Journal of Environmental and Development Studies
Journal homepage: https://talenta.usu.ac.id/jeds

Correlation between Housing Quality and the Human Development Index in North Sumatra

Lasma Melinda Siahaan[*1] & Natasya Santa Elisabeth Siahaan[2]

[1*]*Faculty of Economics and Business, Jalan Dr. T. Mansur No. 9, Medan, 20155, North Sumatera, Indonesia*
[2]*Universitas Sumatera Utara, Jalan Dr. T. Mansur No. 9, Medan, 20155, North Sumatera, Indonesia*

*Corresponding Author: lasmamelinda@usu.ac.id

ARTICLE INFO

Article history:
Received 10-07-2025
Revised 21-08-2025
Accepted 29-08-2025
Available online 03-09-2025

E-ISSN: 2745-4592

How to cite:
Siahaan Melinda Lasma & Siahaan Elisabeth Santa Natasya. Correlation between Housing Quality and the Human Development Index in North Sumatra. Journal of Environmental and Development Studies 2024. 5(1):14-26.

http://doi.org/10.32734/jeds.v6i2.22599

ABSTRACT

A society's housing quality is a fundamental factor in its social and economic well-being, and it is presumed to be correlated with the Human Development Index, which measures a country's development. This study seeks to analyze the relationship between various indicators of housing quality and the components of the HDI in North Sumatra. The research utilizes a quantitative approach, employing numerical data and statistical analysis. The variables for housing quality include floor area per capita, access to drinking water, source of electricity, and decent sanitation conditions. The results of the Pearson correlation test showed a strong positive relationship between all four housing quality indicators and the HDI. The correlation coefficients ranged from 0.60 to 0.71, indicating that as these housing quality factors improve, the HDI is likely to increase as well. Specifically, floor area per capita showed the strongest correlation at 0.7167859, followed by electricity source and drinking water. These findings highlight that development is an interconnected system, not a series of isolated projects. The study concludes that policymakers in North Sumatra should adopt an integrated and holistic approach, prioritizing investment in basic housing facilities as a crucial pillar for human capital development and economic competitiveness.

Keywords: Correlation, Housing Quality, Human Development Index, North Sumatra.

1. Introduction

A society's housing quality is fundamental to its social and economic well-being. A good home is not only livable but also safe and healthy for those who live there. Both a house's physical state and the presence of adequate sanitation and a clean environment are directly related to the quality of life that families and individuals enjoy (Chen et al., 2019). Many developing countries continue to struggle to provide decent housing. Slum conditions, unsafe drinking water, and unsanitary waste disposal hamper public health, national productivity, and social order. As a result, investment in the housing industry is viewed as a long-term strategy to improve the overall well-being of the population (Baker et al., 2016).

In contrast, the HDI has been universally acknowledged as a reliable indicator of a country's level of development (Cohen, 2016). The HDI is composed of three basic measures: a long and healthy life (health), knowledge (education), and a decent standard of living (income). These three indicators together provide a more comprehensive picture of regional advancement than measuring economic growth alone (UNDP, 2022). The correlation between quality housing and the HDI is not coincidental. Presumably, housing of good quality is linked to better health status because such housing is less likely to be exposed to disease. A child-friendly, stable, and secure home provides a conducive learning environment for children, leading to improved school performance (Das & Lall, 2020).

Socioeconomically, good housing is even an investment in property value, which can protect family finances. Secure housing provides people the capacity to concentrate on their jobs and other economic contributions without a base of an unsafe living environment. At the regional level, it is crucial to consider this relationship, as characteristics differ across regions (WHO, 2018). North Sumatra is one of the most populous and important provinces in Indonesia, making it an interesting case to examine this relationship. Given the wide range of geography, people, and levels of prosperity in North Sumatra, through its values and mission, one can learn how to develop strategies for all. Development imbalances between urban and rural areas are also challenges faced in North Sumatra. Housing infrastructure in Medan, the primary urban center, and other major cities is far more developed; however, numerous inland areas still face severe housing problems, including limited access to basic amenities and inadequate infrastructure coverage.

