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Mapping Health Information System for Breast Cancer Patients through an Epidemiological Study at Prof. W. Z. Johannes Hospital and Its Distribution in East Nusa Tenggara, Indonesia

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Abstract. Mapping the spread of disease patients with the Geographic Information System (GIS) is very helpful in providing information on the location of who comes for treatment at the hospital. This research was conducted on all breast cancer patients who were recorded in the medical records of 2017-2019 at Prof. W.Z. Johannes Hospital Kupang. This research is an analytic observational with a cross-sectional study approach, using a Geographic Information System (GIS) modeling through spatial analysis to obtain an overview of the distribution of breast cancer based on epidemiological variables. Based on the results of research on breast cancer from 2017 to 2019 at Prof. W.Z. Johannes Hospital Kupang according to the host epidemiology variable was based on age in highest are between the age of 51 and 60 with 18 patients in total; based on the education level is highest, there are 112 patients in a total of Senior High School graduates; based on the occupation in highest, there are 81 patients worked as Civil Servant, according to the highest time variable in 2019, there were as many as 91 cases, followed by 83 total cases in 2018, and there were as many as 74 cases in 2017.

***Keyword**: Epidemiology, Ca Mamae, Mapping, Geographic Information System (GIS)*

Abstrak. Pemetaan penyebaran penyakit pasien dengan Sistem Informasi Geografis (SIG) sangat membantu dalam memberikan informasi lokasi yang datang berobat di rumah sakit. Penelitian ini dilakukan pada seluruh pasien kanker payudara yang tercatat di rekam medis tahun 2017-2019 di RSUD Prof. W. Z. Johannes Kupang. Penelitian ini merupakan penelitian observasional analitik dengan pendekatan studi potong lintang, menggunakan pemodelan Sistem Informasi Geografis (SIG) melalui analisis spasial untuk memperoleh gambaran sebaran kanker payudara berdasarkan variabel epidemiologi. Berdasarkan hasil penelitian kanker payudara dari tahun 2017 hingga 2019 di RSUD Prof. W. Z. Johannes Kupang menurut variabel epidemiologi pejamu berdasarkan usia terbanyak adalah antara usia 51 sampai 60 tahun dengan jumlah pasien sebanyak 18 orang; berdasarkan tingkat pendidikan tertinggi, ada 112 pasien dengan total lulusan SLTA; berdasarkan pekerjaan terbanyak yaitu pasien berprofesi sebagai Pegawai Negeri sebanyak 81 orang, menurut variabel waktu tertinggi pada tahun 2019, sebanyak 91 kasus, disusul jumlah kasus sebanyak 83 kasus pada tahun 2018, dan pada tahun 2017 sebanyak 74 kasus.

***Kata Kunci**: Epidemiologi, Kangker Payudara, Pemetaan, Sistem Informasi Geografis (SIG)*

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Introduction

One of the important methods for breast cancer surveillance in monitoring public health is an analysis using a Geographical Information System (GIS). GIS is used to determine the epidemiology, disease trends, and the location of the distribution of patients, namely the formation of an area around the object with a certain distance from the object of the case and to analyze surveillance data, especially disease surveillance (Prahasta, 2009). Risk assessment and early warning can be identified using space-time permutation model analysis, which is a statistical spatial test method with clusters based on time and place (Prahasta, 2009).

Cancer is a group of diseases that cause cells in the body to change and grow out of control. Most types of cancer cells eventually form a lump or mass called a tumor and are named after the part of the body where the tumor originated. Cancer can also be referred to as a malignant tumor. This means that the emerging cancer cells destroy the surrounding healthy cells and spread rapidly, pushing the healthy cells, and taking their nutrients. In general, breast cancer patients are found out after an advanced stage. Breast cancer occurs in both men and women, although male breast cancer is rare (Arafah & Notobroto, 2017).

