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# Result Representation of Congenital Hypothyroid Screening (CHS) Based on Area Topography in Bandar Lampung City in May-October 2019

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## ABSTRACT

Congenital Hypothyroid Screening (CHS) is a screening test performed on neonates to detect Congenital Hypothyroidism (CH). Screening is important to prevent delays in the diagnosis and management of CH. Until now, Indonesia does not have data on the result representation of national and regional CH based on regional topography. This descriptive research used a cross-sectional design. The research was conducted at the Public Health Office of Bandar Lampung. This research used the secondary data of the incidence of CHS, CHS service provider health facilities, and babies born alive in May-October 2019. The results' representation is then grouped by subdistrict and topography of the region (tidal, choppy to wavy, and hilly to mountainous). The number of CH incidents was highest in Panjang District (235 data) and there was no CHS data in Enggal Subdistrict. The result representation was the highest in Tanjung Karang Timur District (41%). An overview of the result representation by sub-district was obtained by 18%. Overview of the result representations were in tidal topographic areas with 24%, choppy to wavy had a percentage of 18%, and the lowest hilly to mountainous areas had 15%. The topographical areas that have the highest result representation of CHS results are tidal areas, while the lowest are hilly to mountainous areas.

***Keywords:*** *congenital hypothyroid screening, district, newborn screening, topography*

## BACKGROUND

Congenital Hypothyroidism (CH) is a condition of decreased or non-functioning thyroid gland that is acquired since the newborn period. This can occur due to the emergence of abnormalities in the anatomy and metabolism of thyroid hormone formation or iodine deficiency[1]. Congenital hypothyroidism can cause long-term adverse effects, mainly involving mental retardation. An examination of the newborn is required to detect congenital hypothyroidism[2]. Congenital Hypothyroidism Screening (CHS) is a screening test performed when the baby is a few days old to sort out babies who have CH from babies who do not. Newborn screening is done with the aim of detecting congenital disorders as early as possible, so that babies with abnormalities can be treated as soon as possible[1].

The prevalence of CH that has been reported from various parts of the world today shows a variation from 1:4,000 to 1:1,000 in newborns. The reported incidence of CH after the presence of CHS is increased to 1:3,000–1:4,000 live births. Before any newborn screening program began, delayed clinical diagnosis of CH was between 1:7,000 to 51:10,000. After screening in a large population, the incidence increased to between 1:3,000 to 1:4,000[3].

The CHS program has also been conducted in Indonesia because of the very important role of CHS as a preventive measure in order to reduce the incidence of mental retardation in children. Until now, Indonesia does not have any national CH data. Indonesian CH data can only be obtained from Dr. Hospital. Cipto Mangunkusumo Jakarta and Hasan Sadikin Hospital Bandung. Since 2000–2013, screening has been done in 11 provinces in Indonesia on

199,708 infants with the result that there are 73 cases or 1:2,736 events[4].

The CHS program in Lampung Province started in 2016 in Metro City. In the course of the CHS program from 2016 - 2017 in Lampung, the number of newborn babies reported to have been screened was around 2,000 newborn babies, or 42% of the total of 4,748 newborn babies. This percentage is still far from the expected target, which is 100 percent or total newborn babies[4]. The implementation of the CHS program in Bandar Lampung City began in May 2019. However, there are no data on the results of the CHS in Bandar Lampung City to date.

Children who suffer from CH can experience mental retardation with IQ abilities below the normal average value if there is a delay in early discovery and treatment. The results of research in Indonesia show that delays in therapy within 5-6 months can affect a person's IQ, namely children with this condition tend to have an IQ of around 70. In the evaluation results of medical records at RSUD Dr. Cipto Mangunkusumo and Hasan Sadikin Hospital showed that more than 70% of CH cases were diagnosed at the age of over one year with permanent mental deficits. Only 2.3% of cases were diagnosed at the age of less than three months, where the baby had the characteristics of minimal growth and developmental disorders[3]. For this reason, CHS is very important to do to prevent delays in the diagnosis and treatment of CH.

