

Air Ventilation in Tuberculosis Patient Care Room in Sidoarjo Regional Hospital

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Abstract:- Tuberculosis or frequently known as TB is a lung disease caused by Mycobacterium Tuberculosis bacteria colonies, this disease is transmitted through the air when a tuberculosis sufferer sneezes, coughs, spits, or even talks, where the air containing the bacteria is inhaled by another person

Today Tuberculosis is categorized as a deadly disease for centuries, because tuberculosis has claimed around 1.4 million lives, and because TB has a rapid spread, causes deadly disease, and requires a long time of treatment if someone is exposed to tuberculosis. Therefore TB control is a long-term health problem for humans. During the last 20 years, Indonesia has been ranked number 2 with the most TB sufferers in the world after the Philippines with a prevalence of 756 out of 100,000 people suffering from TB, where the most TB sufferers are in the regions of Sumatra and Java Island, with TB sufferers in Sidoarjo district reaching 2521 people in 2020

Ventilation is one of the things that plays an important role in preventing the transmission of tuberculosis infection in the hospital environment this was also proven in a study conducted by Cronin et al, and Albrer to Franchi that there was transmission of tuberculosis in areas or rooms who have little ventilational though contact with patients has been kept to a minimum accompanied by other preventive measures

At RSUD Sidoarjo, tuberculosis patients are treated in the white rose pavilion which is located far from other wards. The pavilion has 6 x 6 inpatient rooms with 3 beds in each treatment room. The inpatient room has adequate air ventilation, because there are several air vents, allowing air exchange in the treatment room, and patients in the treatment room can still get UV light without having to leave the treatment room. In addition, there is a HEPA filter on the ventilator fan and exhaust fan which can prevent the spread of tuberculosis bacteria from the treatment room.

Keywords:- Component; formatting; style; styling; insert.

I. INTRODUCTION

Tuberculosis or frequently known as TB is a lung disease caused by colonies of Mycobacterium Tuberculosis bacteria, this disease dispersed through air when people with Tuberculosis sneeze, cough, spit, or even spoke. Where the air the contain bacteria inhaled by another person.[1] Mycobacterium Tuberculosis has long history since around 20.000 – 15.000 BC infected people in Eastern Africa region, and since that time Tuberculosis infection was recorded.[2] Afterwards around 1720, for the first time the hypothesis origin of Tuberculosis was founded by Benjamin Martin an English Physician in his publication "Theory of Consumption". [3] One Hundred year later after Benjamin Martin publication, in March 24th 1883, A scientist named Robert Koch able to isolate and explaining the origin of tuberculosis disease, which was later published in physiology conference in Berlin, and afterwards Robert Koch was known for his discovery of Mycobacterium Tuberculosis [4][5]

Nowadays, tuberculosis categorized as a deadly disease for centuries, as it was taken out 1,4 Million lives, rapidly spread, causing another deadly disease, and need long time for treatment when someone has infected with Tuberculosis. And because of that Tuberculosis prevention still a major health problem for humanity. [6][7] In last 20 years, Indonesia has 2nd largest Tuberculosis infected people in the World after Philippine, [8] where the most Tuberculosis infected people are in Sumatra and Java island, with a prevalence 756 out of 100.000 are infected, especially in Sidoarjo Region has 2521 people with tuberculosis in 2020. [9][10]

In accordance to Nica who had conducted a research in 1955, healthcare setting had higher rate of tuberculosis transmission among it's user with approximately 3-6 more infectious to healthcare workers. Therefore as a tuberculosis prevention in healthcare setting, tuberculosis patient needed a special care room, due to correlation between room space with highness rate of tuberculosis infection.[11] Aside from room spaces, ventilation play an important role of prevention from tuberculosis infection, beside from its's main purpose as ventilation for patient, healthcare workers, and visitors to remain pleasant.[12] Air ventilation had an additional function such as temperature control, humidity control, airborne disease prevention such as tuberculosis.[13]. Air ventilation is one of non medical approach airborne disease prevention such as tuberculosis.[14] Therefore, this paper aims to describe and analyze air ventilation in Tuberculosis care room in Sidoarjo Regional Hospital.

