

# **Factors of Stunting in Children Under Two Years in Papua, Indonesia: A Literature Review**

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## **Factors of Stunting in Children Under Two Years in Papua, Indonesia: A Literature Review**

A thesis submitted in partial fulfilment of the requirement for the degree of Master of Science in Public Health

by

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## Abbreviations

<b>AARR</b>	Average annual rate of reduction
<b>ACT</b>	Artemisinin-based Combination Therapy
<b>AIDS</b>	Acquired immunodeficiency syndrome
<b>AMI</b>	Annual Malaria incidence
<b>AOR</b>	Adjusted odds ratio
<b>API</b>	Annual Parasite Incidence
<b>ARI</b>	Acute respiratory infection
<b>ARV</b>	Antiretroviral
<b>ASI</b>	<i>Air susu ibu</i> (breastmilk)
<b>BCG</b>	Bacillus Calmette-Guerin vaccine
<b>CED</b>	Chronic Energy Deficiency
<b>CLTS</b>	Community-Led Total Sanitation
<b>DHD</b>	District Health Department
<b>DPT</b>	Diphtheria-pertussis-tetanus vaccine
<b>EBF</b>	Exclusive breastfeeding
<b>EED</b>	Environmental enteric dysfunction
<b>GDP</b>	Gross Domestic Product
<b>GRDP</b>	Gross Regional Domestic Product
<b>Ha</b>	Hectare
<b>HIV</b>	Human Immunodeficiency Virus
<b>IUGR</b>	Intrauterine growth restriction
<b>Km<sup>2</sup></b>	Square kilometre
<b>JKN</b>	<i>Jaminan Kesehatan Nasional</i> (National Health Insurance)
<b>LBW</b>	Low birthweight
<b>MOH</b>	Ministry of Health
<b>MMF</b>	Minimum Meal Frequency
<b>NHI</b>	National Health Insurance
<b>NIRD</b>	National Institute of Research and Development
<b>ODF</b>	Open Defecation Free
<b>OR</b>	Odds ratio
<b>ORS</b>	Oral rehydration salts
<b>PC</b>	Preventive chemotherapy
<b>Poskesdes</b>	Pos kesehatan desa (village health post)
<b>Posyandu</b>	Pos pelayanan terpadu (integrated health service post)
<b>Puskesmas</b>	Pusat kesehatan masyarakat (primary health care centre)
<b>Pusling</b>	Puskesmas keliling (mobile Puskesmas)
<b>Pustu</b>	Puskesmas pembantu (auxiliary Puskesmas)
<b>RDA</b>	Recommended Dietary Allowance
<b>Riskesdas</b>	<i>Riset Kesehatan Dasar</i> (Basic Health Research Survey)
<b>SDG</b>	Sustainable Development Goals
<b>SES</b>	Socio-economic Status
<b>SGA</b>	Small-for-gestational age
<b>U5</b>	Under five years old
<b>UNICEF</b>	United Nations Children's Fund
<b>WHO</b>	World Health Organisation
<b>Yoy</b>	Year-over-year

## Glossary

**Adolescent pregnancy:** a woman is pregnant when they are at 10-19 years of age (1)

**Appropriate handwashing:** wash the hands with soap before preparing foods, every time the hands dirty (after contact with money, animals, and pesticide), after gardening, after defecation, after clean children's stool and pee, before breastfeeding, and before eating (2)

**Basic sanitation:** the use of improved latrine at a household level where the excreta is not safely managed. This latrine is used by the member of the household without sharing with other household (3)

**Child marriage:** when a couple are legally married or informally live in union before the age of 18 years (4)

**Chronic energy deficiency:** among women, the value of mid-upper arm measurement is  $<23.5$  cm (5)

**Complementary feeding:** the introduction of family foods as addition to breastfeeding, which typically covers the period 6 to 18-24 months of age (6)

**Exclusive breastfeeding:** Infant under six month only receives breast milk, without any additional liquid or food (7)

**Improved latrine:** a latrine that is connected to a septic tank (8)

**Improved water:** water collected from a protected well, borehole, tube well, protected spring; from a rainwater collector tank; from pipes that are connected to a public tap excreta; or packaged water (3,8).

**Moderate stunting:** when the length/height-for-age Z-score is between -3 SD and -2 SD from the WHO Child Growth Standards median (9)

**Posyandu:** a community-based health effort to provide services on maternal and child health; family planning; vaccination; and prevention and management of Diarrhea; and basic sanitation which is managed by local cadres (mothers) under supervision of Puskesmas.

**Puskesmas:** a public facility that provide primary care including curative, rehabilitative, preventive, and promotive care (10)

**Sever stunting:** the condition when children's length/height-for-age Z-score is  $<-3$  SD from the WHO Child Growth Standards median (11)

**Small-for-gestational age:** infant sex-specific birthweight is lower than the 10<sup>th</sup> percentile for gestational age according a reference standard (12)

**Stunting:** children are considered stunted when their length/height-for-age Z-score is below -2 SD from the WHO Child Growth Standards median (11)

**Surface water:** water from a river, lake, pond, or canal (3)

**Treated water:** water are considered "treated" when it goes through a disinfection process such as boiling, bleaching, or solar disinfection, or was filtered (8)

**Undernutrition:** "The outcome of insufficient food intake and repeated infectious diseases" (13)

**Unimproved latrine:** a latrine without connection to septic tank or bucket latrine (3)

**Unsafe disposal:** other method than flush child's faces into a toilet or latrine or assist the child to defecate in a toilet or latrine (2)



## **Abstract**

**Background:** The stunting prevalence among children under two years in Papua is very high and rising over the past two years. Stunting affects the human capital and threatens the economics of the Papuan community. This thesis aims to explore the factors of stunting in children under two in Papua, Indonesia, and their interrelations and associations to the local context.

**Methods:** This exploratory study used the literature review and desk study. The World Health Organisation conceptual framework on childhood stunting was adopted as guidance.

**Findings:** Toddlers in Papua receive a short period of breastfeeding, low minimal meal frequency and less diverse complementary feeding. People there live in poverty, with a wide deficit food supply and cultures where children and women are least prioritise in food sharing. The completion of mandatory vaccination among toddlers is low. Moreover, children live with poor hygiene practices, limited access to an improved latrine and source of clean water; thus, children in Papua are more prone to enteric infection and diarrhoea. Prolonged diarrhoea concomitant with a respiratory infection, as the result of exposure to indoor air pollution, magnifying the risk of stunting.

**Conclusion:** The stunting reduction programs in Papua is currently concentrated at the household level. However, factors of stunting are also associated with the broad local context. Unless there is an intensification of current programs and broaden the multisectoral approach to address local context, childhood stunting will remain a serious public health problem, particularly in terms of the intergenerational effect.

**Keywords:** Stunting, under two years, Papua

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## **Introduction**

Before continuing with my studies at KIT, I worked as a public health volunteer and was involved in an Australian Direct Aid Programme project that focused on improving the health and nutritional status of mothers and their children under five years old (U5) in nine remote locations in Papua. I worked with local governments and the primary health care centre (Puskesmas) and its networks to revitalise integrated health service posts (Posyandu). The programme included facilitating training for Posyandu cadres, assisting the monitoring and evaluation of Posyandu services, delivering financial support to improve growth-measuring tools, and conducting health education and promotion to the public. Childhood undernutrition is a key health issue in those areas. Stunting, a sign of chronic undernutrition, is not always detected due lack of height-measuring tools, lack of knowledge in both providers and parents, or reluctance of parents to use Posyandu due to socio-cultural beliefs.

Stunting does not merely refer to a short stature. Instead, the term refers to a syndrome of linear growth retardation (14) as a mark of chronic undernutrition (15). This syndrome can lead to multiple pathological disorders, which are associated with increased morbidity and mortality, reduced physical and neurological development, reduced cognitive function, and increased risk of chronic disease in adulthood (11,14).

Stunting has short- and long-term consequences on health and development. In the short term, stunting may affect children's health as it increases susceptibility to infections and alters mental and psychomotor development (16). A long period of stunting will result in poor school performance, affecting later economic productivity (11).

The prevalence of stunting in children under two years old and its reduction trends in Indonesia are varied across regions. The prevalence was generally higher in the eastern part of Indonesia (17). In Papua, at least one-third of children under two years old are stunted (2). As a country with a decentralised health system, though there are national goals to improve health levels, each province has autonomy to set their own health priority programmes, depending mostly on local health burdens and resources (5). In Papua, stunting reduction mainly relies on Posyandu and Puskesmas, with support from the National Movement to Accelerate Stunting Prevention 2018-2024 (18).

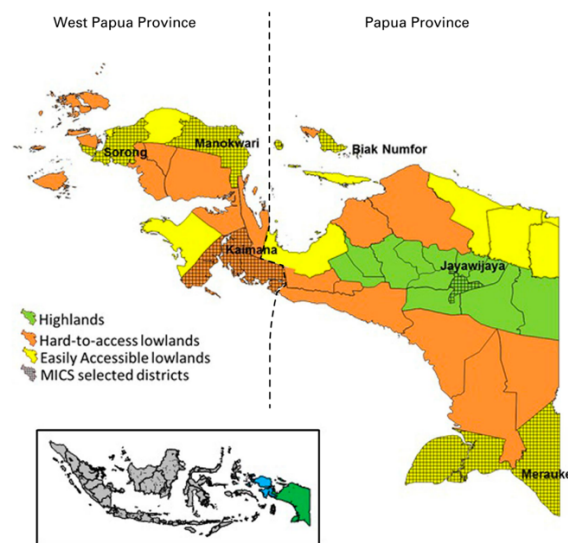
The field experiences and knowledge gained during my Master's degree have given me a broader perspective on the complexity of health problems, particularly in childhood stunting. I have learned that stunting syndrome has an intergenerational effect, where stunted children grow up to be short stature mothers, who are at risk to give birth to stunted children (14).

Children are a vulnerable group but also represent the future of Papua. Papua is also the region where I will go back to work after I graduate from the Master's degree. Therefore, I decided to focus my study on the identification of factors of stunting among children under two in Papua in order to provide a more comprehensive insight and approach to accelerate stunting reduction.

## Chapter 1: Background Information on Papua, Indonesia

### 1.1. Geography

Indonesia is the largest archipelago in the world, consisting of approximately 17,500 islands (19). Papua<sup>1</sup> is situated furthest east from Indonesia's capital city, Jakarta, and has a direct border with Papua New Guinea in the east and the Pacific Ocean in the north (19,20). Figure 1 shows that, administratively, Papua consists of two provinces: West Papua and Papua. West Papua has 12 districts and one city (21), while Papua Province has 28 districts and one city (22). Papua Province is the largest province, with a total area of 319,000 square kilometre (km<sup>2</sup>), while West Papua has the highest number of islands, with over 4000 islands (20). Papua Province's inhabitants are spread in geographically challenging areas, including valleys, small islands, highlands, and lowlands, with dry peat soils and heavy seasonal rainfall that have the potential to cause landslides and erosion (20,23). Refer to Appendix 1 for detailed locations of the districts and cities in Papua.



**Figure 1.** Papua map (24)

### 1.2. Demography

Half of the villages in Papua are located in the slopes, with one-third in in the lowlands (20). In 2017, Papua Province was home to around 3,265,000 people (20), projected to be 3,323,000 in 2018 (25). Children U5 accounted for 10% of the total population (26). The latest population density reported in Papua Province was 10.13 people/km<sup>2</sup> in 2016 (25). West Papua is the second-least populous province, with a total population of 915,000 (27) and a density of 8.96 people/km<sup>2</sup> (21). Eleven per cent of the population in West Papua is children U5 (27). Among the age group of 0-17 years old in Papua Province, only 36.3% have a birth certificate, while in West Papua, 47% of children aged 0-4 years were not registered. In both provinces, the number of males is slightly higher than females (26,27).

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<sup>1</sup> In this study, Papua refers to the entire region, while Papua Province and West Papua refer to the two provinces that administratively divide the region.

### **1.3. Education**

The literacy rate among the age group of 15 years and above in Papua Province reached 76.79%, less than the national goal of 96.10%, in 2018. The literacy rate in males (81.64%) is higher than in females (71.11%). For those who are attending school, only 15.34% reach high school, and only 6.02% finish their education at the university level (26). People who live in urban areas have the opportunity to attend school twice as long compared to those in rural areas (28).

In West Papua, 97.3% of the age group  $\geq 15$  years are literate. Nevertheless, illiteracy in females is twice as high as that in males, 3.7% and 1.7%, respectively (27).

### **1.4. Socio-culture**

The original Papuan is Melanesian, which has a family relation with the Aborigine people in Australia (29). There are more than 300 different tribes and traditional languages in Papua. Some languages are related to others, but some others are totally different (30). Traditionally, mothers are the ones who take the role of nurturing the children, because the fathers (adult males) stay in the separate traditional house, the "honai" (31). Culture and perceived belief have a strong association with health-seeking behaviour among the Papuan (32), with the husband dominating the decision for all family members (31). However, for new-borns, mothers will be the main decision makers when seeking care (31).

### **1.5. Politics and Governance**

Papua was once called West New Guinea when it was part of the Netherlands Indies, and it remained under Dutch control even after Indonesia proclaimed its independence as the Republic of Indonesia in 1945. For over 20 years, Papua had a political culture distinct from the post-revolution Indonesian government. In 1969, using the right of self-determination in the Act of Free Choice, Papuans opted to be part of Indonesia (33). In 2000, the national system transformed from centralised to decentralised, and Papua Province was granted higher revenue-sharing and special autonomous powers from the national government to govern their local customs and institutions, religious affairs, education, and local development policy, including their own provincial flag and anthem, in an effort to maintain unity and conciliate sporadic armed secessionists (34). In 1999, West Papua became a new province, separated from Papua Province; this new province was also granted the same special autonomy status as its mother province (35).

