Recent studies on knowledge, attitude, and practice toward tuberculosis among university students

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ABSTRACT
According to the World Health Organization, tuberculosis (TB) remains the most dangerous infectious disease, causing a major problem for public health globally. Lack of knowledge and negative attitudes toward TB create immense challenges in the prevention, controlling, and curing of TB disease. Students have a high risk of contracting TB. This article summarizes the knowledge, attitudes, and practices regarding TB among university students, using a literature search conducted through a PubMed electronic database in March 2020 that yielded 12 articles from a total of 64. The studies were conducted worldwide, with 5,915 university student participants. This study revealed that students in 8 out of 12 studies had poor knowledge levels, students in two of six studies had a negative attitude, and 11.6% of the students in a study had poor practices toward TB. Curriculum innovation regarding infectious diseases is needed to improve TB knowledge, attitudes, and practice among students.

INTRODUCTION
Tuberculosis (TB) is an infectious disease caused by an acid-resistant bacterium called Mycobacterium tuberculosis and is one of the 10 main causes of death (Ministry of Health Republic of Indonesia, 2018). TB symptoms are divided into respiratory and systemic symptoms (Indonesian Society of Respirologist, 2019). Respiratory symptoms consist of coughing up phlegm for more than 3 weeks, bleeding cough, and shortness of breath, while systemic symptoms include fever, decreased body weight, and night sweats (Indonesian Society of Respirologist, 2019).

According to the World Health Organization (WHO), TB remains the most dangerous infectious disease and a major problem for global public health (World Health Organization, 2019). In 2018, the WHO estimated that 10 million people suffered from TB, with 1 case being equivalent to 132 cases per 100,000 people (World Health Organization, 2019).

Research about the knowledge, attitude, and practice (KAP) has been frequently used in health studies. KAP research was also used as a research tool to obtain information known and believed among research participants (Haq et al., 2012). Therefore, KAP studies play an important role in determining community ambiguity (Haq et al., 2012).

A previous study has reported that a high prevalence of TB occurred among students in a university in Ethiopia (Wolde et al., 2017). A crowded environment and high-contact person-to-person environment in the universities and schools can be potential sources of disease transmission including TB (Dorji et al., 2020). It has been shown that lack of knowledge and negative attitudes toward TB are major problems in the prevention, controlling, and curing of TB disease (Luba et al., 2019). It is important to research KAP toward TB among students because students have a high risk of TB spread (Zhang et al., 2018). Therefore, this article summarizes the TB knowledge, attitudes, and practice among university students.

METHODS
Literature searches were conducted in March 2020 through the PubMed electronic database. PubMed is a free search engine that comprises more than 32 million citations for biomedical literature from MEDLINE, life science journals, and online books. The keywords for literature search are “Knowledge,” “Attitude,”
“Practice,” “University student,” and “TB.” The following are the search details: (“knowledge” [MeSH Terms] OR “knowledge” [All Fields]) AND (“attitude” [MeSH Terms] OR “attitude” [All Fields]) AND (“Practice [Birm]” [Journal] OR “practice” [All Fields]) AND (“TB” [MeSH Terms] OR “TB” [All Fields]) AND (“universities” [MeSH Terms] OR “universities” [All Fields] OR “university” [All Fields]) AND (“students” [MeSH Terms] OR “students” [All Fields] OR “student” [All Fields]) NOT (“review” [Publication Type] OR “review literature as topic” [MeSH Terms] OR “review” [All Fields]). The initial search results yielded 64 articles. Articles prior to 2010 and non-English language were excluded. From 64 articles, 12 articles of knowledge, attitudes, and practices toward TB among university students were obtained. The literature search flowchart is shown in Figure 1.

RESULTS AND DISCUSSION

Studies of knowledge, attitudes, and practices toward TB

Table 1 shows 12 articles about knowledge, attitudes, and practices toward TB among students globally. All articles are cross-sectional studies; 11 used questionnaires as research instruments, while an additional article used the method of direct interviews with respondents. Respondents who participated in the studies are university healthcare and nonhealthcare students. Respondents totaled 5,915 students globally, ranging from 60 to 2,220 with random, convenience, and stratified random sampling techniques.

TB knowledge among university students

Table 2 shows the 12 articles presenting students’ knowledge of TB. Nine articles were studies on university healthcare students and three articles on nonhealthcare university students.

Research on nonhealthcare students conducted in Bangladesh, Sweden, and Serbia revealed that they have a poor level of TB knowledge (Nkulu et al., 2010; Pesut, 2014; Rana et al., 2015). Students in Sweden have an average TB knowledge score of TB 2.7 ± 1.3 (SD) (maximum = 8). Only 40 (15%) out of 268 respondents answered correctly for half of the questions (Nkulu et al., 2010). In general, nonhealthcare students’
knowledge level in Bangladesh and Serbia is poor, and there are misconceptions about TB disease (Pesut, 2014; Rana et al., 2015).

