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Analysis Of Service Facilities On The Distribution Pattern Of Stunting Toddlers

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ABSTRACT

Stunting is a serious health problem in Indonesia, especially in toddlers and in Pesawaran Regency; its prevalence indicates the need for serious action. This study analyses the distribution pattern of stunting cases and its relationship with access to health services, food facilities, and agricultural land areas. Using quantitative methods and the application of the Quantum Geographic Information System (Q-GIS), data on stunted toddlers were collected through coordinate point surveys and interviews with health facility managers. The study results showed a very clustered distribution pattern of stunted toddlers, with a high concentration in areas with limited access to health and food services, especially in rural areas. The ratio of health workers, the presence of food facilities, and the area of agricultural land were shown to have a significant correlation with the prevalence of stunting. Areas with a high ratio of health and food facilities showed lower stunting rates, while areas with limited resources, especially in rural areas, had higher cases of stunting. These findings emphasize the importance of improving the quality and equity of health services and access to adequate nutrition to address the problem of stunting. Further research is recommended to explore other factors that contribute to this phenomenon, through a holistic approach involving cross-sectors to overcome stunting effectively.

Keywords: Stunting; Service; Distribution Patterns; QGis

ABSTRACT

Stunting merupakan masalah kesehatan serius di Indonesia, terutama pada balita, dan di Kabupaten Pesawaran, prevalensinya mengindikasikan perlunya tindakan serius. Penelitian ini bertujuan menganalisis pola sebaran kejadian stunting serta relasinya dengan akses terhadap layanan kesehatan, fasilitas pangan, dan luas lahan pertanian. Menggunakan metode kuantitatif dan aplikasi Quantum Geographic Information System (Q-GIS), data balita stunting dikumpulkan melalui survei titik koordinat dan wawancara dengan pengelola fasilitas kesehatan. Hasil penelitian menunjukkan pola distribusi balita stunting yang sangat berkelompok, dengan konsentrasi tinggi di daerah dengan akses terbatas ke layanan kesehatan dan pangan, terutama di daerah pedesaan. Rasio tenaga kesehatan, keberadaan fasilitas pangan, dan luas lahan pertanian terbukti memiliki korelasi signifikan terhadap prevalensi stunting. Daerah dengan rasio tinggi terhadap fasilitas kesehatan dan pangan menunjukkan angka stunting yang lebih rendah, sementara daerah dengan sumber daya terbatas, terutama di wilayah pedesaan, memiliki kasus stunting yang lebih tinggi. Temuan ini menekankan pentingnya peningkatan kualitas dan pemerataan layanan kesehatan serta akses terhadap gizi yang memadai untuk mengatasi masalah stunting. Penelitian lebih lanjut disarankan untuk mengeksplorasi faktor-faktor lain yang berkontribusi terhadap fenomena ini, melalui pendekatan holistik yang melibatkan lintas sektor dalam upaya penanggulangan stunting secara efektif.

Keywords: Stunting; Service; Distribution Patterns; QGis

INTRODUCTION

Stunting is one of the serious health problems in Indonesia, especially in toddlers. Growth stunting or stunting in toddlers occurs when the child's height is lower than the standard set by the World Health Organization (WHO) for the same age. This condition not only has an impact on physical

growth but also on the cognitive development of children, which ultimately affects the quality of human resources in the future (Khoeroh & Indriyanti, 2015) .

Various factors have been identified as the main causes of stunting events in addition to chronic nutrition accompanied by infectious diseases, namely the state of environmental health, socio-economists, and health services (Aurima et al., 2021) . Adequate and easily accessible health service facilities can improve the quality of the health status of toddlers through monitoring and providing appropriate nutritional intake, as well as educating parents about the importance of balanced nutrition and children (Widayati et al., 2021; Yuana et al., 2021) 's health.

Nutrition counseling services for pregnant women play an important role during pregnancy for the fetus and the child born. Maternal and child health services effectively prevent stunting events (Sheila C. Vir, 2016) . Nutrition intake services and treatment of infectious diseases for pregnant women and children under 2 years old, as well as distance to health care facilities are important factors for efforts to prevent stunting events (Festilia, 2022; Purnamasari et al., 2022; Sutarto et al., 2020) .

Factors that affect the incidence of stunting can be influenced by regional, geographical, and even demographic factors of an area and do not just spread without cause (Nurlina et al., 2024) , however, stunting cases form (Putra & Suariyani, 2021) clusters. Each work area has a different scope of health service performance, and other factors that affect it, so that a certain area also has different stunting prevention outputs, which in the end stunting events in groups form clusters (Aryastami & Mubasyiroh, 2019; Beal et al., 2018) . The formation of clusters in health problems is the result of the performance of stunting prevention services that vary in the region due to unequal resources, so this condition has an important meaning in health data analysis (Harjanto et al., 2021)

In Pesawaran Regency, there were 547 cases of stunting of children under five in 2022 and spread across 11 sub-districts in 15 health centers (Ministry of Health of the Republic of Indonesia, 2023) . Each region has a different performance coverage due to different resources, this condition is affected by various factors, including the location of the region (Aryastami & Mubasyiroh , 2019; Beal et al., 2018; Son & Suariyani , 2021) . The number of health workers in an area is a determining factor in dealing with stunting. Areas with an adequate number of health workers tend to be able to provide better health services, including monitoring children's growth and development and nutrition education for families. On the other hand, the shortage of health workers can hinder efforts to prevent and handle stunting effectively (Bukit et al., 2021; Lestari et al., 2023)