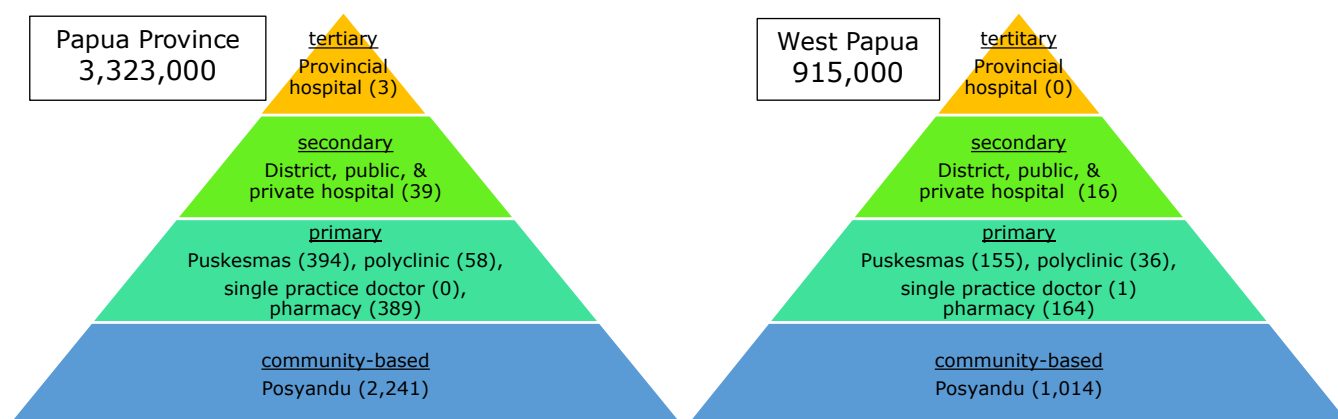
### **1.6. Economy**

The economy in Papua mostly relies on mining (in the case of Papua Province) and natural gas (in the context of West Papua) (36,37). In 2018, the Gross Regional Domestic Product (GRDP) growth in Papua Province in the first quarter was at 26.1% (yoy), almost five times higher than the national Gross Domestic Product (GDP) growth, 5.3% (yoy). GRDP relies mainly on copper and gold mining (GRDP is at 4.8% (yoy) without mining industries), but also includes the agriculture, forestry, and fishery sectors (36). In West Papua, GRDP growth in the last quarter of 2018 fell to 0.8% (yoy) compared to the third quarter of 2018 (6.92%) (37). In the same year, Papua Province and West Papua had the highest percentage of poor people in Indonesia (20).

### **1.7. Health System**

In 2014, the Indonesian government launched *Jaminan Kesehatan Nasional* (JKN), a National Health Insurance (NHI) (38). JKN holders in Papua are able to access free basic primary healthcare at Puskesmas and its networks, including the auxiliary Puskesmas (Pustu), mobile Puskesmas (Pusling), village health posts (Poskesdes), and Posyandu

(10). In 2017, 30% of the total sub districts in Papua did not have Puskesmas; when they exist, not every village has electricity (39). In Papua Province, of 394 Puskesmas, only 32 met accreditation criteria, while in West Papua Province, only 30 out of 155 Puskesmas met them. The number of nutritionists in Papua Province was 614, 287 of whom worked in Puskesmas; in West Papua, 96 of the total 135 nutritionists worked at the Puskesmas level. In 2015-2017, the Ministry of Health (MOH) delegated a total of 64 medical teams to assist Puskesmas to meet the standard quality for the duration of one or two years (5). Figure 2 shows the number of health facilities in both provinces of Papua.



**Figure 2.** The number of health facilities for every level of care in Papua Province and West Papua, adapted from Indonesia Health Profile 2017 Data (5,25,27)

### 1.8. Health Profile of Children Under Five

Besides the high burden of stunting, children in Papua also suffer from other forms of undernutrition. In 2018, 17% and 18% of children U5 were underweight in Papua Province and West Papua, respectively. Wasting affected 10.5% of children in Papua Province and 12% in West Papua. From the Sustainable Development Goals (SDG) progress report in 2015, in West Papua, the children U5 mortality rate was 109 deaths per 1000 live births, while the neonatal mortality rate was 35 deaths per 1000 live births (40). In Papua Province, children U5 mortality was higher (115 deaths per 1000 live births), but neonatal mortality was lower (27 deaths per 1000 live births) (41).

### 1.9. Stunting Response in Indonesia

Starting in 1980's the government began to train local mothers at the village level to start a cadre of Posyandu to combat malnutrition. Posyandu provide monitoring of child health, including vaccinations, child growth and development, nutrition, and the prevention and management of diarrhoea (42), besides its focus on maternal health (10).

In 2017, the President Joko Widodo established the National Movement to Accelerate Stunting Prevention 2018-2024. The team set 1,600 villages in 160 districts as priority areas. The government invested 30% of the program's budget to nutrition-specific interventions and 70% to nutrition-sensitive programmes (Appendix 2). The nutrition-specific programmes mainly tackle the immediate determinants of stunting in pregnant women, mothers who breastfeed, children aged 0-23 months, women at reproductive age, and children aged 24-59 months (43). The nutrition-specific intervention was implemented to help 373,000 stunted children under two years old in 2018. The present nutrition-sensitive programmes include improving access to water and sanitation, healthcare, nutritious foods, and good childcare practices (43). In 2018, the national team established coordination with community leaders to expand allocation for health in village budgets (44). The government also launched a website as a national reporting platform for children's nutritional status. In 2018, notification of stunting cases through this website reached 28.9% (45).

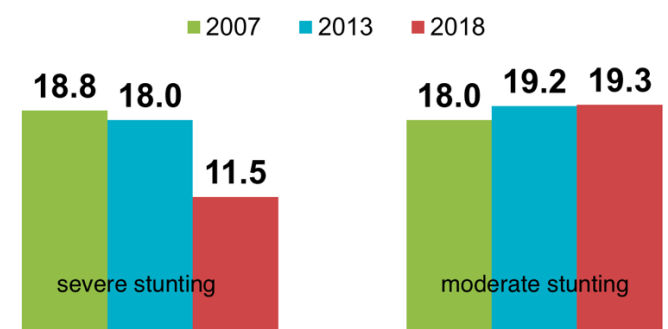
## Chapter 2: Problem Statement, Justification, Objectives, and Methodology

### 2.1. Problem Statement

In areas where short stature is common, society barely recognises childhood stunting, as it is considered normal (11); this includes Papua. Although linear growth can be an overall indicator of children's health status, and a measure to point out inequity in human development (11,46), the underlying mechanisms of linear growth restriction remain unclear (14). The antenatal determinants of stunting can be a result of intergenerational effects through the mechanism of genetic sharing, epigenetic effect, metabolic setting changes, and restricted space for foetal growth, as discussed by de Onis and Branca. Pregnant women who themselves experienced childhood stunting are likely to bear stunted children (11,15). After birth, growth restriction is a result of chronic undernutrition during the first two years of life, due to proximal factors such as household and family, feeding practices, and children's health; and a broader factors: cultural, socioeconomic, and environmental conditions (11,16).

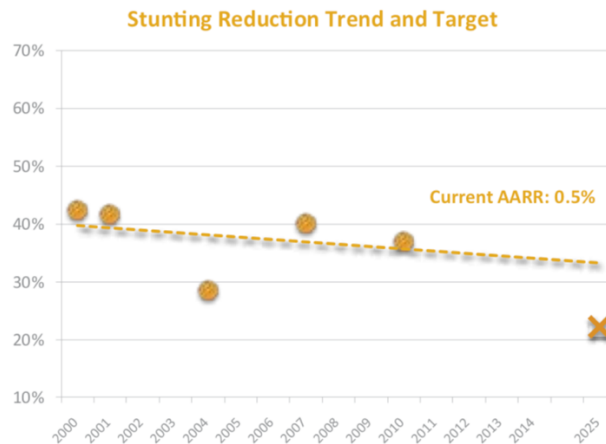
Globally, the prevalence of stunting among children U5 has decreased from 32.5% in 2000 to 21.9% in 2018 (47). Despite the remarkable decline, the Global Nutrition Report in 2018 highlighted the high number of children affected by stunting (151 million). Stunting and other forms of undernutrition are also responsible for 45% of the deaths children U5 globally (48).

In Asia, there was a relative decrease in the number of stunted children of 35% over 16 years, from 2000 to 2016 (49). In Indonesia, the reduction of stunting prevalence among children U5 in the past 11 years (2007-2018) only reached 6%, from 36.8% to 30.8% (2,50). The prevalence among children under two years old in 2018 was 30% (2). Figure 3 shows that, among children U5, the pattern of the decline in Indonesia is mainly in the prevalence of severe stunting (<-3 SD), while the prevalence of moderate stunting is rising (<-2 SD).



**Figure 3** Proportion of severe stunting and moderate stunting of children under five years in Indonesia, 2007-2018 (2)

The Global Nutrition Report targeted a 40% reduction in the number of stunted under-five children by 2025 (51). Specifically for Indonesia, the target is to reduce the prevalence of stunting to 26.52% (52). However, according to the latest Scaling Up Nutrition (SUN) report, Indonesia is projected to miss the reduction goal if the trend of the average annual rate of reduction (AARR) remains below the required AARR (3.9%) (53) (Figure 4).



**Figure 4.** Projection of stunting reduction in Indonesia (52)

Similar to the national pattern, between 2013 to 2018, the number of stunted children under five also declined in Papua Province, from 40.5% to 37%, and in West Papua, from 44.7% to 30% (2,54). In 2017, 16.9% and 15.9% of children U5 in Papua Province lived with moderate and severe stunting, respectively; in West Papua, 19.9% were moderately stunted and 13.4% were severely stunted (5).

Since 2016, the prevalence of stunting in children under two years old has been gradually increasing in both provinces. The prevalence in 2016, 2017, and 2018 in Papua Province was 25%, 24.3%, and 34.5% respectively (2,5). In West Papua, in the same three consecutive years, the prevalence was 24.47%, 24.9%, and 30%, respectively (2,5). The prevalence of stunting in 2018 in both provinces is considered to be very high ( $\geq 30\%$ ) according to WHO's cut-off values (55) and two times higher than the prevalence in Jakarta, the capital city (2).

Stunting affected 173,200 children U5 in both provinces in Papua (56). Although the total number was small compared to the national level, which was 9 million, five districts in Papua were among the 15 highest districts for the prevalence of stunted children in Indonesia (18). Additionally, according to the National Movement to Reduce Stunting 2018-2019 plan, from a total of 42 districts/cities located in Papua, 27 are currently under close attention for stunting reduction because of their exceptionally high stunting prevalence (44) (Appendix 3).

In comparison to other regions in the world, the prevalence of stunting among children U5 in both provinces is higher than the average in Asia (23%). Moreover, the prevalence of stunting among the same group in Papua Province is higher than in Africa (30%) (57).

## 2.2. Justification

Stunting not only has devastating effects at the individual level, but is also a threat to the economics of households and communities (16). In 2017, the human development index in Papua Province and West Papua was 59% and 63%, respectively, the lowest in Indonesia. Furthermore, as the area furthest from the capital city, Papua is one of the most underserved areas of Indonesia (5). Papua Province and West Papua are the provinces with the highest proportion of children who live under the national poverty line, 35% and 32%, respectively (58). Referring to the stunting intergenerational theory (Appendix 4), poverty is part of the cause of stunting and is also the long-term impact of stunting, making the poverty cycle difficult to break (14).

The first 1000 days from conception until 24 months of age is a crucial time for growth and development, particularly for the brain (11,59). Therefore, this period is a critical

window of opportunity for modifying the factors of stunting (14) before it is firmly established and children become 'forever stunted' (14,15,60).

In order to accelerate stunting reduction, knowledge about the determinants of stunting in relation to local context is essential for developing effective solutions to the various geographical challenges in Indonesia (61). However, the factors of stunting in Papua have not been well explored, and the few studies that have been done are mostly related to statistical reports. One of the reasons for the limited number of studies in this region is geographical constraint.

This study aims to fill the knowledge gap, focusing on finding the factors of stunting in children under two years old in Papua by considering the local context and providing recommendations for a better approach to reducing stunting.

## **2.3. Objectives**

### **2.3.1 General Objective**

The general objective of this research is to explore factors of stunting in children under two years in Papua, Indonesia for a more comprehensive understanding of its interrelations and association with local context to provide insights and recommendations to policymakers, key stakeholders, health care providers, community organisations, and community leaders in their efforts to reduce stunting cases.

### **2.3.2 Specific Objectives**

The specific objectives of the research are as follows:

1. To identify different causes of stunting among children under two years in Papua.
2. To explore the relation between different causes and the specific local context in Papua.
3. To provide recommendations to policymakers, key stakeholders, health care providers, community organisations, and community leaders in accelerating stunting reduction based on the findings and conclusions made from this study, specifically in Papua.

## **2.4. Methodology**

### **2.4.1. Study Design**

The study type used was exploratory, using literature review and desk study from published articles in peer-reviewed journals, as well as reports from international organisations and local governments (non-peer reviewed/grey literature). For the literature review, the search was done through databases and search engines: PubMed, Google, Google Scholar, and the Vrije Universiteit (VU) e-library for inaccessible articles. Reports, policies, interventions, and factsheets from the WHO, UNICEF, World Bank, MOH, and Papua local governments were used in the desk study. Combinations of various keywords from different groups in Table 1 and their synonyms with conjunctions AND and/or OR, following the Boolean type of search, was used to specify searches and draw relevant articles. Selection of the literature was based on the title; it was then followed by the content of the abstract before a thorough read of the relevant articles. A search for original articles from references was also done to retrieve proper information.



