

Assessment of Multicausal Factor related Stunting at Limited Resources Area, Indonesia: A case study in Nias Island, Indonesia

Tri Bayu Purnama, Rapotan Hasibuan, Nofi Susanti, Yulia Khairina Ashar, Arrafi Insani1, Moch Thoriq Assegaf

Abstract

The problem of stunting is still threatening the health of children worldwide and the problem of stunting will be greater in underdeveloped areas. This study aims to map the multi-casual factor of stunting in a resource-limited area of Nias. This study was located on Nias Island, North Sumatera Province, Indonesia which is categorized as a remote area then collected data from the

Tri Bayu Purnama. M.Med. Faculty of Public Health, Universitas Islam Negeri Sumatera Utara, Medan, Indonesia, Department of International Health (Public Health), Graduate School of Medicine and Dental Sciences, Niigata University, Niigata, Japan. e-mail: tribayupurnama@uinsu.ac.id

Rapotan Hasibuan. MPH. Faculty of Public Health, Universitas Islam Negeri Sumatera Utara, Medan, Indonesia, e-mail: rapotanhasibuan@uinsu.ac.id

Nofi Susanti. MD, MPH. Faculty of Public Health, Universitas Islam Negeri Sumatera Utara, Medan, Indonesia, e-mail: nofisusanti02@yahoo.com

Yulia Khairina Ashar. MPH. Faculty of Public Health, Universitas Islam Negeri Sumatera Utara, Medan, Indonesia, e-mail: yulia.ashar@gmail.com

Arrafi Insani. BPH. Faculty of Public Health, Universitas Islam Negeri Sumatera Utara, Medan, Indonesia, e-mail: arrafi.insani@uinsu.ac.id

Moch Thoriq Assegaf. BPH. Faculty of Health Sciences, Universitas Islam Negeri Syarif Hidayatullah Jakarta, Indonesia, e-mail: thoriq.alayubi@gmail.com

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Indonesian Basic Health Survey in 2018. Treemap was used to map environment, behavior, access to health care, and infectious diseases among children less than 5 years old. The highest prevalence of severe stunting in infants aged less than 2 years on Nias Island in 2018, respectively, were Nias District (35.9%), North Nias (28.6%), South Nias (21.8%), GunungSitoli (17.9%) and West Nias (12.31%) and the highest prevalence of severe stunting among infants less than five years old was Nias Districts (35.81%). The impact of difficult access to health services can affect the monitoring of health services for infants and mothers. This can be seen from the high prevalence of diseases in children under five such as diarrhea, ARI, and pneumonia. In Nias Districts, the prevalence of diarrhea, pneumonia, and ARI were 13.67%, 13.73%, and 13.07% respectively. The highest incidence of ARI and diarrhea was recorded in South Nias Districts with a prevalence of 27.52% and 21.64% respectively. **Keyword:** Stunting, spatial distribution, multi-causal

Introduction

The problem of malnutrition among children remains public health problem worldwide. The estimated prevalence of stunting in children under 5 years of age reaches 22% globally (1), where East Africa (37%) and Southeast Asia dominate with the highest prevalence (2). Of 30.8% of children under the age of 5 years suffer from stunting in Indonesia, which makes Indonesia as the country with the second largest prevalence rate in Southeast Asia (3).

Stunting is one of the priority child health problems to be resolved in the Sustainable Development Goals (SDGs) (4). It has an impact

on the quality of individual life, both in the short and long term, and leads to a cycle of economic downturn and poverty as well as the quality of human resources in the future (5,6). Previous literature explains that is a factor causing reduced survival, reduced health status during childhood to adulthood, and reduced learning capacity and productivity (5,7).

This public health issues will be greater in underdeveloped areas. For example, Nias Island, which is categorized as an underdeveloped area, became the area with the highest prevalence of stunting (61.3%) in 2018 (3). This makes Nias Island one of the 100 priority districts/cities in 2020. Moreover, according to the Indonesia Nutrition Status Survey report in 2021, the prevalence on Nias Island reaches 27.9%, which is above the average prevalence rate at The Province of North Sumatera (24.4%) and Indonesia in general (25.8%) (8).