These cancer cells arise if there has been a genetic mutation that results from DNA damage in normal cells. Because cancer is an abnormal growth of cells that duplicate itself out of control and the name of cancer is usually based on the part of the body where the cancer cells first grow, then breast cancer is a malignancy in the breast that comes from glandular cells, glandular ducts, and breast supports tissues, excludes the breast skin (Handayani, dkk, 2013). Breast cancer is the proliferation of epithelial cell malignancies that limit the ducts or lobes of the breast (Price & Wilson, 2014). Breast carcinoma is a malignant tumor, it is usually an adenocarcinoma originating from the epithelial cells of the lactiferous ducts in the mammary glandular lobules (Moore, dkk, 2013).

The cause of the cancer is still unknown until now, but this cancer usually develops in the ducts (tubes that carry milk to the nipple) or lobules (glands that make milk). There are also other causes of this cancer, one of which is medical history, if there is a history of cancer in the family, then there is hormone therapy, breast X-rays, consumption of unhealthy food, smoking, hormones, and others (Tanjung & Hadi, 2018).

Risk Factors for Breast Cancer in General

The causes of cancer are not certainly known, including the causes of breast cancer. However, several internal and external hormones increase a person's risk of developing breast cancer. Some of the breast cancer risk hormones that may never be changed include gender, age, family history, early menstrual age, and late menopause. Meanwhile, other hormones that are associated with the increasing of breast cancer risks, including postmenopausal obesity, the use of estrogen and progestin hormones at the menopause stage, smoking behavior, and consumption of hormones are modifiable risks (Ricky, Rachmawaty, & Syam, 2018).

Breast cancer shows the proliferation of malignant epithelial cells that restrict the ducts or lobes of the breast. There is only cell hyperplasia with atypical cell development initially. These cells then develop to carcinoma in situ and induce the stroma. Cancer takes 7 years to grow from a single cell into an enormous mass to be palpable (approximately 1 cm in diameter). There are about 25% of breast cancers have metastasized at the size (Price & Wilson, 2014). The spread of breast cancer occurs by direct invasion to the breast parenchyma, along the ducts or lobules on the surface skin, and extending through the lymphatic tissue of the breast. The regional lymph nodes involved are the axillary, internal mammary, and supraclavicular glands (Rasjid, 2010). Cancer cells passed through the lymphatic channels then eventually enter the blood vessels, can also directly invade the blood vessels until there is distant metastasis which can affect any organ, however, the

most common places are bones (71%), lungs (69%), liver (65%), pleura (51%), adrenals (49%), skin (30%), and brain (20%) (Smeltzer & Bare, 2012).

Types of Breast Cancer According to the Centers for Disease Control and Prevention (2016), cancer cells that remained in their structure are called non-invasive or in situ cancer cells. Meanwhile, cancer cells that can spread beyond the basement membrane of the ducts and lobules are described as invading cancer cells. According to Andrews (2010), there are several types of breast cancer, including:

1. Carcinoma in situ. Carcinoma in situ is characterized by the proliferation of malignant epithelial cells that remain confined in the terminal duct. There are two types of disease in situ that have been described as lobular carcinoma in situ and ductal carcinoma in situ.
2. Invasive breast cancer. Invasive carcinoma can spread from the breast structures. This cancer has the potential to metastasize. The two main types of invasive breast cancer are carcinomas of the lobules and ducts.
3. Paget's disease. The disease usually affects the epidermal tissue of the nipple and there is discharge from the nipple, skin changes such as eczema, nipple retraction, and there is sometimes thickening of the basic breast tissue.
4. Inflammatory breast cancer. The type of cancer shows swelling and redness of the breasts, as well as edema of the skin with induration of the breast lower tissue (Peau d'Orange).

Breast Cancer Prevention According to the American Cancer Society (2015), many life factors affect a woman's risk of developing breast cancer. Some factors hardly to be changed, such as aging or a family history of breast cancer. However, every woman may well prevent herself from developing breast cancer by maintaining personal health, including ideal body weight, do the exercising regularly (at least four hours a week), having adequate and regular sleep hours, limit in alcohol consumption, avoid to chemicals exposure that causes cancer (carcinogens) and chemicals that interfere with normal body function, limit exposure to radiation from medical imaging tests such as X-rays, CT scans, and PET

scans if they are not medically necessary, consult with the doctor when decide to use hormone replacement therapy or oral contraceptives (birth control pills), discuss any concerns with a doctor, do the breastfeeding for the baby.

