



Proportion of Primary Drinking Water Source Locations among Households by Socio-Demographic Characteristics: Analysis of the 2023 Indonesian Health Survey (SKI)

Muhammad Iqbal^{1*}, Sunil²

^{1*}Department of Land and Environmental Resources Engineering, State Polytechnic of Lampung, Indonesia

²Veteran Health Indiana, India

*Corresponding Author: E-mail: m.iqbal@polinela.ac.id

ARTICLE INFO

Manuscript Received: 16 Nov, 2025
Revised: 16 Dec, 2025
Accepted: 19 Dec, 2025
Date of Publication: 16 Jan, 2026
Volume: 1
Issue: 02

KEYWORDS

Indonesian Health Survey (SKI),
Primary Drinking Water, Socio-
Demographic Characteristics

ABSTRACT

Introduction: Access to safe drinking water remains a key environmental health challenge in Indonesia, with persistent inequalities in household access despite national progress. The location of the primary drinking water source is a critical dimension of water safety, influencing exposure to contamination and health risks.

Objective: This study aimed to analyze the proportion of primary drinking water source locations among households by socio-demographic characteristics using data from the 2023 Indonesian Health Survey (SKI).

Methods: A cross-sectional analytical study was conducted using nationally representative secondary data from SKI 2023. The study included households with complete information on drinking water source location and socio-demographic characteristics. Descriptive and bivariate analyses were performed using survey weights to account for the complex sampling design.

Results: Marked socio-demographic disparities were observed. Households with higher education, formal employment, urban residence, and higher economic status were more likely to have drinking water sources located inside the house, whereas households with lower education, informal occupations, rural residence, and lower economic status showed greater reliance on sources located outside the household compound. A clear gradient was evident across education and economic status categories.

Conclusion: Significant inequalities in household drinking water source locations persist in Indonesia. These findings highlight the need for equity-oriented water and environmental health policies that prioritize disadvantaged populations to ensure safe and sustainable access to drinking water.

Publisher: Mantaya Idea Batara

INTRODUCTION

Access to safe drinking water remains a fundamental environmental health challenge and a critical determinant of population health worldwide. Inadequate access to improved and safely managed drinking water sources is strongly associated with increased risks of waterborne diseases, child undernutrition, and preventable mortality, particularly in low- and middle-income countries (1,2). Despite global progress under the Sustainable Development Goals (SDG 6), substantial disparities persist in terms of the location, safety, and reliability of household drinking water sources. In Indonesia, household reliance on different primary drinking water source locations—such as piped water inside the dwelling, yard connections, public taps, protected wells, or surface water—reflects not only environmental conditions but also socio-demographic inequalities. Data from the 2023 Indonesian Health Survey

(Survei Kesehatan Indonesia, SKI 2023) indicate that a considerable proportion of households still depend on drinking water sources located outside the dwelling or from unimproved sources, raising concerns regarding water quality, accessibility, and household exposure to environmental health risks (3).

Evidence from previous national surveys and international studies suggests that patterns of household drinking water source locations in Indonesia have evolved over time but remain uneven across population groups. Analyses based on earlier national health surveys, including SKI 2020, demonstrated gradual improvements in access to improved drinking water sources, particularly in urban areas; however, persistent gaps were observed among rural households, lower socioeconomic groups, and households with lower educational attainment (4). Comparable findings have been reported in international studies, which consistently show that socio-demographic characteristics such as income, education, place of residence, and household composition are significant predictors of drinking water source type and location (5–7). While SKI 2020 provided important baseline evidence, changes in infrastructure development, urbanization, climate-related pressures, and policy interventions necessitate updated analyses using more recent data. The availability of SKI 2023 offers a timely opportunity to examine whether improvements in drinking water access have been equitably distributed and how socio-demographic gradients continue to shape household reliance on different drinking water source locations.