Poor household environmental conditions due to limited resources in disadvantaged areas are the main cause of stunting (9,10). Previous studies have explained that the lack of stimulation and activities of children, lack of health behavior, inadequate water, and sanitation supplies, food insecurity, improper storage of food ingredients, lack of economic capacity, and low education on parenting patterns in families in disadvantaged areas have contributed greatly. on the incidence of stunting (9–11). In addition, the difficulty of access to health in disadvantaged areas also contributes to the high problem (12,13). Previous studies in Indonesia reported determinant factors related to malnutrition among children, such as high diarrheal incidents (14), low maternal education (15), high poverty rates (16), poor immunization completeness (17), inadequate sanitation (18), and difficulty in accessing health services (19).

The high prevalence might be threaten the health status of vulnerable groups living in limited resource areas in the short and long term. This is why it is necessary to solve the stunting problem through holistic risk management with an assessment of multifactoral inequality relevant to the malnutrition determinant framework (20). Therefore, this study aims to map the multi-casual factor of stunting in a resource-limited area of Nias.

Methods

Study setting

This study was located on Nias Island, North Sumatera Province, Indonesia which is categorized as a remote area. This island consists of 4 districts (Nias, North Nias, South Nias, West Nias) and 1 city (Gunung Sitoli) which was estimated around 813.155 population in 2017. Secondary data was used to investigate the multi-aspects of stunting in this study. Nias is classified as an outermost area, lagging with limited resources. This study used secondary data methods that data originated from a cross sectional survey conducted by Ministry of Health, Indonesia.

Data source and outcomes variable

In this study, we have collected data from the Indonesian Basic Health Survey in 2018 (3). This survey was conducted by the Ministry of Health, the Republic of Indonesia. We have obtained the data from the Indonesia Basic Health Survey of 2018 (Riset Kesehatan Dasar 2018) that originated from the Ministry of Health, Republic of Indonesia. The cross-sectional survey was conducted in March 2018 with 300.000 household samples in 34 Provinces in Indonesia. A total number of households have participated in North Sumatera Province around 18014 households where 2313 households (12,8%) have been interviewed in this study sites (Nias Island).

Outcomes variable. To identify stunting status, we used the height of children based on age as an indicator of stunting. Microtoise with 0,1 cm precise was used to collect height data of children. This study referred to WHO, 2005 classification as a gold standard of stunting case definition (Z-score). Severe stunting was defined as a Z score < -3 and moderate stunting with a Z score result of $\geq -3,0$ to $\leq -2,0$. This outcomes variable was obtained from the Indonesian Basic Health Survey 2018

Stunting Parameters.

Environment health. In this study we used several variables to describe environmental health parameter as follow; daily water consumption of less than 20 L/day/capita, a household without water improved, and without improved sanitation facilities. Daily water consumption has referred to water quantification

service level and health (21). The proportion of daily water consumption was formulated by the average daily water consumption per day per capita in the household with a total number of households. disposal of children of feces without a latrine or elsewhere was defined as unsafe household disposal of feces. Waste disposal by burning, and throwing on the river or elsewhere was considered as poor waste household management. We also compiled house condition as an environmental parameter in this study with the availability of windows, ventilation, and appropriate light in the dining room, kitchen, and bedroom that referred to the Ministry of Health classification for healthy house criteria.

Behavior health. Smoking behavior was defined as smoking frequency in the last month of data collection with daily and seldom options of smoking. This study also collected data of tobacco exposure in the homes, offices, and public areas. Owning maternal and child books were also considered in this study to observe children's health status as follows; immunization status, frequency of children's height measurement, premature status, and supplementary food program.

Health-care. This study collected the accessibility to hospital and community-based healthcare data with 3 components (mode of transportation, travel time and traveling healthcare cost) that originated categorized from a basic health survey in 2018. In this study, we have combined the data with the coverage of delivery by health professionals in health care facilities, the proportion of general practitioners and midwives per sub-district, and maternal-child health care per village.

Disease definition. We also used the data of diarrhea, pneumonia, and acute respiratory infection in children less than 5 years old. Children who were diagnosed with diarrhea, pneumonia, and acute respiratory infection by medical staff or showed clinical symptoms of these diseases in the last year were considered as a case. Pneumonia cases was diagnosed with high fever, cough and difficulty breathing in last 1 year ago. Diarrhea cases was defined as three or more liquid or loose stools per day within a month ago. Acute respiratory infection was defined with fever, cough less than 2 weeks, sore throat, and nasal obstruction within a month ago (3).

