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## Missed nursing care in highly specialized hospitals: A Mexican case study

Sandra Hernández-Corral, Edson Serván-Mori, Luis A. Benítez-Chavira, Gustavo Nigenda, Rosa A. Zárate-Grajales

First Published: 20 June 2022

### Highlights

- We estimated 16% prevalence of missed nursing care, less than that reported for general hospitals in the Mexican public sector
- The dimensions of patient education and discharge planning as well as continuous patient assessment yielded the lowest rates of missed care
- Is needed to ensure optimal working conditions and safe work environments
- Our results serve as a pre-pandemic reference for comparisons and for assessing the effects of the COVID-19 pandemic

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## Missed initial appointments at Israeli child development centres: Rate, reasons, and associated characteristics

Galit Hirsh-Yechezkel, Saralee Glasser, Lidia V. Gabis, Avi Eden, David Savitzki, Adel Farhi, Osnat Luxenburg, Gila Levitan, Liat Lerner-Geva

First Published: 16 June 2022

### Highlights

- The missed appointment (MA) rate at Child Development Centres (ChDCs) was 26.6%
- The most frequent reasons was unexpected personal events, for example, child's illness
- Children who had received previous rehabilitative therapy had lower MA rates
- Organisational factors, for example, insurance, reminders, were associated with MA rates

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## The evolutionary trends of health inequality among elderly Chinese people and influencing factors of these trends from 2005 to 2017

Yiwei Liu, Yanan Duan, Yuhang He

First Published: 16 June 2022

### Highlights

- This paper analysed the influencing factors and evolution trend of health inequality among the elderly with high age in China from 2005 to 2017.
- In 2005–2017, the self-rated health distribution of the elderly with high age showed an obvious inverted “U” shape.
- Lifestyle, family income, and age were the main important factors to expand health inequality.
- For solving the health inequality of the elderly with high age, developing good living habits and narrowing the income gap should be encouraged.

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## The influence mechanism of psychological contract on primary medical staff's turnover intention in the context of COVID-19 pandemic in China

Xiaoyan Zhang, Xin Chen, Chen Chen, Yuxuan Wang, Kenyiti Shindo, Xiaojin Zhang

First Published: 16 June 2022

### Highlights

- The purpose of this research is to explore the influence mechanism of psychological contract on the turnover intention of primary medical staff under the work of fighting against COVID-19.
- The three dimensions of psychological contract (normal, interpersonal, and developmental contracts) had a significant negative effect on turnover intention and emotional exhaustion.
- Normal contract had no effect on emotional exhaustion.
- Emotional exhaustion partially mediated the effects of interpersonal and developmental contracts on turnover intention.

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# The experience of working with anaesthesia associates in the United Kingdom and the impact on medical anaesthetic training

Claudie Sellers, Nigel Penfold, Cleave Gass, Vari M. Drennan

First Published: 12 June 2022

## Key points

- UK Anaesthesia Associates were introduced to alleviate longstanding workforce shortages
- Robust data examining the impact on patients, hospitals or medical anaesthetists is lacking
- The experience of working alongside Anaesthesia Associates in 2017 was positive
- Statutory regulation was agreed by the Government in 2019 but not yet implemented

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Franklin Dexter, Richard H. Epstein, Christian Diez, Brenda G. Fahy

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The International Journal of Health Planning and Management | Early View

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RESEARCH ARTICLE

## The characteristics of occupational tuberculosis risk in healthcare workers

Rizqy Amelia Zein, Ratna Dwi Wulandari, Ilham Akhsanu Ridlo, Wiwin Hendriani, Fendy Suhariadi, Anang Rianto

The International Journal of Health Planning and Management | Early View

First published: 07 May 2022

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## Locked out of healthcare: A descriptive context of migrant health considerations in pediatrics

Aysha Jawed, Christine Peck

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# The characteristics of occupational tuberculosis risk in healthcare workers

Article in *International Journal of Health Planning and Management* · May 2022

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**Authors' contributions:**

1. RAZ conceived the idea, collected the data, analysed the data, wrote and revised the manuscript.
2. RDW conceived the idea, collected the data, and revised the manuscript.
3. IAR collected the data and revised the manuscript.
4. WH conceived the idea and revised the manuscript.
5. FS secured the funding and revised the manuscript.
6. AR collected the data.

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2. We have posted the pre-publication version of this manuscript on a non-profit pre-print server: <https://osf.io/preprints/inarxiv/4qke5/>
3. All authors declare that they do not have competing interests.

\*Additional notes: Anang Rianto does not have any institutional email.

## 68 **The characteristics of occupational Tuberculosis risk in healthcare workers**

69

70

### **ABSTRACT**

71 Tuberculosis remains to be one of the most common causes of morbidity worldwide, but the  
72 discourse of its prevention has disproportionately singled out the occupational risks that affect  
73 healthcare workers. In this research, we aimed to: (1) investigate the underlying factor structure of  
74 risk characteristics, specifically the risk of nosocomial TB transmission in health care facilities;  
75 (2) estimate the effects of work-related determinants and risk characteristics on risk perception;  
76 and (3) compare occupational risk perception of contracting TB with expert risk assessment. A  
77 paper-based questionnaire was administered to 179 HCWs working at ten public health centres  
78 and two hospitals in Surabaya, Indonesia. We analysed our data using exploratory factor analysis  
79 (EFA) to unravel the latent structure of risk characteristics and structural equation modelling  
80 (SEM) to identify determinants of risk perceptions. EFA revealed a two-factor solution for nine  
81 qualitative risk characteristics: controllability of damage and knowledge-evoked dread. Our SEM  
82 analysis found evidence that the controllability aspect of the TB risk was a more profound  
83 determinant in predicting risk perception than knowledge-evoked dread, implying that HCWs  
84 might benefit from training aims to increase their beliefs on the controllability of TB risk despite  
85 its severity. Although further research is necessary, our study highlights the importance of  
86 addressing occupational risk perceptions in health facilities, encouraging HCWs to become more  
87 active in advocating for the necessary allocation of resources for their workplaces, and raising  
88 communities' awareness of TB transmissions.