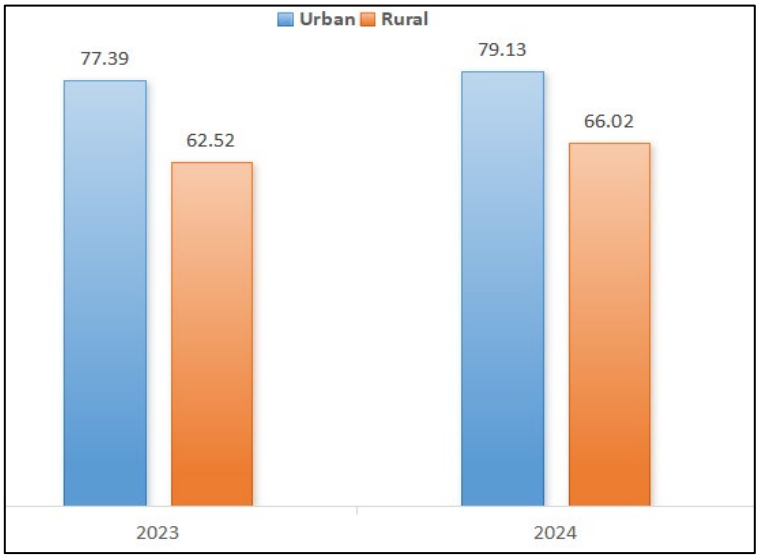

Figure 1. Percentage of Households Occupying Livable Housing
by Area of Residence, 2023-2024
Source: BPS-Statistics North Sumatra Province (2024)

Housing in North Sumatra is not homogeneous; it consists of both formal housing built by real estate companies and informal settlements that are established spontaneously at the periphery of cities or in the countryside. Which of these shapes has which effect on health and well-being? These housing quality problems are also linked to a range of other social issues, including poverty and income inequality. Low-income families frequently live in substandard houses and become trapped in the cycle of poverty. This also adds weight to the argument that good housing is at the heart of sustainable human development. In this case, the key question is: how significant is the relationship between housing quality and HDI as an indicator in North Sumatra? Is an increase in the quality of housing a major driver of the HDI increase in a region? Conversely, do regions with a high HDI generally experience better housing quality as well?

This paper aims to address these questions by drawing on evidence from existing empirical studies. We would analyze the statistical relationship between the different indicators of housing quality (including those indicators such as the proportion of households with access to clean water and the proportion of households with proper sanitation) with the component of HDI in the districts and cities in North Sumatra. The purpose of this research is to identify patterns and trends in the data. We quantify the degree of association using suitable statistical techniques to examine the strength of the relationship between these two variables. The findings will directly inform the dynamics of development in this province (BPS-Statistics North Sumatra Province, 2024) and also serve a more practical goal.

By appreciating this nexus, local governments and policymakers may be able to develop more precise and successful strategies (Morton et al, 2021). Instead of random interventions, it is possible to focus the interventions on the housing sector with the most significant contribution to the growth of the HDI. Hence, this study has both academic and very practical implications. The results of this study are anticipated to provide

useful inputs for the provincial and district/city governments of North Sumatra to optimize resources, making them more effective in achieving the Sustainable Development Goals.

2. Method

2.1. Type and Design of Research

Quantitative research is an approach that uses numerical data to examine a theory or hypothesis. It is characterized by the use of variables that can be measured numerically, and the analysis of data is performed using statistical procedures to discover cause-and-effect relationships or correlations between variables. This research is a quantitative study, as it utilizes data from the Central Bureau of Statistics-North Sumatra Province to analyze the statistical relationship between housing quality and the Human Development Index (HDI) in North Sumatra.

The study aims to quantify the association between variables such as access to clean water and proper sanitation (indicators of housing quality) and the components of the HDI (health, education, and income). The research seeks to identify patterns and trends in the data to determine the strength of the relationship between the two variables using appropriate statistical techniques. Furthermore, the findings aim to inform local governments and policymakers on how to develop more effective strategies by focusing interventions on the housing sector that contributes most significantly to HDI growth. The use of numerical data and statistical analysis makes a quantitative approach suitable for this study (Sugiyono, 2019).