**Table 1. Research Strategy**

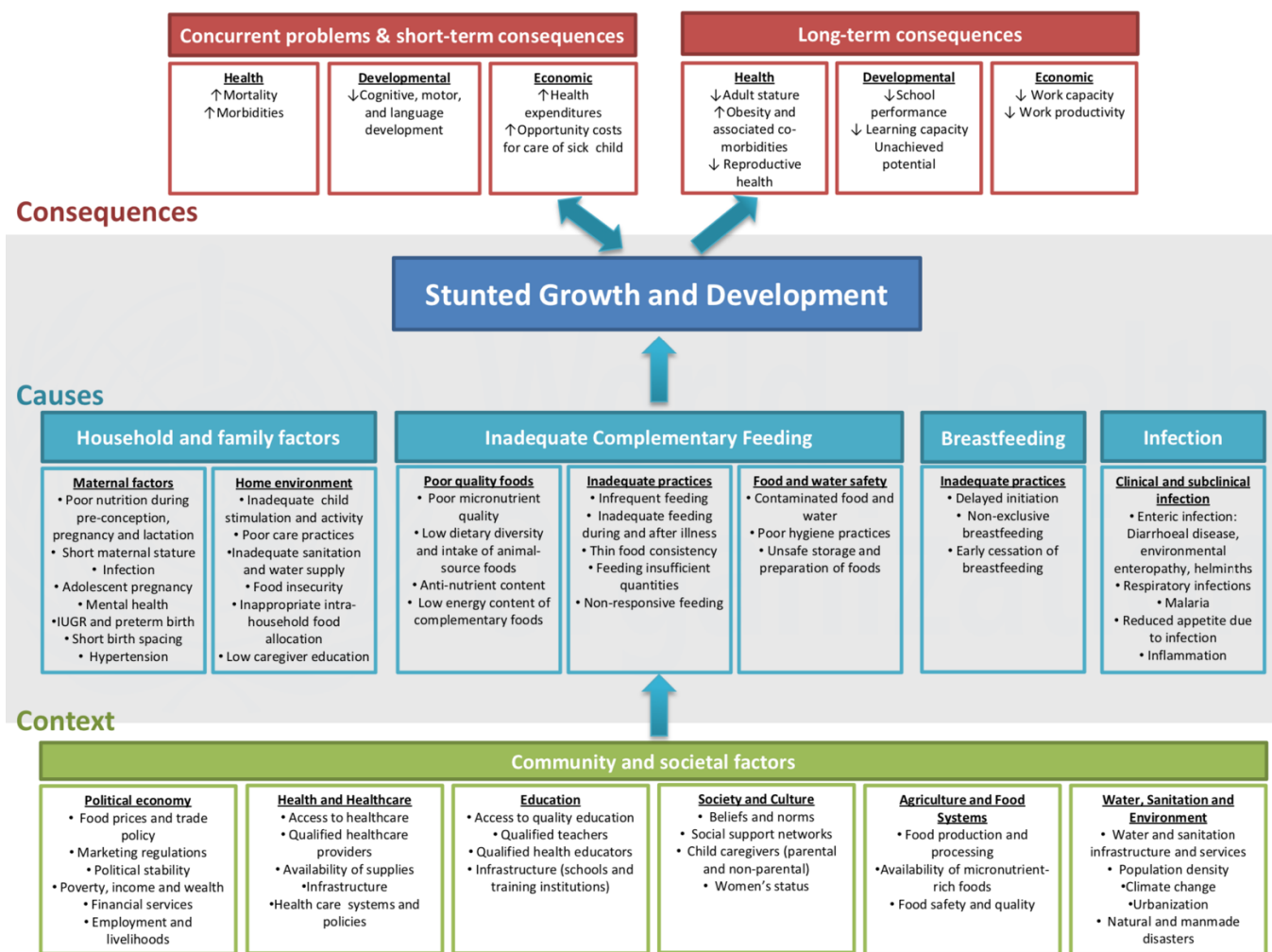
Keywords		Source
English	Bahasa Indonesia	
<b>Region:</b> Indonesia, Papua, Asia, South East Asia, Papua New Guinea, low middle-income country, developing country, remote, island, rural	<b>Area:</b> Indonesia, Papua, Asia, Asia Tenggara, Papua Nugini, negara berpenghasilan rendah, negara berkembang, terpencil, pulau, pedesaan	<b>Data base</b> PubMed, Vrije Universiteit (VU) e-library  <b>Search engine:</b> Google, Google scholar  <b>International organization website:</b> WHO, UNICEF, World Bank  <b>Local organizational website:</b> MOH, Basic Health Research Survey, Papua governments
<b>Health term:</b> stunting, malnutrition, undernutrition, growth, framework, prevalence, malaria, infection	<b>Istilah kesehatan:</b> kerdil, malnutrisi, gizi kurang, pertumbuhan, framework, prevalensi, malaria, infeksi	
<b>Subject:</b> children, under two, under five	<b>Subjek:</b> anak-anak, baduta, balita	
<b>Determinant:</b> determinant, factor, household, family, feeding, nutrition, complementary food, breastfeeding, infection, government, politic, program, intervention, stunting reduction, economy, health system, access to healthcare, education, community, culture, belief, tradition, norm, social support, caregivers, parents, agriculture, fishery, food production, water, sanitation, hygiene, environment, population density, infrastructure	<b>Faktor penentu:</b> penentu, faktor, rumah tangga, pemberian makan, nutrisi, makanan pendamping air susu ibu (ASI), menyusui/ASI, infeksi, pemerintah, politik, program, intervensi, pengurangan stunting, ekonomi, sistem kesehatan, akses ke fasilitas kesehatan, pendidikan, masyarakat, budaya, kepercayaan, tradisi, norma, dukungan sosial, pengasuh, orang tua, pertanian, perikanan, produksi pangan, air, sanitasi, kebersihan, lingkungan, kepadatan penduduk, infrastruktur	

#### 2.4.2. Limitations

A language limitation of English and Bahasa Indonesia was set for searching for literature for this study. Publishing years of 2000 to present were set to ensure relevancy to the current condition. The search focused on studies with a study population of children under two years old, but still considered articles with study populations of children under five years old. Studies involving only the age group 2-5 years were excluded.

#### 2.4.3. Theoretical Framework

The WHO conceptual framework on stunting from 2013 is adapted from the determinants of child nutrition by UNICEF in 1990, which provides a more timely and complete picture of stunting assessment to recognise the contexts, causes, and consequences of faltered growth and development, including attention to complementary feeding. This framework is useful for the structure assessment of determinants through contextual and comprehensive transdisciplinary approaches (16). The WHO conceptual framework has also been used in a study of determinants of stunting in Indonesia by Beal *et al.*, as it provides broad categories and sub-categories to understand proximate causes of childhood stunting from various worldwide data (61). Therefore, this study reflected on the WHO framework (Figure 5) in order to catch all possible causes and local contexts of stunting in Papua.



**Figure 5.** WHO conceptual framework on Childhood Stunting: Context, Causes, and Consequences, with an emphasis on complementary feeding (62)<sup>2</sup>

<sup>2</sup> The WHO framework was developed by Steward *et al.* in 2013 (16)

## Chapter 3: Findings

This chapter elaborates on the findings from the literature review and desk study. The stunting theoretical framework by WHO is used to categorise and organise the findings. The proximal causes of stunting, such as household and family factors, inadequate complementary feeding, breastfeeding, and infection, are discussed first, followed by the community and societal context in Papua.

### 2.5. Causes

In the WHO framework, the causes of stunted growth and development are grouped into four categories: household and family factors, inadequate complementary feeding, breastfeeding, and infection (16,62).

#### 2.5.3. Household and Family Factors

##### 2.5.3.1 Maternal Factors

A study in developing countries stated that maternal undernutrition (16), short stature, and early pregnancy increases the risk of low birth weight (LBW) and stunting (14).

The size of a new-born is a reflection of complex interactions between maternal nutrition adequacy, biological process, and the development of the placenta (14). When the mother is undernourished or underweight, the foetus had to compete with their mother to fulfil their nutritional needs (14,61), which is subsequently linked to LBW (15).

LBW reflects intrauterine growth restriction (IUGR) and it includes preterm babies and small-gestational for age (SGA) babies (12,14). A study in Southeast Asia showed that the odds of childhood stunting (at 12-60 months) is strongly associated with adequate-for-gestational age (AGA)-preterm, SGA-term, and SGA-preterm, at odds ratio (OR) 1.56 with 95% confidence interval (CI) 1.31-1.87, OR 2.25 (95% CI 2.03-2.50), and OR 3.63 (95% CI 2.50-5.28), respectively (12). The odds of finding stunting among infants with a birth weight less than 2500 gram is two times higher with adjusted odds ratio (AOR) 2.55 (95% CI: 2.05-3.15) than the infants with a birth weight  $\geq$ 2500 gram (17). In 2018, the prevalence of infants born <2500 grams in Papua Province was 5.8%; in West Papua, it was 5.7% (2).

The incidence of LBW can be reduced by daily iron supplementation during pregnancy (14). In Indonesia, governments distribute free iron (Fe) tablets to pregnant women as an anaemia prevention measure. In 2015, the distribution of Fe-1<sup>3</sup> covered 43.5% of pregnant women, with Fe-3<sup>3</sup> being distributed to 33% of pregnant women in Papua Province (22). In West Papua, around 50% of pregnant women received Fe-1 and Fe-3 in 2017 (21). The reasons of the low coverage of Fe tablet in Papua has not been documented yet. However, one study in Indonesia (63) found the reluctance of Fe tablet is related low economic status and education, lack of women autonomy, poor knowledge of obstetric complication.

A study in Bangladesh estimated a growth halt of around 0.6 to 2.7 cm among pregnant teenage girls (12-19 years), with the assumption that height can increase until 21 years of age (64). Referring to the socio-culture, child marriage (<18 years) is still practised in Papua (40,41); it may lead to teenage pregnancy, where the mother herself is not fully grown, increasing the risk of becoming short stature mother (14). A review of child stunting determinants in Indonesia found that children are more likely to become stunted when they have mother with height less than 145 cm (61,65).

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<sup>3</sup> Fe-1 packages contain 30 Fe tablets, while Fe-3 contains 90 Fe tablets

In 2017, the adolescent fertility rate in Papua was 66 births per 1000 women in the age group of 15-19 years, surpassing the national average (47 births per 1000 women) (19). Data in West Papua in 2018 showed that the percentage of first pregnancy was 8.3% among women under 17 years old, 14.5% between age 17-18 years, and 24.6% at 19-20 years (27). The first pregnancy data in Papua Province was not available.

Besides early pregnancy, the energy intake in Papua Province and West Papua among women 13-55 years, as reported in 2014, was also very low<sup>4</sup>, while the average of protein intake among women aged 13-18 years and 19-55 years in Papua Province were considered low<sup>5</sup> and in West Papua were low<sup>5</sup> and very low<sup>5</sup>, respectively. The percentage of protein intake was always lower in rural areas compared to urban. The deficit of protein and energy intake among women was reflected in their nutritional status (66). Data in 2015 showed that the prevalence of growth impairment among the age group of 13-18 years in Papua Province and West Papua was 42.6% and 34.7%, respectively (67,68) (Appendix 5). In 2018, 40% of women at reproductive age (15-49 years) in both provinces of Papua suffered from chronic energy deficiency (CED)<sup>6</sup>. CED among pregnant women in Papua Province and West Papua were 25% and 21%, respectively (2).

Malaria infection in pregnant women can result in anaemia and lead to IUGR and growth impairment in the infant after birth (16). In 2017, malaria prevalence among general population in Papua Province was 12%, while West Papua was 8.3%, the first and second highest prevalence in Indonesia, respectively. The most common Malaria plasmodium found in laboratory tests was *Plasmodium falciparum* (2).

Differing from other parts of Indonesia, where HIV is concentrated in key populations, in Papua, HIV is a generalised epidemic, with its major route being heterosexual transmission (69). The prevalence of HIV among the general population in Papua was 2.3% in 2013 within the main age group of 20-49 years. In this region, HIV infected more women (60%) compared to national average (37%) (69,70). A longitudinal study in Uganda reported that a mother living with HIV is not inherently associated with stunting in an uninfected baby (71). However, pregnant women living with HIV need more caloric intake; thus, they require counselling with health personnel to ensure their nutritional needs are fulfilled, particularly when they engage with antiretroviral treatment (72).

Short birth interval is associated with increased nutritional needs in mothers (14). Birth spacing data is not available in Papua, but the percentage of contraceptive usage among women (10-54 years) in Papua Province and West Papua has increased from 28% to 90%, and from 40% to 82%, respectively, between 2013-2018 (2). With a high rate of contraceptive use, half of women in West Papua had one or two children. However, a few women still give birth to up to four children (10%) and five children (9%) (27).

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<sup>4</sup> Energy intake cut-off point: very low (<70%), low (70 - <100% of RDA), and normal (100 - <130%) from the RDA (66)

<sup>5</sup> Protein intake cut-off point: very low (<80%), low (80 - <100%), and normal (100 - <130%) from the Recommended Dietary Allowance (RDA) (66)

<sup>6</sup> In glossary

The category of maternal factors, according to the WHO framework (62), also includes mental health and hypertension as causes of stunting in children. Unfortunately, there is no specific data found related to maternal hypertension in Papua, or related to mental health among pregnant or child-bearing women. However, according to *Riset Kesehatan Dasar* (Riskesdas) in 2018, the proportion of households with member living with schizophrenia/psychosis markedly increased compared to 2013, from 1.2 to 5 households per mil in Papua Province and from 1.6 to 7 households per mil in West Papua. Among the general population above 18 years old, the prevalence of hypertension was 4% in Papua and 7% in West Papua (2).

### **2.5.3.2. Home Environment**

Access to improved water and improved latrines are predictor factors for the improved health of children. The better the access to a healthy environment, the less children are stunted (61).

Water is considered 'treated' when it goes through a disinfection process, such as boiling, bleaching, or solar disinfection, or if it was filtered. The sanitation level of a household is assessed by looking at the availability of a latrine, and is considered 'improved' if it is connected to a septic tank. When a family is living with an unimproved latrine<sup>7</sup>, combined with limited access to treated water, the odds of stunting in children is two times higher (AOR 2.60, 95% CI 1.37-4.93) (8).

According to Riskesdas 2018, around 68% of households in Papua Province and 52% in West Papua practiced unsafe disposal<sup>8</sup> of the faeces of children U5 (2). Unsafe excreta disposal behaviour was also high (38%) among households with improved latrines. Parents tended to dispose child faeces outside the house: leaving it in an open area, burying it in the yard, and rinsing a washable diaper. Among households with children U5, the younger the age of the children, the more they reported unsafe disposal practices (73). In 2015, UNICEF Indonesia reported the percentage of people who had access to basic sanitation<sup>9</sup> at home was low in Papua (27%), while access was better in West Papua (52%) (40,41). Papua Province has had the lowest percentage of population older than 10 years old who defecate in latrine for the last five years (2013-2018), with the last percentage being 56%. In contrast, people in West Papua had much better excreta disposal practice (90%) (2)

Regarding food allocation in a household, traditionally, women and children are the lowest priority (74). This issue will further be discussed under the societal and cultural context.

The education of caregivers is an important home environment factor that needs to be considered, as mothers with no or low education were often less knowledgeable about growth and development in children, the importance of breastfeeding, adequate complementary feeding, and healthy environments (75,76); they also had less adherence towards children vaccination programmes (77). Children with partial vaccinations or an absence of them were more prone to diarrhoea, fever, and anaemia compared to children who finished their vaccination course (77).

Torlesse *et al.* reported that the prevalence of stunting among children in Indonesia whose mothers never attended formal education or did not complete primary school (43.4%) is almost twice as high as those who graduated from high school (23%) (8). In both Papua Province and West Papua, women are more illiterate than men and have less opportunity to attend higher education(26,27).

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<sup>7-9</sup> In glossary

Under the home environment category, there are other factors, such as inadequate child stimulation and activity, and poor care practices. However, there are no studies to be found regarding those factors in Papua.

Additionally, a study in India found that an increased exposure to indoor biofuel smoke<sup>10</sup> in children under five is significantly associated with higher prevalence of anaemia which increases the risk of stunting. In the context of Papua, children often live with indoor air pollution as the result of biofuel combustion for cooking (78). In 2018, many households in Papua Province still relied on wood (64%) and kerosene (34%) for cooking. Wood was used dominantly by households in rural and highland areas (26). In West Papua, 67% of households used kerosene and 27% used wood for cooking (27).

#### **2.5.4. Inadequate Complementary Feeding**

##### **2.5.4.1. Poor-Quality Foods**

A cross-sectional study in Indonesia (2016) reported that children aged 12-23 months have four times the odds of being stunted compared to infants aged 0-5 months (AOR: 4.40, 95% CI: 2.97-6.53) (8). During the age of 12-23 months, children should be at a stage of complementary feeding, according to WHO's recommendations, which emphasises adequate complementary foods at six months to 18-24 months. Adequacy in complementary foods refers to adequate frequency, amount, safety, and appropriateness (6). This section focuses on quality of complementary foods intake, while the quantity will be discussed in the inadequate practices section.