The cause of hypothyroidism can be associated with various factors, one of which is topography. The topography of the region will affect consumption patterns, health status, and other factors[5,6]. The topography of the city of Bandar Lampung can be categorized into 3 areas, namely: a. tidal area (southern part and has a height between 0 – 10 m above sea level); b. wavy to wavy areas (areas that have low hills surrounded by narrow plains, with an altitude of >80-150 m above sea level); and hilly to mountainous areas (altitude >150-250 m asl)[7].

Based on the above background, researchers are interested in conducting research on the description of the results of CHS based on regional topography in Bandar Lampung City in May-October 2019.

## RESEARCH METHODS

This descriptive research was conducted with a cross-sectional approach. This research was done in the Bandar Lampung City Health Office and Public Health Centers in the work area of Bandar Lampung City, Lampung Province in October 2021 - March 2022 by taking secondary data on the incidence of CHS and live births.

The population in this study were all infants aged 24-72 hours who were born in Bandar Lampung City in May-October 2019. The sampling technique used was total sampling because in this study an overview of the results of the CHS was obtained based on the topography of the Bandar Lampung City area. The sample of this study is the population that meets the research criteria. This study has several inclusion and exclusion criteria. The inclusion criteria used are:

a. All babies born alive in May-October 2019 recorded in the Bandar Lampung City Health Office data;
b. Infants undergoing Congenital Hypothyroid Screening (CHS).

Meanwhile, the exclusion criteria are:

a. Infants who perform CHS at health facilities outside the city of Bandar Lampung;
b. Infants who do not have information on the name of the health facility when doing CHS.

Data from health facilities that have been collected were analyzed using Microsoft Excel and the SPSS for windows program, then presented in the form of tables and diagrams. The calculation formula based on the description of the results of the CHS used is:

$$\frac{\text{Number of babies doing CHS}}{\text{Number of live births}} \times 100\%$$

The CHS data obtained were grouped by sub-district in order to obtain an overview of the results in general and an overview of the results based on the topography of the area in Bandar Lampung City.

## RESULTS

This research was conducted at the Bandar Lampung City Health Office from October 2021 to March 2022. Secondary data were obtained totaling 1,470 babies who did CHS from the Bandar Lampung City Health Office. From these data, there are 30 data that are excluded, namely 20 data on infants who underwent CHS at health facilities outside Bandar Lampung City and 10 data on infants who are not recorded in health facilities where CHS is performed. A total of 1,440 data that met the research criteria were then processed. As for the data on live births, there were 7,784 baby data obtained from the *Puskesmas* in the working area of Bandar Lampung City.

The description of the results of the CHS obtained is based on the sub-district and topography of the area in Bandar Lampung City. There are 20 sub-districts in Bandar Lampung City. The topographical categories used in this study are tidal areas or coastal areas, wavy to wavy areas or plain areas, and hilly to mountainous areas. The sub-districts in Bandar Lampung City are then grouped into these three topographical areas.

The division of the topographic area is based on the height of the sub-district in Bandar Lampung City. In the tidal area, there are 4 sub-districts included in it, namely Bumi Waras, Panjang, Teluk Betung Selatan, and Teluk Betung Timur. The sub-districts of Enggal, Peace, Labuhan Ratu, Rajabasa, Sukarame, Tanjung Glad, Teluk Betung Barat, Teluk Betung Utara, and Way Halim are included in the wavy to bumpy areas. The hilly to mountainous area includes 7 sub-districts consisting of Kedaton, Kemiling, Langkapura, Sukabumi, Tanjung Karang Barat, Tanjung Karang Pusat, and Tanjung Karang Timur.

