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Effectiveness of Oral hygiene with Chlorhexidine in the Prevention of VAP: Literature Review

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A B S T R A C T

Ventilator Assisted Pneumonia (VAP) is the most well-known nosocomial disease that occurs 48 hours after a patient is intubated on a ventilator in the ICU. The incidence of VAP can increase the length of stay of patients in the ICU, increasing patient morbidity and mortality. One of the efforts to prevent VAP is to perform oral hygiene. This study aim to determine the effectiveness of chlorhexidine in oral hygiene on the prevention of VAP. The method consists of five stages, namely, identifying questions, identifying relevant articles using the Google Schoolar, PubMed, and Scopus databases with keywords. The selection of articles using PRISMA Flowchart and data extraction compiled, summarized and reported the results. The inclusion criteria were articles related to the effectiveness of chlorhexidine, lactoperixidase with the occurrence of VAP, articles published from 2010 to 2021, full text articles in English and Indonesian, the patient population was patients on ventilators. Results Of the 55 articles relevant to the title and abstract, 6 articles met the inclusion criteria. Where 0.2% chlorhexidine is more effective in reducing the risk of VAP. Although chlorhexidine 0.2% is more effective than lactoperoxidase, other agents can be used in the field to prevent VAP. It was concluded from the six existing articles that 0.2% chlorhexidine was more effective in reducing the risk of VAP, to prevent infection other alternatives could be used, namely 0.1% chlorhexidine, Echinacea ingredients, lactoperoxidase solution and listerin.

Kata kunci:

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A B S T R A K

Ventilator Assisted Pneumonia (VAP) merupakan penyakit nosokomial paling terkenal yang terjadi 48 jam setelah pasien diintubasi pada ventilator di ICU. Kejadian VAP dapat meningkatkan lama rawat pasien di ICU, meningkatkan morbiditas dan mortalitas pasien. Salah satu upaya pencegahan VAP adalah dengan melakukan oral hygiene. Penelitian ini bertujuan untuk mengetahui efektivitas klorheksidin dalam kebersihan mulut dalam pencegahan VAP. Desain tinjauan pustaka dengan artikel yang relevan menggunakan database Google Schoolar, PubMed, dan Scopus. Kriteria inklusi adalah artikel terkait efektivitas klorheksidin, laktoperiksidase dengan terjadinya VAP, artikel terbitan 2010 sd 2021, artikel full text dalam bahasa Inggris dan Indonesia, populasi pasien adalah pasien yang menggunakan ventilator. Enam artikel digunakan dalam review. Dimana klorheksidin 0,2% lebih efektif dalam menurunkan risiko VAP. Meskipun klorheksidin 0,2% lebih efektif daripada laktoperoksidase, agen lain dapat digunakan di lapangan untuk mencegah VAP. Untuk mencegah infeksi dapat digunakan alternatif lain yaitu klorheksidin 0,1%, bahan Echinacea, larutan laktoperoksidase dan listerin. Klorheksidin 0,2% lebih efektif dalam menurunkan risiko VAP.

INTRODUCTION

Ventilator Associated Pneumonia (VAP) is the most common nosocomial infection occurring 48 hours after a patient is intubated on a ventilator in the ICU(World Health Organization Department of Communicable Disease, 2002). Incidents of VAP can have far-reaching implications not only for the patients themselves but also for their families, hospital health workers and even the country at large. There have been many previous studies showing that VAP worsens the patient's condition, increases mortality, increases the need for care, use of antibiotics and other diagnostic tests, and increases length of stay and other treatment needs (Koenig, SM, and Truwit, 2006). This impact then has implications for increasing the workload of health workers and hospitals as well as having a financial impact on patients, families and the government in general as well as having an impact on customer (community) dissatisfaction and a bad image of existing health service facilities (Ministry of Health RI, 2020). Thus it can be concluded that VAP has a broad impact so it is very important to seek prevention (Torres A, Niederman MS, Chastre J, 2017).Mikroorganisme gram negatif adalah penyebab utama VAP (CDC, 2021). Mikroorganisme yang menyebabkan VAP antara lain *enterobacteria aerobik (25%), Staphylococcus aureus (20%), Pseudomonas aeruginosa (20%), Haemophilus influenza (10%), dan streptokokus*(Timsit JF, Esaied W, 2017). 76% bakteri penyebab VAP menjajah mulut dan trakea(Khezri, HD, Zeydi, AE, Firouzian, A., Mahmoodi, G., Kiabi, FH, Moghaddasifar, 2014).