Understanding the distribution of primary drinking water source locations is particularly important from an environmental health perspective, as the location of water sources influences water safety, storage practices, exposure to contamination, and household time burden—especially for women and children (8). Water sources located outside the dwelling or compound may increase vulnerability to microbial contamination during collection and transport, while also reflecting broader structural inequalities in environmental services. International evidence highlights that inequities in drinking water access are closely linked to social determinants of health and require targeted, evidence-based policy responses rather than solely infrastructure-focused solutions (2,6). However, empirical evidence examining these issues using the most recent nationally representative data from Indonesia remains limited.

Therefore, this study aims to analyze the proportion of primary drinking water source locations among households by socio-demographic characteristics using data from the 2023 Indonesian Health Survey (SKI). Specifically, the study seeks to (1) describe the national distribution of household drinking water source locations and (2) assess differences according to key socio-demographic factors, including place of residence, household socioeconomic status, education level, and other relevant characteristics. The findings are expected to provide updated evidence to inform environmental health policies, water supply planning, and equity-oriented interventions aimed at improving safe and sustainable access to drinking water in Indonesia.

METHOD

Research Design

This study employed a cross-sectional analytical design using secondary data derived from the 2023 Indonesian Health Survey (Survei Kesehatan Indonesia, SKI 2023). A cross-sectional approach was considered appropriate to examine the proportion and distribution of primary drinking water source locations among households and their association with socio-demographic characteristics at a single point in time. The use of nationally representative survey data enables population-level inference and supports environmental health surveillance and policy evaluation.

Methods and Sampling

The study population consisted of all households included in the SKI 2023 dataset. SKI 2023 is a nationally representative household survey conducted by the Indonesian Ministry of Health, covering all provinces in Indonesia through a multistage stratified cluster sampling design. The analytical sample included households with complete information on primary drinking water source location and selected socio-demographic characteristics. No additional sampling procedures were performed in this study, as the analysis relied entirely on the existing SKI 2023 sample.

Inclusion and Exclusion Criteria

Households were included in the analysis if they met the following criteria:

1. recorded data on primary drinking water source location, and
2. complete information on key socio-demographic variables of interest, such as place of residence, household wealth index, education level of the household head, and region.

Households were excluded if they had missing, incomplete, or inconsistent data on drinking water source location or key socio-demographic variables. Exclusion was applied solely for data quality purposes and followed standard practices in secondary data analysis of large-scale health surveys

Data Collection

Data were obtained exclusively from the SKI 2023 dataset, which was collected through structured household interviews using standardized questionnaires administered by trained enumerators. The survey captured information on household characteristics, environmental health conditions, and access to basic services, including drinking water. For this study, the primary outcome variable was location of the main drinking water source, categorized according to SKI 2023 classifications (e.g., inside the dwelling, within the yard/compound, or outside the household premises). As a secondary data analysis, no primary data collection or direct contact with respondents was conducted.

Data Analysis Process

Data analysis was performed in several stages. First, descriptive statistics were used to estimate the proportion of households according to primary drinking water source location at the national level. Second, bivariate analyses were conducted to examine differences in drinking water source locations across socio-demographic characteristics, including urban–rural residence, household socioeconomic status, education level, and geographic region. Results were presented as proportions and percentages, with appropriate weighting applied to account for the complex survey design of SKI 2023. Where relevant, chi-square tests were used to assess statistical associations between drinking water source location and socio-demographic variables. All analyses adhered to standard guidelines for the analysis of complex survey data to ensure nationally representative estimates

RESULTS

Primary Drinking Water Source Location By Education

A consistent gradient was observed across education categories: higher educational attainment was associated with a higher proportion of sources located inside the house and a lower proportion located outside the household compound. Among households where the education category was no schooling, 35.7% reported drinking water sources located inside the house, 38.2% within the compound, and 26.1% outside the compound (weighted N=13,031). For incomplete primary school (did not finish SD/MI), 42.0% were inside the house, 35.5% within the compound, and 22.5% outside the compound (weighted N=17,409). The proportion of inside-house sources increased progressively with higher education from 42.3% (completed SD/MI) to 46.0% (completed SLTP/MTS), 51.9% (completed SLTA/MA), and 53.8% (completed D1/D2/D3/PT) while the outside-compound proportion declined from 23.8% to 19.7%, 15.3%, and 13.1%, respectively.