Material and Method

The design of this study is an Observational Analysis with a Cross-Sectional approach using Geographical Information System (GIS) modeling through spatial analysis to obtain an overview of the spatial distribution of ca mammae patients based on the epidemiological variables in all districts in East Nusa Tenggara. The data used in this study consisted of primary data and secondary data obtained directly from Prof. W. Z. Johannes Hospital Kupang between 2017 and 2019. This research was conducted at Prof. W. Z. Johannes Hospital Kupang. The period for the study was carried out from August to October 2020. The sampling technique in this study was total sampling, which covered all recorded in medical records at Prof. W. Z. Johannes Hospital Kupang from 2017 to 2019, sampling was carried out on all members of the population or the total population, or in other words, all members of the population were studied (Notoatmodjo, 2011), so that the number or size of the sample corresponding to the total population obtained, with the total of 74 cases in 2017, and had 83 cases in 2018 and with 91 cases total in 2019.

Results and Discussion

Breast cancer research is an epidemiological study that aims to identify and map the breast cancer recorded at Prof. W. Z. Johannes Hospital Kupang from 2017 to 2019, this is an effort to determine epidemiologically (time, place, and person) of breast cancer patients in Prof. W. Z. Johannes Hospital Kupang and carried out a mapping of its distribution in East Nusa Tenggara Province as an effort to enforce the health information system.

Distribution of Breast Cancer Patients According to Host Epidemiology Variables Education

Table 1.
Distribution Of Breast Cancer Patients In 2017 To 2019 Based on The Education Level at Prof. W.Z Johannes Hospital Kupang, East Nusa Tenggara

Year	Level of Education						
	Primary School	Junior High School	Senior High School	Undergraduate	Graduate	Post-Graduate	TOTAL
2017	1	0	37	14	19	3	74
2018	0	0	38	17	28	0	83
2019	4	2	37	21	27	0	91
Total	5	2	112	52	74	3	248

Out of the total number of 248 breast cancer patients were being inspected, there were 112 with high school graduate, followed by 74 with graduate education; and there were 52 with undergraduate; 5 with primary school graduate; there was 3 postgraduate education and the lowest was junior high school graduate as many as 2 patients (See Table 1). It shows the level of education with the spread of disease and death. Highly educated community groups tend to be more aware of ways to prevent the disease (Notoatmodjo, 2011).

Occupation

Table 2.
Distribution of Breast Cancer patients in 2017-2019 based on Occupation at Prof. W. Z. Johannes Hospital Kupang, East Nusa Tenggara

Year	Occupation						
	Civil Servant	Military/Police	Private Sector	Priest	Farmer	Housewife	TOTAL
2017	30	1	21	0	4	10	74
2018	21	1	33	1	0	27	83
2019	30	0	20	0	10	31	91
Total	81	2	74	1	14	68	248

Based on the results of a study on 248 breast cancer who were carried out at Prof. Dr. W. Z. Johannes Hospital Kupang for 3 years, starting from 2017 until 2019, the results obtained in 2017 proved that the highest breast cancer patients were civil servants with 30 cases, followed by the private sector workers with 21 cases; there were 10 housewives, and there were 4 farmers and 1 Indonesian Military / Police (See Table 2). In 2018, the highest number of breast cancer patients came from private-sector workers with 33 cases, followed by housewives as many as 27 cases; Civil servants as many as 21 cases; there was 1 case that came from Military officer/Police Officer and 1 Priest was being found. In 2019, the highest breast cancer was among housewives, which had 31 cases, followed by civil servants as many as 30 cases, then there were 20 cases came from private-sector workers, and there were also 10 farmers.