Previous studies have shown that VAP caused by Pseudomonas aeruginosa, Acinetobacter spp., and Stenotrophomonas maltophilia causes higher mortality rates. VAP occurs as a result of the entry of microorganisms into the lungs which is influenced by many factors. The type and duration of ventilator use and the quality of care such as oral hygiene, hand washing, and use of sedation and antibiotics are factors associated with the incidence of VAP (Koenig, SM, and Truwit, 2006).

Oropharyngeal colonization is a major risk factor for the development of VAP (Khezri, HD, Zeydi, AE, Firouzian, A., Mahmoodi, G., Kiabi, FH, Moghaddasifar, 2014). In addition, the severity of the disease and the number of organ failures that occur are factors that also increase the risk of VAP (World Health Organization Department of Communicable Disease, 2002). Based on this, the prevention of VAP is very important for health workers, especially nurses. VAP can be prevented by reducing the number of microorganisms in the oral cavity. Therefore, oral hygiene is one of the important nursing interventions to prevent VAP. Previous studies have reported that reliable and routine/comprehensive oral hygiene practices can reduce the risk of VAP by up to 60%(Khezri, HD, Zeydi, AE, Firouzian, A., Mahmoodi, G., Kiabi, FH, Moghaddasifar, 2014).

Materials that are often used for oral hygiene include water, sterile water, oxygenated water and saline solution, bicarbonate of water, hydrogen peroxide, lactoferoxide, biotene gel and chlorhexidine (Bassan, LT, Peres, MPSDM, Franco, 2018). Of these, chlorhexidine is the one with the most reviews of its effectiveness in reducing mouth microbes and preventing VAP. Chlorhexidine is an antisepsis and disinfectant agent that has bactericidal and bacteriostatic properties. Gram (+) and gram (-) bacteria are often used in special health practices in personal care such as in toothpaste and oral cleansers (Purnama A., Fikri, 2020). Various previous studies have proven the effectiveness of using chlorhexidine in reducing the number of colonizing microorganisms in the oral cavity so as to reduce the risk of VAP (Carvajal, C; Pobo, A; Diaz, E; Lisbon, T; Llauradó, M; Rello, 2010). Both the use of 0.12% chlorhexidine and 0.20% chlorhexidine both have the same effect, namely being able to reduce colonization of microorganisms in the mouth, thereby reducing the risk of VAP (Gershonovitch, R., Yarom, N., & Findler, 2020). However, when comparing its effectiveness, 0.20% chlorhexidine was more effective than 0.12% chlorhexidine (Nicolosi, LN, Rubio, M, d. C., Martinez, CD, González, NN, Cruz, 2014). The use of chlorhexidine using a manual or machine toothbrush has also shown the effectiveness of chlorhexidine in reducing bacterial colonization in the mouth and in preventing VAP (Silva et al., 2021). The effectiveness of chlorhexidine will be more effective when accompanied by other oral care protocols such as binding and removal of biofilms (Pinto, A., Silva, B., Santiago-Junior, JF, & Sales-Peres, 2021). However, in another study it was stated that the use of chlorhexidine should be done with caution because it has a risk of inflammation and even advertising reactions that can cause irritation to other allergic reactions that can be life-threatening (Lim, K., Kam, 2008). Based on these data, it can be concluded that chlorhexidine is one of the antisepsis ingredients that can be used in oral hygiene to reduce bacterial colonization in the mouth, reduce the risk of VAP but must be used with caution because it has the potential to cause sensitivity reactions to chlorhexidine
ingredients.Selain *chlorhexidine* , *lactoperoxid* juga merupakan bahan yang dapat digunakan untuk *hygyene oral.*

Lactoperoxidase or lactoperoxidase (LPO) is a natural enzyme produced by the body, especially by the salivary, tear, milk and other body parts that function as a humoral immune response against bacteria, fungi and viruses in the mucous membranes, especially in the oral cavity. The lactotoxiceroxidase system causes the oxidation of microbial amino acid proteins, which results in impaired function, division and death of microorganisms. This is what causes the lactoperoxid enzyme to have an antimicrobial effect (Magacz, M., Kędziora, K., Sapa, J., & Krzyściak, 2019). Several previous studies reported that the lactoperoxide enzyme was effective in reducing the accumulation of microorganisms in the oral cavity and reducing the risk of VAP (Vyas, N., Mathur, P., Jhawar, S., Prabhune, A., Vima, 2021). Thus it can be concluded that the lactoperoxid enzyme is also an alternative choice for oral hygiene .