The difference in the distribution of stunting in rural and urban areas also needs attention. In rural areas, access to health and food facilities is often more limited than in urban areas. This causes the prevalence of stunting in rural areas to be higher. However, despite better access in urban areas, other problems, such as population density and lack of green space, can contribute to nutritional and child health problems. (Budiana et al., 2023; Nugroho & Putri, 2020)

Nearest neighbor analysis is a statistical method used to identify the distribution pattern of an event including stunting events in a data set that each has a certain physical distance. This method is often used in a variety of disciplines, including the field of health (Kulldorff, 2021) . With this method , it is easier to understand the relationship between the availability and quality of service facilities and the incidence of stunting, and an overview can be obtained to make steps in order to reduce the prevalence of stunting in Pesawaran Regency. This study aims to analyze the distribution pattern of stunting events with health services in Pesawaran Regency which is visualized in several maps.

METHOD

The location of the research was carried out in the working area of the Pesawaran Regency government, Lampung Province. The type of research uses a qualitative approach from the results of the analysis of the distribution pattern of stunting areas with health services using the Quantum

Geographic Information System (Q-Gis) application. QGIS is an open-source geographic information system (GIS) software used to create, edit, visualize, analyze, and publish geographic data in the form of map visuals. The software supports a wide range of vector, raster, and database data formats, which are often used in the fields of geography, environment, regional planning, and including the health field. (Kim et al., 2022; Shibu & S. Ayoob, 2021)

The subjects of the study were all stunted toddlers and the coverage of health services by health facilities. All stunting toddler locations were recorded with their coordinate points using a portable GPS device. GPS (Global Positioning System) is a device used to determine the location of a person or object on the earth's surface using satellite signals (Dada et al., 2023; Firouraghi et al., 2022) . The coordinate point survey was carried out by a team of trained surveyors from the geography study program, Faculty of Teacher Training and Science, Universitas Lampung. To obtain data on health service coverage, interviews were conducted with health data managers in each health center work area at the location of the coordinates of stunting toddlers.

RESULTS AND DISCUSSION

Overview of the research location: Pesawaran Regency is part of Lampung Province. Astronomically, this region is located between 104.92° - 105.34° East Longitude (E) and 5.12° -5.84° South Latitude (LS), with an area of about 1,173.86 km² or 117,386 ha.

Pesawaran Regency has a tropical climate with an average rainfall of 23-312 mm, air temperature ranging from 26.05-27.47 °C, and air humidity between 80.37-87.51%. This regency consists of 11 sub-districts and 148 villages and has three islands: Legundi Island, Pahawang Island, and Kelagian Island. In addition, the region has several mountains, with Mount Pesawaran in Padang Cermin District being the highest, reaching a height of 1,604 m. The longest river is Way Semah, with a length of 54 km and a watershed of 135.0 km². The contours of the Pesawaran Regency area vary, ranging from coastal areas to hills. Four sub-districts are located in the coastal area: P下载 Pidada District, Marga Pundung District, Padang Cermin District, and Teluk Pandan District. P下载 Pidada District has the highest number of islands, reaching 29 islands.

Health facilities are locations used to carry out health efforts, including hospitals, maternity homes, health centers with inpatient care, health centers without inpatient health centers, accompanying health centers, polyclinics/health centers, doctor's practice places, maternity homes, midwifery practices, village health posts (poskesdes), village maternity homes (polindes), pharmacies, and posyandu. The number of health centers in Pesawaran Regency until the end of 2022 is 15 (14 health centers have been registered, and 1 health center is in the process of registration). Puskesmas are spread across 11 sub-districts with 9 inpatient health centers and 6 non-inpatient health centers.

Figure 1 below is a map of the distribution of stunting in 2024. This map uses the Universal Transverse Mercator (UTM) projection system of zone 48 S with the 1984 datum. Provincial, county, and sub-district boundaries are marked on a map, along with rivers, provincial roads, and the sea. Several symbols are used to mark stunting toddler spots in various sub-districts.