89 **Keywords:** healthcare workers, nosocomial TB, psychometric paradigm, risk characteristics, risk  
90 perceptions.

91

92 **Research Highlights**

- 93 1. TB prevention in healthcare settings has often ruled out risk perceptions.
- 94 2. Risk characteristics of nosocomial TB risks were condensed into two-factor solutions.
- 95 3. Believing that TB risk is dreadful but possible to control predicted risk perceptions.
- 96 4. Increasing the beliefs on the controllability of TB risk should be a priority.

97

## INTRODUCTION

98

99 The eradication of lung tuberculosis (TB) in Indonesia, albeit its remarkable progress, is still far  
100 from over. Being ranked second as the country with the highest TB burden globally, the Indonesian  
101 government has a lot to think about controlling the spread of TB. World Health Organization  
102 (WHO) recorded that in 2018, TB incidence fell globally at 2 per cent<sup>1</sup> and remained the cause of  
103 the highest mortality worldwide from any infectious diseases<sup>2,3</sup> until 2019. In addition to this, there  
104 was a gap of 3.6 million cases between the estimated actual number of TB cases and the case  
105 notification rate (CNR), of which almost a half of the number comes from India, Indonesia, and  
106 Nigeria<sup>1</sup>. In Indonesia, TB incidence has been trending downward from 2000 to 2020, but in 2016  
107 alone, the total incidence of active TB was doubled the 2015 estimated number of TB incidents,  
108 reaching a million new cases<sup>4</sup>. In 2020, Indonesia was ranked second as the country with the  
109 highest burden of TB, accounting for approximately 8.5 per cent of the total case globally<sup>3</sup>.

110 The discourse of TB control is often too focused on the patient while lacking proper attention to  
111 preventing nosocomial infection, which affects health care workers (HCWs). Initially, nosocomial  
112 TB infection was not a priority due to the impressive progress of antibiotics therapy and declining  
113 TB incidence, mainly in high-income countries<sup>5</sup>. However, since around 1980, nosocomial  
114 infection as an occupational risk has been a global concern, following a multi-drug resistant  
115 (MDR) TB epidemic commonly transmitted in health care facilities from people living with  
116 HIV/AIDS<sup>5,6</sup>. For this context alone, 200 new TB cases had developed with mortality rates  
117 reaching 50-80 per cent<sup>5</sup>. A meta-analysis study further demonstrated the urgency of preventing  
118 transmission to HCWs by showing that HCWs are three times more likely to be infected with  
119 active TB than the general population due to occupational exposure to patients with active TB<sup>7</sup>.

120 According to the hierarchy of control<sup>8</sup>, the most effective strategy is eliminating the risk, albeit the  
121 cost-effectiveness of such procedure, especially in low-resource settings, has been called into  
122 question<sup>5</sup>. Other less powerful alternatives include using personal protective equipment and  
123 performing administrative control. Although implementing a hierarchy of control has effectively  
124 held down TB transmission in health care facilities, the effect of each stage in the hierarchy is  
125 difficult to investigate<sup>5</sup>. Moreover, in developing countries with heavy TB burden, increasing  
126 HCWs adherence to guidelines of TB treatment, expanding access to health care service, reducing  
127 the cost of treating TB patients, achieving cost-effectiveness of implementing a hierarchy of  
128 control, and increasing HCWs' efficacy to manage and to control TB infection are still daunting  
129 tasks to deliver<sup>5,9-12</sup>.

130

### 131 *Occupational TB risk perception*

132 Research in developing countries on occupational TB risk provided evidence that HCWs are prone  
133 to contract active and latent TB due to intense interaction with TB patients since the prevalence of  
134 TB cases in developing countries is often much higher. A meta-analytic study concluded that  
135 HCWs, in general, are two to three times more likely to be infected with TB than the general  
136 population<sup>7</sup>. Additionally, most hospital wards in developing countries do not meet the minimum  
137 standards, and the costs of minimising and controlling the risk of TB transmission are often  
138 unaffordable<sup>13</sup>. Prior research on TB transmission risk in HCWs also showed worrying trends –  
139 confirming that in countries with high-prevalence TB cases, there is an increasing trend of TB  
140 transmission risk, albeit inconsistent, that HCWs have to deal with as a part of their daily duties<sup>9-  
141 11,13-15</sup>.



142 In Indonesia, a study was conducted in 6 districts of 3 provinces and concluded that 2 out of 509  
143 HCWs working at public health centres were contracting active TB. Their disease was suspected  
144 to be primarily related to their occupation as an HCW<sup>16</sup>. Another study at a hospital in Medan,  
145 North Sumatra, showed that, after a mandatory tuberculin screening test, 53 out of 100 HCWs  
146 were positively diagnosed with latent TB<sup>17</sup>. Therefore, our study is relevant to the context in  
147 Indonesia, especially TB transmission is long considered one of the most dangerous risks for  
148 HCWs<sup>5,11,13</sup>. Preventive measures are undeniably urgent, especially in health care facilities<sup>13</sup>.  
149 Protecting HCWs from the risk of TB transmission is also morally imperative since HCWs play  
150 an essential role in treating patients. Furthermore, should HCWs be contracted with TB, it would  
151 also increase the possibility of spreading the disease further and infecting healthy people<sup>18</sup>.

