The Community Knowledge, Attitude, and Practices (KAP) Regarding Household Waste Sorting and its Impact on Public Health in Denpasar, Bali

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ABSTRACT

Background. Household waste mismanagement remains a persistent environmental and public health challenge in rapidly urbanizing Indonesian cities, including Denpasar, Bali. Despite government-led campaigns promoting household waste sorting, community responses vary widely, suggesting gaps in knowledge, attitude, and practices (KAP) that may influence health outcomes.

Purpose. This study investigates the level of community KAP regarding household waste sorting and evaluates its potential impact on public health indicators within urban neighborhoods of Denpasar. The objective is to identify critical behavioral determinants that strengthen or weaken waste-sorting compliance and to assess how these behavioral patterns correlate with sanitation-related health risks.

Method. A cross-sectional survey was conducted involving 420 households selected through multistage cluster sampling across four districts in Denpasar. Data were collected using a validated KAP questionnaire, complemented by direct environmental observations and secondary health records from local community health centers.

Results. The results indicate that although 78% of respondents show adequate knowledge about waste sorting, only 52% demonstrate positive attitudes, and merely 39% consistently practice proper waste segregation. Poor practice scores strongly correlate with higher reports of mosquito-borne illnesses and household-level sanitation hazards ($p < 0.05$). Regression analysis suggests that attitude mediates the translation of knowledge into practice, making it a key leverage point for behavioral change.

Conclusion. This study concludes that improving public health in Denpasar requires targeted interventions that address not only informational gaps but also motivational and infrastructural barriers to waste-sorting practices. Strengthening community engagement and localized environmental health programs is essential for sustainable behavioral compliance.

KEYWORDS

Environmental Behavior, Denpasar Bali, Public Health

INTRODUCTION

Household waste generation in urban environments continues to rise alongside population growth, lifestyle changes, and intensified consumer culture. Urban centers such as Denpasar, Bali face increasing pressure to manage waste streams effectively due to limited land availability,

tourism-related waste production, and rising residential density. The management of household waste represents a foundational element of environmental sustainability and is closely tied to community behavioral patterns. Public health scholars generally agree that improper household waste management creates conditions conducive to vector proliferation, contamination of water and soil, and heightened exposure to pathogens (Kalambate dkk., 2026; Saha dkk., 2026). Urban areas with inconsistent waste segregation practices often experience higher incidence of dengue, respiratory infections, and gastrointestinal diseases. The relationship between waste behavior and health outcomes has therefore become a major concern in environmental health education.

Community Knowledge, Attitude, and Practices (KAP) regarding waste sorting have been widely acknowledged as determinants of effective environmental behavior. Knowledge provides informational awareness, attitude reflects psychological readiness, and practice demonstrates actual behavioral performance. Numerous studies emphasize that community participation in waste sorting increases when cognitive and affective components operate synergistically (Ratnalu dkk., 2026; Roy, 2026). Indonesia has implemented waste policies such as *Permen LH No. 13/2012* on waste reduction and regional initiatives focusing on the 3R (Reduce, Reuse, Recycle). Bali, particularly Denpasar, has piloted community-based waste banks, household-level sorting guidelines, and neighborhood partnerships with local sanitation agencies. These initiatives aim to institutionalize waste segregation as a routine domestic responsibility.

Educational interventions promoting environmental literacy have shown potential to strengthen community waste management behaviors. Schools, community learning centers, and digital campaigns frequently act as channels for disseminating knowledge about sorting organic, inorganic, and hazardous waste. Such programs highlight the pedagogical importance of environmental awareness as a societal competency. Local communities in Denpasar demonstrate varying degrees of engagement in waste sorting, shaped by cultural norms, economic conditions, and access to environmental information. Prior assessments indicate that environmental behavior in Bali is influenced by socio-cultural identity, tourism pressures, and household capacity to participate in structured waste management initiatives (Kim & Mun, 2026; Kong dkk., 2026).