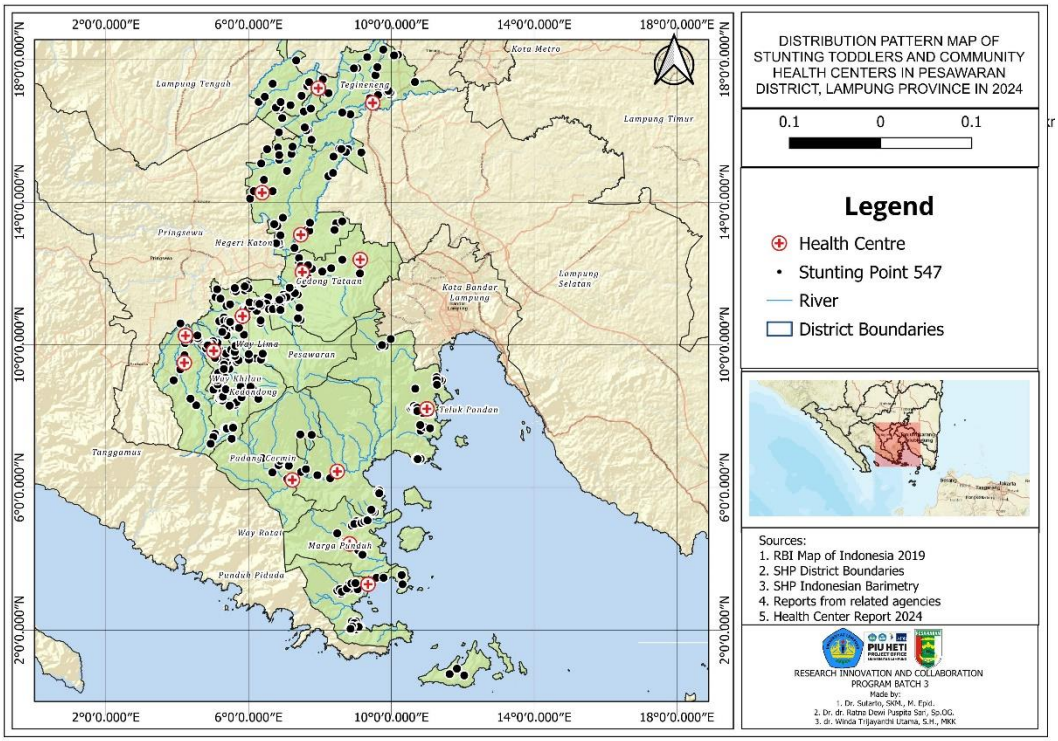

Figure 1 Distribution Map of Stunting Toddlers and Health Centers

Figure 1 explains the distribution pattern of stunted toddlers in Pesawaran Regency, Lampung Province. The widespread and even distribution pattern of stunting toddlers is depicted in the symbol of black dots that indicate the location of stunted toddlers who are evenly distributed in almost all areas of Pesawaran Regency. This condition shows that stunting is not concentrated in one specific area but is widespread in various villages and sub-districts throughout the district.

There is a denser concentration of stunting black spots in certain areas, especially in the central and northern parts of the district. Other high concentrations are also seen around the southern coastal areas and in some places along large rivers.

Rivers provide water for drinking, irrigation, and other needs, play an important role in access to clean water, important in combating stunting and health risks for toddlers. The river also supports agricultural productivity with a consistent water supply and rich in biodiversity, providing nutritious foods such as fish that improve nutrition (Sebisil N. Magagula, 2024; Dahliansyah et al., 2023; February et al., 2022) .

The relationship between stunted toddlers and the location of the health center is spread both near and far from the location of the health center. From this pattern, there is no clear pattern that the relationship between the working areas of the health center has fewer stunted children under five, which suggests that access to health services may not be the only cause of this problem. Mountainous and inland areas and areas farther from city centres and health centres showed stunted children under five, indicating possible accessibility issues to adequate health and nutrition services. Increasing the use of health services is carried out by providing health information for mothers, such as counseling and nutrition education for children under five who are stunted. The media used must be interesting and able to create interactive communication with the mother of the toddler (Suhartanti et al., 2023) .

Explaining the spatial distribution of stunted toddler spots in Figure 2 can provide important insights into their patterns. One of the methods used to analyze distribution patterns is the Nearest Neighbor Analysis. This method allows us to understand that the distribution of outcome points can occur randomly, group, or even spread. In this context, an analysis of the nearest neighbors has been carried

out for a dataset of stunting toddler distribution points representing locations in the Pesawaran Regency area.

This analysis contains several important parameters, such as the observed mean distance, the expected average distance, the ratio of the nearest neighbor value, and the z-score and p-value, to measure the statistical significance of the results obtained. By understanding these parameters, we can more accurately assess distribution patterns and provide more precise recommendations based on the findings of the analysis. The following are the results of the analysis of the Nearest Neighbors for the dataset of the distribution points of stunted toddlers in the Pesawaran Regency area. (Mutammimul Ula et al., 2022)