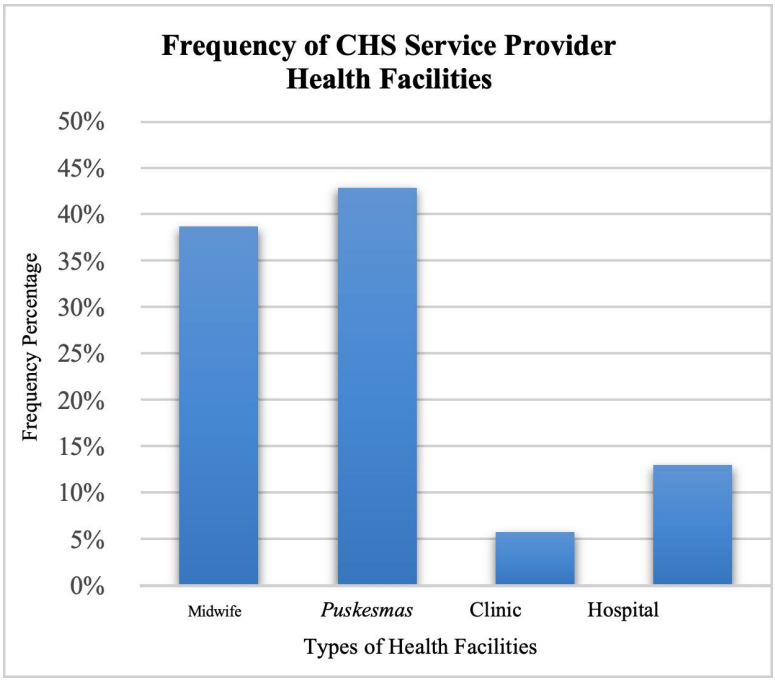


**Figure 1. Frequency of Types of Health Facilities for CHS Service Providers.**

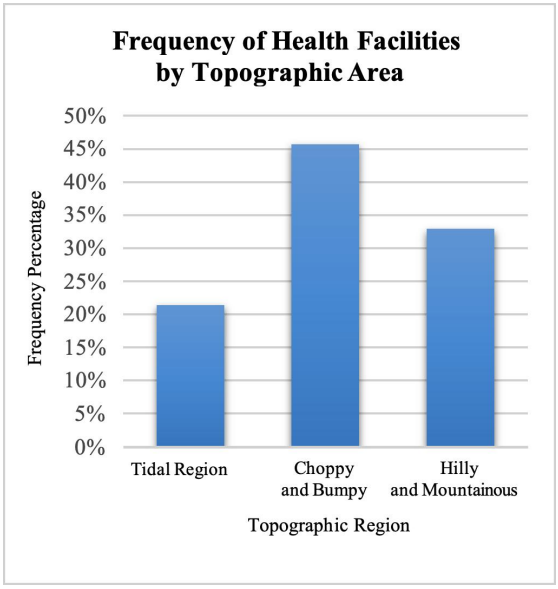


**Figure 2. Frequency of Health Facilities by Topographic Area.**

Figure 1 shows the frequency of health facilities providing CHS services in Bandar Lampung City. The type of health facility with the highest number is *Puskesmas*, which is 30 (42.9%). There were 27 (38.6%) midwives who provided screening services, while 9 (12.9%) went to hospitals. The health facilities with the least number are 4 (5.7%) at clinics.

Figure 2 shows the percentage of the frequency of health facilities to variations in topographic areas, where the number of health facilities that perform CHS in the tidal area category are 15 health facilities (21.4%), while wavy to wavy areas have 32 health facilities (45.7%), and hilly and mountainous areas have 23 health facilities (32.9%). There are a total of 70 health facilities that provide CHS services in Bandar Lampung City. These health facilities include *Puskesmas*, independent practice midwives, hospitals, and health clinics.

Table 1 shows the incidence of CHS and a description of the results of CHS based on the District of Bandar Lampung City. The data vary in wide amounts. The highest number of CHS events was in Panjang District, while in Enggal District there were no CHS events. The description of the results of CHS is mostly found in Tanjung Karang Timur District as much as 41%. The number of CHS incidences is not directly proportional to the description of the CHS results obtained because it is compared with the number of live births in the sub-district.