Statistical Analysis

This study was performed descriptively with the proportion, mean and standard deviation of variables in the study area by using R software. Treemap was used to map environment, behavior, access to health care, and infectious diseases among children less than 5 years old. We also mapped the prevalence of severe and moderate stunting, diarrhea, pneumonia, acute respiratory infection, accessibility to hospital and community health care to investigate spatial distribution by using QGIS 1.8 with quantile interval as a cut of point. Ethical approval hasn't needed due to data is available for public and open access.

Result

The highest prevalence of severe stunting in infants aged less than 2 years on Nias Island in 2018, respectively, were Nias District (35.9%), North Nias (28.6%), South Nias (21.8%), GunungSitoli (17.9%) and West Nias (12.31%) and the highest prevalence of severe stunting among infants less than five years old was Nias Districts (35.81%). In West Nias District, the highest number of cases of infants with moderate stunting was reported for those aged less than 2 years (26.6%) and 5 years (25.76%) (Figure 1). The distribution of stunting cases in Nias Island occurs in almost all districts/cities with a prevalence of stunting greater than the regional prevalence of severe stunting in the province of North Sumatra (13.55%) and nationally (11.5%).

More than 80% of households answered that access to hospitals was still very difficult in terms of time, distance, and cost to these health services except Gunung Sitoli City. Access to community-based health services such as primary health centers and integrated healthcare centers, the community also admits that they still experience difficulties in accessing these health services with an average percentage of households experiencing access difficulties of 85% except for Gunung Sitoli City with a percentage of 70% (Figure 2).

The impact of difficult access to health services can affect the monitoring of health services for infants and mothers. This can be seen from the high prevalence of diseases in children under five such as diarrhea, ARI (Acute Respiratory Infection), and pneumonia. In Nias Districts, the prevalence of diarrhea, pneumonia,

Figure 1. Stunting Prevalence in Study Location.

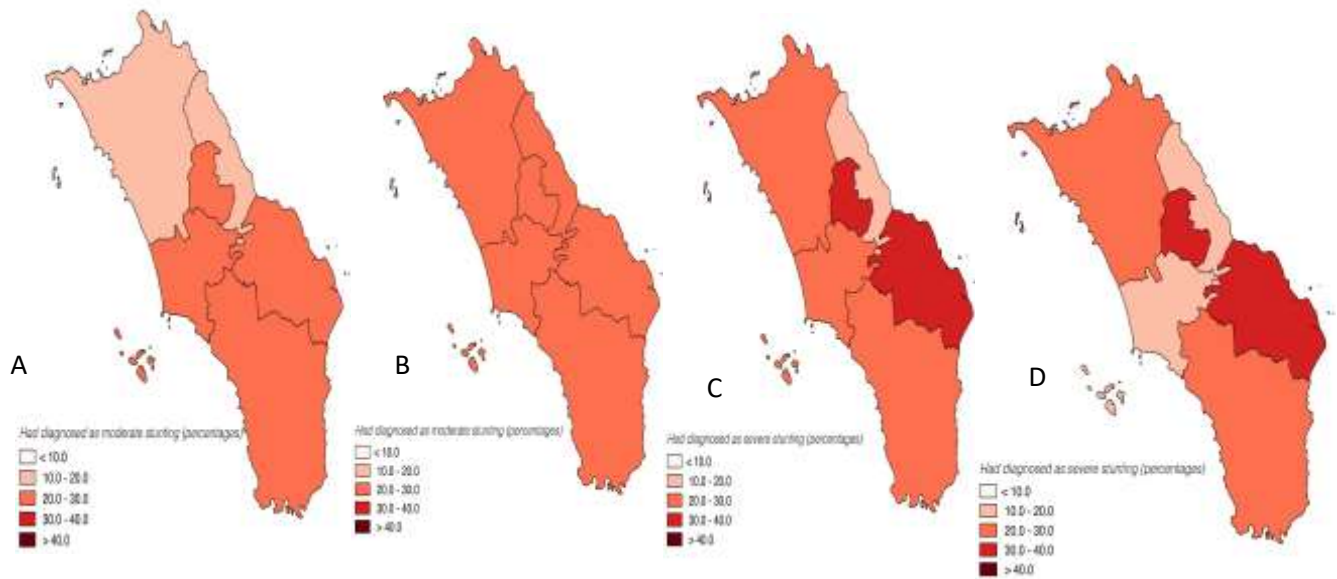
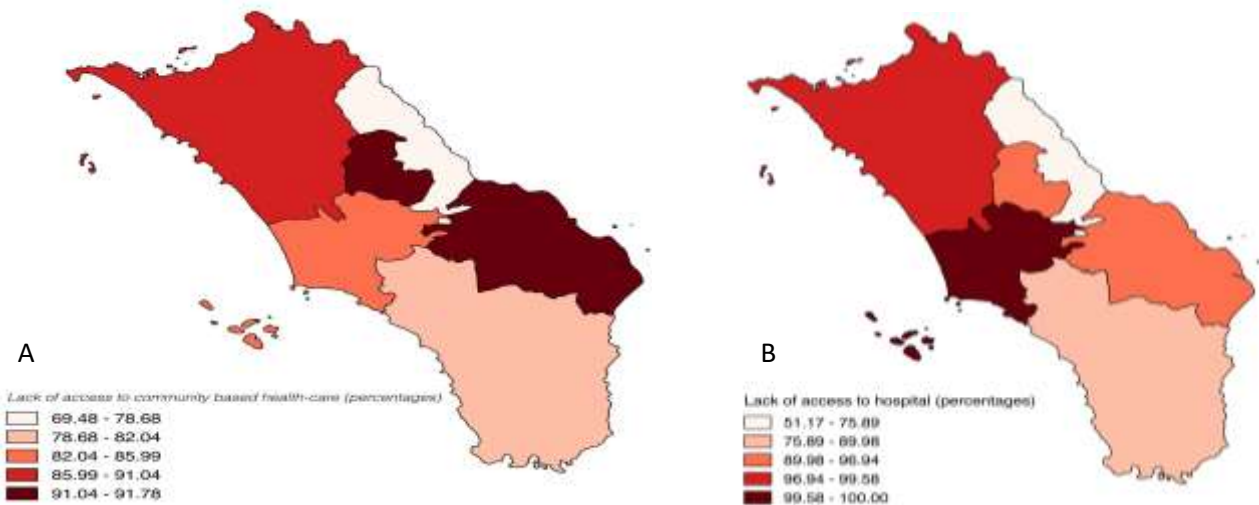