Both chlorhexidine and the enzyme lactoperoxide have been demonstrated to be powerful in diminishing microbial colonization in the oral hole and lessening the gamble of VAP.Based on this, the authors are interested in comparing the effectiveness of the two ingredients (chlorhexidine, lactoperoxid enzymes) with the standard listerine ingredients that are generally used. It is hoped that the results of this review literature can be a recommendation for nurses, especially hospitals to develop SOPs for oral hygiene interventions so that they can be used consistently so as to prevent VAP.

METODE

The method that the author uses to get articles to be included in the literature review by using a systematic approach and selection process. Sources of literature are searched from national and international databases, including: PubMed, Google Schoolar, Scopus. With

keywords *Efectivity AND*, Oral hygiene AND *, Chlorhexidine AND *, Ventilator associated pneumonia and prevention * , Activity mouth care AND * , which is* described in the table with inclusion criteria: Articles related to the effectiveness of chlorhexidine, lactoperixidase with the occurrence of VAP, Articles published from 2010 to 2021, Articles in English and Indonesian full text, The patient populace is patients who are on ventilators. All significant articles were examined in view of value and importance to the survey subject, questions and targets of the writing audit. To coordinate articles, the writer utilizes catalog programming to assist with arranging articles.This writing has also passed the end note review process to determine the quality of the article using the critical appraisal tool from the Joanna Briggs Institute (JBI) . Reviev is done by schema or tree diagram (PRISMA)

