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Effect of infectious disease on paramedic students' willingness to perform mouth to mouth ventilation at a university

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Abstract: This study was conducted to confirm factors that negatively affect mouth-to-mouth ventilation (MMV) by laypersons. An internet non-face-to-face survey was conducted using NAVER Office with 101 respondents out of 157 paramedic students at a university. Whether or not to apply MMV according to the infection status of adults, children, and infants was analyzed through the Chi-Square test for each variable. There was a statistically significant difference between the proportion of willingness to perform MMV for suspected infection adult patients by male and female students (p=.004), for non-infection adult patients by training session (p=.030), for non-infection adult patients by experience in providing CPR (p=.011), for infection child patients by male and female students (p=.011), for suspected infection child patients by male and female students (p=.040), and for infection infant patients by male and female students (p=.011). Concerns over infection had a negative impact on paramedic students' willingness to perform MMV.

Keywords: *Experience, Female, Infection, Male, Paramedic students, Training.*

1. Introduction

The core American Heart Association (AHA) emergency cardiovascular care (ECC) educational concept includes hands-on practice to meet psychomotor and non-technical or leadership skill performance objectives [1], but there is a limit to developing the willingness to perform cardiopulmonary resuscitation (CPR). In general, education is achieved through the appropriate harmony of not only knowledge and skill but also attitude. To develop willingness to perform CPR, misunderstandings about brain death, fear of performing CPR incorrectly, concern for injuring the victim, physical limitations, fear of infection, victim characteristics, and fear of liability must be overcome [2]. With concerns over infection growing due to the recent COVID-19 pandemic, the fear of infection could be a negative factor in providing CPR. It should be taught that the risk of infection from CPR is low [3]. Fear of infection to the public acts as a barrier to performing CPR [4-13]. The AHA guidelines for CPR and ECC also emphasize pushing hard and fast in chest compressions to lower concerns about infection caused by contact. They focus on enhancing the effectiveness of out-of-hospital CPR while increasing blood flow to the brain and facilitating implementation by making it easier for laypersons to learn. The recommendation of compression-only (CO) CPR helps laypersons perform CPR without concerns about infection caused by mouth-to-mouth ventilation (MMV). CO-CPR is effective for cardiac arrest with cardiac etiology, but MMV and chest compressions are required for children and infant patients, who usually have cardiac arrest due to dyspnea [14-19]. If the factors that negatively affect MMV are analyzed in detail, it would be possible to further increase the willingness to

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perform CPR by using the identified factors for layperson CPR education. This study was conducted to confirm these factors in detail, assuming that the infection condition of cardiac arrest patients will negatively affect MMV by laypersons.

2. Materials and Methods

From September 27 to October 8, 2021, an internet non-face-to-face survey was conducted using NAVER Office on a total of 157 paramedic students, including 46 freshmen, 29 sophomores, 37 juniors, and 45 seniors. The survey designed for this study consisted of 25 questions to analyze the effects of infection on the respondents' willingness to perform CPR. It confirmed previous CPR training and experience of providing CPR, self-assessed scores on CPR knowledge, skills, and attitudes using by Likert scale. The respondents were asked to answer their willingness to perform CPR with 'yes or no' under conditions that do not involve body substance isolation, according to the cardiac arrest patients (adult, child, and infant), possibility of infection (infected, suspected, and non-infected), and CPR methods (MMV).

The collected data were analyzed using SPSS 20.0 for Windows (IBM Inc., New York, USA) at the α=.05 (two-tailed). Whether to apply or not MMV according to the infection status of adults, children, and infants was analyzed through the Chi-Square test for each variable. In addition, a reliability analysis was conducted on 18 questions that investigated the willingness to perform MMV. Since Cronbach's α was .889, the questions had good internal consistency. This investigation was conducted with the consent of the students, and there was no disadvantage to responding; consent could be withdrawn at any time. To induce sincere answers, the name and school number were entered, but personal information was discarded while organizing the data.

3. Results and Discussion

The average age of the respondents was 21.2 years old, and 101 respondents out of 157 eligible students, including 63 females and 38 males, responded to the survey. The freshman was the largest group with 38 respondents, followed by 27 juniors, and 18 sophomores and seniors. 97 respondents had experience in CPR training, and the highest number of training sessions attended was 57, while 90 respondents had no experience in providing CPR. Self-assessed CPR scores were 4.1 in knowledge, 4.0 in skill, and 4.2 in attitude [Table 1].

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Table 1.
Characteristics of respondents (N=101).

Respondents	**N (%)**
Age, M(SD)	21.2(2.23)
Sex	
male	38(37.6)
female	63(62.4)
Paramedic student	
freshman	38(37.6)
sophomore	18(17.8)
junior	27(26.7)
senior	18(17.8)
Previous CPR training	
yes	97(96.0)
no	4(4.0)
Number of CPR training, M(IQR)	2.6(2.0)
0	4(4.0)
1	57(56.4)
2	11(10.9)
3	5(5.0)
4	8(7.9)
5	8(7.9)
8≤	8(7.9)
Experience in providing CPR	
yes	11(10.9)
no	90(89.1)
Number of providing CPR, M(SD)	0.6(2.87)
0	90(89.1)
1	5(5.0)
2	1(1.0)
3	1(1.0)
4	1(1.0)
5	1(1.0)
6≤	2(2.0)
Self-assessed score*, M(SD)	
knowledge	4.1(0.70)
performance	4.0(0.72)
attitude	4.2(0.71)

Note: M: mean, SD: standard deviation, CPR: cardiopulmonary resuscitation, IQR: interquartile range.
*Likert scale: 1, not at all; 2, not really; 3, undecided; 4, somewhat; 5, very much.