Age

Table 3.
Distribution of Breast Cancer patients in 2017-2019 based on Age at Prof. W. Z. Johannes Hospital Kupang, East Nusa Tenggara

Year	Age					
	< 30	31 - 40	41 -50	51 – 60	>60	TOTAL
2017	1	5	30	31	7	74
2018	3	71	25	33	11	83
2019	3	14	33	32	9	91
Total	7	90	88	96	27	248

Based on the results of the research on the age variable for 3 years, started from 2017 until 2018 (See Table 3), it was obtained that in 2017, the highest age of breast cancer cases was at the age range between 51 and 60 years old, there were 31 patients, followed by 30 patients at the age range between 41 and 50 years, then there were 7 patients at the age range above 60 years old; there were 5 patients at the age range between 31 and 40 years old, and there was 1 person as the lowest at the age under 30 years old. In 2018, the highest was patients who were 31-40 years old, followed by 33 patients from the age range between 51 and 60 years old, then

there were 25 patients, aged from 41 to 50 years, 11 patients were above 60 years old and there were 3 patients as the lowest of under 30 years old. In 2019, the highest case was between the age of 41 and 50 years old as many as 33 patients, followed by 32 patients, aged 51 to 60 years, then there were 14 patients of the age 31 to 40 years old; there were 9 patients of the age above 60 years old. The lowest case was under the age of 30 years old as many as 3 patients.

Distribution of Breast Cancer According to Time Epidemiological Variables (2017-2019)

The distribution of breast cancer by month for 3 years, 2017 - 2019 can be seen in Figure 1 below.

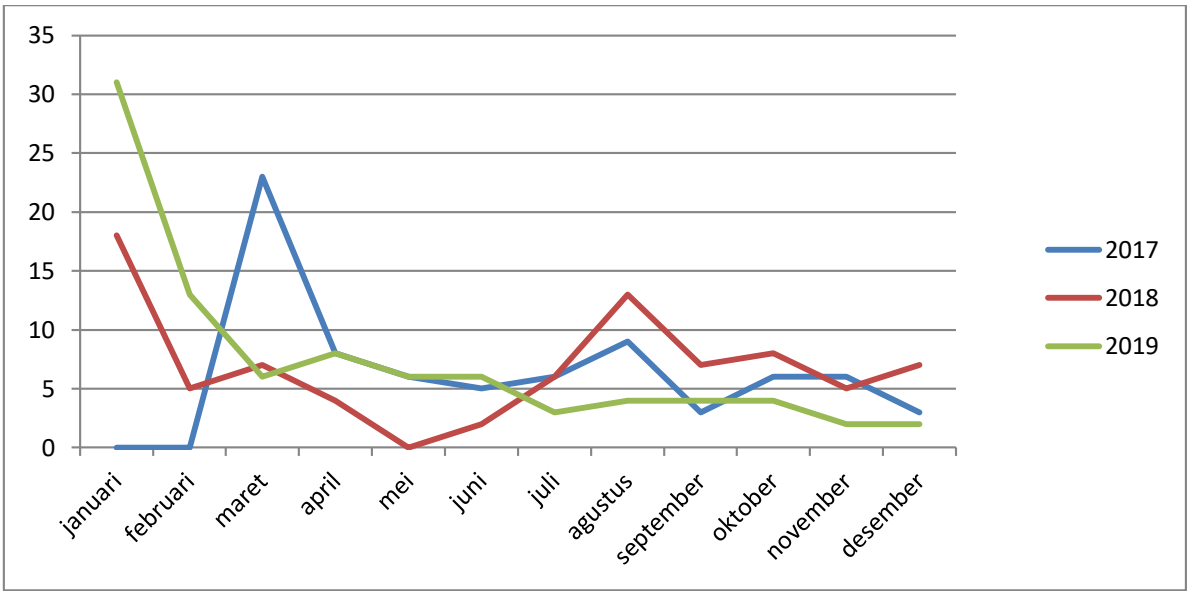

Figure 1. Distribution of Breast Cancer by time (2017-2019)

There was 248 breast cancer in 2017-2019, based on the results of research conducted in July and August at Prof. W. Z. Johannes Hospital Kupang, it was found that in February 2017 was the highest cases as many as 23 patients; For 2018, the highest cases were in January with 18 patients and, also in 2019, there were 31 patients as the highest rate. The total number of cases was 91 in 2019 followed by 83 in 2018, and there were 74 in 2017.