II. METHODS

Data collected using survey methods, then processed using descriptive – analytic methods, which the authors describe then analyze the condition of rooms., this pavilion had 6x6.

In Sidoarjo Regional Hospital tuberculosis patient are treated in white rose pavilion which located far from other wards, this pavilion had several 6m x 6m treatment room, and had 3 beds in each treatment room. For further explanation can be seen in figure below.

III. DISCUSSION AND RESULT

A. Discussion

Ventilation played an important role in prevention of tuberculosis incetion in healthcare settings[15], this was also proven in a study conducted by Cronin and Albertus Franchi there was a transmission of tuberculosis in a room with inadequate ventilation.[16][17] Although contact with patient has been kept to minimum, accompanied with other strict prevention measure.[18][19]



Fig. 1: White rose pavilion, it's exact location can be seen in number 44

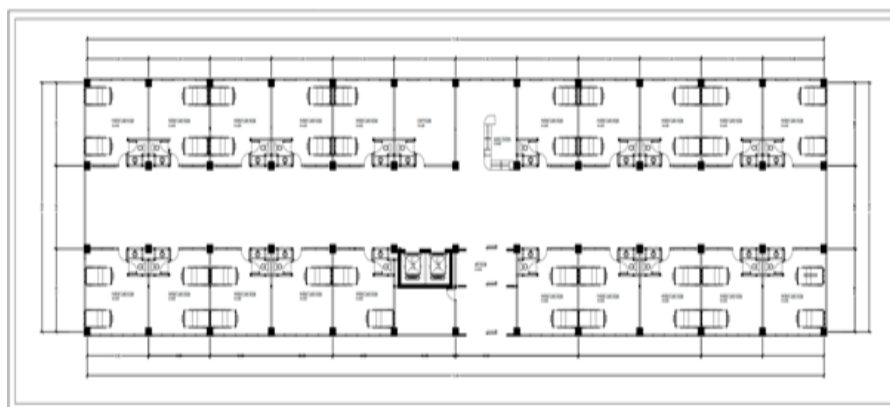


Fig. 2: White rose pavilion, ground floor plan

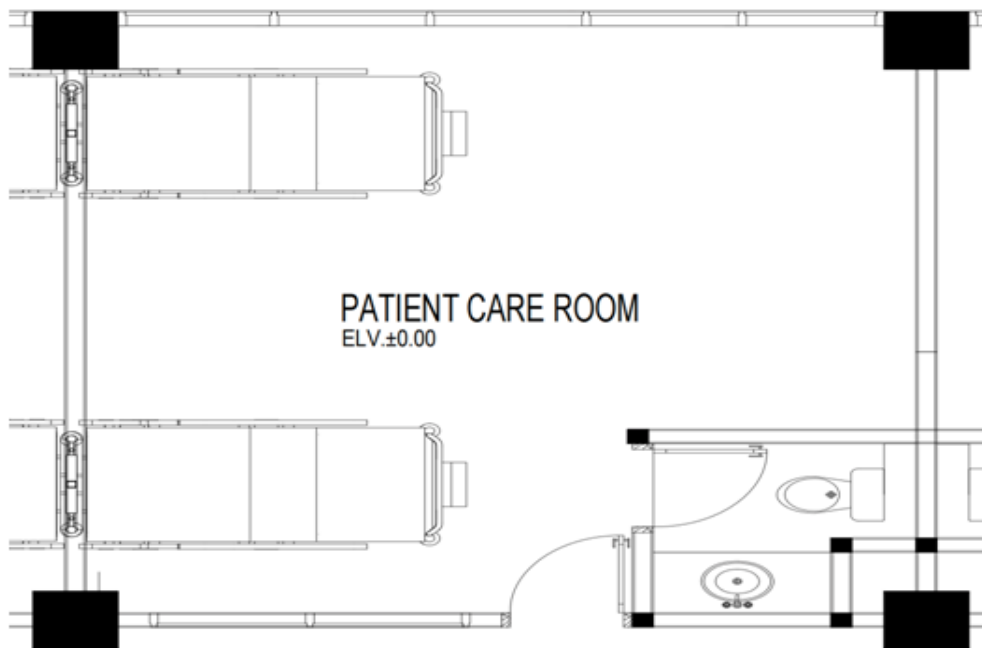


Fig. 3: Detailed treatment room floor plan in white rose pavilion, Sidoarjo Regional Hospital