2.2. Study Area and Research Period

The comparison will be conducted in the North Sumatra province of Indonesia, which presents an interesting case study due to its complex location, diverse population, and varying wealth levels. The province struggles with the issue of development inequalities between rural and urban regions, which are clearly delineated by differences in housing infrastructure and services. Studies will examine the relationship between housing quality and HDI in the districts and cities of North Sumatra. Research shall take place from 2024.

2.3. Data Sources

This research utilizes secondary data obtained from the Central Bureau of Statistics in North Sumatra Province. The indicators for the housing quality variable are floor area per capita, access to drinking water, source of electricity, and decent sanitation conditions, while the HDI variable is the overall human development index in 33 regencies and cities in North Sumatra.

2.4. Data Analysis Method

Correlation analysis is a statistical technique that can indicate whether and to what extent pairs of variables are related. It is a multi-step process, ranging from data normalization to result interpretation. The data for such studies, in this case the relationship between housing quality and the Human Development Index (HDI) in North Sumatra, would normally be collected from secondary sources, such as the Regional Central Bureau of Statistics (Sugiyono, 2019).

In this study, the correlation test used is Pearson's correlation test. Pearson correlation is a measure of correlation used to measure the strength and direction of a linear relationship between two variables on an interval or ratio scale. The Pearson correlation test is a parametric statistical analysis that requires the data to be normally distributed. Pearson's correlation test can be used to measure the relationship between housing quality and the Human Development Index in 33 regencies and cities in North Sumatra Province. This test will determine whether and to what extent the relationship between these variables is present. The model equation for this type of correlation analysis is based on the general linear model, where one variable is predicted by another (Sugiyono, 2019).

The equation is:

$$\mathbf{HDI = \beta_0 + \beta_1\ (Housing\ Quality) + \epsilon}$$

In this model, HDI is a dependent variable (Y), which is an indicator of the overall quality of human resources in 33 regencies and cities in North Sumatra. Housing Quality is the X or independent variable that is a pre-computed composite (it includes floor area per person, access to drinking water, place of residence, supply of PLN electricity, and condition of toilet). β_0 indicates the value of the HDI when housing quality is equal to

zero. Is the slope, which measures how the HDI is expected to change per unit increase in housing quality. Finally, ϵ is the error term, capturing the variation between the HDI that is not accounted for by the housing quality variable.

For the Pearson correlation test, the two primary values to examine are the correlation coefficient (r) and the p-value. The correlation coefficient r is a crucial index for indicating the strength and direction of a linear relationship between variables, with a value of r ranging from -1 to +1. As the value r approaches +1,, this indicates a strong positive relationship, which suggests that if one variable increases, the other is also likely to increase. If -1, it indicates a strong negative correlation, meaning that one variable tends to increase as the other decreases. If the value of the valuer is in the vicinity of 0, this implies that there is no distinct linear relation between the two properties.

Table 1. Interpreting the Correlation Coefficient

Coefficient Interval	Level of Relationship
0.00 - 0.19	Very Weak
0.20 - 0.39	Weak
0.40 - 0.59	Moderate
0.60 - 0.79	Strong
0.80 - 1.00	Very Strong

Source: Sugiyono (2019)

Apart from that, , p-value is important to decide if the relation you found is significant enough to be considered. This is the p-value for testing the significance of the correlation. In general (assuming the usual significance level $\alpha = 0.05$), you may say there is a correlation between X and Y if ρ-the result is less than 0.05. This suggests that the correlation in the sample data is likely to be present in the population.

3. Result and Discussion

3.1. Overview of Housing Development in North Sumatra

Habitable housing is an indicator of environmental health. Habitable homes are dwellings that meet the requirements for good living conditions, building safety, minimum building area, and the health of their occupants. In 2024, the percentage of households occupying habitable homes in North Sumatra was approximately 73.47%. When grouped by urban and rural areas, the percentage of households occupying habitable homes in North Sumatra increased in 2024. Approximately 79.13 percent resided in urban areas and 20.87 percent in rural areas (North Sumatra Statistical, 2024). A home is more than just the place we live; it also represents our health and the well-being of our communities.