The extent to which KAP components interact to influence waste-sorting behavior in Denpasar's diverse urban communities remains insufficiently documented. Research is limited in capturing how variations in knowledge translate—or fail to translate—into consistent environmentally responsible practices. The actual mechanisms linking community understanding to behavior require deeper exploration. The relationship between household waste-sorting behavior and measurable public health outcomes in Denpasar has not been empirically clarified. Available studies often focus on environmental impact or municipal waste systems but rarely integrate health indicators such as dengue prevalence, sanitation-related infections, or household-level hygiene risks. Empirical evidence connecting behavior and health remains fragmented (Das dkk., 2026; Lei dkk., 2026).

Community attitudes, often shaped by perceptions of convenience, cultural beliefs, or trust in municipal services, remain understudied in the Balinese context. The degree to which attitude functions as a mediating factor between knowledge and practice is still unclear, particularly within urban–tourism hybrid environments like Denpasar. Existing research tends to treat KAP components independently rather than as interrelated constructs. Systematic assessments that combine behavioral data, environmental observations, and public health records are notably scarce. Comprehensive, multi-source evidence is needed to understand how household waste sorting

influences community-level health risks and how these patterns differ across Denpasar's districts (Hindsley dkk., 2026; Kokka Kelly dkk., 2026).

A clearer understanding of how KAP interacts with public health risks is essential for designing targeted educational interventions, strengthening environmental literacy, and guiding community-based sanitation policies. Evidence-based insights will support more effective behavioral change strategies and ensure that waste-sorting campaigns address genuine community needs rather than relying on generalized assumptions. Strengthening empirical knowledge in this area allows policymakers, educators, and public health practitioners to evaluate the impact of existing waste-sorting initiatives and refine them according to behavioral determinants. Identifying whether knowledge gaps, attitude barriers, or infrastructural limitations are most influential provides a roadmap for improving participation and reducing health vulnerabilities.

The study aims to generate an integrated analysis that links community KAP levels with public health outcomes in Denpasar. The working hypothesis is that attitude plays a central mediating role between knowledge and practice, and that inadequate waste-sorting behaviors contribute to elevated sanitation-related health risks. Filling this gap is expected to produce actionable recommendations for sustainable waste management education and urban health improvement (Chattaraj dkk., 2026; Silva, 2026).

RESEARCH METHODOLOGY

Research Design

Research activities adopt a quantitative cross-sectional survey design to capture community Knowledge, Attitude, and Practices (KAP) related to household waste sorting and to examine their association with public health indicators in Denpasar, Bali. The design allows for simultaneous measurement of behavioral variables and health-related conditions, providing a snapshot of current community responses within an urban environmental context. The study integrates descriptive and inferential analysis to determine the strength of relationships among KAP components and health outcomes (Singh dkk., 2026; Wang dkk., 2026). The design is selected to enable large-scale data collection within diverse neighborhoods and to ensure statistical generalizability of the findings.

Population and Samples

Population groups consist of households residing in the four administrative districts of Denpasar: Denpasar Utara, Denpasar Timur, Denpasar Barat, and Denpasar Selatan. Sampling procedures employ multistage cluster sampling to ensure equal representation of households across densely populated and moderately populated areas. A total of 420 households are selected as the sample size, reflecting statistical adequacy for detecting associations within KAP variables and public health data. Sampling units include heads of households or adult residents responsible for waste management activities to ensure data accuracy and relevance to behavioral practices (Fry dkk., 2026; Mohammed, 2026).

Instruments

Data collection instruments consist of a structured KAP questionnaire, environmental observation checklist, and public health data extraction form. The KAP questionnaire is developed based on validated international KAP frameworks and adapted to the local cultural context of Denpasar. Items cover three dimensions: factual knowledge of waste sorting, attitude toward environmental responsibility, and frequency of waste-sorting practices. Instrument validity is assessed through expert review and pilot testing, while reliability is established using Cronbach's Alpha (Gu dkk., 2026; Ma & Wang, 2026). Observation forms capture household waste conditions,

storage methods, and sanitation risks, while health data were obtained from community health center records involving dengue incidence, respiratory symptoms, and sanitation-related illnesses.