Figure 1a and 1c shows the stunting prevalence among children less than 2 years old and figure 1b and 1d for children under 5 years old. The lightest red indicates low prevalence of stunting and the darkest red indicates of high prevalence.

Figure 2. The percentages of community to accessing health care services.



The percentages of community to accessing health care services. 2a. Public health center and 2b, hospital

and ARI were 13.67%, 13.73%, and 13.07% respectively. The highest incidence of ARI and diarrhea was recorded in South Nias Districts with a prevalence of 27.52% and 21.64% respectively (Figure 3). The high rate of infectious diseases in toddlers is a factor in causing disturbances in the growth and development function of babies.

Figure 4 shows that in the group of children less than 2 years old who are stunted, it is known that several factors consume water less than 20 liters per day per capita and the quality of latrines and poor waste management in Nias and Nias Selatan Districts have a high prevalence of stunting. This study results found that higher stunting prevalence in Nias District was observed in higher diarrhea, pneumonia, and ARI prevalence (Figure 5). It also found that immunization coverage also observed lower in Nias district compare with other study location.

Discussion

The prevalence of stunting in Indonesia has remained high over the past decade, and at the national level is approximately 37%, with the highest prevalence of stunting in the province of East Nusa Tenggara at 52%. Differences in stunting prevalence between urban and rural children have been reported several times before. A study shows that children in rural areas are more at risk of stunting than in urban areas (9), other studies in Iran show that stunting is significantly higher in rural areas than in urban areas (22). This Research shown that majority of households have difficult access in term of time, distance, and cost to raise health services facility. The difficulty of perceptions of access to health services is also influenced by geographical and topographical conditions where Nias is one of the regencies in the Nias archipelago, which has an impact on inaccessibility of transportation and accommodation.