Research in China, Rome, Brazil, and Nigeria showed that healthcare students have a poor level of knowledge of TB, answering more than 50% of the questions incorrectly (Ou et al., 2018). Other questions that included basic inquiries relating to symptoms, diagnosis, and treatment were also answered incorrectly (de Fátima Carvalho et al., 2019; Laurenti, 2013; Olakunle et al., 2014; Ou et al., 2018; Traldi et al., 2012). The percentage of the total average correct answers regarding TB knowledge was 44.4% (SD 13.5%) for healthcare students in China, while students in Rome have a percentage of 56.6% (SD 11.6%) (Laurenti, 2013; Ou et al., 2018). Research in Iran showed that healthcare students have a medium to high level of knowledge (moderate to high) with a knowledge score of 16.13 ± 2.06 (low < 10, moderate 10–15, and high > 15) (Behnaz et al., 2014). Research in Italy compared the knowledge between medical and nursing students, revealing that medical students have better knowledge about TB compared to nursing students. The knowledge level of students in Italy was sufficient (>60% of students answered questions correctly) (Montagna et al., 2014). Research in Turkey compared the knowledge of nursing and midwifery students with 615 participants (Akin et al., 2011). The result found a poor level of student knowledge, with a score of 7.22 ± 1.92 (Akin et al., 2011). The American study of pharmacist students used the Student Pharmacists as Tuberculosis Screeners (SPATS) program created by the Washington State Pharmacy Association (Mckennon and Arnold, 2016). Students received training in TB epidemiology, pathophysiology, and treatment. Before and after conducting the training, students were asked to complete questionnaires about TB knowledge (Mckennon and Arnold, 2016). Before the SPATS program was conducted, the average score of students’ knowledge about TB was 48.7% (SD 51.7%); after the SPATS program was implemented, the average score was 86.5% (SD 55.5%). This indicates that students’ knowledge almost doubled following the SPATS program (Mckennon and Arnold, 2016).

### Attitude toward TB among university students

Table 3 shows a list of articles discussing students’ attitudes toward TB. Six articles discuss students’ attitudes toward TB (two on nonhealthcare students and four on healthcare students). The nonhealthcare students in Sweden have an average score of 5.1 ± 3.3 (SD) (maximum = 12), which shows that most students have a negative attitude toward TB disease and its patients (Nkulu et al., 2010). In Serbia, six out of eight nonmedical students did not visit TB patients for fear of contracting it, and 61 out of 69 students never wanted to be close to TB patients (Pesut, 2014). Negative attitudes toward TB disease and patients are caused by adverse stigma and cultural barriers. These negative attitudes affect not only TB sufferers but also their family members and closest relatives (Nkulu et al., 2010).

| Article no. | Author | Year | Country | Type of study | Participant type | Number of participants | Instrument | Sampling method |
|------------|--------|------|---------|--------------|------------------|------------------------|------------|-----------------|
| 1          | Nkulu et al. (2010) | 2010 | Sweden  | Cross-sectional study of KA | Nonmedical students | n = 280 | Questionnaire | Convenience sampling |
| 2          | Akin et al. (2011) | 2011 | Turkey  | Cross-sectional study of KA | Nursing and midwifery students | n = 615 | Questionnaire | Convenience sampling |
| 3          | Pesut et al. (2014) | 2012 | Serbia  | Cross-sectional study of KA | Nonmedical students | n = 69 | Questionnaire | NA |
| 4          | Traldi et al. (2012) | 2012 | Brazil  | Cross-sectional study of K | Nursing students | n = 76 | Questionnaire | NA |
| 5          | Laurenti (2013) | 2013 | Italy   | Cross-sectional study of KA | Medical students | n = 186 | Questionnaire | NA |
| 6          | Montagna et al. (2014) | 2014 | Italy   | Cross-sectional study of K | Medical and nursing students | n = 2,220 | Questionnaire | NA |
| 7          | Olakunle et al. (2014) | 2014 | Nigeria | Cross-sectional study of K | Medical students | n = 241 | Questionnaire | Simple random sampling |
| 8          | Behnaz et al. (2014) | 2014 | Iran    | Cross-sectional study of KAP | Medical students | n = 145 | Questionnaire | NA |
| 9          | Rana et al. (2015) | 2015 | Bangladesh | Cross-sectional study of K | Nonmedical students | n = 839 | Interview | Stratified random sampling |
| 10         | Mckennon and J. Arnold (2016) | 2016 | America | Cross-sectional study of KA | Pharmacist students | n = 96 | Questionnaire | NA |
| 11         | Ou et al. (2018) | 2018 | China   | Cross-sectional study of K | Medical students | n = 1,088 | Questionnaire | Randomized sampling methods |
| 12         | de Fátima Carvalho et al. (2019) | 2019 | Brazil  | Cross-sectional study of K | Nursing students | n = 60 | Questionnaire | Convenience sampling |