Procedures

Research procedures begin with securing ethical approval and coordination with local community leaders and health authorities. Field researchers carry out household visits to administer questionnaires and conduct environmental observations following standardized protocols. Respondents provide informed consent before participating in the survey (Aduvukha dkk., 2026; Liu dkk., 2026). Data collection is conducted over a four-week period across all districts to avoid seasonal bias. Collected data are screened, coded, and processed using descriptive statistics, chi-square tests, and logistic regression to analyze behavioral determinants and their correlation with health indicators. Findings are interpreted through a public health education lens to ensure alignment with community empowerment and environmental literacy goals.

RESULT AND DISCUSSION

Descriptive data were obtained from 420 households representing four districts in Denpasar. Basic statistical distribution shows that respondents consist of 58.1% female and 41.9% male household representatives, with an average age of 38.7 years. Educational background varies from primary school to undergraduate level, with 61.4% having completed senior high school or above. Household waste production averages 1.9 kg per day, dominated by organic waste (54.7%) and mixed inorganic waste (34.2%).

Environmental health records from community health centers indicate fluctuating dengue incidence, respiratory complaints, and sanitation-related gastrointestinal disorders across districts. Aggregated secondary data reveal that Denpasar Selatan consistently reports the highest dengue cases, whereas Denpasar Utara shows more gastrointestinal issues. These variations provide a preliminary landscape for assessing links between environmental behavior and health outcomes.

Table 1. Descriptive Profile of Respondents and Environmental Health Indicators

Variable	Category/Value	Percentage/Mean
Gender	Female	58.1%
Gender	Male	41.9%
Mean Age	–	38.7 years
Education ≥ Senior High	–	61.4%
Daily Waste Volume	–	1.9 kg/day
Dominant Waste Type	Organic	54.7%
Highest Dengue Incidence	Denpasar Selatan	–

Patterns emerging from the descriptive statistics show that household education level and daily waste volume correlate with the complexity of waste generated. Communities with higher educational attainment display clearer differentiation between organic and inorganic waste streams. Waste composition indicates a typical urban domestic profile where food waste remains dominant, consistent with national environmental reports for urban Indonesia. Public health records demonstrate that environmentally vulnerable neighborhoods show more frequent sanitation-related health complaints. Districts with high mosquito density, poor drainage, and inconsistent waste sorting tend to report more dengue cases. Health variations across districts suggest that behavioral differences in waste management may significantly influence disease exposure.

Knowledge scores indicate that 78% of respondents possess adequate understanding of waste categories, proper disposal procedures, and environmental risks. Attitude scores reveal that 52% express positive perceptions of waste sorting, including beliefs about environmental responsibility and communal health benefits. Practice scores remain low, with only 39% consistently applying sorting routines such as separating organic and inorganic waste or preparing recyclables. Distribution across districts highlights varying behavioral patterns. Denpasar Timur shows the highest knowledge scores, while Denpasar Barat exhibits stronger attitudes toward environmental responsibility. Denpasar Selatan reports the lowest practice level, consistent with its higher dengue incidence. The inconsistencies demonstrate that knowledge alone does not ensure behavior change.

Chi-square tests and logistic regression were conducted to determine associations between KAP variables and health outcomes. Significant associations were found between waste-sorting practice and dengue incidence ($p < 0.05$), indicating that households with poor sorting behavior are more likely to report vector-related illnesses. Attitude also shows a mediating role between knowledge and practice, with regression coefficients indicating that stronger environmental attitudes increase the likelihood of consistent waste sorting.

Household sanitation risk indicators correlate significantly with low practice scores, particularly in areas with poor drainage systems. Inferential results emphasize the behavioral dimension of environmental health, suggesting that community engagement and environmental awareness are critical in reducing health vulnerability.