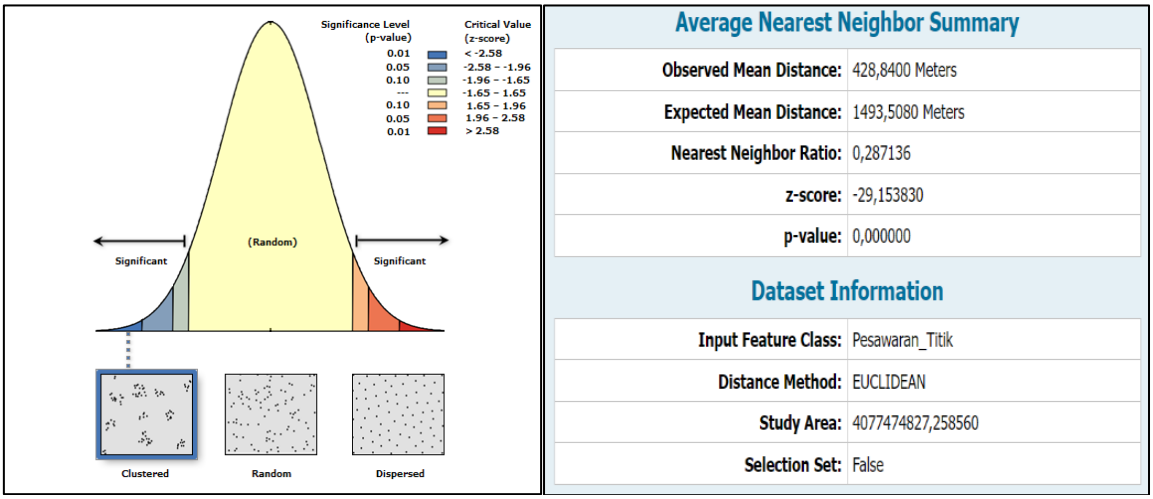

Figure 2. Results of Analysis of Nearest Neighbors in the Pesawaran Regency Area in 2024

Figure 2 is the result of a spatial analysis that measures the distribution pattern of points in Pesawaran Regency using the Nearest Neighbor Analysis method. This analysis compares the observed mean distance between the points in the dataset to the expected average distance in a random distribution.

The average distance observed was 428.8400 meters, the average distance between each stunted toddler point in the data set. The expected average distance (Expected Average Distance) is 1493.5080 meters; This information is available. This is the average distance expected if the dots are randomly scattered within the study area. Nearest Neighbor Ratio: 0.287136. The information obtained is that this ratio compares the observed and expected distances. A value of less than 1 indicates a distribution pattern that tends to be very grouped, while a value of more than 1 indicates *a scattered distribution pattern.* Z-score value (*z-score):* -29.153830. The z-score measures the distance between the coordinate points of stunted toddlers, and the observed data deviates from the expected data in the normal distribution. An overwhelming negative value indicates that the distribution of points is much more randomly grouped than expected. The p-value (*p-value*) of 0.000000 is the statistical significance of the analysis results. A very small p-value (usually less than 0.05) indicates that the observed results are doubtful to occur by chance, so this highly grouped distribution is considered statistically significant.

The research area is about 4,077.47 km2, the total area analyzed. Based on this analysis, the incidence of stunting in Pesawaran Regency shows a very grouped distribution pattern, with the average distance observed much smaller than expected in random distribution. These results are statistically significant, suggesting that the distribution of these clusters is not a coincidence. This can indicate the existence of certain factors that cause the grouping of points in the region. Based on the results of the Nearest Neighbor Analysis, the incidence of stunting in Pesawaran Regency shows a very grouped distribution pattern, and this data is not a coincidence and can be shown by certain factors that cause the grouping of points in the area. Some of the factors that can contribute to the grouping of stunting

events are the use of agricultural land, the availability of food facilities, the distribution of stunting in urban areas, and the number of health workers in the area.

Figure 1 shows the distribution pattern of stunting in Pesawaran Regency. Spat stunting is a widespread and complex problem that requires a multi-sectoral treatment approach. With this mapping, intervention programs can focus more on areas with high concentrations and limited access to health and nutrition services.

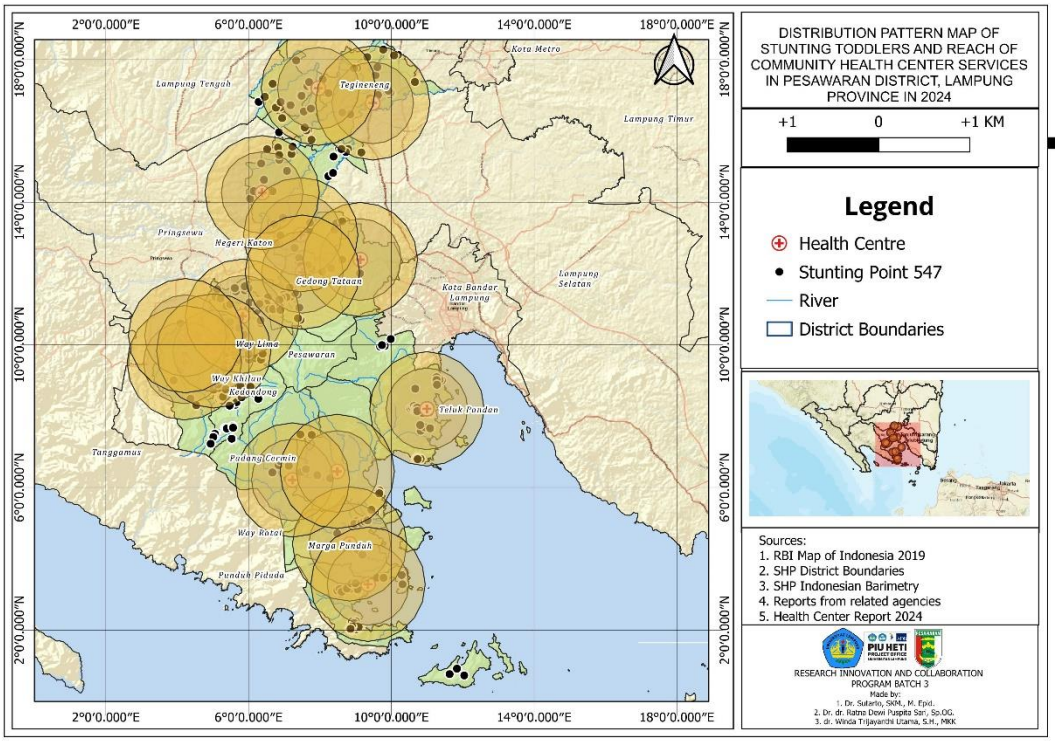

Figure 3. Distribution Map of Stunting Toddlers and Access to Health Center Services

Figure 3 shows that families of toddlers generally reach the reach of stunting toddler health center services within a radius of 7 km.