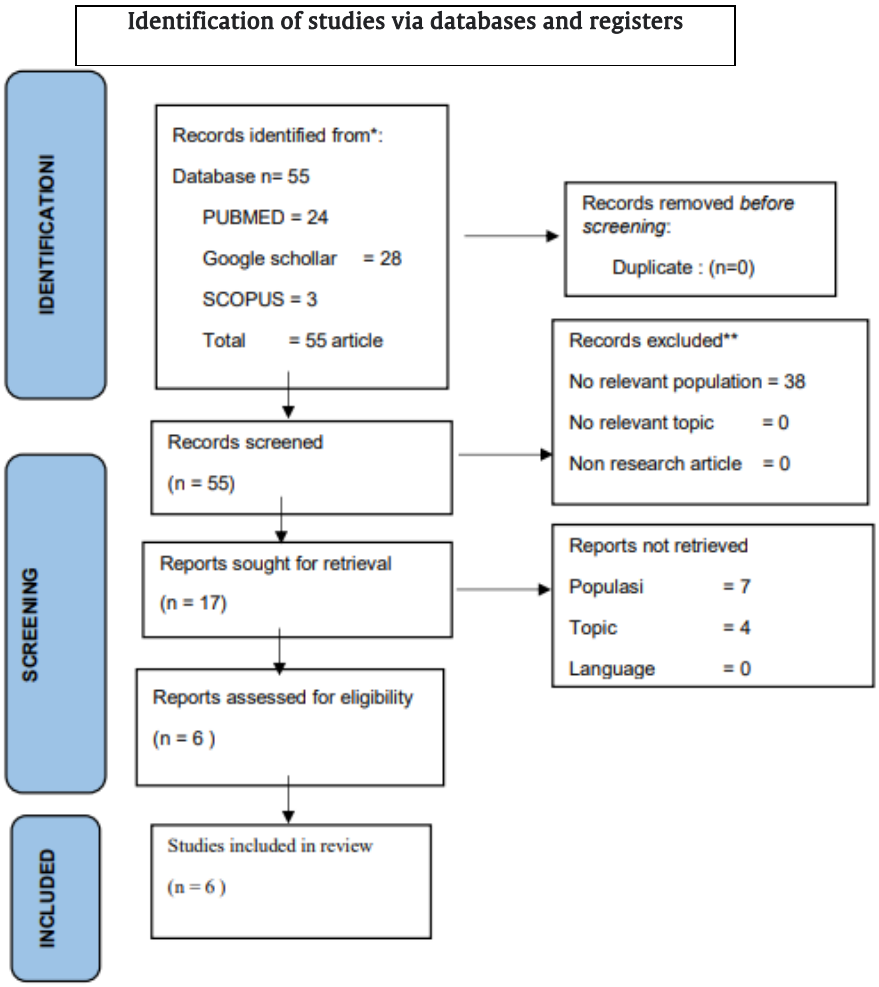

Figure .1 Schematic / tree diagram (PRISMA)

RESULTS AND DISCUSSION

Search results from PubMed, Scopus, and the Google Schoolar database with the keywords: 55 research articles were found, then screening was carried out to find 55 articles, then selection through abstracts got 17 articles. The final stage by reading full text obtained 6 articles to be reviewed. By Population and Articles The sample reviewed was limited to ventilated patients in the ICU.

Based on the results of the six existing literature reviews according to:

(Nicolosi, LN, Rubio, M, d. C., Martinez, CD, González, NN, Cruz, 2014), a lower occurrence of VAP and more limited clinic stays were seen in the mediation bunch. Moreover no tremendous contrast in all-cause in-emergency clinic passing was seen between the gatherings. The gamble of creating pneumonia after medical procedure was multiple times higher in the benchmark group. Subsequently, oral cleanliness and mouthwash with controlled chlorhexidine have been demonstrated to be viable in diminishing the rate of VAP.

(Tuon, F.F; Gavrilko, O; Almeida, S; Sumi, E. R; Alberto, T; Rocha, J. L; Rosa, 2017) After affirmation, multidrug-safe microorganisms, including carbapenem-safe Klebsiella pneumoniae, created. The CHX bunch had a lower rate of methicillin-safe Staphylococcus aureus contrasted with the fake treatment bunch for OM. There is high arrangement among OM and DP social results. VAP created in six patients. The species recognized following tracheal desire of VAP patients were like those found in OM for four cases. The strain showed low MICs and MBCs for CHX. Despite the fact that DP was quickly colonized by MDR microorganisms, the utilization of 2% CHX decreased the rate of S. aureus colonization.

(Vyas, N., Mathur, P., Jhawar, S., Prabhune, A., Vima, 2021), the consequences of the review reasoned that oral treatment with 0.20% chlorhexidine was more compelling

than oral treatment with 0.12% chlorhexidine in counteraction of VAP in precisely ventilated patients.

(Welk, A., Patjek, S., Gärtner, M., Baguhl, R., Schwahn, C., & Below, 2021), The results showed that lozenges containing the complete LPO system, inhibited plaque regrowth and reduced cariogenic bacteria, could be used in daily oral hygiene. The p value between A and B was p = 0.0123.

(Galhardo, L. F., Ruivo, G. F., Santos, F. O., Ferreira, T. T., Santos, J., L Eão, M. V., & Pallos, 2020), The results show that there is a tendency to decrease the riskof VAP subsequent to carrying out oral consideration conventions (opportunity proportion = 0.64-95% CI: 0.39-1.04). There was likewise a decrease in the rate of early pneumonia (as long as 72 hours of hospitalization). Concerning the causative specialist of disease, in spite of the fact that Gram-negative microscopic organisms prevailed in the two review periods, there was a diminishing in instances of Staphylococcus aureus contamination. The oral consideration convention measurably altogether diminished the gamble of growing early VAP in ICU patients, there by showing the barrenness of multidisciplinary collaboration for hospitalized

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Tabel 1. Evaluation and ekstraction of reviev article