A dwelling is considered livable when it meets a minimum standard of habitation, including the physical safety of its structure, sufficient floor area, ease of access to clean water and sanitation, satisfactory ventilation and thermal insulation, among others. 2024 Data Unsurprisingly heavy in North Sumatra at nearly 73.47% of households live in such housing (BPS-Statistics North Sumatra, 2024).

This condition suggests that the level of well-being and public awareness about livable homes in North Sumatra is higher than the national average. Given the importance of housing for the community's welfare, the government is expected to continue striving to provide affordable and livable homes for all segments of society, especially low-income communities. In fact, in 2024, when compared at the provincial level across Sumatra (Figure 2.3), North Sumatra had one of the top two percentages of livable homes in Sumatra. North Sumatra province (73.47 percent) was surpassed by Riau province, which had a higher rate of 74.80 percent. The lowest percentage of livable homes was in the Bangka Belitung Islands province, with a percentage of 30.72 percent (BPS-Statistics North Sumatra, 2024).

Figure 2. Percentage of Households Living in Habitable Homes by Province Across Sumatra, 2024

Now, when comparing the data at a more granular level, we can see sizeable regional differences. 79.13 percent of these habitable housing units are settled in urban areas, markedly higher than 66.02 percent in rural areas. These discrepancies likely arise from a combination of factors, including variations in access to basic infrastructure, the government's focus on urban areas in housing development schemes, and different economic and income levels that affect people's ability to build or repair housing. Although things are generally improving, the evidence provided by these figures suggests that we still have more work to do if everyone, especially those in our rural community, is to have fair access to good and safe shelter.

3.2. Overview of Human Development Index in North Sumatra

Human development is an approach that focuses on expanding people's choices and capabilities, rather than just economic growth (Ezenagu et al., 2024). This concept assumes that human well-being should be measured by the things that truly matter to their lives, not just by income. Therefore, human development is not only measured by a country's Gross Domestic Product (GDP) growth, but also by the improvement in the quality of life of its individuals. Two key indicators inherently attached to this concept are education and health, which serve as the foundation for achieving sustainable and inclusive development.

Health considerations and housing are inextricably linked. A quality home not only provides shelter but also serves as an environment that heavily impacts the physical and mental well-being of the occupants. Poor housing conditions, such as dampness, lack of ventilation, high humidity, and inadequate sanitation, can lead to numerous health issues. For instance, houses that are damp and moldy can cause respiratory issues such as asthma and other allergic conditions.

In addition, a lack of proper sanitation and clean water within the home facilitates the easy spread of infectious diseases like diarrhea and cholera. On the contrary, high-quality homes provide good sanitation and clean water, which protects the occupants from infections, making such homes the first line of defense against diseases. Good home environments can also enhance psychological well-being. Safe and comfortable living situations can improve mental health. Good mental health supports the body in lowering stress levels and strengthens the immune system (Marsh & Kulshreshtha, 2021).

The relationship between a home for decent housing and the Human Development Index (HDI) is almost intimate, given that HDI is not only a synthetic indicator that measures the achievements of a territory in three fundamental dimensions —health, education, and decent standard of living. Decent housing has a direct impact on two fundamental dimensions considered by the Human Development Index (HDI). First, it appears that housing quality directly determines the standard of living. A safe and comfortable home is a sign of economic advancement and community health. The 73.47 percent achievement of household residentss on housing worthy in North Sumatra in 2024 showed a good effort to improve the welfare condition, which can automatically increase the HDI of the province.

Furthermore, the healthy aspect also has a strong correlation to housing. Those homes that are not inhabitable from a health standpoint, particularly those without proper ventilation or sanitation, can be disease generators. Conversely, a habitable home is safe and clean, which is important not only for preventing disease but also for the health of its inhabitants. Thus, raising the proportion of habitable houses in North Sumatra is parallel to the improvement of the good condition of public health. However, data reflecting a contrast of (79.13%) urbanization and (66.02%) rurality suggests that growth is not the same everywhere. The government should focus more on improving housing quality in rural areas to increase North Sumatra's HDI score, building on the development achieved in urban areas and bringing a prosperous life to all social segments (Boch et al., 2020).