Poverty, poor lifestyle, inadequate health services, and low access to clean water mainly cause stunting cases in children under five.

These health services are very important in influencing children's health outcomes. Some of the factors that cause stunting are the lack and limitation of health services such as ANC-Ante Natal Care (health services for mothers during pregnancy), postpartum services, quality early learning, and lack of access to clean water and sanitation (Azizah Andzar Ridwanah et al., 2021) .

The coverage of access and clean water sources is inversely proportional to the prevalence of stunted children under five. If the coverage of access and clean water sources is increased by 1 percent, it will cause a tendency to reduce the prevalence of stunting in children under five by 8 percent (Pitoyo et al., 2022) .

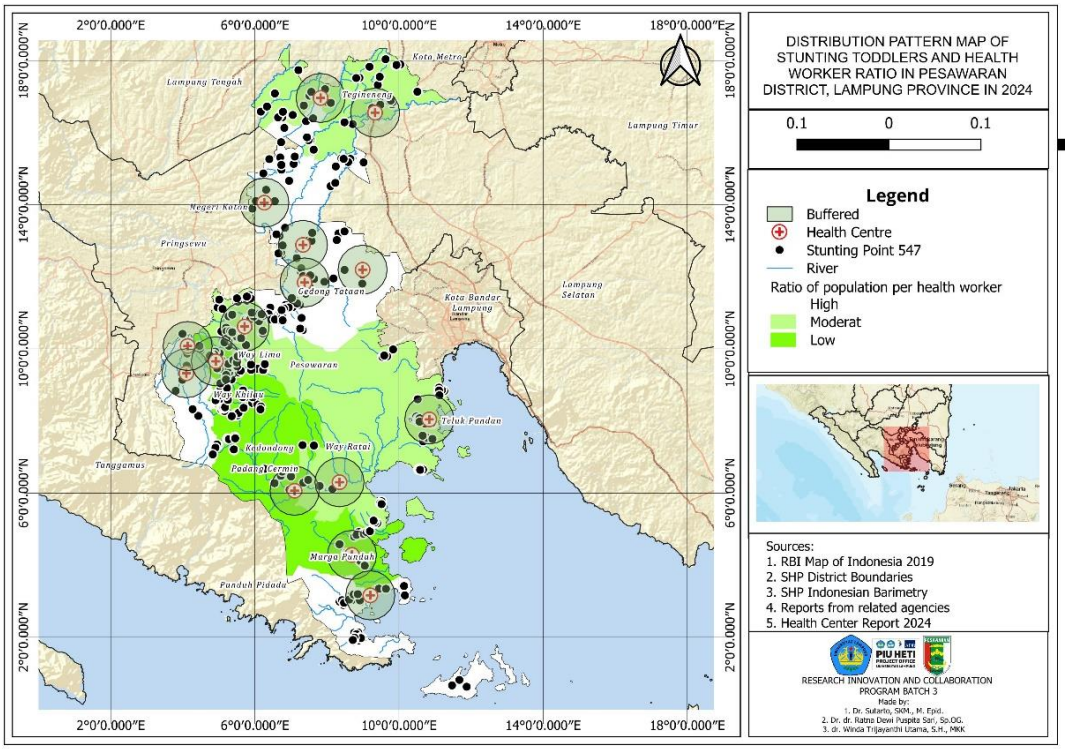

Figure 4. Distribution Map of the Ratio of Stunting Toddlers and Health Workers

Figure 4 above this map shows the relationship between the distribution of stunted toddlers and the ratio of health workers in Pesawaran Regency, Lampung Province, in 2024. The analysis of the relationship between the ratio of health workers to stunting shows that dark green areas (high ratio) with a high ratio of health workers tend to have fewer stunting points in toddlers. These areas, such as around Padang Cermin District and several coastal areas, show a high ratio of health workers. In light green areas (medium ratio) in areas with medium ratios, the distribution of stunting spots varied but tended to be less than in areas with low ratios. This area has a moderate ratio, such as in Kedondong and Gedong Tataan Districts.

White areas (low ratio) in areas with low health worker ratios show a higher concentration of stunted spots in toddlers. Most of them are in the central and northern areas of Pesawaran district, which shows a low ratio of health workers.

The influence of the location of the health center spread across several strategic points can help reduce the number of stunted toddlers around the area, but it is not completely evenly distributed considering that there are many stunted toddler spots in areas with limited access to health centers. Figure 3 shows that there is a significant relationship between the ratio of health workers and the distribution pattern of stunted children under five in Pesawaran Regency. Areas with a higher ratio of health workers tend to have a lower number of stunting cases. This shows the importance of increasing the number and distribution of health workers to effectively overcome the stunting problem.