In this treatment room there are openings that faced to to pavilion corridor and faced to the yard. The openings that faced in pavilion corridor are in shape of solid glass window, yet the opening which faced in the yard are in shape of window that can be opened form inside, and also there is a louvre above the windows which functioned as an air circulation. The openings which is faced to the pavilion corridor more functioned as tool for viewing patient condition, rather than for air circulation. Meanwhile the openings which is faced in the yard has function for air circulation, and for patient to get UV light without going outside, considering the UV light is also one of tuberculosis prevention measurement in healthcare settings, known as UVGI.[20] Aside from openings there also a ventilator fan,

which placed in the ceiling and functioned as an air intake from outside room to treatment room. the ventilator fan has a HEPA filter inside it, to filter air from the outside to be free of contaminant which could worsening patient condition. There also an exhaust fan in this room, which placed under the window opening, has function for circulating air inside the room to outside. Ventilator fan work by sucking outside air and streamed to series of filter, after passing some filter the air streamed to heating coil, cooling coil and HEPA filter, then streamed to the treatment room. Exhaust fan also has same working methods, but in reverse. Further explanation can be seen in figure below:

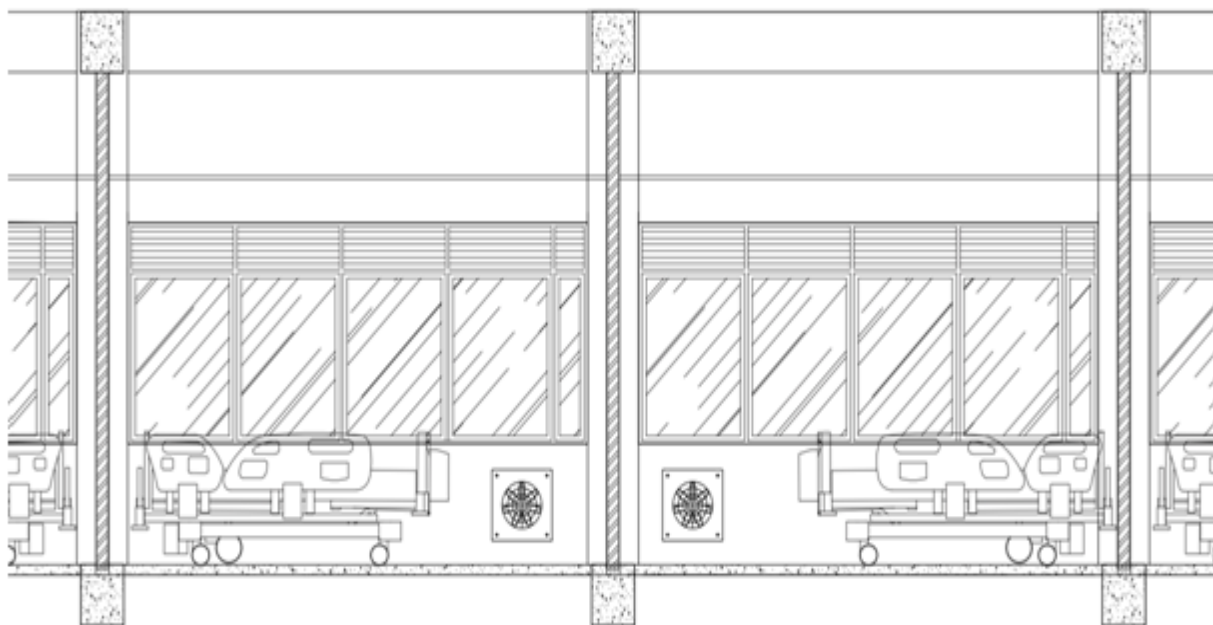


Fig. 4: Section 1, view of ventilation, openings, and exhaust fan which is placed facing the yard

