Cat viral diseases pattern in Prof. Soeparwi Animal Hospital in 2017-2019

M K Al Hafi¹, H Susetya² and W S Nugroho ²*

¹Undergraduate Student of Veterinary Medicine Study Program, Faculty of Veterinary Medicine UGM, Jl. Fauna No 2 Karangmalang, Yogyakarta.
²Department of Veterinary Public Health, Faculty of Veterinary Medicine UGM, Jl. Fauna No 2 Karangmalang, Yogyakarta

*Corresponding author e-mail: weesnugroho@ugm.ac.id

Abstract. Feline Panleukopenia Virus (FPV), Feline Infectious Peritonitis (FIP), Feline Calici Virus (FCV), and other cat’s viral diseases were reported in Indonesia. Viral diseases that appear usually appear in each season with different intensities depending on the type of virus. The research data was taken from Animal Hospital Prof. Soeparwi’s medical record in 2017-2019 along with rainfall, humidity, and temperature data in the Yogyakarta area in 2017-2019 obtained from the Climatology and Geophysics Meteorology Agency (BMKG). Disease data are grouped by diagnosis; temperature, humidity, and rainfall data. Data analysis was performed with Microsoft Excel 2016 in the form of a frequency chart and descriptive. The results of the analysis between the incidence patterns of FPV, FIP, FCV, Feline Viral Rhinotracheitis (FVR), and Papilloma with climatic conditions in the dry and rainy season periods show patterns that vary depending on the character of the virus that causes the disease. High incidence in the rainy season is seen in FPV and FCV, for FIP the incidence of each season is almost the same in each year, whereas the incidence of FVR and Papilloma can be higher in the rainy season and sometimes also can be higher in the dry season. These findings indicate that the incidence of viral diseases in cats has a seasonally based pattern of events.

Keywords: viral disease, cat, climate, animal hospital, season.

1. Introduction
Based on research findings of Fidyaningsih et al. [16] in a study entitled “Expert System for Diagnosing Cat Diseases Using the Case-Based Reasoning Method”, there are several diseases in cats caused by viruses, for example, cat flu which can be caused by Feline Herpesvirus and Feline Calici Virus (FCV), then there is Feline Leukemia Virus which caused by Retrovirus and Feline Panleukopenia Virus (FPV) caused by Feline Parvovirus. The incidence of viral disease in cats depends on the environment, for example, cases of FCV have a prevalence rate at the home of 10%, while the prevalence in captivity is 25-40% [35]. An example of a case of FPV disease has been reported, namely, as many as 236 cats suffering from panleukopenia at a Veterinary Clinic in Jakarta. The prevalence rate of FPV virus infection is believed to be high, but only a few studies have been reported in Indonesia [36].

The environment became one of the factors in the emergence of viral diseases. Climate change that occurs in the environment is a condition of changes in climate variability, including temperature, rainfall, and humidity. Climate change can affect individual health, especially in fighting diseases that
are sensitive to climate variations. Many studies have been conducted to study the impact of climate change in the health sector, but research on the impact of climate change on infectious diseases is still limited [7]. Viral diseases in cats are quite diverse, by looking at the incidence of the emergence of a disease in certain seasons, this study was conducted to describe the pattern of viral diseases in cats diagnosed at the Animal Hospital (RSH) Prof. Soeparwi based on the period of the season.

2. Study Site and Methods

2.1 Data collection

The data used for this study were taken from the medical records of cat patients at the Animal Hospital (RSH) Prof. Soeparwi from 2017 to 2019. Data on rainfall, humidity, and temperature in the Special Region of Yogyakarta in 2017-2019 were obtained from the Meteorology, Climatology and Geophysics Agency (BMKG) Yogyakarta Geophysics station online at http://dataonline.bmkg.go.id accessed on January 5, 2020.