Total n = 5,915
Iranian healthcare students have a score of 36.08 ± 3.76 (low 18–27, moderate 27–35, and high > 35), indicating that the level of student attitudes was medium to high (moderate to high) (Behnaz et al., 2014). A study in Turkey compared the attitudes of nursing students with midwifery students (Akin et al., 2011). The results showed that nursing and midwifery students generally have

Table 2: Knowledge among students.

| Article no. | Author et al. (Year) | Country | Participant | Knowledge score | Knowledge result | Other results |
|-------------|----------------------|---------|-------------|-----------------|-----------------|--------------|
| 1           | Nkulu et al. (2010)  | Sweden  | Nonmedical student | Average 2.7 ± 1.3 (SD) (maximum = 8) | In general, nonhealthcare students had poor knowledge and misconceptions about TB | Most students knew well about the symptoms, treatment, and risk factors for TB but had poor knowledge about the causes, transmission, diagnosis, and prevention |
| 2           | Akin et al. (2011)   | Turkey  | Nursing and midwifery Students | Average 7.22 ± 1.92 | The level of student knowledge was poor | Students’ knowledge about TB was at a poor level, especially related to the causes and transmission of TB disease |
| 3           | Pesut et al. (2014)  | Serbia  | Nonmedical student | NA | Students’ knowledge about TB was at a poor level, especially related to the causes and transmission of TB disease | One in three students did not know the symptoms of TB |
| 4           | Traldi et al. (2012) | Brazil  | Nursing students | NA | Nursing students showed misconceptions about TB | Nursing students were vulnerable to TB contamination due to misunderstanding of knowledge about diagnosis, prevention, and biosafety |
| 5           | Laurenti (2013)      | Italy   | Medical students | Average 56.6% (SD 11.6%) | The level of student knowledge was at the moderate level | More than half the questions about TB treatment knowledge were answered incorrectly, and there was a significant relationship between knowledge and clinical experience |
| 6           | Montagna et al. (2014)| Italy  | Medical and nursing students | More than 60% of the students answered correct answer | Knowledge of TB in healthcare students was at a sufficient level | The level of knowledge of medical students was better than that of nursing students. Almost all students (up to 95%) correctly answered questions about TB knowledge in general (etiology, clinical symptoms, and antibiotic resistance) |
| 7           | Olakunle et al. (2014)| Nigeria| Medical students | NA | Medical students’ knowledge in the final year was at a poor level for various aspects of TB | Only 34.5% were able to correctly identify regimen treatment duration according to standard guidelines |
| 8           | Behnaz et al. (2014) | Iran    | Medical students | Average 16.13 ± 2.06 (low < 10, moderate 10–15, and high > 15) | The majority of students were at the medium to high knowledge level | 43% of students did not know that sputum examination was the most important method for TB diagnosis. Two out of three students also did not know that they had to keep their distance from TB patients |
| 9           | Rana et al. (2015)   | Bangladesh | Nonmedical student | NA | In general, the level of TB knowledge in nonhealthcare students was poor | There is a significant relationship between gender and knowledge about the causes of TB |
| 10          | Ou et al. (2018)     | China   | Medical students | Average correct answer 44.4% (SD 13.5%) | Students generally have poor knowledge about TB | More than 50% of the total questions about TB knowledge were answered incorrectly. Medical students over 23 years old had more accurate knowledge about TB diagnosis |
| 11          | Mckennon and Arnold (2016) | America | Pharmacist students | Before and after SPATS program: 48.7% (SD 51.7%) and 86.5% (SD 55.5%), respectively | The SPATS program significantly increases student knowledge about TB | Students’ knowledge in therapy, identification of TB patients, and alternative methods of TB disease screening increased after the SPAT program |
a negative attitude, but nursing students’ attitudes are better (Akin et al., 2011). The study of pharmacist students in the USA using the SPATS program resulted in significant changes in attitudes toward TB and the willingness to perform a tuberculin skin test (TST) (Mckennon et al., 2016). Students also realized that pharmacists are beneficial regarding TSTs (Mckennon et al., 2016).