The infant mortality rate is used internationally as the best indicator to show the stage of economic and social development of a country or region because it has a direct relationship with socioeconomic variables, and is therefore sensitive to variations (23). Research shows that stunted children may never reach their full potential height and have poor cognitive development leading to suboptimal educational performance and reduced intellectual capacity, and

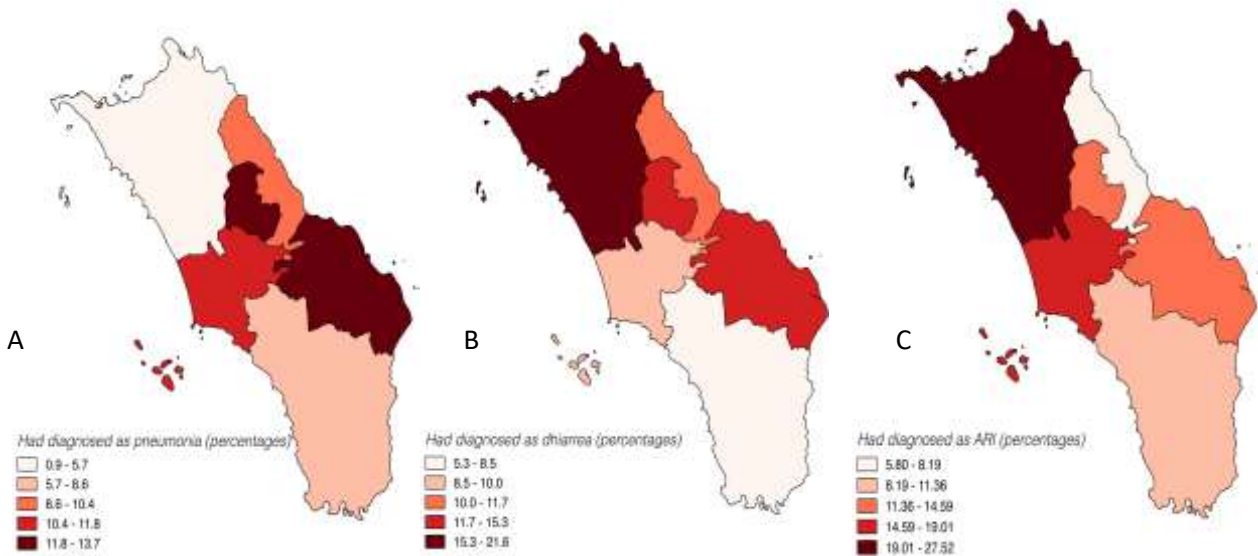
socioeconomic development, stunted children are affected by poor nutrition in-utero and early childhood (24). Stunted children have strongly associated with metabolic risks including systole blood pressure, augmentation index, total cholesterol, low-density lipoprotein cholesterol, triglycerides, insulin, and Homeostatic Model Assessment of Insulin Resistance (HOMA-IR), and therefore have a greater risk for illness and death.

For the detailed, stunted women are at greater risk for developing obstetric complications due to a smaller pelvis, delivering low birth weight infants resulting in an increased risk of chronic non-communicable diseases in adulthood, as well as a cycle of malnutrition, as low birth weight infants are more likely to be smaller as adults (19). This condition might reflect a lower socio-economic condition of communities in the outer Java Bali areas, particularly those in the eastern part of Indonesia. Studies have shown that there are more limited resources and facilities, including healthcare personnel and services in outer Java Bali compared to the Java-Bali region (25).

Identification of stunting is also related to social-economic factors in the community included macro economical situation, gross domestic product, and wealth index in the country (26). A higher wealth index reflects an increased ability of a household to purchase and access good quality food and adequate health care services, as well as improved sanitation facilities and safe drinking water. Appropriate hygienic practices have been reported to potentially improve child growth through the prevention of various morbidities (19). The relationship between a low household wealth index and stunting might work through the food insecurity status of the household (27). The relationship between a low household wealth index and stunting might work through the food insecurity status of the households (28).