A study in developing countries showed complementary feeding to be one factor that contributes to an increased rate of stunting (8,79). Complementary foods are necessary for a child's growth, yet in many cases, including in Indonesia, parents do not provide a sufficient amount and quality of complementary foods, while simultaneously decreasing breastfeeding (76); therefore, children suffer from nutritional deficit (79). The odds of stunting is 1.39 (95% CI: 1.09-1.77) higher among children aged 0-23 months who did not receive a minimum adequate dietary diversity and frequency (8).

Inadequate intake of micronutrients, such as iodine, zinc, and iron, can lead to impaired growth (16). Iron is essential for the distribution of oxygen and electrons, while zinc plays a role in the synthesis and metabolism of macronutrients and supports the immune system. Nuts, legumes, vegetables, and animal proteins, such as dairy products, meat, chicken, and eggs, are sources of many minerals, including iron and zinc (80,81). Lack of these micronutrients can cause childhood stunting (81). In Papua Province and West Papua, 73% and 63% of children 6-23 months did not receive the minimum dietary diversity, respectively (2). More than 70% of children aged less than two years in West Papua received rice porridge and vegetables, whereas only 30% consumed eggs or other animal protein sources, and far less had nuts (15%) (27). Among Indonesian children, the average frequency of dairy consumption was only 30%, and was lower among children who were raised by a mother with a lower level of education (80).

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<sup>10</sup> From burning of biofuel such as wood, dung, crop residues, kerosene, and charcoal

Recommended Dietary Allowance (RDA) includes the energy and protein minimum daily intake (82). In 2017, 55%<sup>11</sup> children below five years old in Papua Province experienced an energy deficit<sup>12</sup>, while in West Papua it was 46%. The percentage of protein deficit among the same age group in Papua Province and West Papua was 51%<sup>13</sup> and 37%<sup>13</sup>, respectively (5).

The Indonesian government has a programme to distribute free vitamin A capsules through Puskesmas and Posyandu as part of micronutrient supplementation. Through this programme, children are expected to receive one capsule during 6-11 months of age and a total of two capsules within 12-59 months of age. However, Papua Province had the lowest percentage (32%) of children U5 who received the complete amount of vitamin A tablets within the two timeframes. In West Papua, the coverage was 42%. A total of 38% of children in Papua and 27% in West Papua missed out entirely on vitamin A distribution (2).

Anti-nutrient content is one element of poor-quality foods. However, with regard to research being done, there is no information regarding this category in Papua.

#### **2.5.4.2. Inadequate Practices**

Appropriate complementary foods refers to the right food texture according to the age of the infant and engaging in responsive feeding (6). The caregiver is advised to give children 6-23.9 months solid, semi-solid, or soft foods, according to the minimum meal frequency (MMF), as additions to breastfeeding. The MMF for breastfed children 6-8 months is twice a day; for children 9-23 months, it is three times a day; while the MMF for non-breastfed children aged 6-23 months is four times a day (83).

A cross-sectional study from a neighbouring province, North Maluku, found that the odds of being stunted among children aged 0-23 months who had more than two meals per day were 30% lower than those who received two meals (84). At the national level, around 60% of children receive MMF (85). In 2018, the percentage of children aged 6-23 months who received MMF in Papua Province and West Papua was low, 27% and 37%, respectively (2).

The practice of inadequate feeding practices during and after illness, thin food consistency, and non-responsive feeding among caregivers in Papua has not been documented yet.

#### **2.5.4.3. Food and Water Safety**

It is important to prepare complementary foods under the measure of preventing contamination (6). The concept of complementary food, therefore, related to the availability of clean water<sup>14</sup>, good hygiene practices, and clean environmental conditions.

A study in Indonesia (8), including Jayapura, found that some households choose to rely on untreated water because it is more affordable than treated water. Among households that consume untreated water, the prevalence of severely stunted children was more than twice compared with those that consume treated water (UOR: 2.19, 95% CI: 1.20-3.98).

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<sup>11</sup> The second highest in Indonesia

<sup>12</sup> When energy intake <80% of RDA

<sup>13</sup> The first and third highest in the country

<sup>14</sup> Improved water that is located  $\geq$  10 m from excreta pit (27)

The prevalence of stunting in children was twice as high in the study population where soap was not part of the handwashing practice (8). Appropriate handwashing<sup>15</sup> was only being practised by 28% of the population of age group  $\geq 10$  years in Papua Province, with 43% in West Papua (2). Access to safe water in schools to improve hygiene was limited, at 59% in both provinces (40,41).

Open defecation is one of the causes of contamination of water sources, and combined with poor handwashing practice, becomes the risk for faecal-oral infections that can induce tropical enteropathy and infectious diarrhoea increases (86). The association of stunting with both diseases will be discussed further in the infection section.

There is no data regarding the storage of foods in Papua. However, according to the writer's personal observations while living for two years in both provinces in different settings (remote, rural, and urban), caregivers usually cook for the whole family in the morning for breakfast, keeping the leftovers on the table (with a cover) for lunch; a few households also have dinner with the same foods, while in some households, different meals are cooked for dinner.

### **2.5.5. Breastfeeding**

Exclusive breastfeeding (EBF) means that an infant under six months of age only receives breast milk, without any additional liquid or food (7). WHO emphasises the importance of the initiation of breastfeeding within one hour after delivery, followed by EBF for six months, and continued breastfeeding of the baby until two years of age, as it is rich with energy and nutrients (72). Continued breastfeeding up to first year of life can fulfil half the nutritional needs of the child and one-third of their needs in the second year of life. Additionally, it protects children from infectious diseases (7). However, EBF over 18 months, and early breastfeeding cessation (at less than one year of age), can increase the rate of stunting (16,79).

In 2018, EBF practice for infants under 6 months in Indonesia remained low (37.3%). This was also the case in Papua Province (33%) and West Papua (48%) (2). Breastfeeding within one hour of birth was related to reduced stunting (8); however, it has not yet been highly practiced in Papua Province (40%), but is slightly more common in West Papua (62%) (2).

The percentage of children under two years old who were breastfed until around 20-23 months in West Papua was very low (5%). The majority (58%) of children only received breast milk for less than 12 months, while 27% were breastfed up to 12-15 months, and 10% were until 16-19 months (27). Unfortunately, there is no data available regarding this issue in Papua Province.

### **2.5.6. Infection**

The first two years of life are a crucial time in the growth and development of children. During this period, children are prone to health issues (11,59).

Earlier introduction of complementary foods in infants than recommended (at six months of age) often causes diarrhoeal infections that may impair growth (79). Children are more prone to diarrhoea when undernourished. The longer that the children have diarrhoea, the higher the risk of being chronically undernourished (79,87), which can result in childhood stunting (88).

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<sup>15</sup> In glossary



A pooled analysis of nine studies from a 20-year period on interaction between diarrhoea and growth showed that the risk of stunting increased when, during the first two years of life, children had many episodes of diarrhoea. The probability of being stunted at 24 months of age significantly increases by a factor of AOR 1.025 (95% CI: 1.01-1.04) per episode of diarrhoea, with the odds increasing by 1.13 (95% CI: 1.07-1.19) for every five episodes of diarrhoea. Moreover, 25% of stunting before 24 months of age can be attributed to  $\geq 5$  episodes of diarrhoea (87).

Prolonged diarrhoeal infection can contribute to stunting in children, particularly when it is concomitant with acute respiratory infection (ARI) (88). The prevalence of diarrhoea in children U5 in Papua Province is the highest (15%) in Indonesia, while West Papua is 10% (2). The estimated proportion of children U5 who have had pneumonia is 2.8% in Papua. However, this proportion may be underestimated as the pneumonia detection rate is very low in Papua Province (0.6%) and higher in West Papua (23.7%) (5).

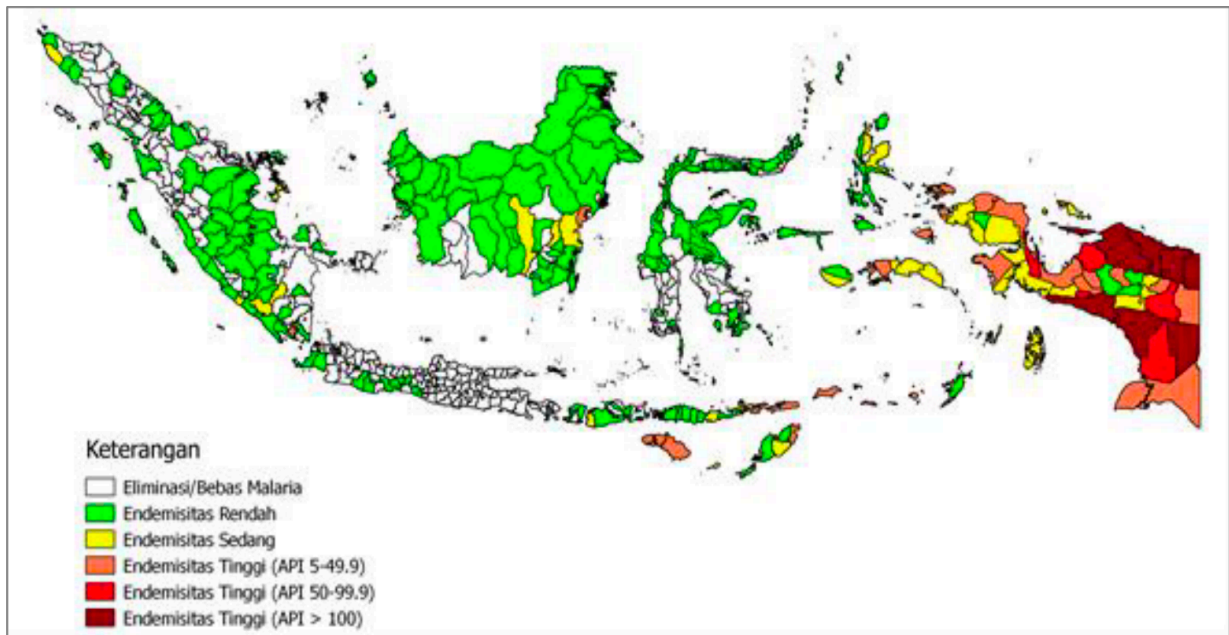
Helminth infections are a commonly neglected disease (89) and cause acceleration of intestinal transit, competition of child's body with a parasite in the absorption of nutrients, reduced appetite, and fever that can directly affect the nutritional status of children (8,79). There is no report available on the prevalence of soil-transmitted helminthiasis (STH) in Papua. However, WHO released a report on STH in Indonesia, where the number of preschool-aged children (0 to <5 years) who require preventive chemotherapy (PC) for STH was 21.4 million with national coverage<sup>16</sup> of this age group, 57.85%, in 2017 (90). *Strongyloides stercoralis* is an infectious intestinal nematode that can cause diarrhoea and vomiting. This parasite is found in monkeys around Papua New Guinea, which borders Papua to the east, and can also infect humans (91). People living in highlands of Papua hunt wild animals in the jungle, such as monkeys, as a food source (29,92).

The manifestations of tropical enteropathy (86), recently termed as environmental enteric dysfunction (EED), include hyperpermeable gut, atrophy of villi, and gut inflammation, with or without diarrhoea (86,93). EED has been related to stunting in children, especially among children under two years old, who require high nutrition for growth. Even though there is no clear elaboration of the pathogenesis from infection to development of EED, the disease can occur in children through repeated faecal bacteria ingestion due to poor sanitation (86,93). The burden of EED among children in Papua is not known. However, the poor sanitation (26,27,40,41) and hygiene (40,41) the people in Papua are struggling with may increase contact with bacteria.

Repeated malarial episodes in children may cause chronic anaemia; thus, it may impair a child's growth and development (94). A 2016 study in Papua New Guinea, a malaria endemic area, shows that stunted children significantly had correlation with having had malaria in the past 30 days (95). The prevalence of malaria in Papua is the highest in the country (2,5). Figure 6 shows that the endemicity of malaria is concentrated in Papua and its surrounding provinces. A high Annual Parasite Incidence (API) presents in the majority of districts of Papua Province (59/1000 population) and West Papua (15/1000 population), the two highest in Indonesia. The Annual Malaria Incidence (AMI) of Papua Province in 2013 was 138/1000 population (22). However, there is no other data found about malaria infection among children in Papua and there is no study found regarding the association of malaria and children's growth.

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<sup>16</sup> "National coverage is the proportion of the population who need PC for STH in the country that have been treated" (90)



**Figure 6.** Malaria Endemicity Map 2017 (5)

## 2.6. Context: Community and Societal Factors

### 2.6.4. Political Economy

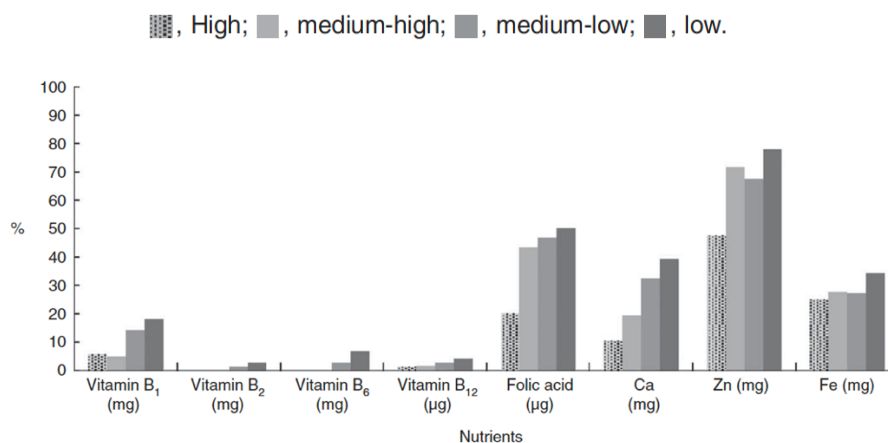
A cross-sectional study that involved 79,500 children U5 across provinces in Indonesia revealed income per capita had a significant negative linear regression with stunting; this means the stunting prevalence is higher when the income per capita is lower, while poverty had a positive correlation with stunting, with a higher poverty level leading to more children found stunted in a household (96). A study in Jayapura revealed that children U5 who live in a low income household are four times at risk to become undernourished (97)

The vast majority of the population in West Papua work in the agriculture sector (33.6%) and community and social services (24.5%) (37), while in West Papua, the percentage for both sectors is 67.4% and 12.3%, respectively (36). Until 2018, Papua Province and West Papua remained the provinces with the highest percentage of the poor, 27.4% and 22.7%, respectively, three times higher than the national level (37). In 2018, the Gini ratio<sup>17</sup> in Papua Province and West Papua was 0.38 and 0.39, respectively, showing that the income distribution was moderately equal (36,37).