Author/year	Title	Resesarh design	Criteria inklusi	Purpose	Periodic intervention	Result
(**Nicolosi, LN, Rubio, M, d. C., Martinez, CD, González, NN, Cruz, 2014**)	Impact of Oral Hygiene and 0.12% Chlorhexidine Gluconate Oral Rinse in Preventing Ventilator-Associated Pneumonia After Cardiovascular Surgery, Respiratory Care,	Quasi-experimental	Inclusion criteria: patients scheduled for CVS requiring sternotomy. All patients in Group 1 signed a consent form. Exclusion criteria: patients requiring crisis medical procedure, patients who kicked the bucket inside the initial 48 hours after medical procedure, patients with preoperative disease, patients getting anti-microbial treatment for 30 days before medical procedure, patients getting immunosuppressive treatment or who were easily affected to chlorhexidine gluconate, and totally innocuous patient.	To determine the effect of brushing teeth plus *chlorhexidine mouth rinse* 0.12% gluconate in preventing VAP after Cardiovascular surgery (CVS).	The intervention group received tooth brushing intervention plus 0.12% chlorhexidine gluconate oral rinse, the control group (historical control) were those who received standard oral hygiene care. The patients rinsed their mouths with 0.12% chlorhexidine gluconate every 12 h for 3 days.	The 210 patients scheduled for elective CVS, as per the consideration/prohibition measures, these 150 patients were signed up for the convention for oral sterilization under the oversight of a dental specialist (Group 1) and contrasted and a gathering of 150 patients who got CVS in previous years, without prior oral decontamination surgery (Group 2). A lower rate of VAP was seen in Group 1 (2.7%, 95% CI 0.7-7.8) contrasted with Group 2 (8.7%, 95% CI 4.9-14.7) (P .04). By and large, chance of creating VAP after medical procedure multiple times higher in patients not getting oral cleaning (3.9, 95% CI 1.1-14.2). Not massive contrasts saw between bunches in regards to. In the excess diseases, a critical decrease long of clinic stay was seen in Group 1 (9 3 days, 95% CI 8.5-9.5) contrasted with Group 2 (10 4 days, 95% CI 9.4 - 10.6) (P 0.01). No huge contrast in all-cause in-medical clinic mortality was seen between the gatherings: 5.3% (n 8) and 4.7% (n 7) (P 0.99) for every one of the patients getting (Group 1) and didn't get (Group 2) oral sterilization.
(**Tuon, F.F; Gavrilko, O; Almeida, S; Sumi, E. R; Alberto, T; Rocha, J. L; Rosa, 2017**)	Prospective, randomized, controlled study evaluating early modification of oral microbiota following admission to the intensive care unit and oral hygiene with chlorhexidine	prospective, randomized, double-blind controlled trial in 16 patients on mechanical ventilation	patients on mechanical ventilation	evaluated the incidence of bacterial pathogens associated with VAP and the extent of dental plaque in the oral cavity in chlorhexidine-treated patients	intervention group receiving oral cleansing using 15 mL 2% chlorhexidine digluconate where this liquid is gently brushed onto the gums, oral mucosa and tongue twice a day until discharge from the ICU, whereas in the control group patients underwent gargling with 0.9% NaCl solution	found that the intervention group had a lower incidence of methicillin-resistant Staphylococcus aureus (MRSA) than the control group. Thus this study concluded that the use of 2% chlorhexidine reduced the incidence of S. aureus colonization
(**Vyas, N., Mathur, P., Jhawar, S., Prabhune, A.,**	Chlorhexidine Mouthwash with 0.12% and 0.2% Concentration on	randomized twofold visually impaired concentrate on plan in 140 patients in a	patients in basic consideration units requiring mechanical ventilation for over 48	for determine the concentration of *chlorhexidine* mouthwash the	for determine the concentration of *chlorhexidine* mouthwash the most effective way to	The outcomes presumed that oral treatment with 0.20% chlorhexidine was more successful than oral treatment with 0.12% chlorhexidine in the anticipation of VAP in precisely ventilated