3.3. Pearson Correlation Test Results

The current section discusses the outcomes of the Pearson correlation test performed to verify the statistical correlation between housing quality and the Human Development Index (HDI) in the districts and cities of North Sumatra. In this case, Pearson's correlation test is used to evaluate the relationship between two variables, assessing how strongly and in what direction they relate to each other. The results will be illustrated with two essential measurements: the correlation coefficient (r), which indicates the strength and direction of the linear relationship, and the p-value, which assesses the statistical significance of the relationship. A p-value of less than 0.05 suggests that the correlation is significant. These results are essential for grasping the key aspects that determine the region's development in North Sumatra and can inform policymakers so they can more effectively concentrate their efforts in the housing area to elevate the HDI.

Table 2. Pearson Correlation Test Results

Variable	Coefficient Correlation	Level of Relationship
Floor area per capita (AR)	0.7167859	Strong
Access to drinking water (WL)	0.6683945	Strong
Electricity Source (EL)	0.6939774	Strong
Sanitation crude rate (SCR)	0.6037368	Strong

From the table above, we can clearly see the relationship between the different variables and the unknown factor. This table shows four variables, including AR (floor area per capita), WL (drinking water), EL (electricity source), and SCR (sanitation crude rate). A correlation coefficient value and its attachment are presented for each of the variables. The correlation coefficient reflects both the strength and direction of the linear relationship between two variables. A coefficient near 1 or -1 suggests a positive or negative linear relationship, respectively, whereas a value near 0 suggests no linear relationship. Here, all the coefficients are positive, meaning that the increase in values of these variables leads to an increase in the values of other variables to which they are related.

There are significant positive correlations with each of the four variables represented, ranging from 0.60 to 0.71. The variables are all rated as a 'strong' relationship according to the relationship rating. Therefore, all four variables are considerably related to the factor being studied. The variable AR has the highest relationship (0.7167859) of the four variables in this study. Therefore, as the floor area per capita increases, the relationship with the Human Development Index (HDI) also increases. The same can be said for the variables WL, with a correlation of 0.6683945 or 'strong', and the use of EL, with a correlation of 0.6939774 or 'strong' relationship.

The variable with the least correlation, though still "strong," is aSCR, with a correlation coefficient of only 0.6037368. Although this value is lower than that of the other variables, this relationship remains relevant. Overall, "strong" correlations for all of the variables show that the factors collectively and individually have a substantial effect or relationship. This probably indicates the general welfare, development, or quality of life of a community in an area, assuming that the necessities of basic facilities are available, such as clean water, electricity, and adequate sanitation. These are highly correlated with having adequate conditions for housing.

In summary, the data in the table provide some empirical evidence supporting the argument that various indicators of living conditions and development have a strong and positive relationship. This strong relationship suggests that if one variable were to improve, for instance, increased floor area or access to sanitation, then other measured variables would also likely improve. These results can provide a valuable

foundation for policymakers to consider when planning comprehensive development programs that target improvements in basic facilities and housing quality in conjunction, thereby achieving comprehensive community well-being.

3.4. Discussion

The analyses show that all four variables —floor area per capita, drinking water, source of electricity, and sanitation crude rate —have a positive correlation coefficient ranging from 0.60 to 0.71. This indicates that as the four variables improve and/or increase, so does the unknown (likely HDI). The word "strong" is used to categorize the relationship between all variables, indicating a significant connection. The variable exhibiting the strongest correlation is floor area per capita (AR), with a corresponding coefficient of 0.7167859, which implies this relationship has the strongest connection to the investigated factor. The following variable exhibiting a strong correlation is the electricity source (EL) with a corresponding coefficient of 0.6939774, followed by drinking water (WL) with a coefficient of 0.6683945. The variable with the strongest, yet weakest, correlation is the sanitation crude rate (aSCR), with a corresponding coefficient of 0.6037368.

The results of the correlation analysis, which show a strong positive relationship between the four indicators of housing quality (floor area per capita, drinking water, source of electricity, and crude sanitation rate) and the Human Development Index, affirm that development isn't just a series of standalone, unconnected projects. The main implication highlights that improving housing quality has a strong correlation with improving the quality of human resources in North Sumatra. This serves as evidence that investing in housing is one of the vital foundations for achieving quality human resources (Oleńczuk-Paszel & Sompolska-Rzechuła, 2025).