152 Much previous research on occupational TB risk has focused on risk reduction and assessment  
153 using workplace risk analysis<sup>19</sup>, while risk assessment is inseparable from its subjective  
154 component, risk perception<sup>20,21</sup>. Risk perception is the less-rational, more intuitive dimension of  
155 risk, of which, according to a few decades of risk perception research, has been profound in  
156 affecting human reactions to imminent danger<sup>22-24</sup>. Health risk perception is undeniably an  
157 essential factor that drives protective health behaviours since risk perception works as a “cue” for  
158 individuals to immediately adopt preventive behaviours that aim to avoid or debilitate the health  
159 risk. However, to bring about behavioural change, individuals must be *aware* of the health risk  
160 and feel *personally* at risk<sup>22</sup>. In addition to this, risk perception can be deemed *absolute* or  
161 *comparative*. The former posits that risk is a guesstimate of probability, ranging from low to high,  
162 whether one is likely to be affected with a specific risk. On the other hand, comparative risk  
163 perception evaluates how people guesstimate their likelihood of being exposed to a particular risk  
164 relative to the risk others face<sup>22</sup>.

165 There is a stark difference between how experts and laypeople evaluate the risk. Experts, in  
166 general, would judge the risk based on its likelihood to happen and the severity of the devastating  
167 consequences<sup>24</sup>. This process tends to be rational, deliberative, analytical, driven by logic and  
168 numbers, and most often, requires effortful and slower time-processing. On the other hand,  
169 laypeople would use a more complex route that involves experiential and affective elements when  
170 experiencing the risk. When one relies on an intuitive system to guesstimate certain risks, their  
171 evaluation is profoundly regulated by associations, metaphors, personal narratives attached to  
172 these risks and is bound to be self-evident. The intuitive route entails a less-cumbersome endeavour  
173 and substantially slower processing time<sup>21,23-25</sup>.

174 A vast array of previous studies on the nosocomial risk of TB-affected HCWs primarily focus on  
175 identifying the risk factors while neglecting the domains where people subjectively *perceive* the  
176 risk. Studies on estimating TB nosocomial risks provided consistent pieces of evidence that HCWs  
177 who are living with people with HIV<sup>11</sup>, have frequent interaction with people with TB<sup>11,13</sup>, have a  
178 more extended period of years of service<sup>6,13</sup>, work in the outpatients, wards, ER or intensive care  
179 unit<sup>13</sup>, are more likely to contract lung TB. Furthermore, apart from appraising risk factors of TB  
180 nosocomial infection, a rare study tapped into how medical students and HCWs approximated their  
181 likelihood of contracting TB and showed that only 16.1 per cent of medical students and 52.9 per  
182 cent of HCWs in South Africa thought that it is likely or highly likely that they are at risk of  
183 developing active TB<sup>26</sup>. However, research investigating the determinant of TB risk perception,  
184 let alone its characteristics, among HCWs has been too scarce to be deemed conclusive.

185 In a workplace context, risk perception and personal evaluation of the workplace environment  
186 would determine how individuals mitigate the risk and affect the lethality of the risk and workplace  
187 safety as a whole<sup>19</sup>. Therefore, if workers misjudged the risk, especially when there is a gap

188 between risk perception and its actual danger, individuals would be reluctant to adopt preventive  
189 behaviour<sup>20,24</sup>. We, therefore, were interested in investigating; (a) the underlying structure of risk  
190 characteristics of TB nosocomial transmission; (b) determinants of the TB risk perception; and (c)  
191 comparing HCWs' risk perception of contracting TB with expert risk assessment.

192

193

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## METHODS

### 195 *Participants*

196 We planned the study in 2017, started to collect data in February 2018, and completed the data  
197 collection process by the end of 2018. We selected ten public health centres and two hospitals with  
198 the highest number of confirmed TB patient visits (>100 patients per year) in 2016 based on  
199 records provided by the Surabaya Public Health Office (*Dinas Kesehatan Kota Surabaya*) as our  
200 research sites. Our research was a cross-sectional survey involving 179 HCWs ( $M_{age} = 38.04$ ,  $SD_{age}$   
201  $= 9.31$ , Female = 67.03%) who returned our questionnaires. We asked the research participants  
202 who were working at those selected health facilities, had direct interactions with TB patients at  
203 least once a week, and had worked at least six months to fill out a paper-based questionnaire after  
204 requiring them to consent to participation by signing a consent form. Before filling out the self-  
205 administered paper-based questionnaire, we provided participants with detailed information  
206 regarding the study and offered to raise any questions. Accessible records of HCWs working at all  
207 health facilities in Surabaya was not available, and therefore, we were unable to excerpt the  
208 sampling frame to allow probability sampling. Demographics data of research participants are

209 available in Table 1. Raw data, analysis codes, and materials of this study is available at  
 210 [https://osf.io/um9gk/?view\\_only=a7859c039b0d4d288dda60f37fe34aff](https://osf.io/um9gk/?view_only=a7859c039b0d4d288dda60f37fe34aff).

211 The research was also conducted in accordance with the Helsinki Declaration and the Indonesian  
 212 Psychological Association Code of Conduct (2010), and ethical clearance was obtained from the  
 213 local Institutional Review Board.

214

215 Table 1. Demographics of Participants (N=179)

Demographics	%
Highest obtained education	
High school/vocational high school	5.03
Diploma	51.40
Undergraduate	19.55
Residency/professional training	21.23
Postgraduate	2.79
Occupation	
Registered Nurse	25.14
General Practitioner	15.08
Laboratory Technician	11.17
Midwives	7.82
Dentist	7.26
Nutritionist	7.26
Apothecary Assistant	5.59
Dental Nurse	5.59
Dentist Specialist	5.03
Specialist	3.91
Radiologic Technician	3.35
Apothecary	1.12
Health Promotion Officer	1.12
Environmental Health Officer	0.56
Gender	
Female	67.03
Male	32.97
Working at	
Hospital	54.49
Public Health Centre	45.51
Tuberculin screening test	
Never	93.85
At least once	6.15