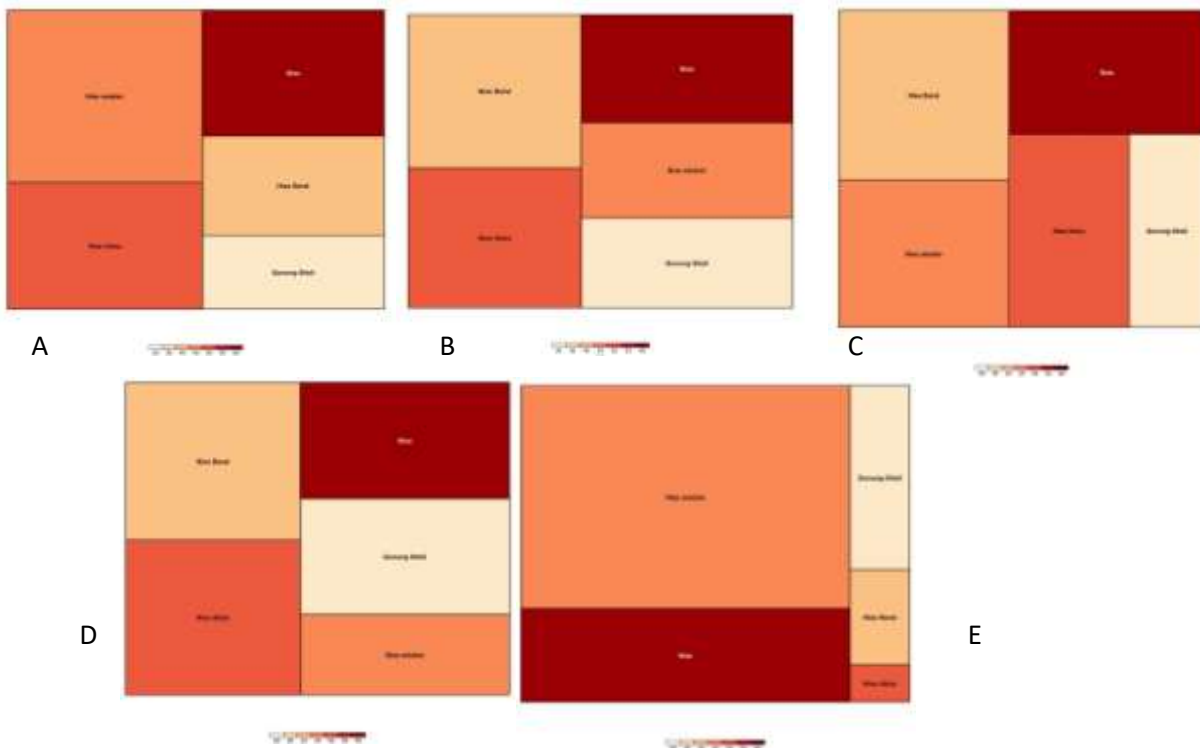
Significant factors at the household level found were the family size and the number of children under five years living in the household. Inappropriate allocation of food and other resources in households with a large number of children can result in poor health and suboptimal nutritional status. In addition, households with large family members may suggest resource depletion, reduced food availability, accessibility, and competition for scarce resources (29).

Figure 3.