In this study, it was found that Enggal District did not have data on the incidence of CHS, so there was no description of the results of CHS in that district. This can be caused by constraints from the research data, where several names of

**Table 1. Overview of CHS Results by District**

| District | Number of CHS | Babies Born Alive | Results Overview |
|---|---|---|---|
| Bumi Waras | 96 | 274 | 23% |
| Enggal | No data | 608 | - |
| Kedamaian | 25 | 284 | 6% |
| Kedaton | 51 | 372 | 13% |
| Kemiling | 97 | 432 | 19% |
| Labuhan Ratu | 30 | 292 | 9% |
| Langkapura | 94 | 418 | 33% |
| Panjang | 235 | 478 | 39% |
| Rajabasa | 35 | 523 | 10% |
| Sukabumi | 36 | 404 | 7% |
| Sukarame | 50 | 259 | 12% |
| Tanjung Senang | 27 | 383 | 8% |
| Tanjung Karang Barat | 28 | 419 | 6% |
| Tanjung Karang Pusat | 130 | 336 | 30% |
| Tanjung Karang Timur | 112 | 338 | 41% |
| Teluk BetungBarat | 36 | 357 | 14% |
| Teluk BetungSelatan | 64 | 489 | 16% |
| Teluk BetungTimur | 80 | 486 | 27% |
| Teluk BetungUtara | 116 | 441 | 31% |
| Way Halim | 98 | 191 | 21% |

**Table 2. Descriptive Analysis of Data by District**

| | Mean | Median | Mode | Minimum | Maximum |
|---|---|---|---|---|---|
| Baby Born Alive | 389 | 393 | 191 | 191 | 608 |
| CHS Incident | 72 | 57 | 36 | 0 | 235 |
| CHS Results Overview | 18% | 15% | 6% | 0% | 41% |

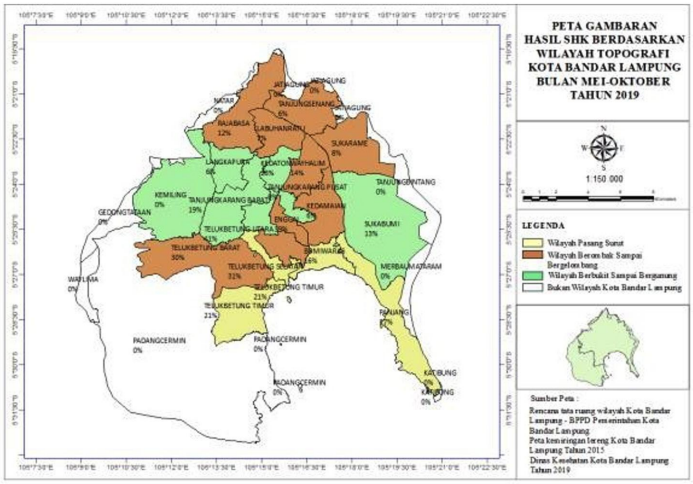


**Figure 3. Map of CHS Results Based on Regional Topography.**

health facilities were found that did not match the names of the actual health facilities, so that when a search was done the place for the implementation of the CHS was not found.

Table 2 shows that the average description of CHS results in 20 sub-districts in Bandar Lampung City is 18%. There are 11 sub-districts that have a below average percentage of CHS, namely Teluk Betung Selatan, Teluk Betung Barat, Kedaton, Sukarame, Rajabasa, Labuhan Ratu, Tanjung Glad, Sukabumi, Tanjung Karang Barat, Peace, and Enggal.

Figure 3 shows an overview of the results of the CHS in the form of a map. Topographic areas that have the highest proportion of CHS are tidal areas (24%), undulating to wavy topographic areas have a percentage of 18%, while the lowest is hilly to mountainous (15%). In these hilly to mountainous areas, the sub-district that has the highest proportion of CHS is Tanjung Karang Timur District (41%) and the lowest is Tanjung Karang Barat District (6%). In choppy to wavy areas, the sub-district with the highest proportion of CHS was Teluk Betung Utara (31%) and the lowest was Enggal District, where there was no CHS. While in the tidal area, Panjang sub-district is the sub-district with the highest proportion of CHS (39%) and the lowest is Teluk Betung Selatan District (16%). It can be seen that the description of the results of the CHS in each topographic area varies greatly.