216

217

218 **Measurement**

219 *Risk Characteristics (RC) and Risk Perception.* We measured RC and risk perception using the  
 220 psychometric paradigm of risk perception<sup>24</sup>. The psychometric paradigm is a well-known  
 221 framework to quantify risk perception by assuming that laypeople actively define the risk, and  
 222 their perception of risk intertwines with psychological, cultural, institutional, and social  
 223 factors<sup>20,24,27</sup>. A fundamental predicate of the psychometric paradigm is that human perception of  
 224 risk works as a cognitive map that contains quantitative assessments of actual and expected  
 225 dangerousness of a particular hazard and its desired control of each hazard<sup>28,29</sup>. Our study included  
 226 nine qualitative risk characteristics commonly used in risk perceptions research: personal  
 227 knowledge, expert knowledge, dread, vulnerability, severity, avoidability, controllability,  
 228 catastrophic potential, and immediacy<sup>28-30</sup>. We asked participants to rate their occupational TB  
 229 risks based on these characteristics.

230 The RC scale was a seven-point extreme-labelled Likert scale with options ranging from ‘very  
 231 low’ to ‘very high’. The scale contained nine items, represented nine different RCs, and was  
 232 inspired and previously validated by Portell *et al.* (2014) ’s study (see Table 2). However, we  
 233 changed the wording to fit the context of assessing TB risks in healthcare facilities.

234

235 Table 2. Characteristics for which the Occupational TB Risk was Rated (N=179)

Risk Characteristics	<i>M</i>	<i>SD</i>
<i>Personal Knowledge</i>	1.78	1.06
To what extent do you know the occupational risk of contracting TB as a part of your job as a health care worker? (1: Don’t know at all; 7: Know very well)		
<i>Expert Knowledge</i>	2.68	1.54
To what extent you would say the health & safety officer at your health care facility knows the occupational risk of contracting TB that is likely to impact		

Risk Characteristics	<i>M</i>	<i>SD</i>
health care workers in your health facility? (1: Don't know at all; 7: Know very well)		
<i>Dread</i>	4.16	2.01
When you consider the risk of contracting TB as a part of your job, what is your level of fear? (1: No fear at all; 7: Very fearful)		
<i>Vulnerability</i>	4.72	1.84
How do you evaluate the possibility of you suffering from TB (despite severe or not, now or later) due to your occupation? (1: Very unlikely; 7: Very likely)		
<i>Severity</i>	4.4	1.69
If you were contracting TB as a part of your occupation, the severity of the illness could that be caused for you is... (1: Very mild; 7: Very serious)		
<i>Avoidability</i>	4.66	1.73
What is the possibility of you avoiding contracting TB due to your occupation as a health care worker? (1: Extremely impossible; 7: Extremely possible)		
<i>Controllability</i>	4.98	1.68
What is your level of control in terms of avoiding or reducing the possibility of contracting TB as part of your occupational risk? (1: Very low; 7: Very high)		
<i>Catastrophic Potential</i>	5.33	1.5
What is the possibility of TB transmission causing personal harm to many people at the same time? (1: Very unlikely; 7: Very likely)		
<i>Immediacy</i>	3.41	1.72
When you are exposed to TB patients, when would the most severe consequences be suffered? (1: Very much later; 7: Immediately)		
<i>Overall risk perception</i>	66.2	18.85
On a scale of 0-100, how do you assess the possibility of your risk of contracting active pulmonary TB owing to your work as a health worker? Please also consider that pulmonary TB can have a negative impact on your health that cannot be fully restored, both in the short term (immediately after exposure to risk factors) and long term. (0: Very small; 100: Very high)		

236

237 *Workplace Safety Questionnaire (WSQ)*. The WSQ is a specific instrument for measuring  
238 individuals' opinions of the risk they might have to deal with in their workplace<sup>31,32</sup>. The WSQ  
239 consists of eight subscales, but we only employed the relative risk and perception of safety  
240 condition subscales for this research. The relative risk scale was a three-point Likert scale  
241 consisting of 11 items asking the participants to compare the possibility of them suffering from  
242 TB to other health care workers in health care facilities. The options ranged from 'less possible'  
243 and 'equally possible' to 'much more possible'. The reliability was estimated using bootstrapped  
244 McDonald's  $\omega^{33}$  with 1000 iterations, and it yielded a satisfying reliability coefficient ( $\omega_t = 0.98$ ,

245  $SE = 0.02$ , 95% CI [0.93, 1.00]). We performed a reliability analysis using MBESS package in  
246 R<sup>34,35</sup>.

247 The safety condition scale was also a three-point Likert scale ranging from ‘unavailable’,  
248 ‘available but in poor condition’ and ‘available with good conditions’, which comprised eight  
249 items. We requested participants evaluate the availability and condition of safety infrastructures  
250 and facilities related to TB control in health care settings, such as room ventilation, exposure to  
251 sunlight, washing basins with flowing water, separation of infection and non-infection wards,  
252 disposable masks, particulate respirators, and medical bins with lids. The reliability was estimated  
253 using the same technique and yielded a moderate reliability coefficient ( $\omega_r = 0.77$ ,  $SE = 0.04$ , 95%  
254 CI [0.66, 0.83]).

255 *TB Risk Assessment.* To estimate the risk of contracting TB in a health care setting, we interviewed  
256 health and safety (H&S) officers of public health centres and hospitals using the modified  
257 Tuberculosis Risk Assessment Worksheet (TRAW)<sup>36</sup>. We modified the worksheet to suit the  
258 context of Indonesia’s healthcare service. The worksheet was applied to aid the H&E officer  
259 performs initial and ongoing evaluations of TB transmission control in health care facilities. We  
260 designed two separate scales for hospitals and public health centres by adjusting the wording to  
261 suit the context of different types of health care facilities. We conducted structured interviews with  
262 H&S officer of each health care facility by asking questions surrounding the number of TB  
263 inpatients and outpatients (including TB MDR cases), managerial control, administrative and  
264 environmental control, the availability of TB control guidelines in the health care facility as well  
265 as the H&S officer’s understanding of the guidelines, availability of training for preventing TB  
266 infection for HCWs, health care facilities’ policy on regular TB screening for HCWs, the condition

267 of health care facility infrastructure and the availability and use of personal protective equipment  
268 (PPE).