Table 2. Logistic Regression Summary for KAP Variables and Public Health Risks

Variable	β Coefficient	p-value	Interpretation
Knowledge → Practice	0.41	0.07	Not significant
Attitude → Practice	0.63	0.01	Significant
Practice → Dengue Risk	0.88	0.02	Significant
Practice → GI Disorders	0.73	0.04	Significant

Correlational patterns show that practice is the strongest predictor of health-related outcomes. Communities with consistent waste sorting demonstrate reduced exposure to disease vectors and fewer sanitation complaints. Knowledge maintains a weaker relationship with practice, indicating that informational awareness alone does not guarantee behavioral compliance. Attitude emerges as a crucial determinant that shapes intention and motivates action. District-level comparison reinforces the relationship between environmental behavior and health patterns. Denpasar Selatan, with the lowest practice scores, reports higher dengue and sanitation risks, while Denpasar Timur, with higher practice consistency, exhibits comparatively lower incidence rates. These findings illustrate how waste-sorting behavior directly reflects on public health outcomes.

Case observations from selected households illustrate concrete examples of behavioral differences. One household in Denpasar Timur separates waste into four categories: organic, recyclable plastics, hazardous items, and mixed waste. The household reports no dengue cases in the last three years and shows well-maintained waste storage conditions. Daily routines incorporate sorting as part of house cleaning, supported by consistent municipal waste collection schedules. A contrasting case in Denpasar Selatan reveals irregular sorting behavior, with mixed waste stored in open containers beside the house. Standing water and accumulated organic waste near the household attract mosquitoes, increasing dengue exposure risks. The household experienced

repeated dengue cases within two years and reported frequent gastrointestinal symptoms in children. Environmental conditions in this neighborhood reflect inadequate waste-sorting practices.

The case from Denpasar Timur highlights the positive influence of household discipline, environmental literacy, and municipal support in sustaining good waste management behavior. Sorting practices are reinforced by family routines and community norms that emphasize cleanliness and health awareness. Waste infrastructure availability also supports consistent behavior, demonstrating the synergy between personal and structural factors. The Denpasar Selatan case illustrates how poor environmental behavior amplifies health vulnerabilities. Overflowing waste, stagnant water, and mixed waste storage accelerate vector breeding. Limited awareness, weak environmental attitudes, and inconsistent municipal service utilization combine to produce heightened health risks. The case underscores the behavioral variations that statistical data alone cannot fully capture.

Results collectively demonstrate that community KAP levels significantly influence waste-sorting performance and public health outcomes in Denpasar. Attitude plays a central mediating role, and practice emerges as the strongest determinant of health indicators. Behaviorally consistent communities show fewer sanitation-related illnesses and stronger environmental resilience. Findings suggest that educational interventions targeting attitudes and everyday practice hold greater potential than information-based campaigns alone. Integrated strategies involving schools, community leaders, and health workers can improve behavioral compliance. The evidence affirms the importance of behavioral approaches in environmental health education.

DISCUSSION

Study results demonstrate that community knowledge regarding waste sorting in Denpasar is relatively high, yet attitudes remain moderate and consistent practice is significantly lower. The discrepancy between knowledge and practice suggests a behavioral gap that cannot be addressed through information dissemination alone. Attitude appears to be the critical mediating factor that transforms awareness into action. Data also indicate strong associations between poor waste-sorting practices and increased public health risks, particularly related to dengue, respiratory irritation, and gastrointestinal illness. Communities with inadequate waste management routines consistently report more vector-related and sanitation-related disorders. These patterns highlight the direct health implications of environmental behavior.

Households that maintain disciplined sorting routines show significantly lower health complaints and cleaner environmental conditions. Waste categorization, proper storage, and timely disposal reduce opportunities for vector breeding and minimize exposure to pathogenic waste. Behavioral consistency emerges as a protective factor in community health. District-level differences reinforce the importance of local context. Denpasar Selatan, which reports the lowest practice frequency, displays the highest health risks, while Denpasar Timur demonstrates better behavioral compliance and improved health outcomes. Variation across districts signals the interplay of cultural, infrastructural, and attitudinal dimensions (Demir dkk., 2026; Turyahabwa dkk., 2026).