## DISCUSSION

In this study, an overview of the results of the CHS based on the District in Bandar Lampung City in May-October 2019 was 18%. These results were obtained from the accumulation of the number of CHS events in each sub-

district compared with the number of live births in that time period. There were a total of 1,440 babies who were screened at Bandar Lampung City health facilities. The number of screening events is much higher when compared to the research of Anggarini et al.[4] which was conducted in Metro City, Lampung Province, which amounted to 35 babies in 2017 and 13 babies as of April 2018. However, when compared to live births of 141 babies, the proportion of screening obtained was 34%, which means there were higher numbers compared to this study.

Based on *Riskesdas*[8], Lampung Province has a 2.5% proportion of CHS for children aged 0-59 months. This result can be said to be low when compared to other provinces and the average proportion of Indonesian CHS is 4.6%. The data show that the highest proportion of screening is in DI Yogyakarta (14.6%), while the lowest is in North Sumatra (1.7%). This comparison shows a significant disparity in proportion between provinces in Indonesia.

The study conducted by Salim et al.[9], discussed the incidence of CHS in infants aged 0-28 days with a gestational age of 36 weeks. The study was conducted at 51 health facilities in Malang City in March-November 2020, with 2,291 babies being screened. However, there were 267 samples that were declared errors so that the number of samples that were successfully checked was 2,024. The incidence of CHS in this study was more, but it was carried out in fewer health facilities and for a longer period of time than this study.

In a study conducted by Hiola et al.[10], the results obtained were that 22 infants were screened out of a total of 1,064 infants at Prof Dr. H Aloe Saboe Hospital, Gorontalo City, so the proportion of CHS obtained was 0.09%. The proportion of screening in Gorontalo City was 6.7%, where there were 280 babies who did CHS out of a total of 4,107 babies. These results are lower than this study. When compared to IDAI's target of 1: 1,500, the total proportion of CHS has not yet reached the specified target. The failure to achieve this is certainly influenced by factors that cause the lack of CHS to be carried out.

The study also mentions that several factors that influence the lack of public awareness to screen newborns, among others, are the mother's lack of knowledge and inadequate family and logistical support, while these aspects affect the incidence of CHS. Mother's lack of knowledge is caused by the lack of information previously obtained. Information about CHS can not only be obtained from health workers, but can also come from social media and the Internet. The results of the study showed that mothers who had less knowledge and did screening were 7.1%, while mothers who had less knowledge and did not screen were 42.9%. In addition to information, mother's knowledge also comes from educational background. Mothers with low education do not always have absolute low knowledge as well. This is because the knowledge possessed is not only sourced from formal education, but can also be obtained from non-formal education. Lack of information owned can be motivated by the work[10].

Health education given to mothers will increase mother's knowledge, because there is a process of entering information from the giver to the recipient. This is evidenced by the research of Tariq et al.[11], regarding the assessment of knowledge, attitudes and practices towards newborn screening, in which mothers will be compared before and after being educated in Pakistan Hospitals. The results of the study showed that there was a significant increase in women's awareness after being given education, from 20% to around 98%. This comparison is also in line with the aspect of agreeing to do CHS for their children, where before education there were 57.7% of mothers and after education there were 78.9% who agreed to do CHS.

Generally, the good knowledge will correlate with a positive attitude. Attitude will affect health behavior, then a positive attitude will result in positive health behavior. The positive attitude in question is the mother who has the right attitude about CHS or the tendency to screen. Thus, mothers with good knowledge are in line with attitudes supporting screening[12].