These findings also have important implications for policymakers. Policy design should not concentrate on only one sector, but rather tend to be integrated and holistic. For example, a government program improving access to clean water, as well as at every housing development project in North Sumatra, should not only address the wells or pipes, but also consider also how these improvements can relate to resident health, sanitation, and household economic productivity. The findings of the correlation analysis provide a strong rationale that budget allocation targeting several sectors at once, such as addressing sanitation development related to housing eligibility, would certainly help ensure the success of significant sectors (Marquez & Main, 2019).

The economic consequences of these results can be interpreted as an increase in productivity. Access to basic household facilities for productive work, such as clean water and electricity, directly boosts human resource productivity. Access to reliable resources enables human beings to allocate their time and energy to work, study, and invest (e.g., in business), rather than expending resources to seek water and light. In addition, improved sanitation and access to clean water can reduce mortality rates from diseases caused by environmental factors and decrease public healthcare costs for both individuals and the government. There should be no ambiguity about the investment in basic household support being an investment in human capital, which in turn should have a direct impact on increasing the economic competitiveness of the regencies and cities in North Sumatra.

In addition, an aspect of the environment suggests sustainable development must involve the environment as a component of development policy strategy. For instance, a proper sanitation system reduces human health risk and prevents water and soil pollution. Adequate access to reliable electricity reduces dependence on polluting fossil fuels and promotes access to renewable energy. Overall, this could impact the improvement of human well-being while also protecting the environment. Then, the existence of a single variable with the highest correlation, floor area per capita, highlights the need for a balanced approach with the three other variables. Although floor area shows the strongest relationship among the other three variables, improvements in sanitation, access to clean water, and electricity are still crucial for improving the quality of life in housing (Checa-Olivas et al., 2021). The implication for policy is the need for appropriate resource allocation, where each intervention is seen as part of a comprehensive policy strategy in North Sumatra.

Therefore, understanding the correlation between housing quality and the HDI is crucial not only from an academic perspective but also for the practical formulation of policy. Previous studies (Boch et al., 2020; Das & Lall, 2020; Checa-Olivas et al., 2021) have demonstrated that adequate housing is strongly associated with

a reduced prevalence of infectious diseases, improved educational performance in children, and greater household economic stability. The correlations found in this study reinforce the empirical evidence that interventions in the housing sector can serve as a strategic entry point for improving health, education, and economic competitiveness, which are the three main pillars of the HDI. In other words, understanding this correlation enables policymakers to establish a clear rationale for prioritizing housing quality as a development lever, as progress in housing directly accelerates achievements in multiple HDI dimensions. This evidence helps shift development planning from fragmented projects to integrated strategies, ensuring that housing investment is recognized as a key component of human development.

4. Conclusion

The results of this analysis indicate that housing quality, as measured by floor area per capita, access to clean water, electricity, and sanitation, has a statistically significant and positive correlation with the Human Development Index (HDI) in North Sumatra. The correlation coefficients, all ranked from 0.60 to 0.71, showed that development is not a collection of separate projects, but rather a system of interconnectedness. For a given aspect of housing quality, such as the availability of electricity, the improvements impact the households, but they also entail improvements across all components of the HDI. Moreover, while floor area demonstrates the strongest correlation, it is nevertheless important to recognize that the other three variables are still relevant and should be included in a development strategy.

The policy implications of these findings are clear: policymakers in North Sumatra must adopt a holistic and integrated approach to development. Rather than allocating budgets in separate sectors, it is recommended to design programs that combine various interventions to achieve a more comprehensive approach. For example, new housing development should be integrated with the provision of adequate sanitation facilities and guaranteed access to clean water. This approach will not only maximize investment effectiveness but also ensure that development in one sector directly supports and accelerates progress in others, creating efficient and sustainable synergies.