Twelve adults, 17 children, and 17 infants responded that MMV and chest compression could be performed on patients with infected cardiac arrest, but 73 adults, 74 children, and 69 infants responded that only chest compression could be performed. Twenty-four adults, 28 children, and 31 infants responded that MMV and chest compression could be performed on patients with suspected cardiac arrest, but 82 adults, 79 children, and 81 infants responded that only chest compression could be performed. Eighty-three adults, 83 children, and 81 infants responded that MMV and chest compression could be performed on patients with non-infected cardiac arrest, but 99 adults, 96 children, and 96 infants responded that only chest compression could be performed.

There was no difference in the willingness to perform CPR according to the age of the infected patient, but there was a difference in the willingness to perform CPR according to the infection status

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and CPR method. In MMV and chest compression, the willingness to perform CPR increased relatively rapidly in the order of infection, suspected infection, and non-infection. However, in CO-CPR, the willingness to perform CPR increased relatively slowly. Overall, the willingness to perform chest compression on non-infected patients was the greatest [Table 2].

Table 2.
Respondents' willingness to perform cardiopulmonary resuscitation according to infection (N=101).

Patient	Willingness*(%)	
	Mouth-to-mouth ventilation & chest compression	Compression-only
Adult		
Infection	12(11.9)	73(72.3)
Suspected Infection	24(23.8)	82(81.2)
Non-Infection	83(82.2)	99(98.0)
Child		
Infection	17(16.8)	74(73.3)
Suspected Infection	28(27.7)	79(78.2)
Non-Infection	83(82.2)	96(95.0)
Infant		
Infection	17(16.8)	69(68.3)
Suspected Infection	31(30.7)	81(80.2)
Non-Infection	81(80.2)	96(95.0)

Note: *The number of respondents who answered yes.

There was a statistically significant difference between the proportion of willingness to perform MMV for suspected infection adult patients by male and female students, and the association between these variables was moderate (p=.004; contingency coefficient=.276). Female students' willingness to perform MMV (14.3%) was small. There was a statistically significant difference between the proportion of willingness to perform MMV for non-infection adult patients by training session, and the association between these variables was moderate (p=.030; contingency coefficient=.221). Students with more than twice the training session's willingness in MMV (92.5%) were large. There was a statistically significant difference between the proportion of willingness to perform MMV for non-infection adult patients by experience in providing CPR, and the association between these variables was moderate (p=.011; contingency coefficient=.244). Students with no experience in CPR's willingness in MMV (92.5%) was large [Table 3].

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Table 3.
Respondents are willing to perform mouth-to-mouth ventilation on an adult according to the infection, n(%).

Patient	**Infection**		**Suspected infection**		**Non-infection**	
Mouth-mouth ventilation	Yes.	No.	Yes.	No.	Yes.	No.
Gender						
Male	10(26.3)	28(73.7)	15(39.5)	23(60.5)	32(84.2)	6(15.8)
Female	2(3.2)	61(96.8)	9(14.3)	54(85.7)	51(81.0)	12(19.0)
p; contingency coefficient	<.001*		.004; .276		.679	
Number of CPR training sessions						
1	3(5.3)	54(94.7)	9(15.8)	48(84.2)	43(75.4)	14(24.6)
2≤	6(15.0)	34(85.0)	12(30.0)	28(70.0)	37(92.5)	3(7.5)
p; contingency coefficient	.104*		.094		.030; .221	
Experience in providing CPR						
yes.	1(9.1)	10(90.9)	1(9.1)	10(90.9)	6(54.5)	5(45.5)
no.	11(12.2)	79(87.8)	23(25.6)	67(74.4)	77(85.6)	13(14.4)
p; contingency coefficient	.762*		.226*		.011; .244	

Note: CPR: cardiopulmonary resuscitation.
*Expected frequency of one or more cells is less than 5.

There was a statistically significant difference between the proportion of willingness to perform MMV for infected child patients by male and female students, and the association between these variables was moderate (p=.011; contingency coefficient=.244). Female students' willingness to perform MMV (9.5%) was small. There was a statistically significant difference between the proportion of willingness to perform MMV for suspected infected child patients by male and female students, and the association between these variables was moderate (p=.040; contingency coefficient=.200). Female students' willingness to perform MMV (20.6%) was relatively small [Table 4].

Table 4.
Respondents willing to perform mouth-to-mouth ventilation for a child according to infection n(%).