2.2 Data analysis

The data collected are the medical records of patients suffering from viral diseases at RSH Prof. Soeparwi from 2017 to 2019. The data obtained were categorized based on the etiology of viral diseases in cats. The climate parameters are temperature, humidity, rainfall based on the dry season (April-September) and the rainy season (October-March). All data are arranged in tabular form per year based on the number of cases of each type of disease. Data from BMKG are the parameters of rainfall, humidity, and temperature in the Special Region of Yogyakarta. These parameters are processed in an average graph per season per year to see the patterns that appear in the dry season and rainy season in 2017-2019. The data is stored in a file using Microsoft Excel 2016 software. Descriptive analysis is presented in a graph of the combination of disease frequency and climate parameters in the dry season and rainy season in the 2017-2019 periods.

3. Results and Discussion

The number of cases of viral diseases in cats of patients at RSH Prof Soeparwi FKH UGM from 2017 to 2019 was 213 cases from 3,641 patients in 2017, 173 cases from 3,575 patients in 2018, and 199 cases from 5,495 patients in 2019. viral disease in cat patients at RSH Prof. Soeparwi during 2017 to 2019 was diagnosed with 5 diseases, namely *Feline Calicivirus* (FCV), *Feline Infectious Peritonitis* (FIP), *Feline Panleukopenia Virus* (FPV), *Feline Viral Rhinotracheitis* (FVR), and Papilloma. The accumulated cases of each viral disease in the 3 years from 2017-2019 are presented in Figure 1. There were 34 FCV cases, 121 FIP cases, 358 FPV cases, 69 FVR cases, and 3 Papilloma cases. The highest case during those 3 years was FPV.

![Figure 1. Viral diseases in cat patients at Soeparwi Animal Hospital during 2017-2019.](image-url)
The average numbers of temperature, humidity, and rainfall by season in the Special Region of Yogyakarta in 2017-2019 are presented in Table 1.

### Table 1. Average numbers of temperature, humidity, and rainfall by season in the Special Region of Yogyakarta in 2017-2019.

| Year | Temperature (°C) | Humidity (%) | Rainfall (mm/y) |
|------|-----------------|--------------|-----------------|
|      | Dry | Rainy | Dry | Rainy | Dry | Rainy |
| 2017 | 25.8±0.7 | 26.0±0.0 | 82.8±1.5 | 82.6±3.8 | 31.7±27.7 | 391.8±156.7 |
| 2018 | 25.5±1.2 | 26.5±0.5 | 82.8±1.5 | 87.8±1.8 | 8.2±9.3  | 252.8±121.9 |
| 2019 | 25.3±1.4 | 26.8±0.7 | 80.2±2.3  | 82.6±3.8 | 0.3±0.5  | 276.8±210.8 |

The average temperature range during 2017-2019 in the dry season is around 25.3-25.8°C, while in the rainy season it is around 26.0-26.8°C. The average humidity range in the dry season is 80-82.2% and the rainy season is 82.6-87.8%; while the average range of rainfall in the dry season is 0.3-31.7mm/year. The table shows the pattern of decreasing the average temperature in the dry season from 2017 to 2019 in contrast to the temperature during the rainy season which tends to increase.

3.1 Description of occurrence of Feline Calicivirus (FCV)

Calicivirus often causes disease in the respiratory tract with a transmission that occurs directly or indirectly [20]. The results of data processing show a pattern of FCV disease in the rainy season and the dry season each year which is presented in Figure 2. The pattern of the incidence of FCV disease in each season per year shows the following results, namely in 2017 the incidence of FCV during the dry season was higher than rainy season, in 2018 the incidence of FCV during the rainy season was higher than the dry season, and in 2019 the incidence of FCV during the rainy season was higher than the dry season.

![Figure 2. Disease pattern of FCV at Soeparwi Animal Hospital during 2017-2019.](image)

The pattern of FCV disease incidence in Figure 2 shows that FCV occurs more often during the rainy season with the largest increase in incidence occurring in 2019. The incidence of FCV disease that appears can be influenced by environmental factors, such as cage management, feedlots, and population density. Calicivirus can survive in the environment for a few days to several weeks on dry surfaces at room temperature and can last even longer in wet conditions in colder temperatures [3]. Higher temperatures on the earth’s surface will trigger an increase in average rainfall [29]. Calicivirus is relatively heat resistant but sensitive to acidic pH values. The incubation period of Calicivirus is two to
five days. Viral replication occurs mainly in the oropharynx [23]. According to Markey et al. [2], the prevalence of FCV in pet cats that are kept in small numbers generally has a relatively low prevalence (±10%). In contrast, cats living in large colonies or shelters usually have a higher chance of becoming infected (±25-40%).