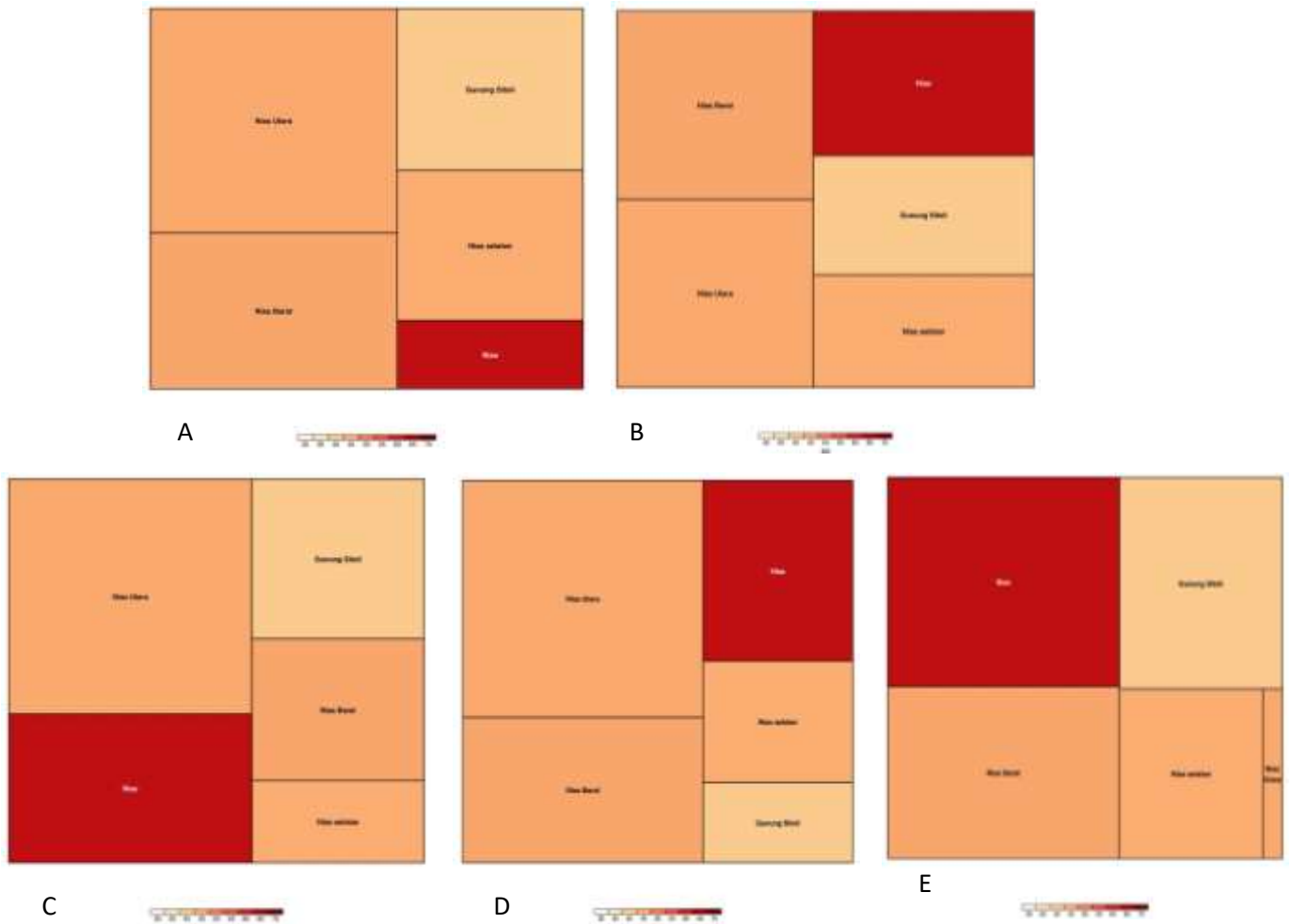
The prevalence of Pneumonia (3a), Diarrhea (3b), and Acute respiratory infection (3c)

Figure 4. The health issues and stunting prevalence.



The size of box represent of higher percentages of (a) having maternal and child books, (b) waste management, (c) sanitation, (d) tobacco exposure, and (e) water consumptions. The color represent of prevalence stunting under 2 years old (light to dark)

Figure 5. The health issues and stunting prevalence



The health issues and stunting prevalence under 5 years old. The size of box represent of higher percentages of (a) immunization, (b) supplementary feeding, (c) diarrhea, (d) acute respiratory infection, and (e) pneumonia. The color represent of prevalence stunting under 5 years old (light to dark).

However, the approach to the number of family members about stunting must be followed by the identification of the purchasing power of the family based on the level of income per capita. In another word, family size and the number of children under five will not interfere with the allocation of food in the family as long as the family has economic resilience above the community average. This discussion continues with a contribution of nutrition knowledge from the mother (or the person responsible to cook and

prepare the food) to decide the kind of food that will be consumed by the family. This is a significant point that will make the children get adequate nutrition in the whole significant stage of growth and development (prenatal and postnatal). Child growth that is less than optimal during the prenatal period is often caused by maternal malnutrition. However, during the postnatal period, optimal feeding can reduce the effects of poor growth during pregnancy (30).

Conclusion

The prevalence of stunting in the Nias Districts is relatively high and also reported in the other study location around at Nias Island including West Nias, North Nias, South Nias, and Gunung Sitoli City. Difficult access to health services facility, in terms of time, distance, and cost, the higher infectious rate that could impact children's growth, like diarrhea, ARI, and pneumonia, water consumption less than the daily average, inadequate of WASH (water, sanitation and hygiene) management, poor-quality of household sanitary, based on indicators of windows, ventilation, lighting, kitchens, and living room, cigarette smoke's exposure, and incomplete immunization coverage might associated with stunting prevalence. The various stakeholders need to work on a comprehensive nutrition intervention with the local wisdom approach to decrease stunting prevalence in Nias Island. Further studies are needed to find out the determinant of stunting using analytic statistical methods and also focus to impact assessment of related regulation and intervention.

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