269 After the interviews, we passed the worksheets to an independent risk expert and asked them to  
270 estimate the likelihood of HCWs contracting active TB in two ways. First, the risk expert estimated  
271 aggregated risk of contracting TB for each health care facility – if the risk would differ across  
272 facilities. Second, the expert estimated the risk of contracting TB for each health care worker  
273 profession working in the health care facility – assuming that the risk would be unequal for  
274 different professionals even though they worked at the same health care facility (for example, the  
275 risk of contracting TB would be different between GPs and nurses). The first risk assessment was  
276 dubbed aggregated risk of contracting TB in health care facilities ( $M = 60.35$ ,  $SD = 2.79$ ), and the  
277 second was labelled profession-based risk of contracting TB ( $M = 65.45$ ,  $SD = 12.76$ ). The expert  
278 assessed risk by allocating a score ranging from 0 (no identifiable risk of TB transmission) to 100  
279 (very high risk of TB transmission).

280

### 281 *Data analysis*

282 Our first research aimed to identify the factor structure of RC. Thus, we performed exploratory  
283 factor analysis on nine RC with varimax rotation and minimum residual as a factoring method.  
284 This analysis was purely exploratory because different risks might lead to different RC factors<sup>28,37</sup>,  
285 and the common findings in previous risk perceptions research are that risk characteristics can be  
286 reduced into a few numbers of factors, often two or three factors<sup>28</sup>. The next step was to enter the  
287 newly identified factors of RC into the structural equation model (SEM).



288 SEM model parameters were estimated using the diagonally weighted least squares (DWLS)  
289 method with the lavaan package<sup>38</sup> in R, since we included ordinal observed variables in our model.  
290 To estimate the model parameter, DWLS estimator requires a polychoric correlation matrix and  
291 thus is superior to the standard maximum likelihood estimation under the condition of including  
292 ordinal indicator variables in the model<sup>39</sup>. The corrected version of DWLS estimator available in  
293 the lavaan package produces robust standard errors and fit statistics even though the predictors do  
294 not follow a normal distribution<sup>40</sup>. We assessed the model's overall fit using absolute ( $X^2$  and  
295 SRMR) and incremental (RMSEA, CFI, and TLI) fit indices<sup>40,41</sup>. The relative risk and perceived  
296 safety conditions were latent variables, and we specifically declared that all of its indicators were  
297 ordinal. Finally, we compared risk perception ( $W = 0.927, p < .001$ ) with the aggregated risk of  
298 contracting TB ( $W = 0.865, p < .000$ ) and profession-based risk of contracting TB ( $W = 0.770, p <$   
299  $.001$ ) via Mann-Whitney comparison testing as all variables do not follow a normal distribution.

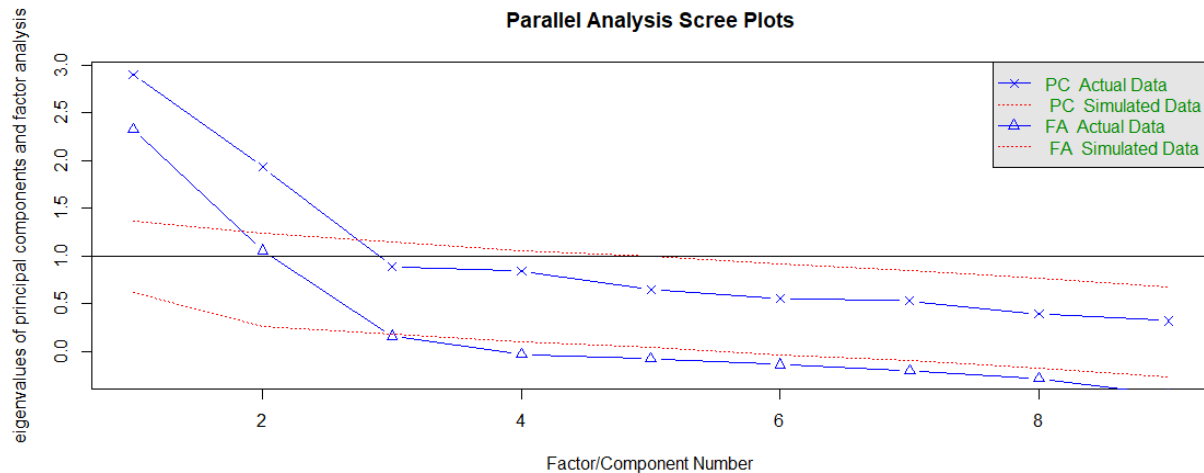
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301

## RESULTS

302 *Factor Structure of Risk Characteristics (RC)*

303 Before performing the factor analysis, we conducted several assumption tests to verify whether  
304 factor analysis was necessary. The Bartlett test of sphericity ( $X^2(36) = 404.212, p < .001$ ) showed  
305 that our variables were related and suitable for factor reduction. KMO of sampling adequacy  
306 (KMO = 0.741) and overall MSA (MSA = 0.74) indicated that underlying latent factors might  
307 cause a considerable variance in our variables. Thus, this supported that factor analysis was  
308 suitable for data reduction.