As a result, the existence of health cadres shows an increase in making referrals for malnutrition in toddlers, while mentoring by cadres has a positive impact on nutritional health services for toddlers (Sari, 2021) .

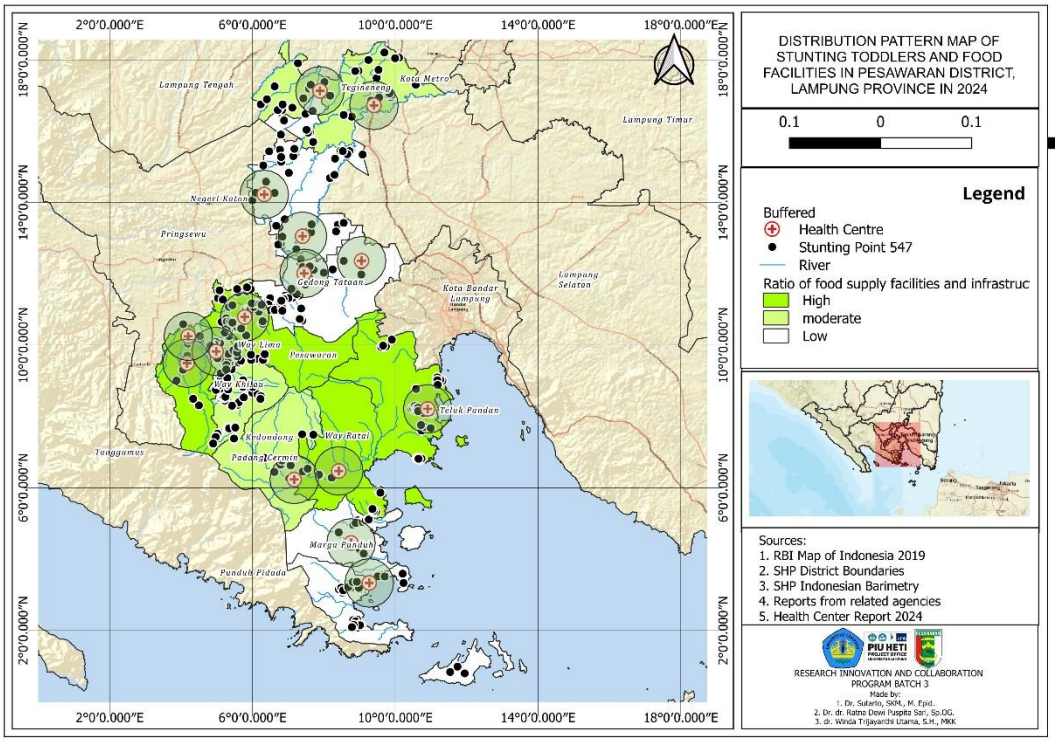

Figure 5. Distribution Map of Stunting Toddlers and Food Facilities

Figure 5 of this map illustrates the relationship between the distribution pattern of stunted toddlers and the existence of food facilities in Pesawaran Regency, Lampung Province, in 2024. Analysis The relationship between the ratio of food facilities and the distribution pattern of stunted toddlers in dark green areas (high ratio) in areas with a high ratio of food facilities tends to have fewer stunting points. This happens around the districts of Way Khilau and Way Ratai, indicating a high ratio of food facilities. Furthermore, in areas with a light green ratio (medium ratio), in areas with a moderate ratio, the distribution of stunting points varies but tends to be smaller than in areas with low ratios such as those in areas such as Padang Cermin and Tegineneng Regencies, which have a moderate ratio. White area areas (low ratio) with low food facility ratios showed a higher concentration of stunting spots in toddlers. Most areas in the central part of Gedong Tataan sub-district and the south in the coastal areas of the district show a low ratio of food facilities.

Figure 5 of this map shows a significant relationship between the ratio of food facilities and the distribution pattern of stunted children under five in Pesawaran Regency. Areas with a higher ratio of food facilities tend to have fewer stunting cases. This shows the importance of increasing the number and distribution of food facilities to effectively overcome the stunting problem. Increasing access to nutritious and adequate food will help reduce stunting rates in areas with low ratios.

Children from highly food-insecure households are more likely to suffer from stunting and wasting and vice versa simultaneously. Poor households are mostly food insecure because all household members have low nutritional status and do not meet food needs. Children from food-insecure households do not get optimal nutrition, leading to short-term and long-term malnutrition. Poverty indirectly affects the nutritional status of households. Food insecurity has a significant impact on the health of children under five in the long term due to the lack of food insecurity. The time span between birth and age 5 is considered to be the main time to achieve optimal physical and mental development. The findings of spatial effects in the research of Edhis (2016) and Singh (2020), show that there are differences in the occurrence of stunting in children living in Lumbini and Karnali provinces. The prevalence of household food insecurity in Karnali province is more than 60%, and food insecurity in children and breastfeeding mothers poses a greater risk of malnutrition, the food supply in the region is affected due to road access. Similarly, results from spatial impacts show that children from

Teria Regency in Madhesh Province and Province 1 are more likely to experience wasting A study reported that 18.9% of children in the East Terai region suffered from wasting, the highest rate compared to other areas in Nepal. The high rate of wastage in Eastern Terry can be attributed to low energy intake and frequent infections (Osei et al., 2010) (Schwarzenberg & Georgieff, 2018) (Edhis , 2016; Singh et al., 2020) (Angela et al., 2020) (Nepal et al., 2020) .