Primary Drinking Water Source Location By Occupation

Differences were also evident by occupation. Households in more formal employment categories tended to have a higher proportion of drinking water sources located inside the house. For example, PNS/TNI/Polri/BUMN/BUMD recorded 52.5% inside-house sources and only 12.8% outside-compound sources (weighted N=6,536), while private employees recorded 52.3% inside-house and 15.8% outside-compound (weighted N=16,838). In contrast, households engaged in more informal and primary-sector livelihoods showed comparatively higher dependence on outside-compound sources, such as farmers/agricultural laborers (39.0%

inside-house; 23.5% outside-compound; weighted N=69,814) and fishers(39.2% inside-house; 25.7% outside-compound; weighted N=2,744).

Primary drinking water source location by residence (urban–rural)

Marked urban–rural disparities were observed. In urban areas, 53.4% of households had drinking water sources inside the house, compared with 38.5% in rural areas. Conversely, reliance on outside-compound sources was higher in rural areas (24.5%) than in urban areas (15.8%). The weighted sample sizes were N=86,355 (urban) and N=100,797 (rural).

Primary drinking water source location by economic status

A strong socioeconomic gradient was apparent. Households in the lowest economic status group (“terbawah”) showed the lowest proportion of inside-house sources (32.0%) and the highest dependence on outside-compound sources (31.1%) (weighted N=42,210). In contrast, households in the highest economic status group (“teratas”) had the highest proportion of inside-house sources (57.4%) and the lowest dependence on outside-compound sources (12.0%) (weighted N=23,523). The pattern was monotonic across groups (menengah bawah → menengah → menengah atas), indicating widening inequities by household economic position.

DISCUSSION

This study reveals pronounced socio-demographic inequalities in the location of primary drinking water sources among Indonesian households based on SKI 2023 data. Households with higher education, formal employment, urban residence, and higher economic status were substantially more likely to access drinking water sources located inside the house, whereas disadvantaged groups showed greater reliance on sources located outside the household compound. These findings are consistent with the environmental health literature, which emphasizes that water source location is a critical dimension of drinking water safety, influencing exposure to contamination during collection, transport, and storage (9,10).

The educational gradient observed in this study aligns with evidence showing that education plays a pivotal role in shaping household access to improved drinking water services. Households with no schooling or incomplete primary education exhibited higher dependence on water sources located outside the household compound, while those with higher education levels predominantly accessed water inside the house. Previous studies have demonstrated that education is associated with greater health literacy, improved economic opportunities, and enhanced capacity to engage with formal service providers, including piped water systems (11,12). From an environmental health perspective, these disparities suggest that less-educated households may face compounded risks due to both limited infrastructure access and reduced capacity to mitigate water-related health hazards.

Occupational differences further illustrate how structural economic factors shape drinking water access. Households engaged in formal employment sectors such as government or salaried private work were more likely to have drinking water sources located inside the house, whereas households reliant on agriculture, fisheries, and informal labor showed higher proportions of outside-compound water sources. Similar patterns have been documented in other low- and middle-income country settings, where informal livelihoods are often concentrated in areas with weaker infrastructure and limited public investment (13). Reliance on external water sources in such contexts has been linked to increased microbial contamination and higher risks of waterborne disease, particularly where sanitation coverage is inadequate (14)

Urban rural disparities identified in this analysis remain a central concern for water equity in Indonesia. Urban households showed substantially better access to inside-house drinking water sources, while rural households continued to rely more heavily on sources located outside the household compound. This finding is consistent with global monitoring reports and peer-reviewed studies indicating that rural populations lag behind urban populations in access to safely managed drinking water, despite overall national progress (9,15). Environmental conditions in rural settings including proximity to agricultural runoff, reliance on groundwater or surface water, and limited water treatment may further amplify health risks associated with externally located water sources.