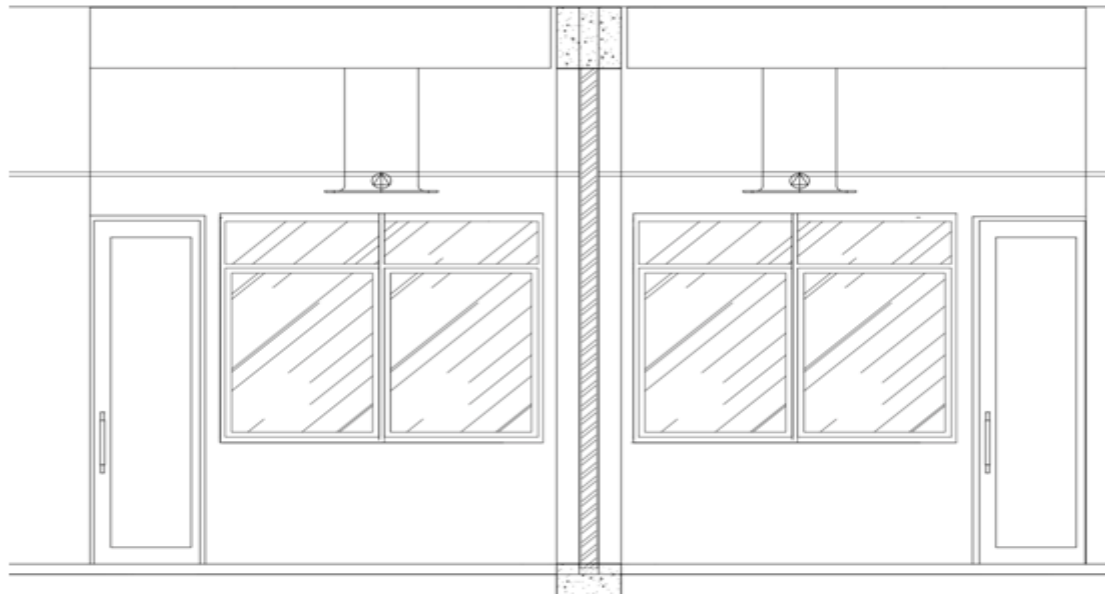


Fig. 5: Section 2, view of ventilation, openings, and exhaust fan which is placed facing the pavilion corridor