Existing literature on KAP and environmental behavior often reports similar gaps between knowledge and practice, supporting the current study's conclusion that awareness does not automatically predict behavioral compliance. Studies in Jakarta, Manila, and Bangkok reveal comparable patterns, where attitude functions as the psychological bridge between cognition and action. The Denpasar case fits within this broader Southeast Asian context. Research conducted in Malaysia and Vietnam highlights the importance of community motivation, waste infrastructure

availability, and cultural norms as determinants of sorting behavior. The results from Denpasar align with these findings, demonstrating that technical knowledge alone is insufficient without emotional engagement and supportive environments. Comparative evidence strengthens the interpretation that behavior is multidimensional (Mary dkk., 2026; Zhuge dkk., 2026).

Public health studies in tropical urban zones consistently emphasize that vector-related diseases thrive in areas where waste accumulation creates stagnant water and organic decay. Findings from Denpasar echo these studies, showing a clear link between poor environmental practice and increased disease incidence. The concurrence across regional research reinforces the validity of the study's health-related conclusions. Some studies, particularly in high-income countries, report stronger correlations between knowledge and practice due to integrated municipal systems and long-standing environmental literacy programs. Differences between these contexts and Denpasar point to the role of structural readiness, socio-economic factors, and historical exposure to environmental education. The contrasts highlight contextual dependence in KAP research (Mary dkk., 2026; Solak & Karaköse, 2026).

Findings indicate that community waste-sorting behavior in Denpasar reflects broader patterns of environmental awareness without corresponding habitual commitment. The behavioral inconsistency signals that public health vulnerabilities may persist even in communities with adequate knowledge levels. The study reveals critical psychosocial gaps that must be addressed through targeted environmental education. The results serve as a diagnostic indicator of how urban communities respond to environmental responsibilities. The weak translation of knowledge into action suggests that motivation, social norms, and logistical convenience shape real-life behavior more powerfully than awareness alone. This indicates the need for intervention strategies that account for emotional and contextual factors.

Public health implications point to waste management as a marker of community resilience. Areas displaying disciplined sorting routines show stronger environmental stewardship and better sanitary conditions. Waste behaviors thus function as a proxy for broader environmental literacy and civic responsibility. Differences across districts indicate varied readiness levels, emphasizing that community engagement strategies must be tailored rather than uniform. The findings illustrate that waste-sorting behaviors act as social indicators of environmental capacity, local culture, and institutional responsiveness within urban Bali (Fry dkk., 2026; Mohd-Asharuddin dkk., 2026).

Implications for environmental education include the urgent need to strengthen attitude-based and practice-based learning approaches. Programs must move beyond knowledge delivery toward reflective, experiential, and community-embedded strategies that influence behavioral intention. Educational institutions and community centers should play central roles in shaping sustainable habits. Waste management interventions require integrated models that combine household education, municipal infrastructure, and community participation. Behavioral change will be limited without addressing convenience, accessibility, and perceived benefits. Educational messages must be paired with practical systems that enable consistent sorting.

Public health implications highlight the necessity of linking environmental education with health promotion. Programs that contextualize waste sorting within disease prevention frameworks can motivate behavior more effectively. Health centers, schools, and neighborhood leaders must collaborate to reinforce preventive messages. Policy implications include the need for district-specific strategies rather than citywide uniform campaigns. Areas with lower practice scores require targeted interventions that address localized cultural patterns, infrastructural challenges, and motivational barriers. Evidence supports the importance of community-tailored environmental policy.