Children with a low socioeconomic status (SES) in some settings often live in a shared house with extended family, which may lead to family food insecurity (76,98). Children living in a household with severe food insecurity were more likely to become stunted (AOR: 2.00, 95% CI: 1.14-3.53) (98). The stunting prevalence significantly increased (AOR: 1.33, 95% CI: 1.03-1.72) among children who lived in a household with at least three children under five years of age (17). Some tribes in Papua practice polygamy, where in one house a husband lives together with more than one wife (29); this will be discussed further in the socio-culture section.

In Indonesia, the prevalence of stunted children in low SES (33.2%) is two times higher than among high SES children (15.7%). Figure 7 shows that children who are raised in low SES are at risk to receive low intake of micronutrients (99). Papua Province and West Papua have the highest percentage of children who live under the national poverty line (58).

<sup>17</sup> Gini ratio ranged from 0 (a perfect equality) to 1 (perfectly unequal) (37)



**Figure 7.** Proportion of children aged 12-23 months at risk of nutrient inadequacy by SES groups (99)

In Papua, due to poor development in transport infrastructure (100), heavy rainfall, and high wave height, inflation has highly increased compared to the western regions of Indonesia, including for food (36). The inflation of food commodities in Papua Province and West Papua increased by 9.7% (yoy) and 5.9% (yoy) at the second quarter of 2018, respectively. The main commodities that had its price elevated as a result of the increased inflation were fish, rice, and chilli in Papua Province (36), while in West Papua it was chicken, fish, and rice (37).

### 2.6.5. Health and Healthcare

Eighty per cent of people in Papua live in hard-to-access areas, where the availability and quality of healthcare facilities are low and require high transportation costs. West Papua has better road access compared to Papua Province, where some areas can only be reached by air transportation (70).

Posyandu is one of the governmental programmes to reduce stunting through community empowerment at the village level (42). Posyandu play an important role in the early detection of growth restriction in children, reporting cases to nearest Puskesmas for follow up (75). The success of growth-monitoring programmes relies on the participation of the mother, health personnel and cadre (community volunteer) performance, and infrastructure (101). In rural areas where Posyandu are functioning well, children U5 who did not regularly utilise Posyandu services and did not own a growth-monitoring chart were twice as likely to be stunted (75). A study in Papua revealed some reasons for irregular visitation to Posyandu, related to poor knowledge about Posyandu, the mother's activities on the farm, distance, young maternal age, and lack of family support (102).

In Riskesdas' 2018 report, ownership of a growth-monitoring book among children 0-59 months in Papua Province and West Papua was still low, 38% and 48%, respectively. This can be due to an absence of visits to Posyandu or limited availability of the growth book. Sixty-two per cent of children 0-59 months in Papua Province had their height/length measured  $\geq 2$  times in the past year, the rate being slightly higher in West Papua (76%), while 21% and 19% of children in both provinces, respectively, never had their height/length measured; the rest had only been measured once (2).

Children who did not complete their mandatory vaccinations or did not receive vaccinations at higher risk of severe malnutrition that can lead to growth impairment. In Indonesia, Posyandu are often the place for children to obtain vaccinations (77). The low visit rate to Posyandu may lead to low completion of mandatory vaccinations: hepatitis B, Bacillus Calmette-Guerin (BCG), polio, Diphtheria-pertussis-tetanus (DPT), and measles. The percentage of mandatory vaccination completion (103) among children aged 12-23

months in Papua Province and West Papua is 30% and 50%, respectively, below the national target (80%) (2).

In some villages of Papua, Posyandu are not completely functioning. Services, such as nutritional counselling and height monitoring, are not available due to the lack of capacity of the cadres or measuring tools. Therefore, routine visits to Posyandu did not contribute to prevent stunting among local children (104). Puskesmas, as a referral place for growth restriction cases and a place to access primary health care, do not always exist, or when they are available, the care quality does not meet the standard (2). In 2017, the ratio between Puskesmas and subdistricts was 0.7 for both provinces in Papua. The reason for the low ratio was the constraints of transportation system, particularly in the highlands and small islands (5).

Recently, the prevalence of diarrhoea in children U5 in Papua Province has been the highest in the country (2). In 2017, the coverage of health facilities in the management of diarrhoea in children U5 in Papua Province was the lowest (4.06%). Better coverage was reported in West Papua (20.66%), although it was below the national coverage (40.7%). The utilisation of zinc for diarrhoea management among children U5 in Papua Province and West Papua was 72.6% and 19.5%, respectively (5). In 2018, the use of oral rehydration salts (ORS) was implemented in 60% of diarrhoea cases among children U5 in Papua Province and 25% of cases in West Papua (2).

Antenatal care (ANC) is an important aspect to keep the nutritional status of pregnant women well-monitored (105). In three places in Indonesia, including Jayapura<sup>18</sup>, the odds of finding stunted children among mothers who had ANC less than four times during pregnancy was 1.71 higher (95% CI: 1.12-2.60). The odds of being severely stunted were double (AOR: 2.58, 95% CI: 1.19-5.58) among children whose mothers had never received ANC in a health facility (8).

The new WHO ANC guidelines suggest pregnant women have ANC contact at least eight times (106) (Appendix 6). In 2018, the percentage of pregnant women in Papua Province who accessed ANC at least once was 66.8%, the lowest among all provinces in Indonesia, and lower compared to itself in 2013 (71.7%). In West Papua, the contact reached 70%. The percentage of pregnant women who attended ANC at least four times in Papua Province and West Papua was much less, 43.8% in 2013 (latest report) and 50% in 2018, respectively (2). In tribes in Papua Province, pregnant women are reluctant to have ANC contact because they prefer to visit traditional healers (32).

One of the Indonesian government's nutrition-specific strategies to reduce stunting is nutrition supplementation (43). This programme is intended to improve the nutritional status of pregnant women with CED and undernourished children U5. In 2017, Papua Province had the second lowest proportion of pregnant women with CED who received a therapeutic biscuit<sup>19</sup> (26%). Food supplements for children consisted of local foods and a nutritious biscuit. In Papua Province, this programme only covered 44% of the total undernourished children. The coverage of food supplementation for mothers and children was much higher in West Papua, at 86% and 82%, respectively (5).

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<sup>18</sup> Capital City of Papua Province.

<sup>19</sup> Contained protein, linoleate acid, carbohydrates, 11 vitamins, and seven minerals (5)

The treatment of malaria in pregnant women can be started on the 13<sup>th</sup> week of pregnancy, as is suggested in the WHO ANC schedule (Appendix 6) (106), and it can be accessed for free at Puskesmas and public hospitals in Papua (10). In 2018, Artemisinin-based Combination Therapy (ACT) was used to treat 80% and 88% of malaria cases among general population in Papua Province and West Papua, respectively (2). However, access to malaria treatment among pregnant mothers depends on the frequency of accessing ANC in a health facility that has sufficient tools for malaria diagnosis and an adequate stock of anti-malarial drugs. Considering Papua is an endemic area of malaria, pregnant women who do not access ANC may miss malaria diagnosis and treatment (5).

In 2016, the number of new HIV infections in Papua Province and West Papua was 3,866 and 530, respectively. The AIDS case rate was 15 and eight times higher than the national rate in Papua Province and West Papua, respectively (107). Antiretroviral (ARV) treatment for HIV is available at 13 hospitals and 14 Puskesmas; however, only 21% of the total people living with HIV (PLHIV) in Papua are on ARV. In Papua, there is only one hospital that has polymerase chain reaction service, located in Jayapura, and there is no viral load test available (70).

### **2.6.6. Education**

The less education a mother has, the higher the risk of stunting in her children (8). The relation of a mother's education and stunting in children has been discussed under the home environment section; therefore, this section will describe in further detail the education infrastructure and access to education in Papua.

In 2018, Papua Province had 2474 primary schools, 645 junior high schools, and 356 senior high schools. The number of school infrastructure for all three levels of education increased by 11%, 13%, and 4% compared to the previous year, respectively. The ratio between teachers and students at the primary school level was 1:28, while the junior and senior high school ratios were 1:17 and 1:13, respectively, (28). In West Papua, the ratio between teachers and students in primary school, junior high school, senior high school, and vocational high school in school year 2016/2017 was 1:19, 1:15, 1:13, and 1:13, respectively (20). This means that teachers at primary schools in Papua Province have to teach more students than the national standard according to Indonesian government decree No.74 2008 (108). There were 45 universities in Papua Province and 21 in West Papua in 2017 (20).

In 2017, the percentage of people attending school among age groups 7-12 years, 13-15 years, 16-18 years, and 19-24 years in West Papua was 97%, 97%, 77%, and 32%, respectively, while Papua Province was generally lower, at 82%, 80%, 64%, and 25%, respectively (5). The percentage of those attending school were reflected in the labour force participation, where half of the population above 15 years old in West Papua obtained a job with a primary and junior high school diploma, and only 18% applied to a job with a university diploma (37).

### **2.6.7. Society and Culture**

In 2008, a study<sup>20</sup> about cultural practises of the Nayak, Nduga, Yali, and Lani tribes in highland areas of Papua Province (29) reported that some men and women from these tribes live separately in different traditional houses (honai). In one honai live around ten adult men that are responsible for hunting wild animals, such as wild pigs and cassowary, while women are responsible for raising the children and growing tubers, vegetables, fruits, and legumes.

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<sup>20</sup> A grey study (29). All four tribes from this study are among the 160 priority districts of the National Movement to Accelerate Stunting Prevention programme (44)

One tribe that live around the coast limits themselves to consume fish compared to people who live in the city, because consuming much fish is believed to be a violation of the culture and causes worm infection (109). Among Yepase ethnic, there is a spread believe that consuming a big fish during pregnancy can cause antepartum bleeding, while eating fruits can increase vaginal discharge (32).

In some other tribes, a man lives in a honai with several wives, depending on how many pigs he has to propose to women (29). Previously, it has been discussed that more people in a household increases the vulnerability of family food security, as it is related to the economic power to purchase foods (76,98) and the prioritisation of food sharing (74)<sup>21</sup>.

A Papuan living within a culture where a husband is prioritised in term of the amount and choice of foods, followed by male children, from the oldest to youngest, and then wives and female children. In some cultures, children are allowed to have meals with male household members; in other cultures, they are grouped at a different table or start eating after the adult males finish their meals. In cases of famine or economic difficulties, children and women are affected the most, as they receive the least in food sharing (74). The impact of these cultural practice is that protein intake among women is lower than in men (66).

In Papua Province, 14% of women are married or live in a union with their partner before they reach their 18<sup>th</sup> year, while in West Papua, the percentage is 15% (40,41). In 2018, the constitutional court has cancelled the minimum marriage age regulation from the Law of the Republic of Indonesia Number 1 of 1974 concerning Marriage which previously allowed boys and girls to be legally married at 19 and 16 years old, respectively (110). However, until now, there is no legal action to revise the Law. Additionally, there is a Decree of Ministry of Religious Affairs No. 19 of 2018 Concerning Marriage Registration for Muslims that regulates the same minimum marriage age as the Marriage Law (111).

Marrying at a younger age can lead to adolescent pregnancy<sup>22</sup>, which may increase the risk of growth restriction in mother, because the mother herself is still growing but has to share nutrition with her foetus (14). According to the theory of the intergenerational effect of stunting, short mothers have a higher likelihood to bear stunted children (11,61,65).

#### **2.6.8. Agriculture and Food System**

Besides the behaviour of the caregiver that has been discussed previously, the diversity and quality of complementary foods are also related to access and availability to foods. Biodiversity in agriculture and promotion of indigenous foods may have a positive impact on the diversity of dietary feeding and child nutrition (16).

Generally, native Papuans consume local foods, such as sago, taro, and sweet potato, as source of carbohydrates. The most frequent vegetables consumed by local people are cassava leaves, papaya leaves and flowers, and water spinach. For fruits, the majority consume banana and papaya (74). Sources of protein for Papuans who live in the highlands mainly come from wild animals; for those along the coast, fish is the main component of their diet (92). However, food restrictions and food sharing norms apply among indigenous people (32,74,109), as previously discussed in the society and culture section.

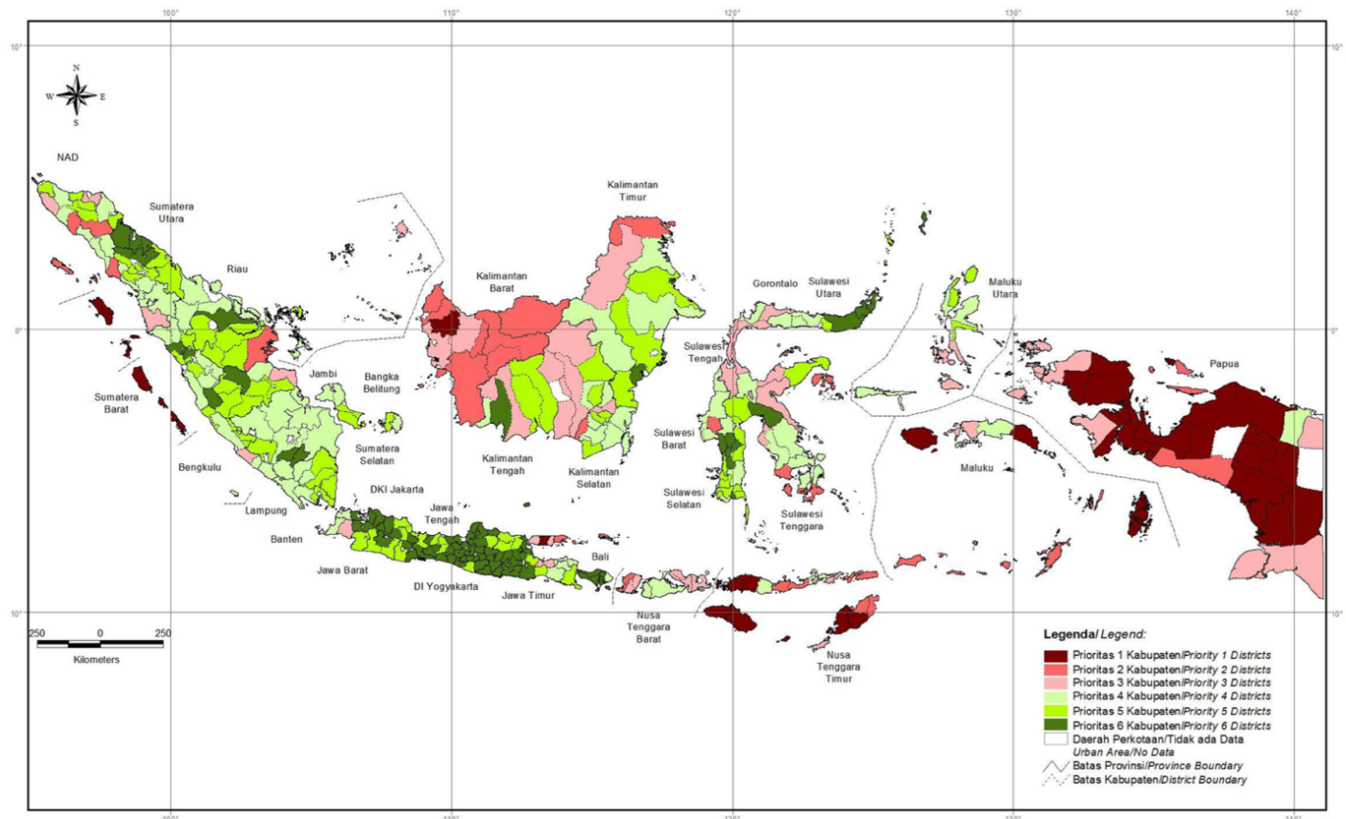
The majority of fishermen in both provinces use traditional fishing methods; therefore, fish production is influenced by the weather and the height of sea waves, particularly between May and June, when the waves usually reach their highest level, the fish production is lower (36,37).