3.2 Description of Occurrence of Feline Infectious Peritonitis (FIP)
The incidence of FIP is distributed worldwide and is a major problem in domestic cats living in large groups [2]. The results of data processing show the pattern of FIP disease in the rainy season and dry season in each year which is presented in Figure 3.

The pattern of FIP disease incidence in Figure 3 shows that in 2017 and 2018 the incidence of FIP during the dry season was as much as the rainy season and in 2019 the incidence of FIP during the rainy season was higher than the dry season. This shows that in 2017-2019, the incidence of FIP is evenly distributed in every season in every year, except in 2019 there was an increase in the incidence of FIP in the rainy season. The FIP disease pattern in Figure 3 shows that in 2019 the incidence of FIP in the rainy season was higher than in the dry season with higher temperature and humidity conditions in that year, and also the temperature in the dry season in 2019 was lower than in 2017 and 2018 (Table 3).

According to Chan et al. [10], the stability of coronavirus virions at low pH values is quite stable at pH 3. And one of the types of coronavirus that has caused the Severe acute respiratory syndrome (SARS) outbreak is known to be able to maintain its viability for more than 5 days at a temperature of 22–25°C and with a relative humidity of 40–50%. However, viral viability is lost rapidly at higher temperatures and higher relative humidity (eg at 38°C and relative humidity >95%).

Feline infectious peritonitis occurs sporadically in many domestic cats. While cats of all ages are susceptible to infection, cats younger than one year of age are more susceptible to FIP. In infected residential areas, about 15% of cats are carriers that are continuously infected and are responsible for the continuation of FIP infection in the environment [23]. This virus is found to be very common in cats and is transmitted by the oral-fecal route from cat to cat [28]. According to Markey et al. [2], coronavirus is sensitive to heat, formaldehyde, oxidizing agents, and non-ionic detergents, so the low ambient temperature makes the coronavirus easier to live.

3.3 Description of Occurrence of Feline Panleukopenia Virus (FPV)
Feline panleukopenia virus (FPV) belongs to the family Parvoviridae, is classified as a subgroup of feline parvo and this virus is highly resistant to the environment [23]. The results of data processing of viral disease patterns show the pattern of FPV disease in the rainy season and dry season each year which is presented in Figure 4.
Figure 4. Disease pattern of FPV at Soeparwi Animal Hospital during 2017-2019.

The pattern of FPV disease incidence in Figure 4 shows the following results, namely, in 2017 the incidence of FPV during the rainy season was higher than the dry season, in 2018 the incidence of FPV during the rainy season was higher than the dry season, and in 2019 the incidence of FPV during the rainy season higher than the dry season. This shows that in 2017-2019, FPV events occur more frequently during the rainy season with the largest increase in incidence occurring in 2019. This is in line with the statement of Athena and Cahorini [11] which stated that high rainfall can result in the emergence of many puddles, water leading to increased breeding grounds for bacteria, viruses, and parasites. Based on research Kelman et al. [14] who studied one type of parvovirus, namely Canine parvovirus (CPV), analyzed the incidence of CPV with climatic conditions in Australia, which gave the results that the virus could survive in a humid environment for a long time and showed a relationship between the lowest minimum temperature in the month coldest with higher reporting of CPV cases. These findings may reflect the resilience of CPV in colder environmental conditions. According to Wu et al. [34], rainfall plays an important role in the life cycle of disease pathogens. The rainy season is associated with an increase in disease agents in the feces because high rainfall can stir up sediment in the water leading to accumulation of fecal microorganisms, and also unusual rainfall after a long dry spell can cause an increase in pathogens and cause disease outbreaks.