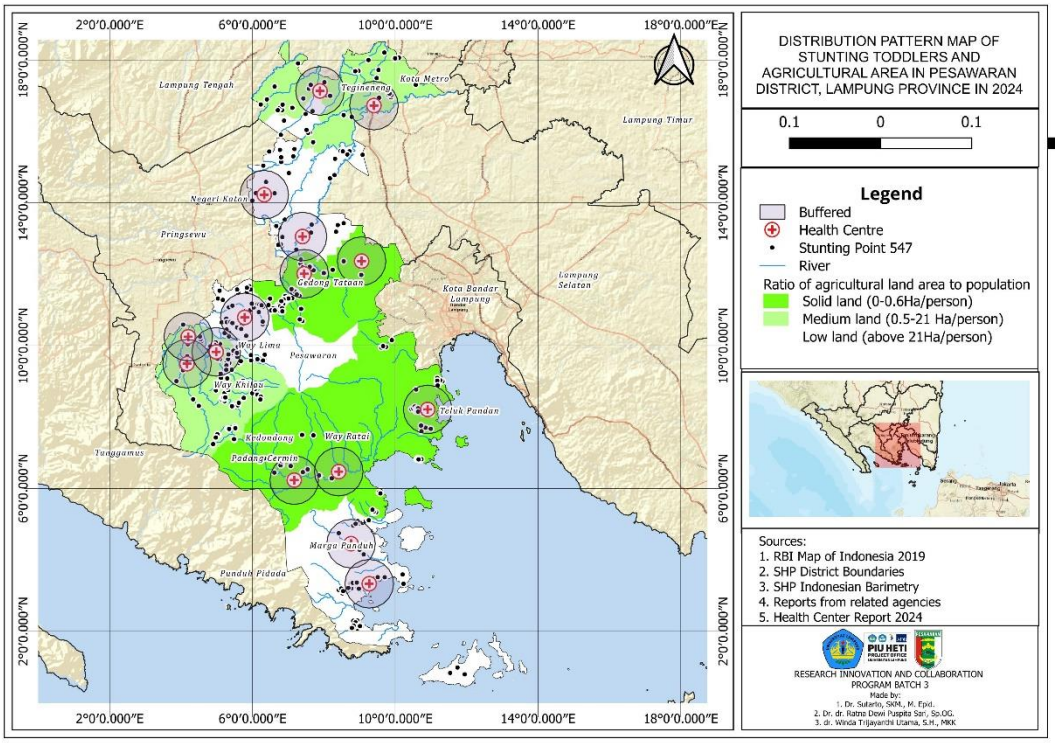

Figure 6. Distribution Map of Stunting Toddlers and Agricultural Land Area

Figure 6 of this map illustrates the relationship between the distribution pattern of stunted toddlers and the area of agricultural land in Pesawaran Regency, Lampung Province, in 2024. Analysis The relationship between the area of agricultural land and the distribution of stunted toddlers in dark green areas (high ratio) in areas with a maximum of 0.6 Ha of land area per person tends to have fewer stunting points for toddlers. This occurred in the area around Padang Cermin, Way Ratai, and Teluk Pandan sub-districts, showing a high ratio of agricultural land area. Furthermore, in light green areas (medium ratio), the distribution of stunting spots varies in these areas with a moderate ratio but tends to be less compared to areas with a low ratio, as is the case in areas such as Way Khilau and Tegineneng Regencies, which have a moderate ratio. White area area (low ratio) with low agricultural land area ratio showed a higher concentration of stunting spots in toddlers. Most areas in the central part of Marga P下载 sub-district show a low ratio of food facilities.

In Figure 6, this map shows a significant relationship between the ratio of agricultural land area and the distribution pattern of stunted toddlers in Pesawaran Regency. Areas with a higher ratio of agricultural land area tend to have fewer stunting cases. This shows the importance of increasing the area of agricultural land to effectively overcome the stunting problem. The increase in the area of high agricultural land increases adequate nutrition and will help reduce stunting rates in areas with low ratios.

Spatial analysis research conducted in India provides information that crop production per capita at the regional level is negatively related to stunting, showing that increased crop production can improve food accessibility and consumption, thereby reducing the risk of stunting in children. The household wealth index and literacy level at the regional level also showed a significant effect in reducing stunting in children under five years old. Integrating climate, agricultural, and

socioeconomic status variables measured at the regional level, correlated contextually and environmentally with stunted children under five in India (Bharti et al., 2019) .