Patient	**Infection**		**Suspected infection**		**Non-infection**	
Mouth-mouth ventilation	**Yes.**	**No.**	**Yes.**	**No.**	**Yes.**	**No.**
Gender						
Male	11(28.9)	27(71.1)	15(39.5)	23(60.5)	32(84.2)	6(15.8)
Female	6(9.5)	57(90.5)	13(20.6)	50(79.4)	51(81.0)	12(19.0)
p; contingency coefficient	.011; .244		.040; .200		.679	
Number of CPR training sessions						
1	4(7.0)	53(93.0)	11(19.3)	46(80.7)	44(77.2)	13(22.8)
2≤	10(25.0)	30(75.0)	14(35.0)	26(65.0)	36(90.0)	4(10.0)
p; contingency coefficient	.013*		.082		.102*	
Experience in providing CPR						
yes.	1(9.1)	10(90.9)	1(9.1)	10(90.9)	7(63.6)	4(36.4)
no.	16(17.8)	74(82.2)	27(30.0)	63(70.0)	76(84.4)	14(15.6)
p; contingency coefficient	.467*		.144*		.089	

Note: CPR: cardiopulmonary resuscitation.
*Expected frequency of one or more cells is less than 5.

There was a statistically significant difference between the proportion of willingness to perform MMV for infection in infant patients by male and female students, and the association between these variables was moderate (p=.011; contingency coefficient=.244). Female students' willingness to perform MMV (9.5%) was small [Table 5].

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Table 5.
Respondents willing to perform mouth-to-mouth ventilation for an infant according to infection n(%).

Patient	**Infection**		**Suspected infection**		**Non-infection**	
Mouth-mouth ventilation	Yes.	No.	Yes.	No.	Yes.	No.
Gender						
Male	11(28.9)	27(71.1)	15(39.5)	23(60.5)	32(84.2)	6(15.8)
Female	6(9.5)	57(90.5)	16(25.4)	47(74.6)	49(77.8)	14(22.2)
p; contingency coefficient	.011; .244		.137		.432	
Number of CPR training sessions						
1	4(7.0)	53(93.0)	13(22.8)	44(77.2)	45(78.9)	12(21.1)
2≤	10(25.0)	30(75.0	15(37.5)	25(62.5)	33(82.5)	7(7.5)
p; contingency coefficient	.013*		.116		.664	
Experience in providing CPR						
yes.	1(9.1)	10(90.9)	1(9.1)	10(90.9)	7(63.6)	4(36.4)
no.	16(17.8)	74(82.2)	30(33.3)	60(66.7)	74(82.2)	16(17.8)
p; contingency coefficient	.467*		.110*		.114*	

Note: CPR: cardiopulmonary resuscitation.
*Expected frequency of one or more cells is less than 5.

Although the willingness to perform MMV differed greatly depending on the patient's infection status, the willingness to perform CO-CPR was relatively small, so CO-CPR amid a pandemic is expected to help activate CPR. However, since the willingness to perform CO-CPR for infected patients was small, it is necessary to strengthen CO-CPR through infection prevention education. Concerns over infection have reduced paramedic students' willingness to perform MMV. The statistically significant small willingness of female students to perform MMV was consistent with the results of previous studies [20-22]. It is believed that education, which can reduce women's fear of infection, should be further strengthened. However, previous studies investigated willingness to perform standard CPR rather than MMV, and there was no statistically significant difference between male and female students in this study's willingness to perform CO-CPR.

Students who trained in CPR more than twice showed a greater willingness to perform MMV, which is consistent with previous studies indicating that training enhances willingness [23-27]. Previous studies did not separate and investigate willingness to perform MMV, and in this study, the difference between once and twice or more was analyzed because more than half of the students were trained once. It is interpreted that the students who trained more than twice had a high willingness, because the training interval was relatively short. Since knowledge and skill decline 3-12 months after training, it is estimated that willingness will decline after several months as well. Therefore, it is judged that it is necessary to analyze the optimal training interval rather than the number of training sessions. The AHA Guidelines: Resuscitation Education Science, mentioned that the addition of booster training to the CPR education is related to maintenance of skills, and the application of spaced learning compared to intensive learning improves clinical performance and technical skills. It indirectly supports the importance of the optimal training interval [1].

The reason why students with no experience in providing CPR were willing to perform MMV on non-infected adult patients is believed to be due to the growing awareness of infection among students who had experience in providing CPR. In a study published in 2008, it was found that the experience of providing CPR increased willingness to perform [23, 28], but in this study, paramedic students who experienced the COVID-19 pandemic were respondents, which is interpreted as a result of increased awareness of infection. It is believed that infection prevention should be strengthened in CPR education, as laypersons are more likely to hesitate not only with mouth-to-mouth ventilation (MMV) but also with CO-CPR.

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4. Conclusion

Concerns over infection had a negative impact on the paramedic students' willingness to perform MMV. In particular, female students had a small willingness to perform MMV for suspected infection adult patients, infection & suspected infection child patients, and infection infant patients. Students who trained more than twice had a greater willingness to perform MMV for non-infected adult patients, and students who had no experience in providing CPR had a greater willingness to perform MMV for non-infected adult patients.

Transparency:

The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.

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