# LITERATURE REVIEW: SENSITIVITY AND SPESIFICITY OF qRT PCR METHOD IN DETECTING SARS-COV-2 IN 3 TYPES OF SPECIMEN

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## *ABSTRACT*

***Introduction****: At the end of December 2019, the world was shocked by the emergence of a new virus originating from the city of Wuhan, China. This virus was given the name by the World Health Organization (WHO) namely Severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) and the name of the disease as Coronavirus disease (COVID-19). Until now, there is no specific therapy for SARS-CoV-2 and other anti-coronaviruses. The gold standard method for the examination of SARS-CoV-2 is the Quantitative Reverse Transcription-Polymerase Chain Reaction (qRT-PCR) method. The qRT-PCR method has sufficient sensitivity to detect early infection.* ***Methodology****: This study used the Systematic Literature Review (SLR) method with 2 journals related to the sensitivity and specificity of the qRT-PCR method in detecting SARS-CoV-2. Literature search is done by tracing the results of scientific publications through the PubMed database.* ***Research findings****: Clinical samples that were positive for 24 non-SARS-CoV-2 respiratory viruses when tested with the Real Time SARS-CoV-2 test were negative for SARS-CoV-2. The results of nasal swabs samples obtained sensitivity and specificity of 100%, for throat swabs samples obtained sensitivity of 97% and specificity of 100%, for sputum samples had a sensitivity of 94% and specificity of 100%.* ***Conclusions****: The sensitivity of the qRT-PCR method is 96% and the specificity of the qRT-PCR method is 100%.*

***Keywords****: qRT-PCR, SARS-CoV-2, , Sensitivity, Specificity*

## 1. INTRODUCTION

At the end of December 2019, the world was shocked with the emergence of a new virus originating from the city of Wuhan, China. This virus was named by World Health Organization (WHO) namely Severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) and the name of the disease as Coronavirus disease (COVID-19) [1]. The SARS-CoV-2 virus attacks human lungs, causing infections in the respiratory tract [2]. Individuals infected with SARS-CoV-2 are mostly not have symptoms or have only mild to moderate symptoms. The symptoms are similar to other flu infections [3].

In Southeast Asia, Indonesia is the country with the highest number of cases the most COVID-19 is 84,882 [4]. Until now there is no therapy specific anti-virus SARS-CoV-2 and other anti-coronavirus. Vaccination too does not yet exist so that the main treatment for these patients is appropriate therapy adapted to the patient's condition [5].

Inspection laboratory play a role important in handling COVID-19. There are two categories of laboratory tests to detect

SARS-CoV-2 is a test to detect the virus itself and detect response from hosts. Each test have advantages and disadvantages [6].

The test used to detect the response from the host is rapid antibody test. Rapid antibody test using the principle of the lateral flow assay, capable of detecting antibodies within 5-30 minutes [7]. The disadvantage of this test is that IgM is detected from day one 3-6 after exposure to the virus, while IgG starts 10-18 days after exposure to the virus [4].

The gold standard method for testing SARS-CoV-2 is the method Quantitative Reverse Transcription-Polymerase Chain Reaction (qRT-PCR). The qRT-PCR method serves to detect the virus in the patient's body through polymerase chain reaction with specific targeting primers the SARS-CoV-2 genome [7]. The qRT-PCR method has a high sensitivity adequate for early detection of infection. Therefore, this method made the gold standard by WHO and used as the main method for the detection of COVID-19.

The purpose of this study was to determine the sensitivity and specificity qRT-PCR method in the detection of SARS-CoV-2.

## 2. METHODS

### 2.1. Journal Search Strategy

The research uses the Systematic Literature Review (SLR) method by looking for theoretical references that are relevant to the problems to be taken. The literature search strategy is based on problem analysis (PICOS) and keywords and a database of research topics.

**Table 1. Analysis of problems with PICOST**

| NO | Metode PICOST | Problem Analysis |
|---|---|---|
| 1 | Population (P) | People with covid-19 |
| 2 | Intervention (I) | Examination of SARS-CoV-2 by the qRT-PCR method on 3 types of specimens |
| 3 | Comparation (C) | There is not any |
| 4 | Output (O) | The sensitivity and specificity of the qRT-PCR method |
| 5 | Study (S) | Experimental |
| 6 | Time (T) | March to May 2021 |

### 2.2. Data analysis

Based on the search for literature relevant to the theme of sensitivity and specificity of the qRT-PCR method in detecting SARS-CoV-2 in 3 types of specimens, the researchers obtained 2 international journals that met the criteria for review.