Distribution of Breast Cancer According to Place Epidemiology Variables (2017-2019)

The increase in the number of breast cancer by the district for 3 years, between 2017 and 2019 can be seen in Figure 2 below.

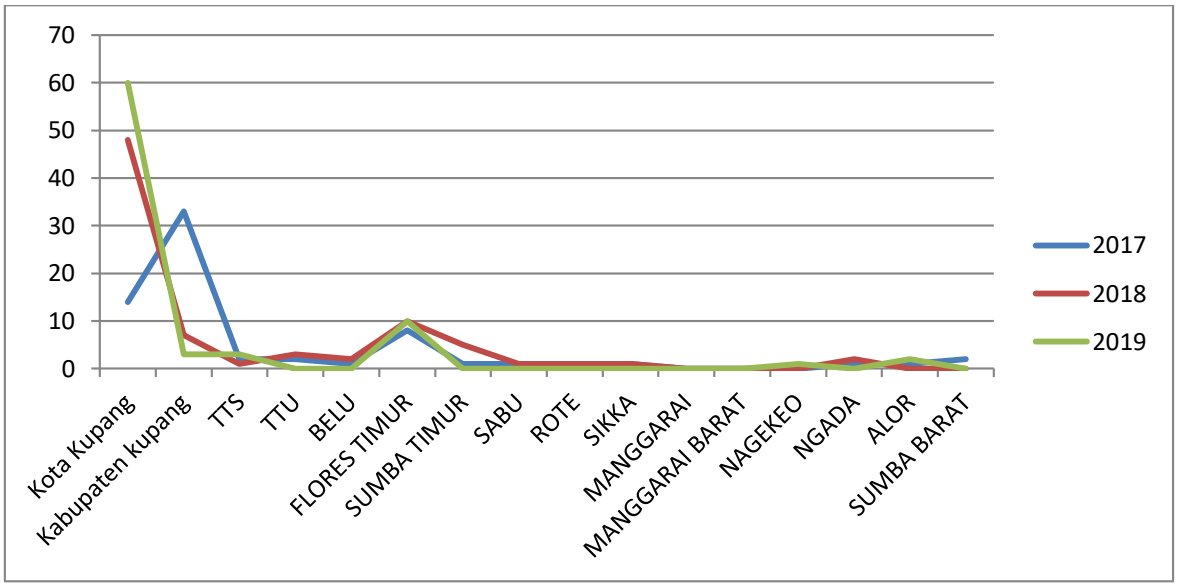

Figure 2. Distribution of Breast Cancer by The District in East Nusa Tenggara Province (2017-2019)

The results of the study were based on the spread of breast cancer cases in all districts in East Nusa Tenggara province based on the highest district cases, that is in Kupang district as many as 33 patients in 2017; and the Kupang City as many as 48 patients in 2018, while there were 60 cases in 2019.

Mapping of Breast Cancer by districts in the province of East Nusa Tenggara Province (2017-2019).

Mapping based on the distribution of breast cancer by Districts in East Nusa Tenggara Province can be seen in Figure 3 below.