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<sup>21</sup> A grey literature

<sup>22</sup> In glossary

Figure 8 shows that people living in Papua are more vulnerable to food insecurity compared to the rest of the regions of Indonesia. According to a Ministry of Agriculture report, agriculture at a national level is growing and the availability of food is adequate; however, Papua experiences a deficit in cereal (39). The areas of the map that are marked with dark red are the districts with high food insecurity (39), which are also where the high prevalence of stunting in children U5 is present in Papua (67,68).



**Figure 8.** Vulnerability to food insecurity map of Indonesia, 2009 (39)

In Papua Province, the chief of the clan arranges land distribution for rice cultivation among the indigenous farmers; this often becomes a sensitive issue and provokes conflicts. Irrigation of the rice fields mainly relies on rainwater and surface water<sup>23</sup>. Only a few farmers use ground water, because it is often not available during the dry season (112).

In 2017, total rice production in Papua Province was 257,900 tonnes. The highest production was in Merauke (224,400 tonnes), accounting for around 87% of the total production in Papua (113). Among the 29 districts/city in Papua Province, 14 did not produce rice (113); these were the areas where the stunting prevalence of children U5 were very high (31.4% - 68.9%) (Appendix 7) (68), and are the priority districts of the National Movement to Accelerate Stunting Prevention (44). The surplus of rice production in Merauke was distributed to other areas in Papua (112). However, among the 14 areas with an absence of rice production, 11 are located in the highlands, one in hard-to-access lowlands, and two are small islands (22,114,115); therefore, geographical constraints interfered with rice and other food distributions to these areas.

<sup>23</sup> In glossary

During the period of January-December 2018, a total of 13,900 tonnes of rice were harvested from a total of 3,120 hectares (Ha) of fields in West Papua. The highest peaks of the harvest were in May and October, with 3,400 Ha and 4,000 Ha, respectively. Although Manokwari contributes around 90% of the total rice production, stunting in this district is high (45.9%). Around 60% (seven out of 13) of the districts/city in West Papua did not engage with rice production; the prevalence of stunted children U5 in those seven districts/city ranged from 38% to 61% (Appendix 7) (116). The highest prevalence was Sorong Selatan (60.7%), a hard-to-access district (24).

Besides its function to support food production, agriculture is a main employment sector in Papua, and can increase a household's economic and food purchasing power (79). However, the latest data from local governments in Papua Province documented that of the total potential areas for agriculture (14,269,376 Ha) in 2012, only 2.92% have been utilised to grow rice, fruits, and vegetables (117). In West Papua, less than 0.5% of the total 7,105,145 Ha potential areas are used for paddy cultivation (116).

### **2.6.9. Water, Sanitation, and Environment**

In 2018, the percentage of households in Papua Province and West Papua that drank from clean water sources was 45% and 67%, respectively (26,27). The majority of the urban population in Papua Province drank bottled water (68%) and from public taps (17%), with a few using water from borewells (4%), protected wells (4%), and rainwater (3%). In the rural areas of Papua Province, mostly located in the highlands, the top three major sources of drinking water were springs<sup>24</sup> (38%), rainwater (25%), and bottled water (17%) (26).

In West Papua, most people used bottled water (45.8%) as their source of drinking water, followed by rainwater (13.2%) and protected wells (10%). Some water from natural sources was reported to have negative odour, taste, and colour, and was cloudy or foamy (27).

The implication of the shortage of water sources is that 72.5% of people in urban areas in Papua Province (26) and 49.3% in West Papua have to purchase their drinking water (27). A cross-sectional study in Indonesia, including Papua, shows that there were more stunted children living in a family that drank untreated water due to it being less expensive than treated water (8).

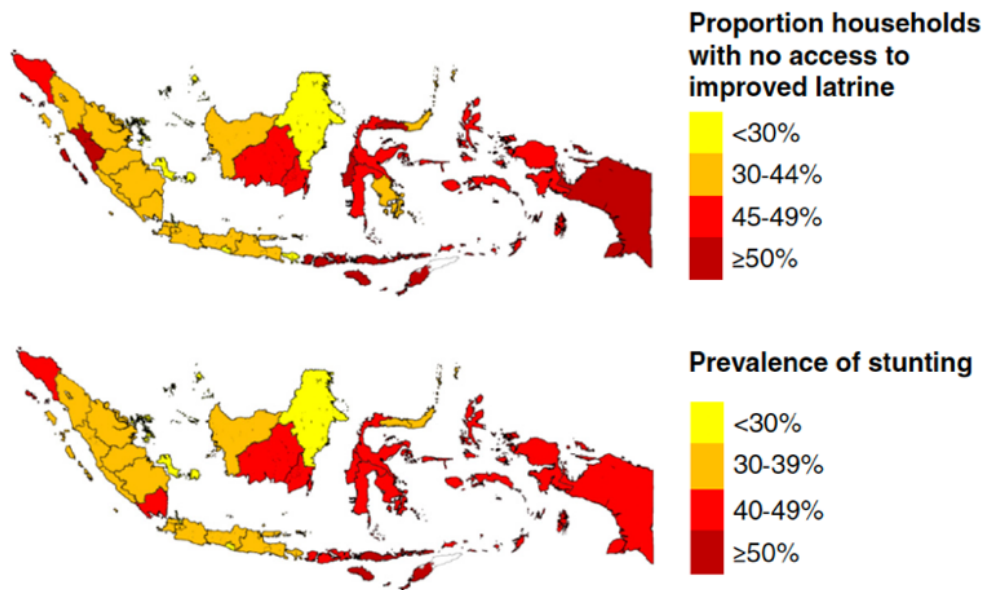
For hygiene and sanitation purposes, in Papua, water is mainly collected from wells (protected and unprotected), bores, and surface water (26, 27).

Figure 9 shows that the prevalence of stunting is higher in areas where access to improved latrines are low. More than 50% of households in Papua do not have access to improved latrines; this is linear with the higher prevalence of stunted children (8).

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<sup>24</sup> Protected and unprotected springs





**Figure 9.** Provincial estimates of the proportion of households without access to an improved latrine and the prevalence of stunting in children aged 0-59 months in Indonesia (8)

In 2017, the government adopted a sanitation programme called Community-Led Total Sanitation (CLTS) in an effort to improve willingness to practice sanitation, access to sanitation, and environmental health. Open Defecation Free (ODF) is one of the programme goals (5). In 2017, at the national level, the percentage of villages that have applied CLTS was only 48%. In Papua Province and West Papua, the percentage of villages engaged in the CLTS programme was much lower, at 5% and 18%, respectively. People there also still defecated in open areas: 33% in Papua Province and 7% in West Papua (40,41). The evaluation report for the National Movement to Accelerate Stunting Prevention in 2018 noted that the project for building improved latrines has not yet covered Papua (44). Additionally, there are 18.8% of households in Papua Province and 26.6% in West Papua that still have their latrine located less than 10 meters from their water source (26, 27).

## **Chapter 4: Discussion**

The focus of this thesis is to identify the factors of stunting in children under two years old in Papua and explore the relations between different causes and the local context.

The findings suggest that household and family factors, inadequate complementary feeding, breastfeeding, and infection are interrelated and have interactions with the local context in Papua, determining the nutritional status of pregnant women and infants, which can cause childhood stunting.

### **4.1. Causes of Childhood Stunting in Papua and Its Interrelation and Association with Local Context**

An undernourished condition in young mothers seems to be one factor of childhood stunting in Papua. The nutritional status of the foetus depends solely on the mother. In the case of Papua, women experience a deficit intake of protein and energy. The inadequacy of energy and protein intake is reflected in CED affecting one in every four pregnant women in Papua. One reason for undernutrition among pregnant women in Papua is related to the cultural tradition where women have the lowest priority in food sharing, as well as food restriction norms. Another reason is that almost half of women experience adolescent pregnancy, an impact of the child marriage tradition and the low law protection. These young mothers tend to be more likely short for their age, as they have to share their already deficit nutrition with their baby when they themselves need it for their own growth (64). In Papua, at least one of every three teenagers have a short stature, increases the risk of giving birth to a LBW baby, which is one factor of growth and development impairment in children. In Papua, the prevalence of a baby born less than 2500 grams is around 6%. However, only 45-60% of mothers in Papua give birth at health facilities, where there are tools to measure a new-born's weight; the LBW baby born at home or at a traditional healer may be missing from the weight measurement statistics. Additionally, the baby who was born outside a health facility may also miss immunisation.

Mothers who are undernourished are also at risk of anaemia, which can impact the nutritional status of the infant in utero. In Papua, a government effort to reduce anaemia among pregnant women, and thus LBW cases, through Fe supplementation is not yet a successful intervention. The iron tablet distribution in Indonesia was limited through Puskesmas and other health facilities. In case of Papua, one-third of subdistricts do not have Puskesmas. The number of ANC contacts at health facilities, particularly in Papua Province, was the lowest in the country. The reluctance of taking Fe tablet can be due to low economic status and education, lack of women autonomy, poor knowledge of obstetric complication (63).

There are several proposed reasons for the low ANC contact. Firstly, in Papua, a man is generally the decision maker in terms of seeking healthcare; therefore, a lack of support from the husband can be a barrier to access of care, including ANC. Secondly, traditionally, the population is encouraged to visit an experienced traditional healer rather than modern care. Lastly, the distribution of the health facilities themselves in hard-to-access areas is uneven, resulting in long distances to reach the nearest facility and high indirect cost. These geographical constraints and cultural practices make the women become more vulnerable to chronic undernutrition and a delay of treatment in the cases of illness that tend to be the cause of growth impairment among mothers in Papua. Short stature mothers, in turn, are more likely to have a LBW baby that is associated with childhood stunting.

Stunting among children under two years old in Papua may also be related to the low percentage of EBF and the low number of mothers who continue breastfeeding their children until two years of age. This practice can interfere with the nutrition intake of the infant, especially when the complimentary feeding practice is not adequate in terms of

quality and quantity, as is often the case in Papua. More than half of children under two years old in Papua received less than the MMF recommendation, as well as less diverse foods. Rice and vegetables are the common food for toddlers in Papua, with animal source protein intake being very low. In the cultural context of Papua, children are prioritised less than adult men in food sharing due to a perceived belief that a man needs more energy to work or hunt animals for the family. Additionally, in Papua, where around one of four households still live in poverty, children may be more vulnerable to less nutrient intake in cases of food insecurity. All of these factors make children more prone to be stunting.

Since the proportion of mothers engaged in EBF is low in Papua, the introduction of complementary feeding to infants is often earlier than that recommended by WHO; this increases the risk of infection and diarrhoea in children (79). There is no study found regarding the reasons of low practice of EBF and discontinuation of breastfeeding before two years in Papua. However, the attendance of mothers and children to Posyandu in Papua, as a place to obtain child health information and growth monitoring, is low; which may result in mothers do not get enough information about the importance of breastfeeding and complementary food. Further research needs to be done regarding the factors of poor breastfeeding practice in Papua in order to develop effective interventions.

The nutritional status of pregnant women and children can also be affected by malaria, an endemic disease in Papua. In 2018, the healthcare system in Papua had provided at least 80% ACT to malaria patients. However, compliance to the therapy course was not monitored and evaluated; therefore, the success of the treatment is unknown. The detection of malaria cases itself is also a challenge in Papua, especially in the highlands and hard-to-access lowlands with their limited number of health facilities.

Posyandu, as an early government effort to reduce stunting in some villages of Papua, is not yet fully functioning or well-utilised. The absence of or irregular visits to Posyandu is a factor in low completion of vaccination courses among children under two years old, low coverage of vitamin A, missing the detection of stunting, and a delaying in growth intervention by Puskesmas, the referral institution from Posyandu in Papua. The low vaccination completion rate puts the children in Papua at higher risk of getting infections, become anaemic and malnourished, which are linked to childhood stunting (77).

Another important finding is that childhood stunting in Papua appears to be very likely associated with poor hygiene and sanitation, combined with limited sources of clean water, related to EED and STH, followed by diarrhoea. Diarrhoea caused by EED or STH can lead to the loss of nutrition in children. Diarrhoea is more common among children U5 in Papua than in the other regions of Indonesia. Prolonged or repeated diarrhoea increases the risk of stunting in children under two years (87) .

Poor sanitation is an urgent issue among the general population in Papua, where more than half of the population disposes of their child's faeces outside a latrine. The access to improved latrines in Papua is among the lowest in Indonesia. Moreover, the majority of the population has yet to practice appropriate handwashing, especially in Papua Province. In a community with poor sanitation and handwashing practices, as is the case in Papua, contact with high levels of bacteria may lead to EED.

Moreover, the CLTS programme that was adopted to trigger good hygiene and sanitation behaviour has not been successful yet in Papua, and there is no follow-up programme to ensure continuation of CLTS in villages that adopted the practice. The improved water sources in Papua are not necessarily free from contamination; in several households, the latrine is located less than 10 meters from the water source. Moreover, the environment has not been free from open defecation, especially in Papua Province, which can be a source of contamination. Repeated ingestion of pathogens in children has been known to cause infectious diarrhoea and EED, which make the children more vulnerable to stunting (86,93).

Additionally, due to geographical and topography constraints, most of the population in both provinces of Papua purchase bottled water as their main source of drinking water. Purchasing water in Papua, where the general price is much higher compared to the other areas of Indonesia, can be an economic burden for households that are already poor and may predispose them to consume unsafe water. The collection of rainwater in a tank is the second most common source of drinking water in rural areas of Papua Province and in West Papua; however, a tank without proper isolation tends to become a breeding ground for mosquitos, making malaria the next concern, as it can be a risk of anaemia and stunting in children.

A poor coverage of diarrhoea management in children under five years by health facilities, especially in Papua Province, put children in an undernourished condition for longer, which can eventually result in stunting. The low coverage of diarrhoea management can be seen through the demand and supply side. In the demand side, even though three-fourths of the population have a formal education, it does not necessarily increase their acceptance of modern healthcare; the trust of local traditional healers across generations, and the distance to the health facilities, can override the intention to seek modern care. On the supply side, the Puskesmas are still struggling with a shortage of health workers, who are reluctant to move to remote areas, which affects the quality of service and the distribution of Puskesmas themselves.

