on the National Suicide Prevention Strategy, of which this paper is part of.

References

1 World Health Organisation. *Suicide*; 2021. Retrieved from: https://www.who.int/news-room/fact-sheets/detail/suicide.
2 Onie S, Vina A, Taufik K, et al. Indonesian first national suicide prevention strategy: key findings from the qualitative situational analysis. *Lancet Southeast Asia*. 2023;16:100245. https://doi.org/10.1016/j.lansea.2023.100245.
3 World Health Organisation. *Suicide worldwide in 2019*; 2019. Retrieved from: https://www.who.int/teams/mental-health-and-substance-use/data-research/suicide-data.
4 Kementerian Kesehatan RI. *Pedoman pencegahan dan penanganan bunuh diri*; 2021. Retrieved from: https://perpustakaan.kemkes.go.id/books/pedoman-pencegahan-dan-penanganan-bunuh-diri/.
5 World Health Organization. *Live life: an implementation guide for suicide prevention in countries*; 2021. Retrieved from: https://www.who.int/publications/i/item/9789240026629.
6 Sutendi E. *Kasus bunuh diri. Period tahun 2017 S.D 2021. Karlodalops SOPS polri* 2022.
7 Pusat Data dan Teknologi Informasi. *Situasi dan penceghan bunuh diri*; 2019. Retrieved from: https://pusdatin.kemkes.go.id/download.php?file=download/pusdatin/infodatin/infodatin-Situasi-dan-Pencegahan-Bunuh-Diri.pdf.
8 Usman Y. *Gambaran Kematian oleh karena Bunuh Diri di Indonesia*. Puslitbang Humaniora & Manajemen; 2021.
9 Rati. *Syarat dan cara mengurus surat keterangan kematian*; 2020. Retrieved from: https://ajaib.co.id/syarat-dan-cara-mengurus-surat-keterangan-kematian/.
10 Badan Pusat Statistik. *Village potential statistics of Indonesia*; 2021. Retrieved from: https://www.bps.go.id/publication/2022/03/24/ceab4ec9f942b1a4fdf4cd08/statistik-potensi-desa-indonesia-2021.html.
11 Badan Pusat Statistik. *Potensi Desa*; 2022. Retrieved from: https://www.bps.go.id/subject/168/potensi-desa.html.
12 Usman Y, Iriawan RW, Rosita T, et al. Indonesia's sample registration system in 2018: a work in progress. *J Popul Soc Stud*. 2019;27(2). Retrieved from: https://pdfs.semanticscholar.org/6274/a7983770ff03796ce7b08816c42967b2acea.pdf.
13 Badan Pusat Statistik. *Jumlah penduduk hasil proyeksi menurut provinsi dan jenis kelamin (Ribu Jiwa), 2018—2020*; 2022. Retrieved from: https://www.bps.go.id/indicator/12/1886/1/jumlah-penduduk-hasil-proyeksi-menurut-provinsi-dan-jenis-kelamin.html.
14 World Health Organisation. *The Global Health Observatory: suicide mortality rate (per 100 000 population)*; 2023. Retrieved from: https://www.who.int/data/gho/indicator-metadata-registry/imr-details/4664.
15 Badan Pusat Statistik Provinsi Sulawesi Utara. *Jumlah Penduduk Menurut Provinsi di Indonesia (Ribu Jiwa), 2019—2021*; 2022. Retrieved from: https://sulut.bps.go.id/indicator/12/958/1/jumlah-penduduk-menurut-provinsi-di-indonesia.html.
16 Arya V, Page A, Armstrong G, Kumar GA, Dandona R. Estimating patterns in the under-reporting of suicide deaths in India: comparison of administrative data and Global Burden of Disease Study estimates, 2005-2015. *J Epidemiol Commun Health*. 2020. https://doi.org/10.1136/jech-2020-215260.
17 Tøllefsen IM, Hem E, Ekeberg Ø. The reliability of suicide statistics: a systematic review. *BMC Psychiatry*. 2012;12:9. https://doi.org/10.1186/1471-244X-12-9.
18 Tøllefsen IM, Helweg-Larsen K, Thiblin I, et al. Are suicide deaths under-reported? Nationwide re-evaluations of 1800 deaths in Scandinavia. *BMJ Open*. 2015;5(11):e009120. https://doi.org/10.1136/bmjopen-2015-009120.
19 Li F, Yip PSF. How to make adjustments of underreporting of suicide by place, gender, and age in China? *Soc Psychiatry Psychiatr Epidemiol*. 2020;55:1133–1143. https://doi.org/10.1007/s00127-020-01856-2.
20 Kabir R, Hasan MR, Arafat SMY. Epidemiology of suicide and data quality in Bangladesh. In: Arafat SMY, Khan MM, eds. *Suicide in Bangladesh. New perspectives in behavioral & health sciences*. Singapore: Springer; 2023. https://doi.org/10.1007/978-981-99-0289-7_1.
21 Mishara BL, Weisstub DN. The legal status of suicide: a global review. *Int J Law Psychiatry*. 2016;44:54–74. https://doi.org/10.1016/j.ijlp.2015.08.032.
22 Vijayakumar L, Pirkis J, Huong TT, et al. *Socio-Economic, cultural and religious factors affecting suicide prevention in Asia. suicide and suicide prevention in Asia*. Geneva: WHO; 2008:19–30.
23 Onie S, Soemarsono A, Setyawan MA, et al. A unified religious stance on mental health and suicide at the G20: the Lombok Declaration. *Lancet Psychiatr*. 2023;10:S2215–S2366. https://doi.org/10.1016/S2215-0366(23)00177-3.
24 "Sensus penduduk 2010–penduduk menurut wilayah dan Agama yang dianut" [2010 population census–population by region and religious affiliations] (in Indonesian). Badan Pusat Statistik. 2013. Retrieved 27 May 2014.