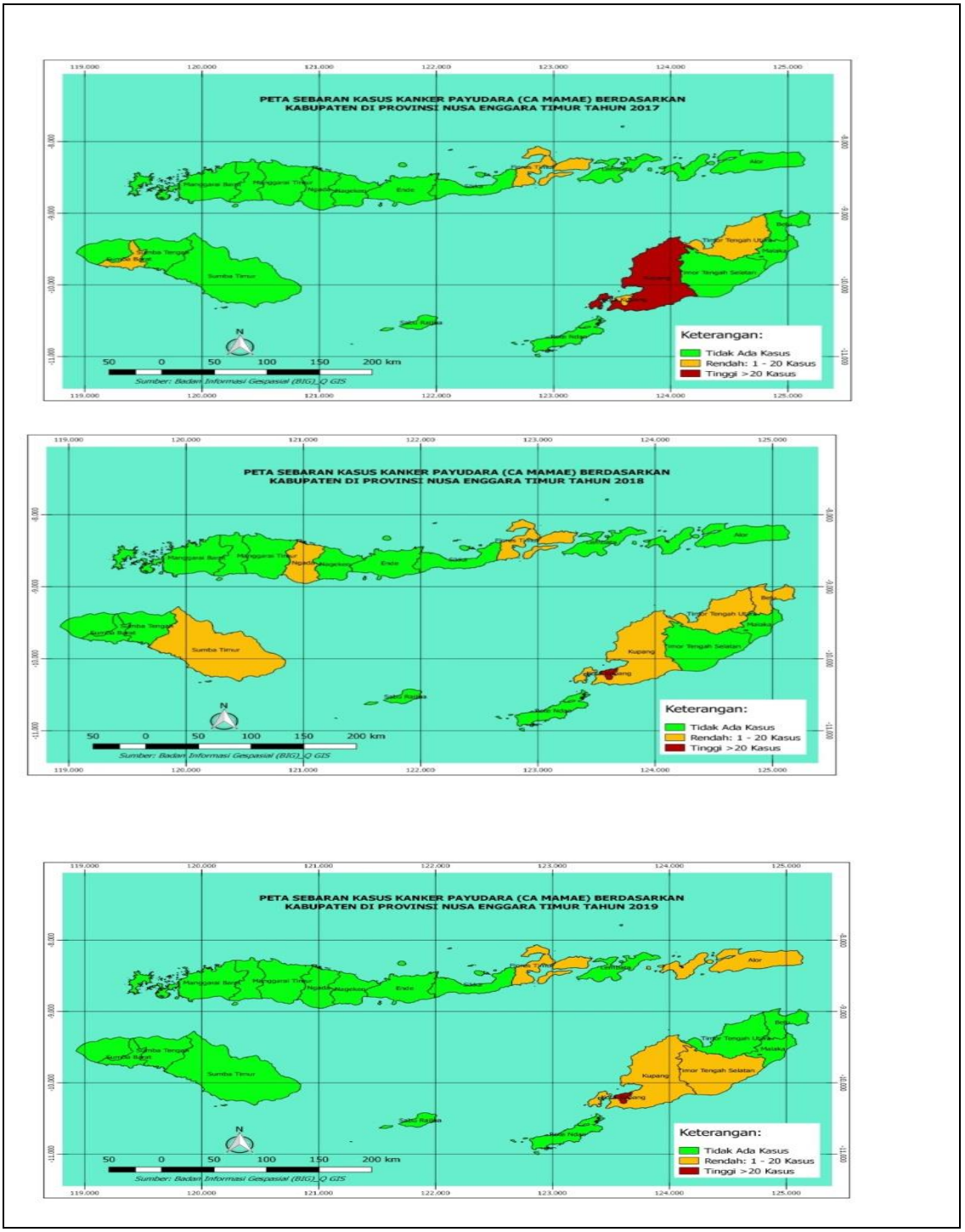

Figure 3. Mapping Of Breast Cancer Based on The District of Origin in East Nusa Tenggara Province, 2017 - 2019

Based on the results of mapping the distribution of breast cancer cases by District in East Nusa Tenggara province, it shows that red shading has dominated Kupang District and Kupang City from the year 2017 until 2019.

Conclusion

Breast cancer cases have increased according to the epidemiological variables and based on the results of research on breast cancer cases prevalence, from 2017 until 2019 at Prof. W. Z. Johannes Hospital Kupang, there were as many as 74 in 2017, There were 83 in 2018, and there were 91 in 2019, Kupang City and Kupang district were the highest in cases distribution.

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