Virion parvovirus was known to be stable in the environment for a few weeks to a few months. The virus is stable at pH values of 3-9 and 56°C for 60 minutes. Parvovirus inactivation can be carried out using formalin, beta propiolactone, sodium hypochlorite, and oxidizing agents [2]. Contaminated environments such as cages, food containers, and trash cans play an important role in the transmission of FPV [28]. According to Kusumawardhani et al. [5], in 2017, it was reported that 236 cats were diagnosed with panleukopenia at the Veterinary Clinic with drh. Cucu is located in Jakarta, and in 2015 it was reported that 97 cats were diagnosed with FPV infection at the clinic. The study shows that the prevalence rate of this disease in Jakarta has increased over the past 3 years.

3.4 Description of occurrence of Feline Viral Rhinotracheitis (FVR)
Feline viral rhinotracheitis (FVR) is an acute upper respiratory tract disease in cats that is distributed worldwide and accounts for about 40% of respiratory infections in cats [23]. The results of data processing show the pattern of FVR disease in the rainy season and dry season in each year which is presented in Figure 5.
The pattern of FVR disease incidence in Figure 5 shows the following results, namely, in 2017 the incidence of FVR during the dry season was higher than the rainy season, in 2018 the incidence of FVR during the dry season was as much as the rainy season, and in 2019 the incidence of FVR during the rainy season higher than the dry season. This shows that in 2017-2019, the incidence of FVR in the rainy and dry seasons has a slight difference in the proportion each year, except in 2018 the incidence of FVR is evenly distributed in each season. This data shows that there is no significant difference between the incidence of FVR each season and the existing climatic factors. A common characteristic of herpesviruses is the ability to create a latent infection while the host is alive which can be reactivated to cause other clinical diseases. Reactivation of herpesvirus infection is related to various factors such as population density and bad weather. One example of herpesvirus, namely canine herpesvirus 1 can replicate more efficiently at temperatures slightly below normal body temperature [2]. According to Roland et al. [26], one of the many risk factors for respiratory disease is poor air quality. Especially in closed barns without optimal ventilation, air quality, and pathogen concentrations. One type of herpes virus, namely Bovine herpesvirus 1 can survive better in dry air, and also the increased life cycle time of most other pathogens is supported by high humidity.

Reactivation and release of the virus that causes FVR can occur at any time, especially concerning stressful periods such as birth, lactation, or change of residence. Kittens from carrier mothers can be subclinically infected with FVR. These kittens can then become carriers and when they are adults the virus will continue its infection in the cat's body. The prevalence of FVR infection was higher in colony cats than domestic cats living alone. It is estimated that almost all cats that recover from FVR remain latently infected [2]. According to Lewin et al. (2018), a serological study showed that 97% of cats had been exposed to feline herpesvirus type 1 (FHV-1). More than 80% of cats will be infected continuously after exposure, and another 45% will release the virus from the body in response to stressful stimuli. Clinical signs of FHV-1 at the beginning of exposure will show symptoms of conjunctivitis, keratitis, and upper respiratory disease. This phase is usually self-limiting but can lead to permanent corneal scarring and symblepharon formation followed by blindness.

3.5 Description of Occurrence of Papilloma

Papillomavirus is an epitheliotropic, which causes proliferative lesions called papillomas on the epidermal or mucosal epithelium that are often located in certain locations on the skin [2]. The results of data processing show the pattern of papilloma disease in the rainy season and dry season in each year which is presented in Figure 6.
The pattern of occurrence of papilloma in Figure 6 shows that the number of cases of papilloma disease is very small compared to the incidence of viral diseases in other cats Animal Clinic (RSH) Soeparwi. In 2017, the incidence of papilloma appeared twice in the dry season, while in 2019 the incidence of papilloma appeared once in the rainy season. For 2018, no papilloma events were recorded. These data show that there is no significant difference between the incidence of papillomas that appear in each season with the existing climatic factors. Papillomaviruses tend to be species-specific, but sequences associated with PVs in cattle and humans have been found in cats, suggesting cross-species transmission [12]. Papillomavirus is resistant to acidic pH and heating at 60°C for 30 minutes outside the body. This viral infection is persistent and usually occurs early in the individual's birth [23]. Lesions due to PVs are most commonly observed in young animals and they usually regress spontaneously after a few weeks or months. Regression is thought to be caused by the development of immunity in the host body. In certain cases, associated with other factors, benign tumors caused by PVs can develop into malignant neoplasms [2]. According to Munday et al. [21], compared to other species that can be infected by PVs, cats are a species that is very rarely infected by this virus.