309  
 310 Figure 1. Parallel Analysis Scree Plot of Risk Characteristics (N=179)

311  
 312 We conducted a parallel analysis using a maximum likelihood estimation (MLE) as the factoring  
 313 method to determine how many factors should be extracted. The analysis subsequently showed  
 314 that two factors were adequate and yielded eigenvalues more than one (see Figure 1). Two factors  
 315 were reliably identified in the subsequent exploratory factor analysis using the minimum residual  
 316 factoring method (Tucker-Lewis Index of factoring reliability = 0.918, RMSEA = 0.06 [95% CI  
 317 0.02, 0.11],  $X^2(19) = 34.87, p = .014$ ) and those latent factors are *controllability of damage* (Factor  
 318 1) which accounted for 26% of the variance. In contrast, *knowledge-evoked dread* (Factor 2)  
 319 accounted for 15% of the variance.

320 Vulnerability, avoidability, controllability, and catastrophic potential were grouped into  
 321 *controllability of damage*, while personal and expert knowledge and immediacy were in  
 322 *knowledge-evoked dread* factor. On the other hand, severity and dread were highly loaded in both  
 323 Factor 1 and 2 and yielded the highest communalities, signalling that these risk characteristics are  
 324 more profound than the rest. Participants inclined to higher controllability of damage would  
 325 perceive nosocomial TB risks as more dreadful and severe but are more assured to control and

326 avoid it. On the other hand, a higher knowledge-evoked dread implied that participants were more  
 327 knowledgeable about the severity and the dreadfulness of nosocomial TB risks, believed that their  
 328 H&S experts in the facilities were, too, proficient in handling the risks, and thought that the worst  
 329 consequences of contracting TB risk would emerge immediately.

330 We subsequently examined the reliability of RC scale using McDonald's  $\omega$  and yielded a  
 331 somewhat satisfying coefficient ( $\omega_t = 0.77$ ). Factor loadings of all RC are presented in Table 3.

332

333 Table 3. Exploratory Factor Analysis Across Nine Risk Characteristics (RC) (N=179)

RC	Controllability of Damage (Factor 1)	Knowledge- evoked Dread (Factor 2)	Communality
Personal Knowledge		0.590	1.2
Expert Knowledge		0.615	1.0
Dread	0.395	0.513	1.9
Vulnerability	0.499		1.2
Severity of consequences	0.749	0.397	1.5
Avoidability	0.600		1.1
Controllability	0.659		1.1
Catastrophic potential	0.760		1.0
Immediacy		0.346	1.0
% Variance accounted for	26%	15%	41%

334 Note: An exploratory factor analysis with varimax rotation and minimum residual as a factoring  
 335 method was employed. Only factor loadings  $\geq 0.3$  are reported.

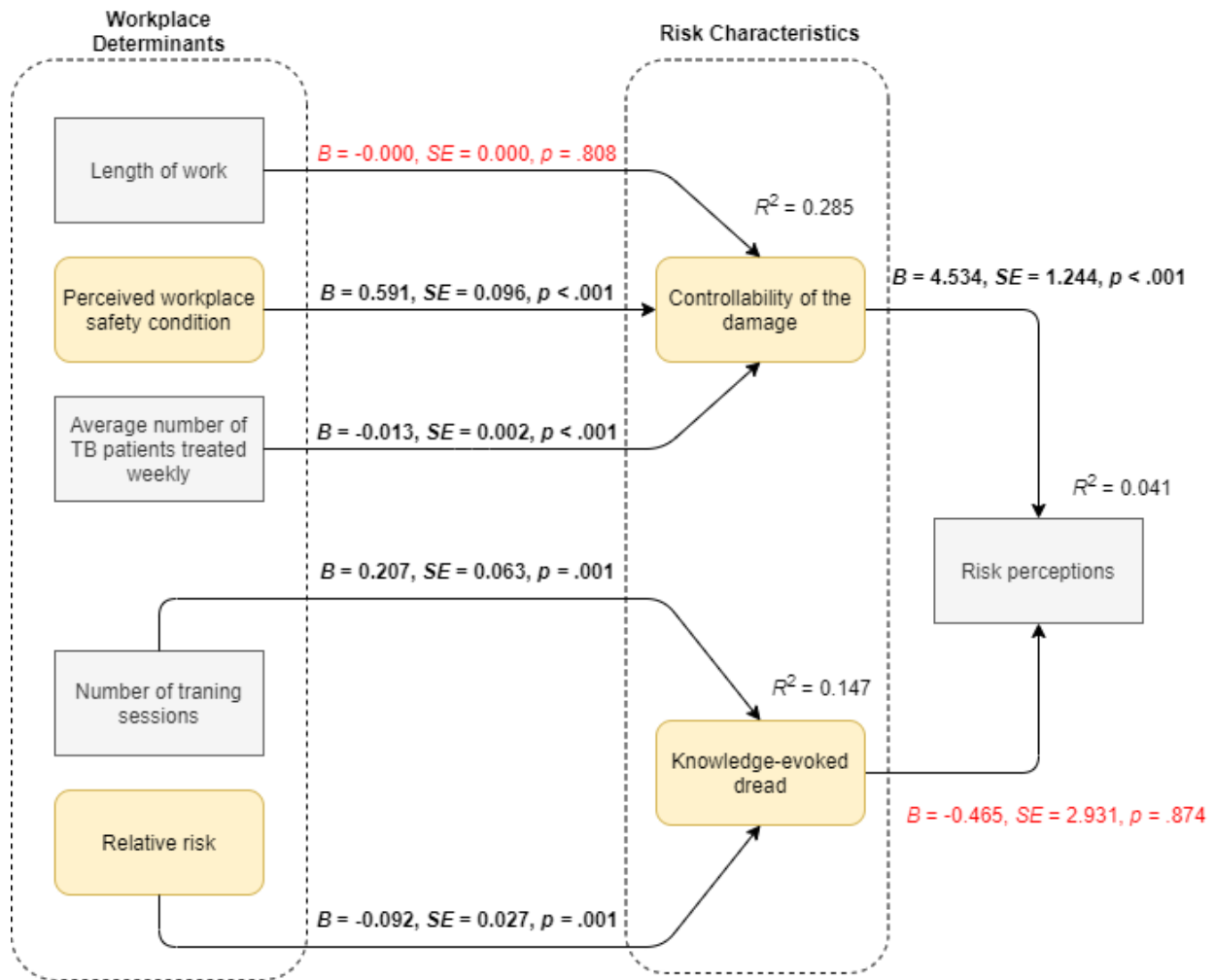
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### 337 *Identifying Determinants of Risk Perception*