25 Vijayakumar L, John S. Is Hinduism ambivalent about suicide? *Int J Soc Psychiatry*. 2018;64(5):443–449. https://doi.org/10.1177/0020764018777523.

26 Wirasto RT. *Suicide prevention in Indonesia: providing public advocacy. Symposium, the role of physicians in suicide prevention*; 2011. Retrieved from: https://www.med.or.jp/english/journal/pdf/2012_01/098_104.pdf.

27 Han B, Kott PS, Hughes A, McKeon R, Blanco C, Compton WM. Estimating the rates of deaths by suicide among adults who attempt suicide in the United States. *J Psychiatr Res*. 2016;77:125–133. https://doi.org/10.1016/j.jpsychires.2016.03.002.

28 Banerjee S, Chowdhury AN, Schelling E, Brahma A, Biswas MK, Weiss MG. Deliberate self-harm and suicide by pesticide ingestion in the Sundarban region, India. *Trop Med Int Health*. 2009;14(2):213–219. https://doi.org/10.1111/j.1365-3156.2008.02199.x.

29 Vijayakumar L. Suicide in women. *Indian J Psychiatry*. 2015;57:S233. https://doi.org/10.4103/0019-5545.161484.

30 Seidler ZE, Rice SM, Ogrodniczuk JS, Oliffe JL, Dhillon HM. Engaging men in psychological treatment: a scoping review. *Am J Mens Health*. 2018;12(6):1882–1900. https://doi.org/10.1177/1557988318792157.

31 Australian Institute of Health and Welfare. *Deaths by suicide in Australia*; 2023. Retrieved from: https://www.aihw.gov.au/suicide-self-harm-monitoring/data/deaths-by-suicide-in-australia/suicide-deaths-over-time.

32 Muis I, Andi A, Andi A, Arlin A. "Elderly poverty: social demographic, work distribution, problem health & social Protection." *Asian J Soc Sci Humanit*. 2020;9:40–48.

33 Nurdiyanto FA, Jaroah S. The characteristics of suicide in Gunungkidul Indonesia. *Dis Prev Public Health J*. 2020;14(2). https://doi.org/10.12928/dpphj.v14i2.2027.

34 Bonvoisin T, Utyasheva L, Knipe D, et al. Suicide by pesticide poisoning in India: a review of pesticide regulations and their impact on suicide trends. *BMC Public Health*. 2020;20:251. https://doi.org/10.1186/s12889-020-8339-z.

35 Stanaway JD, Shepard DS, Undurraga EA, et al. The global burden of dengue: an analysis from the global burden of disease study 2013. *Lancet Infect Dis*. 2016;16:712–723. https://doi.org/10.1016/S1473-3099(16)00026-8.

36 Wijaya P, Umar MZ, Arsyad M. Dua Belas Teknik Ikat Konstruksi Kayu Pada Rumah Vernakular Tolaki. *Etnoreflika Jurnal Sosial dan Budaya*. 2020;9(2). Retrieved from: https://www.google.com/url%3Fsa=t&rct=j&q=&esrc=s&source=web&cd=&ved=2ahUKEwismLqkp9_5AhXR4TgGHSImA20QFnoECAsQAQ&url=http%3A%2F%2Fjournal.fib.uho.ac.id%2Findex.php%2Fetnoreflika%2Farticle%2Fdownload%2F830%2F735%2F&usg=AOvVaw2CthORMJA9NYB6KyaD-PLV.

37 Weerasinghe M, Pearson M, Konradsen F, et al. Emerging pesticides responsible for suicide in rural Sri Lanka following the 2008–2014 pesticide bans. *BMC Public Health*. 2020;20:780. https://doi.org/10.1186/s12889-020-08871-7.

38 Hirsch JK, Cukrowicz KC. Suicide in rural areas: an updated review of the literature. *Rural Ment Health*. 2014. https://doi.org/10.1037/rmh0000018.

39 Wamser R, Brian V, Rachel H. Religious fundamentalism, religious coping, and preference for psychological and religious treatment. *Int J Psychol Relig*. 2011;21:228–236.

40 Hunt A, Pohl H, Onie S. *Out of the shadows: a brief introduction to mental health in Indonesia*; 2022. Retrieved from: https://bookshop.iseas.edu.sg/publication/7825.

41 Ariyanto MD. *Terapi Ruqyah Terhadap Penyakit Fisik, Jiwa dan Gangguan Jin*. SUHUF; 2007:48–59. Retrieved from: http://hdl.handle.net/11617/901.