4. Conclusion
The pattern of the incidence of viral diseases in cats when compared with the existing seasonal conditions has various patterns depending on the character of the virus that causes the disease. In 2017-2019 at the Animal Hospital (RSH) Prof. Soeparwi, the incidence of FPV always occurs more in the rainy season than in the dry season. For FIP events occur evenly in every season in every year, except in 2019 there was an increase in the incidence of FIP in the rainy season. In 2017-2019, the incidence of FCV was more common during the rainy season with the largest increase in incidence occurring in 2019. Meanwhile, FVR and papilloma had the same pattern of occurrence in the rainy season and dry season.

5. Suggestion
Further research is needed to determine other environmental factors besides weather changes, such as cage management and feed management factors as a reference in anticipating disease events that will appear every year.
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References
[1] S Fidyawati, F Agus, and S Maharani. 2016. Proceedings of the Seminar on Computer Science and Information Technology 1(1) 113–119
[2] B Markey et al. 2013. *Clinical Veterinary Microbiology* 541–658
[3] A D Radford et al. 2007 *Vet. Res* 38 319–335
[4] Sulistyawati. 2015. *Journal of Public Health* 8(1) 342–348
[5] S W Kusumawardhani et al. 2018. Proc. of the 20th FAVA CONGRESS & The 15th KIVNAS PDHI.
[6] M Alfonso et al. 2017. *Vaccine* 35 2753–2760
[7] Arimbi. 2010. *Veterinaria Medika* 3(2) 109–114
[8] R A Awad, W K B Khalil, and A G Attallah. 2018. *Veterinary World* 11(5) 578–584
[9] MA Brown et al. 2009. *Emerging Infectious Diseases* 15(9) 1445–1452
[10] KH Chan et al. 2011. *Advances in Virology*
[11] Cahorini Athena Dan. 2016. *Journal of Health Ecology* 15(3) 167–178
[12] H Egberink et al. 2013. *Journal of Feline Medicine and Surgery* 15 560–562
[13] T M Fumian et al. 2018. *Viruses* 10(433) 1–16
[14] M Kelman et al. 2020. *Preventive Veterinary Medicine* 174 104816–104816
[15] A Kipar et al. 2010. *Journal of General Virology* 91 1698–1707
[16] M K Kok et al. 2019. *J. Vet. Med. Sci* 81 660–666
[17] A C Lewin et al. 2018. *Virology* 518 385–397
[18] M T Madigan et al. 2012. *Brock Biology of Microorganisms*. Benjamin Cummings, USA 237
[19] R Maes. 2012. *ISRN Veterinary Science* 2012 1–16
[20] J S Munday et al. 2007. *Vet Pathol* 44 924–927
[21] J S Munday et al. 2015. *Veterinary Microbiology* 177 289–295
[22] N C Pedersen. 2014. *The Veterinary Journal* 201 133–141
[23] P J Quinn et al. ”*Veterinary Microbiology and Microbial Disease*”. In: Wiley-Blackwell, 2001, pp. 301–386.
[24] J M M Rodriguez et al. 2017. *Veterinary Pathology* 54(6) 922–932
[25] K Rogers. 2011. *Bacteria and Viruses*. Britannica Educational Publishing, USA 119-183.
[26] L Roland et al. 2016. *J. Dairy Sci* 99 2438–2452
[27] H Satyawardhana and A Susandi. 2015. *Journal of Aerospace Science* 13(1) 1–14
[28] MA Scherk et al. 2013. *Journal of Feline Medicine and Surgery* 15 785–808
[29] E Schwoerer et al. 2008. *The Open Epidemiology Journal* 1 53–56
[30] S Sulasm et al. 2017. *Effect of Rainfall* 3(1) 22–27
[31] J P Sundberg et al. 2014. *Vet Pathol* 37 1–10
[32] I K E Supartika and G A J Dan Uliantara. 2014. *Buletin Veteriner* 26(85) 1–10
[33] S D Widhyari et al. 2018. *ARSHI Vet Lett* 2(1) 15–16
[34] X Wu et al. 2016. *Environment International* 86 14–23