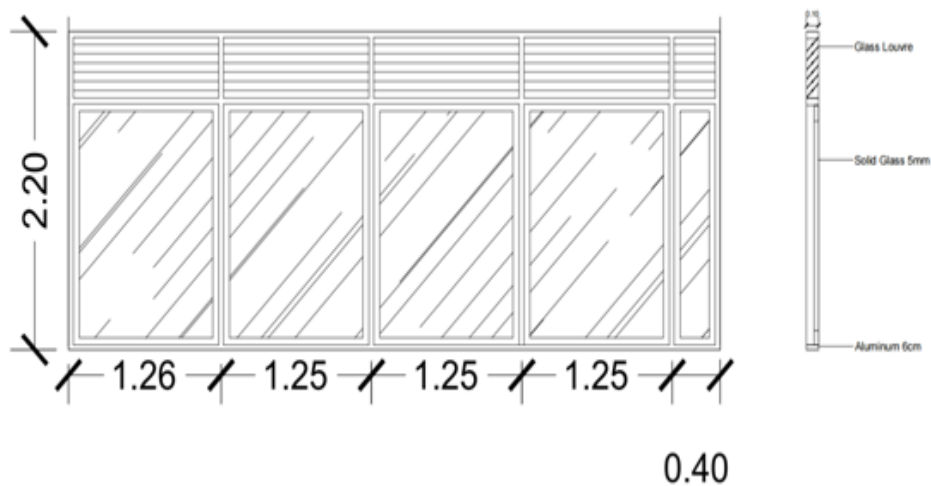


Fig. 6: Detailed view of ventilation and opening 1

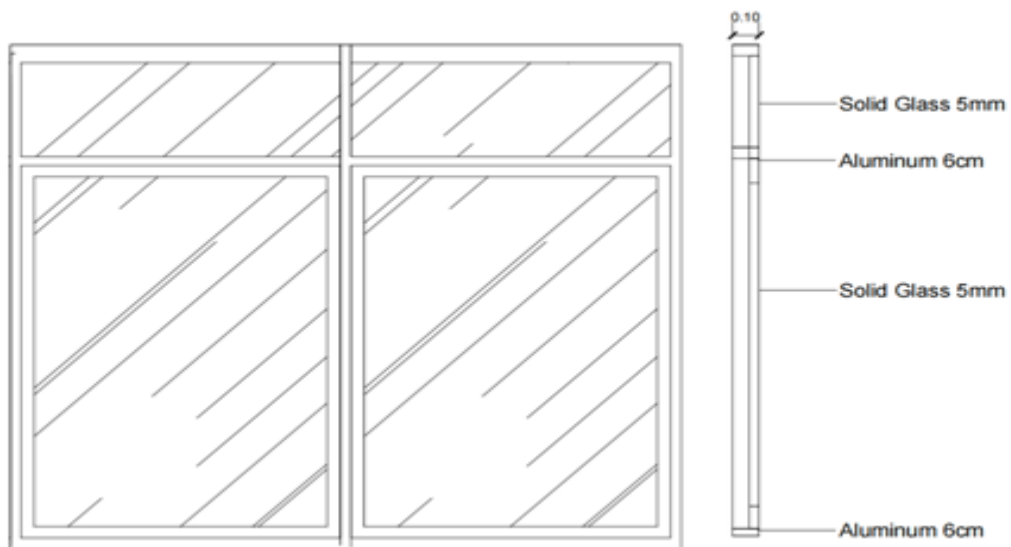


Fig. 7: Detailed view of ventilation and opening 2

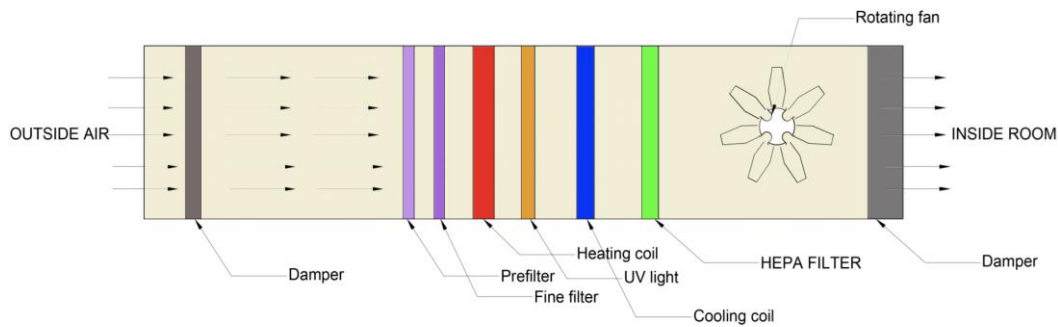


Fig. 8: Ventilator fan or Exhaust fan mechanism

B. Result

Tuberculosis treatment room in Sidoarjo Regional Hospital has an adequate ventilation, which able to maintain air circulation within room, and patient who are inside the room are still able to get UV light without going outside. Some series of filter and HEPA filter which placed inside ventilator fan, and exhaust fan are great way to prevent tuberculosis from spreading, although it must be maintained properly with proper handling.

IV. SUMMARY

Tuberculosis is a deadly airborne disease caused by mycobacterium tuberculosis, which has present on earth since around 20.000 – 15.000 BC. In 1883 Robert Koch was able to isolate and explaining bacteria that caused tuberculosis. Nowadays, Indonesia had the largest people with tuberculosis infection after philipine, where the most Tuberculosis infected people are in Sumatra and Java island, with a prevalence 756 out of 100.000 are infected, especially in Sidoarjo Region has 2521 people with tuberculosis in 2020. In accordance from a study conducted by Nicas in 1995, healthcare workers has 3-6 times higher infection rate than non healthcare workers. Therefore tuberculosis prevention measurement are needed in healthcare settings, which one of prevention measure is from air ventilation.

In Sidoarjo Regional Hospital, tuberculosis infected patients are treated in white rose pavilion which is far from other wards, this pavilion has an adequate ventilation to prevent tuberculosis spread. The ventilation are able to maintain air circulation within rooms, the HEPA filter which placed inside the ventilator fan and exhaust an also play an important role of keeping the air free from contaminant.

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