338 We performed structural equation modelling (SEM, see Figure 2) to test our hypotheses. Initially,  
 339 our model was poorly fitted. Thus, we made a few modifications by allowing observed variables  
 340 that were indicators of relative risk to co-vary. After examining absolute and incremental  
 341 goodness-of-fit indices, the modified model was overall a close fit ( $X^2(536) = 1030.09, p < .001$ ,

342 CFI = 0.961, TLI = 0.964, RMSEA = 0.072 [90% CI 0.066, 0.079],  $p$  RMSEA < .001,  
 343 SRMR=0.113).

344



345

346 Figure 2. Structural Model of Risk Perceptions Determinants (N=179). Notes: yellow boxes are  
 347 latent variables; grey boxes are observed variables.

348

349 Our model indicated that the controllability of damage ( $B = 4.534, SE = 1.244, p < .001$ ) was  
 350 positively related to overall risk perceptions, while we failed to find evidence that knowledge-  
 351 evoked dread ( $B = -0.465, SE = 2.931, p = .874$ ) predicted risk perceptions. Additionally, perceived

352 safety conditions ( $B=0.306, p=.006$ ) yielded a positive and moderate association to the  
353 controllability of damage. At the same time, the average number of TB patients treated per week  
354 ( $B=-0.362, p=.003$ ) was negatively correlated to the controllability of damage, which means that  
355 a higher number of treating TB patients was associated with less controllability of damage. The  
356 number of training sessions ( $B=-0.150, p=.259$ ) nor relative risk ( $B=0.128, p=.150$ ) substantially  
357 explained knowledge-evoked dread.

358 Before testing our main hypotheses, we failed to plan our sample size *a priori* while this process  
359 is essential to justify the sample size in detecting an effect size optimally. In SEM analysis, the  
360 size of an effect stems from the degree of discrepancy between the saturated, more restrictive  
361 model with the general, hypothesised model<sup>42</sup>. Therefore, we carried out a *post hoc* power analysis  
362 which aims to estimate the achieved power of our model given to the sample size by accounting  
363 for the observed model effect size, which is the root mean squared error approximation (RMSEA),  
364 the model degree of freedom, a specified  $\alpha$  error probability (0.05), and the sample size. We ran  
365 the analysis using semTools<sup>43</sup> package in R, and the observed power was 0.9997, which implied  
366 that the probability of falsifying our model when it is actually wrong in the population was 99.97  
367 per cent. However, we can only obtain information about *observed* power, and it often does not  
368 reflect the true power of detecting the actual, true effect size in the population, so that cannot be  
369 translated as such<sup>44</sup>.

370

### 371 *Comparing Expert Risk Assessment with Risk Perception*

372 After carrying out a Mann-Whitney test, we found no evidence to confirm a significant difference  
373 ( $W = 15180, p = .385$ ) between HCWs self-rated risk perceptions ( $Mdn = 65$ ) and profession-based  
374 actual risk assessed by our risk expert ( $Mdn = 70$ ) with a trivial effect size ( $r = 0.045$  [95% CI

375 0.002, 0.157]). However, there was a suggestive difference ( $W = 18338, p = .016$ ) between HCWs'  
376 risk perceptions and aggregated actual risk of contracting TB in health care facilities according to  
377 our risk expert ( $Mdn = 58$ ), albeit only via relatively small effect size ( $r = 0.127$  [95% CI 0.014,  
378 0.253]).

## 379 **DISCUSSION**

380 Prior research on the relationship between risk perception and self-protective behaviour  
381 highlighted an essential conclusion that individuals' beliefs are critical determinants to their  
382 actions towards risk<sup>45-47</sup>. We, therefore, aimed to investigate the determinants of HCW's risk  
383 perception of contracting TB as an occupational risk. We identified RC's underlying factors  
384 since risk perceptions are generally based on RC<sup>21,37,47</sup>. Thus, we hypothesised that RC would  
385 mediate the relationship between work-related determinants and risk perceptions.

386 Our exploratory factor analysis yielded a two-factor solution and was supported by prior research  
387 that argues the factor structure of RC can differ depending on the hazard<sup>28,48</sup> but most often are  
388 condensed into two or three-factor solutions<sup>28,49</sup>. In our findings, dread and severity were loaded  
389 in both latent factors, indicating that these risk characteristics are more pivotal than other  
390 characteristics. Interestingly, the immediacy showed a similar pattern to the previous research by  
391 appearing in the same factor as an expert and personal knowledge, indicating that the unknown  
392 risk is expected to have a more long-term impact. In contrast, better-known risk tends to be  
393 associated with more immediate consequences.

394 Factor 2 (controllability of damage) consisted of not only preventive-related (avoidability,  
395 controllability, and vulnerability) but also protection-related characteristics (dread, severity of  
396 consequences, and catastrophic potential). Preventive-related characteristics reflect the degree of  
397 efficacy in controlling the risk of TB transmission, while protection-related characteristics focus

398 on the likelihood of mitigating the damage caused by TB transmission. In the context of  
399 nosocomial TB transmission, this pattern seems sensible because HCWs understand that TB can  
400 cause severe damage to their health in the long run but believe that there are many ways to  
401 control and avoid it.