Vima, 2021)	Incidence of Ventilator Associated Pneumonia (VAP) in Intubated Patients - A Parallel arm Double Blind Randomized Controlled Trial, Annals of Orang Medical and Dental Research	basic consideration unit requiring mechanical ventilation for over 48 hours	hours	most effective way to prevent VAP, with minimal side effects	prevent VAP, with minimal side effects	patients
(Welk, A., Patjek, S., Gärtner, M., Baguhl, R., Schwahn, C., & Below, 2021)	Antibacterial and antiplaque efficacy of a lactoperoxidase - thiocyanate-hydrogen-peroxide-system-containing	design *cross-over* four test	Patient on ventilator	for evaluate effectiveness two lozenges _ cleanliness mouth that contains *lactoperoxidase - thiocyanate-hydrogen peroxide system (LPO-system)* in cleanliness mouth	compare group control A that receives drug gargle (Listerine) and group intervention B and C receiving lozenges _ for 4 days	Results study this report that lozenges containing complete LPO system capable hinder growth return plaque and reduce bacteria cariogenic so that could used in cleanliness mouth everyday
(Safarabadi, M., Ghaznavi-Rad, E., Pakniyat, A., Rezaie, K., and Jadidi, 2017)	*Contrasting the Effect of Echinacea and Chlorhexidine Mouthwash on the Microbial Flora of Intubated Patients Admitted to the Intensive Care Unit*	*double blind, randomized clinical trial*	patients who use intubation trachea through mouth	compare effect two solution drug gargle (chinacea and *chlorhexidine*) against microbial flora cavity mouth patients admitted to the care unit intensive	group intervention accept care in the form of drug gargle given use drug gargle echinacea 0.01% while group control receive chlorhexidine 0.2% 15 ml twice daily for each group	Results study show both of them effective reduce microbial flora cavity mouth however solution chinacea more effective in reduce microbial flora cavity mouth patient in care unit intensive . Researcher recommend use Echinacea herb as alternative for *chlorhexidine*
(Galhardo, L. F., Ruivo, G. F., Santos, F. O., Ferreira, T. T., Santos, J., L Eão, M. V., & Pallos, 2020)	*Impact of Oral Care and Antisepsis on the Prevalence of Ventilator-Associated Pneumonia. Oral health & preventivedentistry*	a *retrospective study* comparing receiving group _ intervention care mouth use *chlorhexidine* and a control group that received standard oral hygiene care	Patients on a ventilator	for evaluate impact care mouth and use *chlorhexidine gluconate* to prevention of ventilator-associated pneumonia (VAP) in patients	The intervention protocol included: the oral cavity was aspirated with a sterile aspirate before brushing with *chlorhexidine gluconate* (0.12%) and by using a disposable toothbrush. Next, sterile gauze soaked in a saline solution is used to clean the	Results show there is trend drop risk occurrence of VAP after application protocol care mouth. Besides that there is drop incidence of early pneumonia up to 72 hours of hospitalization stay, regarding with agent reason infection, found there is drop case infection due to Staphylococcus aureus. With thereby protocol care mouth event significant reduce risk early VAP development on ICU patient

		admitted to the care unit intensive care unit (ICU)	oral mucosa. Finally, the remaining salivary contents of the oral cavity are aspirated again	

CONCLUSION :

It was finished up from the six existing articles that 0.2% chlorhexidine was more successful in decreasing the gamble of VAP, to prevent infection an alternative to 0.1% chlorhrxidine, Echinacea herb, lactoperixidase solution and listerine could be used. Where the researchers recommend the following research to be able to continue research on the effectiveness of chlorhexidine compared to other ingredients. The results of this study can provide recommendations for hospitals related to improving standard operating procedures in carrying out *oral hygiene actions* in the ICU. It is hoped that if the recommendations from this study can be implemented properly and consistently by nurses, it is expected to reduce the incidence of VAP in hospitals.

LIMITATION OF THE STUDY

This article is only limited to the search for the six databases analyzed due to the lack of research that discuses this issue and all the literature sources obtained in this study are english article

CONCLUSIONS AND SUGGESTIONS

It was concluded from the six existing articles that 0.2% chlorhexidine was more effective in reducing the risk of VAP, to prevent infection an alternative to 0.1% chlorhrxidine, Echinacea herb, lactoperixidase solution and listerine could be used. Where the authors recommend for the following research to be able to continue research on the effectiveness of chlorhexidine compared to other ingredients. The results of this study can provide recommendations for hospitals related to improving standard operating procedures in carrying out oral hygiene actions in the ICU. It is hoped that if the recommendations from this study can be implemented properly and consistently by nurses, it is normal to decrease the frequency of VAP in hospitals. A complete of 12 articles were removed, we found several things in analyzing the implementation of contacts tracing such as the impact of implementing

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The writer proclaims that thre is no irreconcilable situation in the composition and distribution of this paper. This paper can be represented by the creator

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