Stunting in Papua is also related to the food production, where there is a deficit of cereal due to its unequal production and distribution across districts. The majority of farmers use traditional methods, which limit their production capacity. Fishermen also mostly focus on catching fish instead of fish farming; as a result, in the season of high waves, people catch less fish. In the highlands, people are not yet familiar with animal husbandry; instead, they rely on hunting wild animals. These factors may restrict the protein and energy intake in mothers and children that, in the long term, may lead to stunting.

Another factor associated with childhood stunting in Papua is indoor air pollution. This element is not part of the WHO framework, but is probably an important stunting factor in Papua as kitchen usually is located indoor due to heavy seasonal rainfall. In Papua Province, where the majority of households use wood to cook, children are exposed to more indoor air pollution, which was found as a factor of stunting in one study in India. In West Papua, most households rely on kerosene for cooking; even though kerosene is considered less pollutive than solid biofuels, it still significantly increased the risk of childhood stunting (78).

The findings of this study suggest that childhood stunting in Papua is related to multiple stages of life, beginning with the nutritional status of the mother before conception and continuing through the first two years of a child's life. Determinants of childhood stunting at the household level, such as poor nutrition intake, sanitation, hygiene, water sources, and infection, cannot be considered more important than broader factors, such as low ANC and Posyandu visits, management of diarrhoea, poverty, education, socio-culture, and agricultural and food system. All of these factors are clearly associated to each other; therefore, intervention should be designed as a multisectoral approach.

Lastly, it is important to underline that stunting is a problem for the whole community, and the consequences, such as lower economic productivity, do not only affect the children who are confirmed stunted, but also other children living in the shared environment, because stunting and adequate growth cannot be seen as black and white. De Onis and Branca emphasise that growth faltering itself, in reality, is a gradation; therefore, crossing the cut-off point does not make a great difference on suffering from the consequences of stunting (11).

## **4.2. Reflections on the Framework**

The theoretical framework from the WHO has been proven to be an organised framework that has broad scopes of local context. Therefore, it has been useful for identifying almost all the determinants of childhood stunting, and for deepening the exploration to find the root causes of the problems and to interlink the causes. For example, under the food and water safety category, there is food contamination, which can be linked to sanitation and water supply under the home environment category, and also water and sanitation infrastructure under the local context. However, though the findings of this study suggest that indoor air pollution may affect children's health and probably contributes to childhood stunting, it is not yet part of the framework.

## **4.3. Limitations of the Study**

The findings in this thesis used some study results from other provinces in Indonesia, Papua New Guinea, Bangladesh, India, and several countries in Africa, with consideration of similarity in socio-economic and socio-cultural contexts. The results were then compared to the context in Papua according to government reports. Therefore, this thesis has not attempted to measure the strength of association and causality between childhood stunting in Papua and its causes and local context, except when using information obtained from a childhood stunting study done in Papua. Additionally, there are some elements of causes of stunting that are not discussed in the thesis due to limitation of data sources; however, in every subcategory in findings chapter, I have identified the missing elements.

## **Chapter 5: Conclusion and Recommendations**

The prevalence of stunting in children under two years old in Papua is still very high, and it will be alarming if the rise of stunting over the past two years is neglected.

The determinant of stunting among children under two years old in Papua on a household level is related to nutrient deficiencies among pregnant women, which provides a less supportive environment for the foetus to grow optimally. After birth, children live with poor hygiene, sanitation, and water sources, low completion of mandatory vaccination, as well as prolonged exposure to indoor air pollution, all of which increase the risk of diarrhoeal infection and ARI. Moreover, Papua is an endemic area for malaria, which is known to be a cause of anaemia. All of these factors may halt children's growth and development, thus leading to stunting.

Addressing the causes of stunting on a household level alone may not be effective as those factors are largely associated with cultural practices, which make women and children more vulnerable to chronic undernutrition, weak health system responses to health- and nutrition-related problems, a deficit of food supply on a provincial level, large proportion of people living in poverty, and lack of sanitation and water infrastructure.

The current coverage of stunting reduction programmes, such as Fe, vitamin A and food supplementation for undernourished pregnant women and children under five years, is low in Papua Province. Many villages in Papua Province have not yet broadly adopted CLTS programmes, and some Posyandu do not function properly and are utilised to monitor the health and nutritional status of mothers and children. Papua is also not included yet in the project for building improved latrines.

Unless there is an intensification of the current National Movement to Accelerate Stunting Prevention and broaden the multi-sectoral approach, to address the causes of stunting in Papua and the local context, childhood stunting will remain a serious public health problem, particularly in terms of the intergenerational effect.

### **Recommendations:**

#### **Policies**

1. The MOH should improve the quality of services in Posyandu as they are generally the first and main contact to healthcare for mothers and children. This goal should be achieved by establishing accreditation programme of Posyandu and consider including a count of children whose height is measured to the current Posyandu performance indicators to improve the monitoring of children's growth to accelerate revitalisation.
2. The District Health Department (DHD) should expand its current budget for maternal and children's health to improve service quality and distribution of Puskesmas and Posyandu through motivation program for health workers, and to intensify supervision and training for Posyandu cadres, particularly in hard-to-access area. The training should be focus on growth monitoring, referral of undernourished cases to Puskesmas, promotion of local food for complementary feedings, management of diarrhoea, hygiene and sanitation, and nutrition intake during pregnancy.
3. The Republic of Indonesia Government, including The Ministry of Religious Affairs should revise the Law of the Republic of Indonesia Number 1 of 1974 concerning Marriage and the Decree of Ministry of Religious Affairs No. 19 of 2018 Concerning Marriage Registration for Muslims, on minimum marriage age, from 19 for males and 16 for females, to 20 years for both sexes. The dissemination of the change should be through the education system and engagement with community and religious leaders.

## **Interventions**

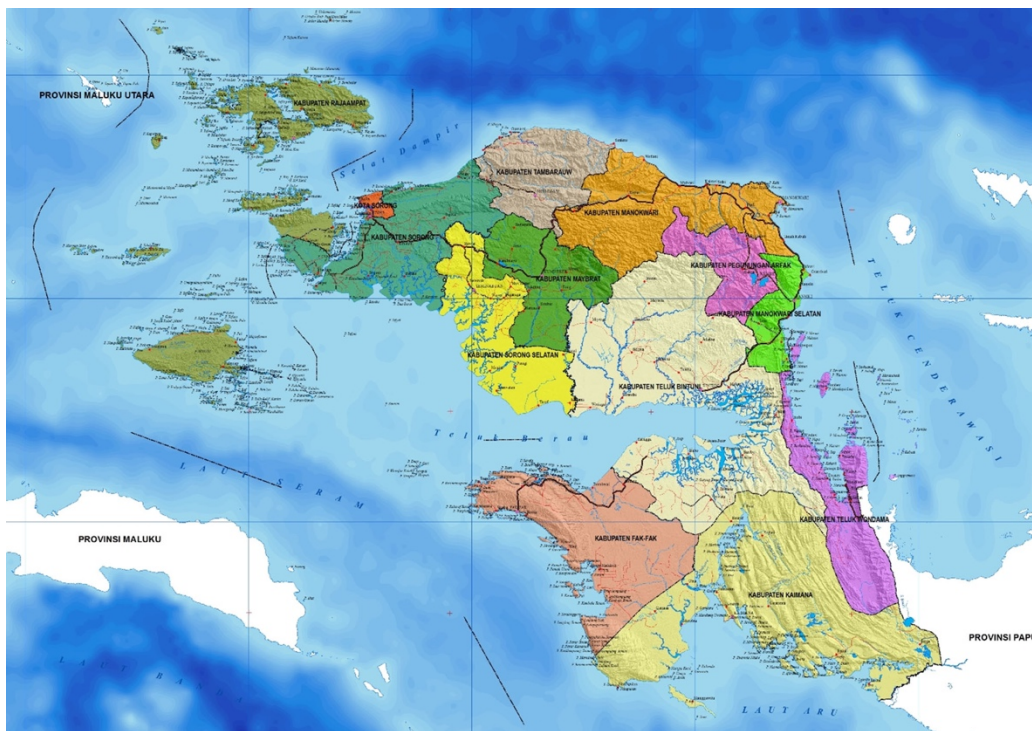
1. The DHD should engage with local NGOs and community volunteers to improve responsiveness of the community to growth impairment cases; referral system to Puskesmas; and increase the production and distribution of growth-monitoring books and growth-measuring tools.
2. The DHD should open dialogues with religious leaders, clan or tribe leaders, chiefs of village, elderlies, women, and men to improve the acceptability of ANC and Posyandu services, and engage with traditional healers to get their support for the programmes. Emphasis on increasing the proportion of health expenditure in the total village budget can also be done through coordination. This kind of engagement should also be established to expand the coverage of CLTS programmes, from triggering the process to monitoring and evaluating to ensure the sustainability of CLTS. Integration of hygiene and sanitation promotion program into education programme is also important to prepare the younger to be agents of change in their family; this will eventually transform society towards a better hygiene and sanitation lifestyle.
3. The Department of Land and Spatial Planning, the Department of Food Crop and Horticulture, and the Department of Maritime Affairs and Fisheries at district level should establish coordination with clan/tribe leaders to open new areas for agriculture, fish farming, and animal husbandry, as they are the main actors in land ownership distribution and agents of movement in the community; and utilise current data to locate the potential agricultural areas. The coordination should be followed by training in food crops cultivation, horticulture, fish farming, and animal husbandry, particularly in the highlands area; and dissemination of free agricultural seeds, young trees, juvenile fish, and livestock to empower the society to start practicing the information they receive from the training. Intensive supervision needs to be provided for the first three months, followed by regular monitoring and evaluation of the implementation, to ensure the sustainability of the program.

## **Research**

1. DHD should conduct a longitudinal study with the malaria laboratory diagnosis test to determine the relation between malaria in both mothers and children and stunting in children under two years old, in order to gain insights into current malaria prevalence and the impact of the disease on the health and nutritional status of infants while in utero and after birth. This research may be conducted through collaboration with Puskesmas, local NGOs, community volunteers, and private companies in Papua that currently have commitments with the government for the malaria eradication programme.
2. The DHD should conduct a research to explore the root cause of the problem of the poor breastfeeding practice in Papua. The study should involve mothers, men, health workers, Posyandu cadres, and community volunteers, elderlies, religious leaders and community leaders. The result of the study should be used accordingly in developing programs to improve breastfeeding practice.
3. The DHD should consider assessing the relation between indoor air pollution and childhood stunting in Papua to enrich the understanding about childhood stunting determinants and use it to evaluate the current stunting reduction strategies. This study may be conducted in collaboration with the basic health survey.

## Appendix

### Appendix 1: Detail district and city of Papua



A. District and city of West Papua (35)



B. District and city of Papua Province (114)



**Appendix 2:** Nutrition-specific and nutrition-sensitive strategies of National Movement to Accelerate Stunting Prevention 2018-2024

<b>Intervensi Gizi Spesifik</b>			
Kelompok Sasaran	Intervensi Prioritas	Intervensi Penting	Intervensi Sesuai Kondisi
<b>Intervensi gizi spesifik - Sasaran prioritas</b>			
<b>Ibu hamil</b>	<ul style="list-style-type: none"> <li>Pemberian makanan tambahan bagi ibu hamil dari kelompok miskin</li> <li>Suplementasi tablet tambah darah</li> </ul>	<ul style="list-style-type: none"> <li>Suplementasi kalsium</li> <li>Pemeriksaan kehamilan</li> </ul>	<ul style="list-style-type: none"> <li>Perlindungan dari malaria</li> <li>Pencegahan HIV</li> </ul>
<b>Ibu menyusui dan anak 0-23 bulan</b>	<ul style="list-style-type: none"> <li>Promosi dan konseling menyusui</li> <li>Promosi dan konseling pemberian makan bayi dan anak (PMBA)</li> <li>Tata laksana gizi buruk akut</li> <li>Pemberian makanan tambahan pemulihan bagi anak gizi kurang akut</li> <li>Pemantauan pertumbuhan</li> </ul>	<ul style="list-style-type: none"> <li>Suplementasi kapsul vitamin A</li> <li>Suplementasi taburia</li> <li>Imunisasi</li> <li>Suplementasi zinc untuk pengobatan diare</li> <li>Manajemen terpadu balita sakit (MTBS)</li> </ul>	<ul style="list-style-type: none"> <li>Pencegahan kecacingan</li> </ul>
<b>Intervensi gizi spesifik - Sasaran Penting</b>			
<b>Remaja dan wanita usia subur</b>	<ul style="list-style-type: none"> <li>Suplementasi tablet tambah darah</li> </ul>		
<b>Anak 24-59 bulan</b>	<ul style="list-style-type: none"> <li>Tata laksana gizi buruk akut</li> <li>Pemberian makanan tambahan pemulihan bagi anak gizi kurang akut</li> <li>Pemantauan pertumbuhan</li> </ul>	<ul style="list-style-type: none"> <li>Suplementasi kapsul vitamin A</li> <li>Suplementasi taburia</li> <li>Suplementasi zinc untuk pengobatan diare</li> <li>Manajemen terpadu balita sakit (MTBS)</li> </ul>	<ul style="list-style-type: none"> <li>Pencegahan kecacingan</li> </ul>

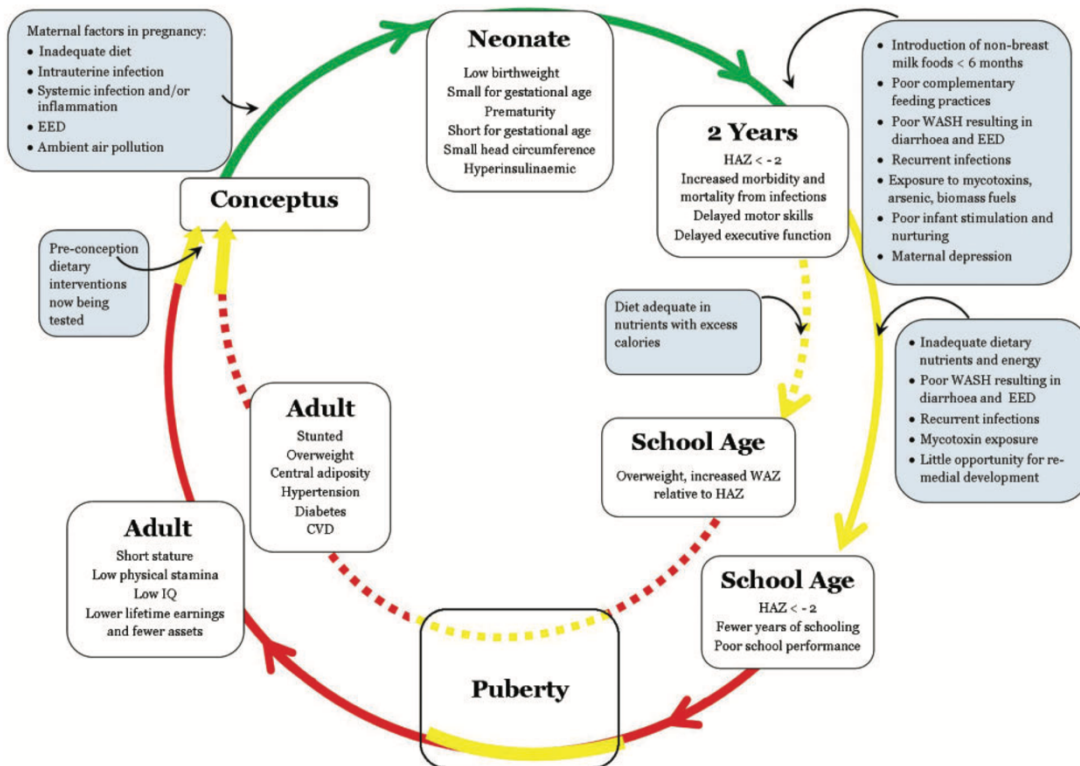
*A. Nutrition-specific strategies of National Movement to Accelerate Stunting Prevention 2018-2024 (43)*