Economic status emerged as one of the strongest determinants of drinking water source location. Households in the lowest economic group exhibited the highest dependence on water sources located outside the household compound, whereas the wealthiest households predominantly accessed water inside the house. This monotonic socioeconomic gradient mirrors findings from international studies demonstrating that drinking water access is deeply embedded within broader systems of social and economic inequality (10,16). These inequalities reflect not only differences in household purchasing power but also unequal spatial distribution of infrastructure and services, raising important concerns related to environmental justice.

Overall, the findings suggest that improvements in national drinking water coverage do not necessarily translate into equitable access to safe and convenient drinking water at the household level. While Indonesia has made measurable progress toward SDG 6, the persistence of socio-demographic gradients in water source location indicates that vulnerable populations continue to face disproportionate environmental health risks. Addressing these inequities requires targeted, equity-oriented interventions that integrate water infrastructure development with broader social policies addressing education, poverty reduction, and rural development.

CONCLUSIONS

This study provides updated national evidence on socio-demographic disparities in the location of primary drinking water sources among Indonesian households using SKI 2023 data. The findings demonstrate a clear and consistent gradient, whereby households with higher educational attainment, formal employment, urban residence, and higher economic status are substantially more likely to access drinking water sources located inside the house, while disadvantaged households remain more dependent on sources located outside the household compound. These patterns indicate that access to safe and convenient drinking water in Indonesia is not only an infrastructural issue but also a reflection of broader social and economic inequalities.

From an environmental health perspective, the continued reliance on drinking water sources located outside the household compound among lower socioeconomic and rural populations raises important concerns regarding water safety, exposure to contamination, and unequal health risks. Water source location influences collection practices, storage, and the potential for microbial contamination, thereby shaping household vulnerability to waterborne diseases. The persistence of these disparities suggests that improvements in national drinking water coverage have not been equitably translated into household-level access to safer and more convenient water sources.

In conclusion, achieving equitable progress toward safely managed drinking water in Indonesia requires policy approaches that go beyond aggregate coverage targets. Targeted interventions focusing on rural areas, low-income households, and populations with lower educational attainment are essential. Integrating water infrastructure development with social policies addressing poverty, education, and regional inequality is critical to reducing environmental health risks and ensuring that progress toward SDG 6 benefits all segments of the population.

CONFLICTS OF INTEREST

All Author Declare No. conflict of interest

FUNDING SOURCES

No. Funding

ACKNOWLEDGMENTS

The authors would like to express their sincere gratitude to the Ministry of Health of the Republic of Indonesia, particularly the Health Policy Agency (Badan Kebijakan Pembangunan Kesehatan), for providing access to the 2023 Indonesian Health Survey (Survei Kesehatan Indonesia, SKI 2023) data used in this study. The availability of nationally representative data is essential for advancing evidence-based research in environmental health and public health policy. The authors also acknowledge all enumerators, field supervisors, and respondents involved in the implementation of SKI 2023, whose contributions made this survey possible. Their participation and commitment are

highly appreciated. This study is a secondary data analysis and did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors. The interpretations and conclusions presented in this article are solely those of the authors and do not necessarily reflect the official views or policies of the data provider.