### Practice toward TB among university students

Table 4 presents an article discussing students’ practice toward TB. The student practice study was only found in final year students conducted in Yazd, Central Iran (Behnaz et al., 2014). The mean practice score was 22.27 ± 4.95 (low < 20, moderate 20–25, and high > 25), and 11.9% of students had poor practice levels. The practice scores for female students were better than those for male students. In addition, one out of four students had the habit of washing hands before and after being in contact with patients. Students had an effective practice of wearing masks (70.2%), with 60% of the students wearing a mask when in contact with TB patients. Half of the students keep a distance from TB patients. The practice relating to medication is not yet evaluated, because the students are still guided by a supervisor. Nevertheless, 95.1% of the students have known that the standard TB medication is taken for 6 months (Behnaz et al., 2014).

### Effort to increase KAP in students

This study revealed poor levels of knowledge for students in 8 of 12 studies; students had a negative attitude in two out of six studies, with one study revealing poor practices in 11.6% of students. KAP improvement must be carried out to help control and prevent TB (Hassan et al., 2017). Poor TB knowledge is one of the main problems in preventing, controlling, and curing TB disease (Luba et al., 2019). In students, poor knowledge was caused by a lack of literacy skills and misconceptions, indicating that curriculum innovation regarding infectious diseases is needed to increase students’ TB knowledge (Laurenti, 2013). Training for pharmacy students in the USA, such as the SPATS program that comprises TB epidemiology, pathophysiology, and treatment, could be conducted to increase knowledge and attitudes among students (Gudeva et al., 2012; Mckennon and Arnold, 2016). The training program resulted in significant changes in students’ knowledge and attitudes toward TB.

### Limitation

There are limitations to this review. The literature search was only conducted in one electronic database; nevertheless, this article could provide an overview of knowledge, attitudes, and practice toward TB among students worldwide.

### CONCLUSION

This article summarizes the knowledge, attitudes, and practices toward TB among university healthcare and nonhealthcare students. Students in 8 out of 12 studies had poor knowledge levels, students in two out of six studies had a negative attitude, and 11.6% of students in a study still have poor practices.

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**Table 3. Attitude among students.**

| Article no. | Author                  | Country | Participant          | Attitude score | Attitude result                                                                 | Other results                                                                 |
|-------------|-------------------------|---------|----------------------|----------------|--------------------------------------------------------------------------------|--------------------------------------------------------------------------------|
| 1           | Nkulu et al. (2010)     | Sweden  | Nonmedical students  | 5.1 ± 3.3 (SD  | Nonhealthcare students had a negative attitude toward TB disease and TB patients | Most respondents would hide if they have TB and were worried about the response of people around them |
| 3           | Pesut et al. (2014)     | Serbia  | Nonmedical students  | NA             | Students have a good attitude toward disease and TB patients                    | 78% of the participants will visit TB patients without fear of contracting the disease |
| 2           | Akin et al. (2011)      | Turkey  | Nursing and midwifery students | NA           | Nursing and midwifery students generally have a negative attitude              | The attitude of nursing students is better than midwifery students |
| 5           | Laurenti (2013)         | Italy   | Medical students     | NA             | Half of the students had a positive attitude toward TB patients                | 57.6% of the students felt that they had a risk of contracting TB |
| 8           | Behnaz et al. (2014)    | Iran    | Medical students     | 36.08 ± 3.76 (low 18–27, moderate 27–35, and high > 35) | Student attitudes were at the medium to high level                           | 60% of the students wear masks when in contact with TB patients |
| 10          | Mckennon and Arnold (2016) | America  | Pharmacist students | NA             | There was a significant change in attitude after the SPATS program            | Students are willing to do TST and realize that pharmacists have an important role in conducting TSTs |

**Table 4. Practice among students.**

| Study no. | Author                  | Country | Participant   | Practice score | Practice result | Other results                                                                 |
|-----------|-------------------------|---------|---------------|----------------|-----------------|--------------------------------------------------------------------------------|
| 8         | Behnaz et al. (2014)    | Iran    | Medical students | Average 22.77 ± 4.95 (low < 20, moderate 20–25, and high > 25) | Student practice was at the moderate level                                  | Practice scores for female students were better than those for male students. One in four students had the habit of washing hands before and after contact with patients |
Curriculum innovation regarding infectious diseases is needed to improve students’ TB knowledge, attitudes, and practices.

CONFLICT OF INTEREST
The authors report no conflicts of interest.

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AUTHOR CONTRIBUTIONS
All authors made substantial contributions to conception and design, acquisition of data, or analysis and interpretation of data; took part in drafting the article or revising it critically for important intellectual content; agreed to submit to the current journal; gave final approval of the version to be published; and agree to be accountable for all aspects of the work. All the authors are eligible to be an author as per the international committee of medical journal editors (ICMJE) requirements/guidelines.

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