Ultimately, investment in basic housing facilities must be understood as an investment in human capital. Access to clean water, electricity, and adequate sanitation directly increases productivity, reduces the burden of disease, and saves on healthcare costs. Individuals and families can redirect their time and energy from basic survival activities to more productive pursuits such as work, study, or entrepreneurship. This improvement in quality of life, which begins at home, will boost the overall economic competitiveness of the region. Therefore, these findings provide a strong foundation for the government to prioritize improving housing quality as a key pillar of its development strategy in its efforts to increase the Human Development Index (HDI) and economic competitiveness.

Thus, the importance of knowing the correlation between housing quality and the HDI lies in its strategic role as a foundation for evidence-based policy-making. With strong evidence that housing quality influences health, productivity, and education, improving access to adequate housing is not merely about meeting basic needs but also represents a long-term investment to accelerate human development in North Sumatra. This emphasizes that decent housing must be regarded as a fundamental pillar of sustainable human development, rather than simply a physical infrastructure project. By explicitly establishing this correlation, the study confirms that housing policy cannot be separated from human development policy. Recognizing this relationship allows governments to design more coherent, impactful, and inclusive interventions, ensuring that improvements in housing conditions translate into measurable gains in HDI across the region.

References

Baker, E., Bentley, R., Lester, L., & Beer, A. (2016). Housing affordability and residential mobility as drivers of locational inequality. Applied Geography, 72, 65–75. https://doi.org/10.1016/j.apgeog.2016.05.007

Boch, S. J., Taylor, D. M., Danielson, M. L., Chisolm, D. J., & Kelleher, K. J. (2020). "Home is where the health is": Housing quality and adult health outcomes in the Survey of Income and Program Participation. Preventive Medicine, 132, 105990. https://doi.org/10.1016/j.ypmed.2020.105990

BPS-Statistics Sumatera Utara Province. (2024). *Sumatera Utara dalam Angka 2024.*

Chen, M., Gong, Y., Lu, D., & Ye, C. (2019). Build a people-oriented urbanization: China's new-type urbanization dream and Anhui model. Land Use Policy, 80, 1–9. https://doi.org/10.1016/j.landusepol.2018.09.031

Checa-Olivas, M., de la Hoz-Rosales, B., & Cano-Guervos, R. (2021). The impact of employment quality and housing quality on human development in the European Union. Sustainability, 13(2), 969. https://doi.org/10.3390/su13020969

Cohen, M. (2016). Urban policy and economic development: An agenda for the 1990s. World Development, 24(1), 1–24. https://doi.org/10.1016/0305-750X(95)00112-U

Das, R., & Lall, S. V. (2020). Housing, sanitation, and health: Evidence from India. Journal of Development Economics, 145, 102473. https://doi.org/10.1016/j.jdeveco.2020.102473

Ezenagu, A., Umeokafor, N., & Ezeobika, C. (2024). Inclusive factor inputs for determination of human development index for informal settlements: The case of Enugu, Nigeria. SAGE Open, 14(4), 1–15. https://doi.org/10.1177/21582440241294144

Marsh, A. T. M., & Kulshreshtha, Y. (2021). The state of earthen housing worldwide: How development affects attitudes and adoption. Building Research & Information, 50(5), 485–501. https://doi.org/10.1080/09613218.2021.1953369

Marquez, C., & Main, K. (2019). Housing quality and child development: Evidence from low-income families. Journal of Family Issues, 40(12), 1731–1757. https://doi.org/10.1177/0192513X19835838

Morton, T., D'Ayala, D., & Fabbri, K. (2021). The state of earthen housing worldwide: How development affects attitudes and adoption. Building Research & Information, 49(8), 903–922. https://doi.org/10.1080/09613218.2021.1953369

Oleńczuk-Paszel, A., & Sompolska-Rzechuła, A. (2025). Housing conditions and the quality of life of the populations of the European Union countries. Sustainability, 17(4), 1550. https://doi.org/10.3390/su17041550

UNDP. (2022). Human development report 2022: Uncertain times, unsettled lives—Shaping our future in a transforming world. United Nations Development Programme. https://hdr.undp.org/

WHO. (2018). Housing and health guidelines. World Health Organization. https://www.who.int/publications/i/item/9789241550376