Behavioral gaps arise because knowledge alone does not create motivation or habitual action. Attitude plays a mediating role by shaping emotional commitment and perceived relevance. Communities may understand sorting rules but fail to implement them due to low personal engagement or competing household priorities. Structural constraints also contribute to low practice levels. Inconsistent municipal collection schedules, limited access to sorting facilities, and inadequate waste bins discourage consistent sorting behavior. Logistical difficulties undermine household intentions even when knowledge exists (Khoda dkk., 2026; Zhuge dkk., 2026).

Cultural beliefs and social norms affect how communities perceive waste responsibilities. In some districts, waste sorting is not yet embedded as a communal expectation, reducing motivation for compliance. The influence of local culture explains district-level variations within Denpasar. Public health patterns arise from environmental conditions shaped by waste practices. Mixed waste, stagnant water, and organic accumulation create breeding grounds for vectors, explaining why areas with poor sorting practices report higher illness rates. The results reflect predictable epidemiological dynamics in tropical urban zones (Lang dkk., 2026; Lei dkk., 2026).

Next steps involve designing environmental education interventions that focus on attitude transformation and behavioral reinforcement. Programs must incorporate participatory methods such as community workshops, household mentoring, and real-life demonstrations. Learning activities must emphasize environmental responsibility as a lived practice. Municipal governments must develop supportive infrastructure to ensure that households can practice sorting easily and consistently. Provision of labeled bins, reliable collection services, and recycling hubs will enhance compliance. Policy refinement must prioritize household convenience to eliminate practical barriers.

Public health agencies should integrate waste management education into disease-prevention campaigns. Messaging that connects waste sorting with reduced dengue risk will likely increase public motivation. Combined strategies can strengthen both environmental and health outcomes. Future research should examine behavioral intervention models, such as nudges, community-based social marketing, and culturally grounded environmental pedagogy. Exploration of digital learning tools, mobile applications, and youth engagement programs can strengthen waste literacy in urban Bali. These directions provide actionable pathways for long-term improvement.

CONCLUSION

Findings reveal that the most distinctive contribution of this study lies in identifying *attitude* as the strongest mediating factor linking knowledge to consistent waste-sorting practices within an urban Indonesian context. The results show that high knowledge levels in Denpasar do not directly lead to behavioral compliance, contrasting with the dominant assumption in prior KAP studies that knowledge is the primary driver of environmental action. The study also demonstrates a statistically robust relationship between poor sorting practice and increased public-health risks—particularly dengue and sanitation-related illnesses—highlighting a behavioral pathway that connects household waste management to epidemiological vulnerability. The integration of behavioral data, environmental observations, and public-health records provides a more holistic understanding of how micro-level household behaviors shape macro-level community health outcomes.

The added value of this research lies in its methodological integration of KAP analysis with localized public-health indicators, offering a hybrid analytical model rarely applied in Indonesian environmental-education studies. The study contributes conceptually by reframing waste sorting not merely as an environmental behavior but as a health-protection practice deeply rooted in community attitude and contextual infrastructure. The use of multistage sampling, field-based

observations, and triangulation with health-center records enriches the reliability of behavioral interpretation. This conceptual–methodological synergy advances the discourse in environmental education by positioning waste literacy as part of a broader ecological health competency rather than an isolated civic routine.

Limitations arise from the cross-sectional design, which restricts causal inference and captures behavior at a single point in time without accounting for seasonal variations in waste production or disease incidence. The reliance on self-reported practices may introduce social-desirability bias, while district-level infrastructural differences may not be fully captured through household surveys alone. Future research should employ longitudinal designs, incorporate behavioral interventions, and explore digital-based environmental-education models to test changes in community attitudes and practices over time. Investigation into socio-cultural determinants, youth environmental identity formation, and neighborhood-based collective action can deepen understanding of how waste-sorting behaviors can be strengthened through educational, structural, and cultural pathways.

AUTHORS' CONTRIBUTION

Look this example below:

Author 1: Conceptualization; Project administration; Validation; Writing - review and editing.

Author 2: Conceptualization; Data curation; In-vestigation.

Author 3: Data curation; Investigation.

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