Another factor that affects the incidence of CHS is the availability of health facilities and infrastructure. Equipment needed for screening is often not available in all health facilities. Qualified medical personnel also greatly influence the incidence of CHS. Cooperation between pediatricians, obstetricians and obstetricians/obstetricians/obstetricians, general practitioners, nurses and midwives who assist in childbirth is required to collect baby blood specimens which will then be examined. Then the sample needs to be examined in a special laboratory and requires a clinical pathologist to re-check the results received. Availability of laboratories that have tools to conduct CHS examination is also another obstacle. The regionalization of the CHS reference laboratory to date is divided into two, namely Dr. Cipto Mangunkusumo Hospital and Dr. Hasan Sadikin Hospital. Currently, the Lampung Province CHS laboratory is located at Dr. Cipto Mangunkusumo Hospital. Thus, the availability of human resources, facilities and infrastructure for CHS will affect the number of screenings carried out by the community[1].

In the results of this study, it was found that the topographic areas with the least number of CHS results were hilly to mountainous topographic areas. According to research by Hastuti et al.[13], mountainous areas tend to have low iodine content, resulting in a high incidence of hypothyroidism in the population. The study took place in Cangkringan, Sleman, Yogyakarta, precisely in the area of Mount Merapi. The results of the study showed 3.2% of 97 mothers had hypothyroidism. When compared with the percentage of hypothyroidism in the world which is 0.5% and in Indonesia it is 2.2%, these results are quite high. This condition is probably caused by the low source of iodine in the surrounding soil, where the living land will be used for farming so that the minimal mineral content of the mountainous area will be carried over to the food consumed by the population. Cangkringan is included in the highlands and is also a place for periodic eruptions of Mount Merapi, so that these aspects will affect soil mineral resources, especially iodine levels. This situation makes Cangkringan predicted to have a fairly high number of

people with iodine deficiency.

Similar to the results above, the study by Bahsir et al.[14] suggested that the area in the Kashmir mountain valley has low mineral and soil iodine content and the prevalence of subclinical hypothyroidism is 21.56%. These results are classified as high when compared to studies in other parts of the world where the prevalence is only around 4-8.5%. The category of the group with the highest prevalence is women aged 20-65 years, in which the age range is included in women of childbearing age. This can result in high hypothyroidism in pregnancy which leads to an increase in the incidence of congenital hypothyroidism.

In endemic areas, the prevalence of hypothyroidism is 5 per 1,000, whereas the prevalence of subclinical hypothyroidism is 15 per 1,000. Hypothyroidism generally occurs in women, with the incidence of primary hypothyroidism in the United States being 3.5 per 1,000 population for women and 0.6 per 1,000 population for men[15]. The tendency for hypothyroidism to occur in women makes the possibility of congenital hypothyroidism even greater in endemic areas that are predominantly mountainous. Highland areas such as the mountains tend to have a higher incidence of hypothyroidism, so CHS is needed to break the chain of hypothyroidism in the population in that area.

Research has been conducted on the evaluation of the CHS program that has been running in Indonesia so far. According to the study of Noflidaputri and Meilinda[16] who evaluated the CHS in Solok City in 2020, there were obstacles in the implementation of the CHS program that came from the community, where as many as 89 respondents who were the research sample did not implement the CHS and only 5 people did the CHS. The majority of parents who do not carry out CHS are low-motivated by their lack of experience related to CHS. In the aspect of health workers, it was found that some midwives had attended CHS training, but during its implementation there were obstacles in the form of fear and hesitation to carry out CHS because the procedure for taking blood samples from the baby's heels was not easy. Another obstacle is the slowness of information on newborns from the village midwife or *Posyandu* supervisor to the field supervisor. According to Anggraini et al.[4], the number of human resources involved in the CHS program at the Karangrejo Health Center, Metro City, Lampung Province is sufficient, but there are obstacles in the form of not all implementing staff receiving adequate CHS training. There are also obstacles in the form of no supporting facilities, namely tools in the form of posters, leaflets and brochures in communication, information, education activities. The procedures done are also considered to be not in accordance with the existing CHS guidelines.

## CONCLUSIONS

The results of congenital hypothyroidism screening in Bandar Lampung City are highest in the tidal topography with 24%, while at wavy to wavy areas it was 18%, and the lowest in hilly to mountainous areas was 15%. In general, the results of congenital hypothyroid screening in Bandar Lampung City are 18% and the highest is in Tanjung Karang Timur District at 41%.

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