BIBLIOGRAPHY

1. World Health Organization, United Nations Children's Fund. Progress on drinking water, sanitation and hygiene: 2023 update and SDG baselines. Geneva: WHO; 2023.
2. Prüss-Ustün A, Wolf J, Bartram J, Clasen T, Cumming O, Freeman MC, et al. Burden of disease from inadequate water, sanitation and hygiene for selected adverse health outcomes. *Int J Hyg Environ Health*. 2019;222(5):765–77.
3. Badan Kebijakan Pembangunan Kesehatan. Survei Kesehatan Indonesia (SKI) 2023: Laporan Nasional. Jakarta: Kementerian Kesehatan Republik Indonesia; 2023. Available from: <https://www.badankebijakan.kemkes.go.id/hasil-ski-2023/>
4. Badan Penelitian dan Pengembangan Kesehatan. Survei Kesehatan Indonesia (SKI) 2020: Laporan Nasional. Jakarta: Kementerian Kesehatan Republik Indonesia; 2021. Available from: <https://www.litbang.kemkes.go.id/laporan-ski-2020/>
5. Irianti S, Prasetyoputra P, Sasimartoyo TP. Determinants of household drinking-water source in Indonesia. *Cogent Med*. 2016;3:1151143.
6. Terefe B, Jembere MM, Assimamaw NT. Access to safe drinking water and its associated factors among households in East Africa. *J Health Popul Nutr*. 2024;43:72.
7. Khan RH, Rahman MM, Ahmed S, Islam MS. Socio-demographic factors influencing household drinking water source selection. *Water (Basel)*. 2024;16(14):1978.
8. Sorenson SB, Morssink C, Campos PA. Safe access to safe water in low income countries: water fetching in current times. *Soc Sci Med*. 2011;72(9):1522–6.
9. Freeman MC, Garn JV, Sclar GD, Boisson S, Medicott K, Alexander KT, et al. The impact of inequitable access to water, sanitation and hygiene on health. *Lancet*. 2017;390(10095):844–52.
10. World Health Organization. Guidelines on drinking-water quality. 4th ed, incorporating the 1st addendum. Geneva: WHO; 2017.
11. United Nations Children's Fund, World Bank. Drinking water, sanitation and hygiene inequalities. Washington DC: World Bank; 2019.
12. Whitehead M, Dahlgren G. Concepts and principles for tackling social inequities in health. Copenhagen: WHO Regional Office for Europe; 2006.
13. Bain R, Cronk R, Wright J, Yang H, Slaymaker T, Bartram J. Fecal contamination of drinking-water in low- and middle-income countries. *PLoS Med*. 2014;11(5):e1001644.
14. Wolf J, Hunter PR, Freeman MC, Cumming O, Clasen T, Bartram J, et al. Impact of drinking water, sanitation and handwashing on childhood diarrhoeal disease. *Trop Med Int Health*. 2018;23(5):508–25.
15. United Nations. Sustainable Development Goal 6: Synthesis Report on Water and Sanitation. New York: United Nations; 2018.
16. Prüss-Ustün A, Bartram J, Clasen T, Colford JM Jr, Cumming O, Curtis V, et al. Estimating the burden of disease from water, sanitation, and hygiene. *Environ Health Perspect*. 2014;122(8):778–85.
17. Clasen T, Bastable A. Faecal contamination of drinking water during collection and household storage. *Trop Med Int Health*. 2003;8(8): 720–9.
18. Wright J, Gundry S, Conroy R. Household drinking water in developing countries: a systematic review of microbiological contamination. *Trop Med Int Health*. 2004;9(1):106–17.
19. Onda K, LoBuglio J, Bartram J. Global access to safe water: accounting for water quality and the resulting impact on MDG progress. *Int J Environ Res Public Health*. 2012;9(3):880–94.
20. Pickering AJ, Davis J. Freshwater availability and water fetching distance affect child health in sub-Saharan Africa. *Environ Sci Technol*. 2012;46(4):2391–7.

21. Howard G, Bartram J. Domestic water quantity, service level and health. Geneva: World Health Organization; 2003.
22. Bartram J, Cairncross S. Hygiene, sanitation, and water: forgotten foundations of health. *PLoS Med.* 2010;7(11):e1000367.