402 After performing the structural equation modelling, we found that the number of training does  
403 not significantly affect knowledge-invoked dread, indicating insufficient evidence to support the  
404 positive association between the number of training and knowledge-related RC. We expected the  
405 relative risk to be positively associated with knowledge-related RC because we assumed that it  
406 could be a cue for HCWs to gain knowledge related to TB transmission risk that they have to  
407 handle. We indeed found a substantial, albeit tiny and negative, effect of relative risk to  
408 knowledge-related RC. Our findings suggest that when participants believed that other HCWs  
409 are exposed to a higher occupational TB risk than themselves, they would be less likely to think  
410 that the TB risks are severe, dreadful, and immediate; and less motivated to gain knowledge  
411 regarding the TB risks. Our conclusion aligns with prior findings in risk research that, when  
412 assessing their risks, individuals who are too favourably comparing themselves against others  
413 show evidence of unrealistic comparative optimism<sup>22,23,50</sup>, and potentially leads to  
414 underestimating risk. However, interestingly, we did not find convincing evidence that  
415 knowledge-evoked dread could affect risk perception, which implied that HCWs relied on a  
416 more intuitive judgment than what they or H&S officers know about the risk of TB transmission  
417 or the dreadfulness of being infected with TB when assessing their likelihood of suffering from  
418 TB infection.

419 A systematic review provides evidence that a longer duration of employment leads to a higher  
420 risk of contracting TB in health care settings<sup>51</sup>. However, our research demonstrated that the

421 length of work did not significantly contribute to HCW's perceived hazard control. On the other  
422 hand, we anticipated a positive correlation between more intense contact with TB patients (more  
423 TB patients to be treated) and controllability of damage, but it yielded a negative yet moderate  
424 correlation. Thus, HCWs with higher exposure to TB patients believed that TB risk is dreadful  
425 and severe but were less confident in avoiding the risk of TB transmission by seeing it as less  
426 controllable. Based on our findings, it would be safe to assume that the more an HCW retains  
427 contact with a TB patient, the more likely they feel less confident of avoiding the risk. Repeated  
428 and daily exposure of TB patients makes HCWs more vulnerable to the risk of TB transmission  
429 and, simultaneously, leads to the fatalism beliefs that TB risks are somehow uncontrollable and  
430 unavoidable. Compared to knowledge-evoked dread, controllability of damage seemed to be a  
431 more critical aspect predicting risk perceptions. Therefore, assuring HCWs that TB risks are  
432 controllable despite their severity and having all the resources should be the cornerstone of any  
433 workplace interventions.

434 We asked participants to rate the condition of safety infrastructure in their workplace and the  
435 availability of personal protective equipment for reducing the possibility of TB transmission.  
436 Aligning with our hypothesis, participants who reported better safety infrastructure were more  
437 likely to feel confident in controlling or avoiding the risk of TB transmission. We assumed that  
438 safety infrastructure and the availability of protective equipment might be helpful to limit hazard  
439 exposure and serve as a nudge against the presence of a hazard. Therefore, providing protective  
440 equipment and better safety infrastructure might indirectly arouse higher risk perception and lead  
441 to the higher motivation to avoid the hazard.

442 We compared the expert assessment of TB transmission for each health care facility with  
443 (subjective) risk perception. We found no substantial difference between HCWs' self-rated risk



444 perception and profession-based risk, implying that our participants might have almost  
445 accurately estimated the risk of contracting TB. However, there was a slight difference between  
446 the aggregated risk of TB transmission assessed by our risk expert and HCWs self-rated risk  
447 perceptions, where the median of participants' risk perception was higher than assessed by our  
448 risk expert. Our findings concluded that HCW might overestimate the risk of TB transmission if  
449 the actual risk was aggregated at the health care facility level. We, nonetheless, believe that  
450 further research is necessary to improve the accuracy of risk assessments. The risk expert only  
451 relied on secondary data to estimate the TB transmission risk in this study. In contrast, a more  
452 comprehensive risk assessment that includes the detection of the prevalence of latent TB  
453 infections could improve the accuracy of risk estimation.

454 Our study has several limitations. First, the limitation is not to compare the TB transmission risk  
455 with other occupational hazards. Although we were only interested in investigating TB  
456 transmission, allowing other hazards in the model might result in multivariate analyses, leading  
457 to a more convincing finding<sup>48</sup>. Second, while investigating how HCW perceive the risk of TB  
458 nosocomial transmission is helpful to infer how they respond by performing or not performing  
459 preventive behaviours<sup>52</sup>, risk perception and safety efficacy beliefs are very dependent on the  
460 context<sup>28</sup>. Performing systematic procedures to obtain information on HCW risk perception  
461 might be helpful to H&S safety officers to characterise the perception of a specific hazard in a  
462 particular workplace context. Addressing HCW risk perception can be a good start to encourage  
463 HCW to be more involved in advocating a necessary resource allocation or even helping to raise  
464 laypeople awareness of TB transmission<sup>53</sup>, especially in the context of high TB burden countries  
465 such as Indonesia. At last, due to the nature of our research context, obtaining a sampling frame  
466 and thus performing probability sampling was not technically possible since there were no

467 accessible records on HCWs who worked at all health facilities in Surabaya. For this reason, the  
468 representativeness of our sample, as well as the generalisability of our findings, are not  
469 warranted.

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Telah melaksanakan penelitian dengan judul sebagai berikut :

No.	Judul Karya Ilmiah	Tahun Pelaksanaan
1	The Characteristics of Occupational Tuberculosis Risk in Healthcare Workers ( <a href="https://onlinelibrary.wiley.com/doi/10.1002/hpm.3489">https://onlinelibrary.wiley.com/doi/10.1002/hpm.3489</a> )	2022

Adapun penelitian tersebut layak dilakukan dan menghasilkan output yang sangat baik.

Demikian surat keterangan ini kami buat untuk dapat dipergunakan sebagai persyaratan pengusulan Jabatan Fungsional Guru Besar.

Surabaya, 16 April 2023

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