<b>Intervensi Gizi Sensitif</b>	
Jenis Intervensi	Program/Kegiatan Intervensi
<b>Peningkatan penyediaan air minum dan sanitasi</b>	<ul style="list-style-type: none"> <li>Akses air minum yang aman</li> <li>Akses sanitasi yang layak</li> </ul>
<b>Peningkatan akses dan kualitas pelayanan gizi dan kesehatan</b>	<ul style="list-style-type: none"> <li>Akses pelayanan Keluarga Berencana (KB)</li> <li>Akses Jaminan Kesehatan (JKN)</li> <li>Akses bantuan uang tunai untuk keluarga kurang mampu (PKH)</li> </ul>
<b>Peningkatan kesadaran, komitmen, dan praktik pengasuhan dan gizi ibu dan anak</b>	<ul style="list-style-type: none"> <li>Penyebarluasan informasi melalui berbagai media</li> <li>Penyediaan konseling perubahan perilaku antar pribadi</li> <li>Penyediaan konseling pengasuhan untuk orang tua</li> <li>Akses Pendidikan Anak Usia Dini (PAUD) dan pemantauan tumbuh-kembang anak</li> <li>Penyediaan konseling kesehatan dan reproduksi untuk remaja</li> <li>Pemberdayaan perempuan dan perlindungan anak</li> </ul>
<b>Peningkatan akses pangan bergizi</b>	<ul style="list-style-type: none"> <li>Akses bantuan pangan non tunai (BPNT) untuk keluarga kurang mampu</li> <li>Akses fortifikasi bahan pangan utama (garam, tepung terigu, minyak goreng)</li> <li>Akses kegiatan Kawasan Rumah Pangan Lestari (KRPL)</li> <li>Penguatan regulasi mengenai label dan iklan pangan</li> </ul>

*B. Nutrition-sensitive strategies of National Movement to Accelerate Stunting Prevention 2018-2024 (43)*



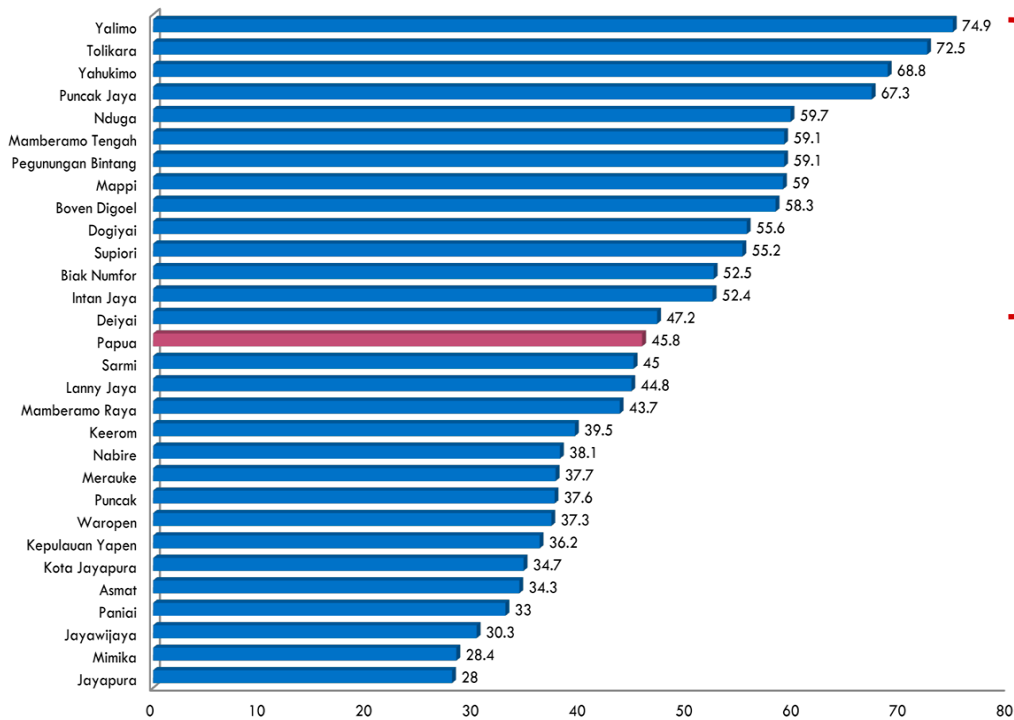
## Appendix 4: The stunting syndrome (14)



## Appendix 5: Prevalence of stunting in aged group 13-18 years in Papua



### PREVALENSI STUNTING PADA KELOMPOK UMUR 13-18 TAHUN MENURUT KABUPATEN/KOTA DI PROVINSI PAPUA – 2013/2014



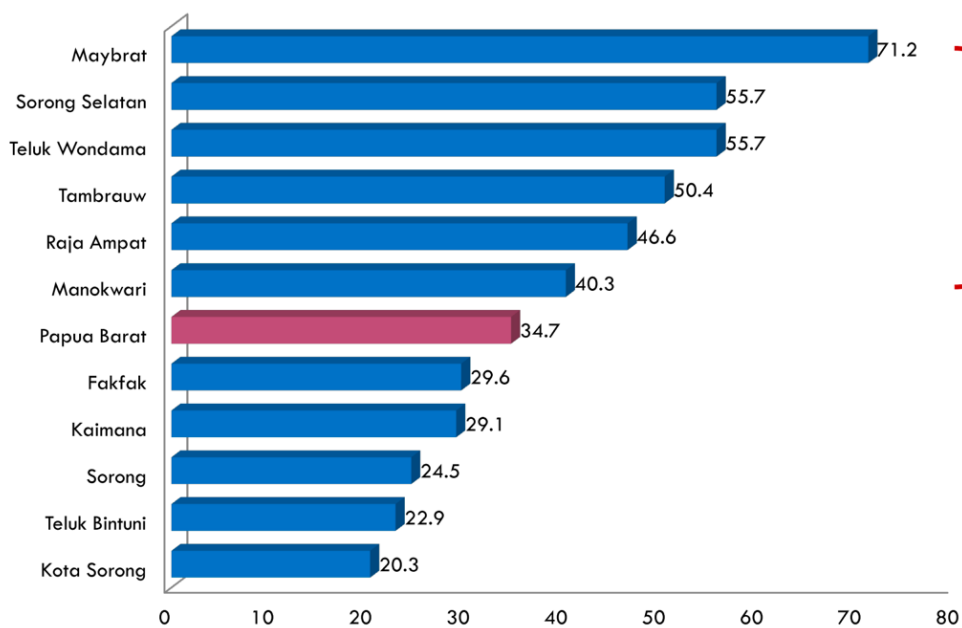
14 Kabupaten/Kota dengan prevalensi stunting **sangat tinggi** dan **lebih besar** dari prevalensi di Papua.

**Tolikara**

A. Prevalence of stunting in aged group 13-18 years in Papua Province (68)  
B.



### PREVALENSI STUNTING PADA KELOMPOK UMUR 13-18 TAHUN MENURUT KABUPATEN/KOTA DI PROVINSI PAPUA BARAT – 2013/2014



6 Kabupaten/Kota dengan prevalensi stunting **sangat tinggi** dan **lebih besar** dari prevalensi di Pabar.

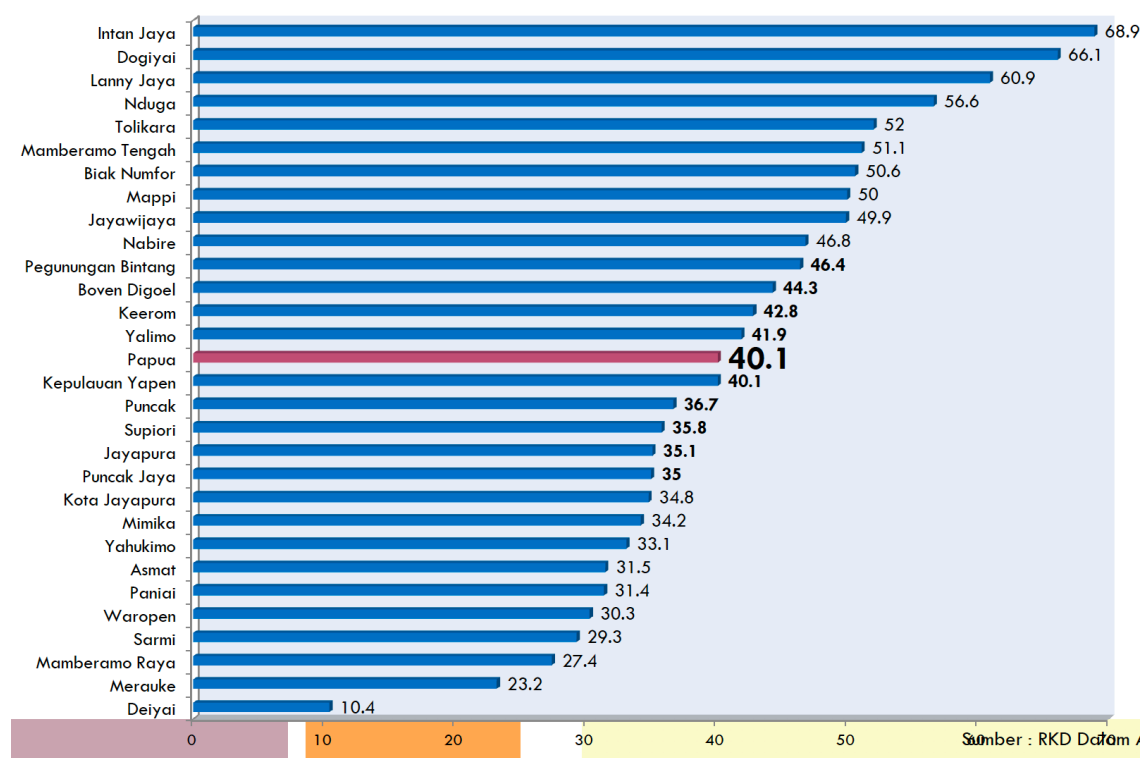
**Kab. Maybrat**

C. Prevalence of stunting in aged group 13-18 years in West Papua (67)

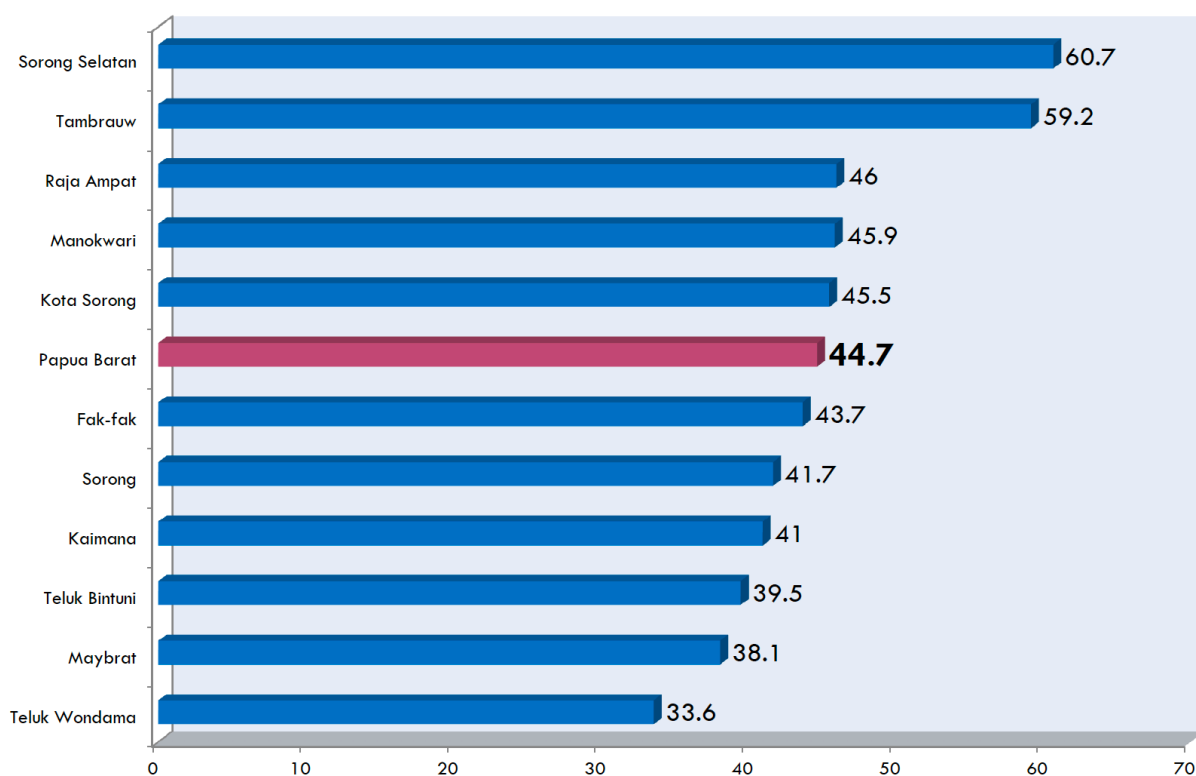
**Appendix 6:** 2016 WHO ANC model (106)

<b>Table 1. 2016 WHO ANC model</b>
First trimester
Contact 1: up to 12 weeks
Second trimester
Contact 2: 20 weeks Contact 3: 26 weeks
Third trimester
Contact 4: 30 weeks Contact 5: 34 weeks Contact 6: 36 weeks Contact 7: 38 weeks Contact 8: 40 weeks
Return for delivery at 41 weeks if not given birth. <i>Note:</i> Intermittent preventive treatment of malaria in pregnancy should be started at $\geq 13$ weeks.

## Appendix 7: Prevalence of stunting in children under five years in Papua



A. Prevalence of stunting in children under five years in Papua Province, 2013/2014 (68)



B. Prevalence of stunting in children under five years in West Papua, 2013/2014 (67)

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