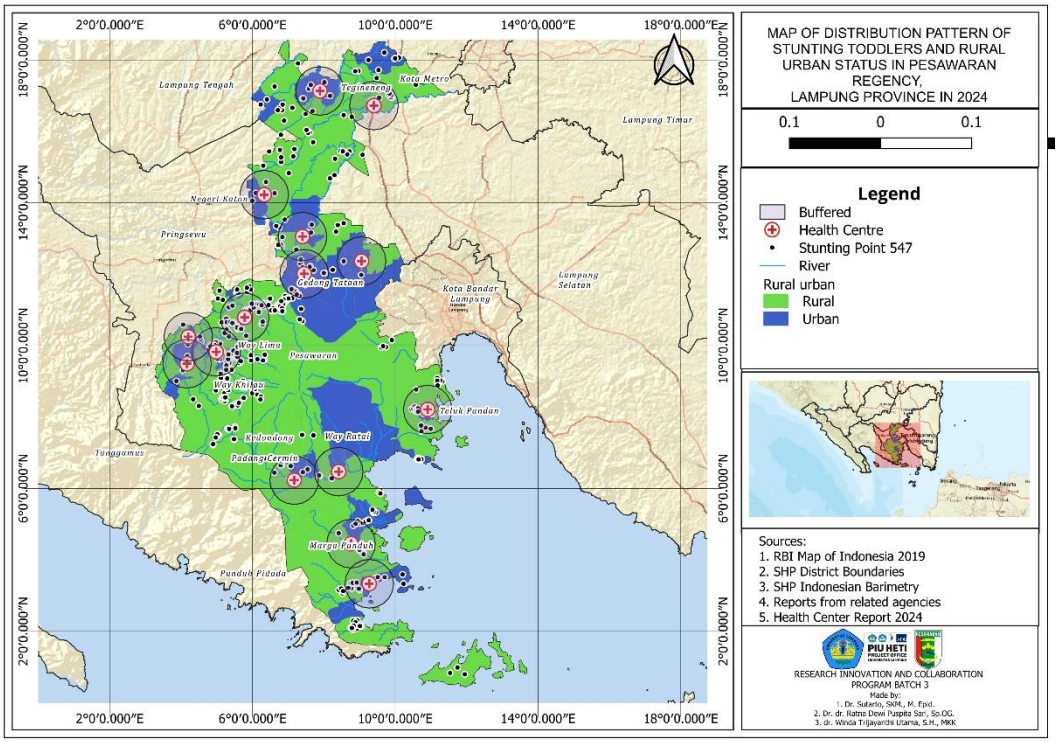

Figure 7. Distribution Map of Stunted Toddlers and Rural-Urban Areas

Figure 7 above, this map shows the relationship between the distribution of stunted toddlers and rural-urban areas in Pesawaran Regency, Lampung Province in 2024. Analysis of the relationship between rural-urban toddler distribution patterns and stunting shows that dark green (urban) areas tend to have more stunted toddler distribution points. This area, such as around Way Ratai sub-district and part of the southern Gedong Tataan sub-district, shows an urban location. In light green (rural) areas in this area, the distribution of stunting spots of toddlers varies but tends to be less than in urban areas. This area occurs in most of the district areas are rural areas.

Figure 7 shows a significant relationship between urban and rural areas and the distribution pattern of stunted toddlers in Pesawaran Regency. Rural areas tend to have a higher number of stunted children under five years old than urban areas. This shows the importance of access to services in effectively addressing the problem of stunting of toddlers.

A meta-analysis that has been conducted has revealed that sixteen demographic and health surveys from ten countries in sub-Saharan Africa found that boys are consistently more likely to be stunted compared to their peers, as boys are more affected by environmental stressors than women. Another factor is the motivation of mothers to start early complementary feeding for boys when they are born young because of their already good nutritional status. The stunting toddler gap in rural areas aged 24-59 months is not protected from risk at the same level as urban children; the urban-rural stunting gap will increase; Most children in urban areas have easier access to a variety of foods, which contain essential nutrients, than children in rural areas. Significant urban-rural differences in stunted toddlers are due to behavioral differences. The educational status of mothers, gender, and age of children are determinants of the urban-rural gap. To narrow the urban-rural stunting gap, emphasis should be placed on the appropriate distribution of resources and the use of available interventions, including improved maternal education, and consideration of gender and age differences during child feeding practices (Tadesse et al., 2023) .

LIMITATIONS OF THE STUDY

This study has limitations in the limited amount of data and the existence of unmeasurable external factors that can affect the results of stunting distribution analysis in Pesawaran Regency.

CONCLUSIONS AND SUGGESTIONS

This study shows that the distribution pattern of stunted toddlers in Pesawaran Regency tends to be very grouped, with a high concentration in certain areas, especially in areas with limited access to health facilities, food facilities, and low agricultural land area. In addition, rural areas tend to have higher stunting cases than urban areas, suggesting that access to health services, clean water, and adequate nutrition are important factors in addressing this problem. The ratio of health workers, the existence of food facilities, and the area of agricultural land have been shown to have a significant relationship with the prevalence of stunting, indicating the importance of improving the quality and equitable distribution of health services and sustainable food access. Further research is suggested to explore other factors that may contribute to the increase in stunting prevalence, namely unemployment and household income, the integration of climate variables and local policies to understand the impact on food production and distribution of health resources. The research is related to cross-sectoral support from the government, the private sector, and the community in strengthening the effectiveness of interventions, and ensuring holistic solutions to stunting problems.

Confession

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ETHICAL CONSIDERATIONS

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Conflict of Interest Statement

The authors had no conflict of interest during the study.

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