## 3. RESULTS

Based on the results of research found from 2 relevant journals and related to research on the sensitivity and specificity of the qRT-PCR method in detecting SARS-CoV-2 in 3 types of specimens as shown in Table 2 as follows:

**Table 2. Research Results of Journals Relevant to the Research Theme**

| No | Author/Researcher and Research Title | Methods | Research findings | Conclusion |
|---|---|---|---|---|
| 1 | Debananda Sahoo,Lalatendu Mohanty,S S Panda,S N Mishra Bacteriological analysis of blood culture isolates in patients with sepsis in a tertiary care hospital of eastern India *International Journal of Contemporary Medical Research* 3(12): 3448-3450 (2016) | prospective study, Clinical data from 100 blood samples of sepsis patients | Bacterial growth in positive blood cultures as many as 26 samples with microorganisms *Escherichia .coli* (35%) *Klebsiella* (27%) *Acinetobacter baumannii* (7%) *Staphylococcus aureus* (23%) *Staphylococcus hemolyticus* (8%) | Gram Positive Bacteria 30% and Gram Negative bacteria 70% |
| 2 | Rachi Agrawal, K P Ranjan Bacteriological profile of sepsis and their antibiotic susceptibility pattern in adult patients in a tertiary care hospital of Madhya Pradesh, India. *National Journal of Medical Research*, 9(2), 65–69 (2019) | prospective study, Clinical data from 296 blood samples of sepsis patients | *Bacterial growth in positive blood cultures as many as 79 samples with microorganisms E.coli* (17%) *K.pneumoniae*(15%) *K.oxytoca(8%) Citrobacter koseri (5%) Citrobacter freundii* (1%) *Enterobacter aerogenes* (4%) *Pseudomonas aeruginosa* (7%) *Acinetobacter baumannii* (10%) *Acinetobacter lwoffii* (1%) *Staphylococcus aureus* (24%) *Staphylococcus negative koagulase* (8%) | Gram Positive Bacteria 32 % and Gram Negative bacteria 68 % |

## 4. DISCUSSION

Quantitative Reverse Transcriptase Polymerase Chain Reaction Method (qRT-PCR) is a method that determines or measures in vitro the number and presence of PCR products (DNA templates) in real time. This method also allows the detection of multiple PCR targets for assessed simultaneously [8].

The SARS-CoV-2 virus attaches to receptors in the respiratory tract, namely ACE2. Angiotensin Convert Enzyme 2 (ACE2) alone many expressed in the airways, particularly in the epithelial cells of the bronchi, alveoli, bronchial and tracheal serous glands. But, ACE2 is found in abundance in lung cells from the trachea [4]. So that the specimen recommended in detecting the SARS-CoV-2 virus is a specimen that from the respiratory tract such as a nasal swab or sputum.

In the study of Fengting Yu, et al. (2020) [12] using the Mini RNA kit Viral QIAamp QIAamp (Qiagen) to perform RNA extraction. Where the QIAamp Mini RNA Viral kit procedure uses a spin column so

that does not require phenol-chloroform. Spin column binds specifically to RNA the virus as the contaminants pass through it. Contaminants are removed in two washing step to produce pure viral RNA. And on research conducted by Degli-Angelia, et al. (2020) not explained kit the RNA used in carrying out RNA extraction, only performs dilution with RPMI for insufficient volume samples in testing. However, Degli-Angelia, et al. (2020) [11] doing test cross-reactivity against non-SARS-CoV-2 viruses in the qRT-PCR assay.

Detection rate as well as detection gene of each kit RNA qRT-PCR varies depending on the procedure in kit RNA the. But, amount copy every target qRT-PCR depending on the number of RNA-containing cells in the clinical sample [9].

Test PCR can give false negative or false positive results. Some of the factors that can affect the qRT-PCR results, namely taking specimens from the wrong place, for example upper respiratory tract specimens to test for infection in early stage and lower respiratory tract specimens are recommended for infection at advanced stage. Incorrect pick-up time, for example specimens are taken at the end of the infection or very early in the infection too affect the results.

Transport of the sample to the laboratory can determine the final result of the test. Where samples must be packaged in accordance with the guidelines of the WHO and the International Air Transport Association (IATA) in order to prevent damage and spillage of the sample. Storage of specimens affects the results of the examination. For storage of different specimens, such as a nasopharyngeal swab or oropharyngeal swab, it should be stored at 4°C for <5 days of storage and for storage duration of >5 days at a frozen temperature of -70°C, while sputum specimens should be stored at 4°C for a long storage time. <48 hours and for storage time >48 hours at -70°C [10].

## 5. Conclusions

Based on the results of the study on the sensitivity and specificity of the qRT-PCR method in detecting SARS-CoV-2 in 3 types of specimens, it was concluded that the sensitivity of the qRT-PCR method was 96% and the specificity of the qRT-PCR method was 100%.

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