

# Practices of personal protective measures against SARS-Cov-2 among undergraduate medical students in South India

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## ABSTRACT

**Introduction:** Personal protective measures (PPMs) hold relevance despite mass coverage of COVID-19 vaccination. Medical students can be vital in training people in infection control practices. This study was therefore done to assess the practices of PPMs among undergraduate medical students against COVID-19.

**Methods:** A cross-sectional study was done in January 2021 among first to final-year students at a private medical college in Mangalore. Data were collected using a Microsoft form. A sample size of 282 was calculated. However, a sample size of 302 was achieved.

**Results:** The mean age of the 302 participants was 21.2±1.6 years. The majority of them were females 179 (59.3%). Face mask was worn by 295 (97.7%) participants. Non-recommended types of face masks like using cloth masks 108 (36.6%) and handkerchiefs 7 (2.4%) were reported by face mask users. Face mask was worn incorrectly on most occasions by 35 (11.9%) users. Replacement of disposable type of face masks was not done every day by 181 (61.4%) face mask users. Discarding of disposable masks was not done whenever it became moist on every occasion by 142 (48.1%) users. Only 79 (26.8%) users always practiced proper disposal of face masks. Hand sanitizer to disinfect hands was always used by 102 (33.8%) participants. Only 42 (13.9%) participants always practiced the six steps of hygienic hand washing. Only 58 (19.2%) participants had a good level of practice of PPMs against COVID-19. Practice level was significantly poorer among males and first-year students.

**Conclusion:** Several gaps in PPMs against COVID-19 were identified among participants which need to be addressed during future training programs.

**Keywords:** COVID-19, Personal protective measures, Practices, Undergraduate medical students

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## Introduction

Personal protective measures (PPMs) hold relevance despite mass immunization coverage of COVID-19 vaccination in the population. This is because vaccination only gives protection from severe COVID-19 and does not prevent of risk of infection. Moreover, there is always a persistent

risk of transmission of new strains of SARS-Cov-2, which are more infectious than previous strains.<sup>1</sup>

Essential components of personal protective equipment (PPE) for preventing SARS-Cov-2 infection comprise wearing facemasks, face shields, and hand gloves, amongst others.<sup>2</sup> The

effectiveness of PPEs further depends upon the method of wearing the facemask, wearing time, and the storage, disposal, and periodicity of decontamination of reusable products. Adherence to these recommendations is a must, as improperly worn facemasks do not offer the desired level of protection. It would rather predispose the user to spread the infection to others. Other preventive measures, such as hygienic hand washing and periodic disinfection of frequently used surfaces, are also beneficial to prevent SARS-Cov-2 transmission.

There is a need to raise the awareness of the general population to continue using PPEs despite being fully vaccinated against SARS-Cov-2. This requires the support of undergraduate medical students who are role models in society. Non-compliance with any of the COVID-19 preventive practices among them gives stakeholders crucial information for planning content to be covered in future training programs. This will enhance the skills of young medical graduates to deal with public health emergencies similar to COVID-19 in the future. Hence there was a need to test the hypothesis of whether the practices of PPMs against COVID-19 were satisfactory or not among medical students in the settings.

Very few studies on this topic have been done in India despite the presence of COVID-19 from the beginning of 2020.<sup>3</sup> Prior studies done elsewhere had limitations. For instance, medical students of only particular semesters were included in a study done in Russia.<sup>4</sup> A study done in Jordan, presented findings combining medical with other health science students.<sup>5</sup> To address these limitations in the review of the literature, and to improve epidemic preparedness among medical students in the setting for dealing with infectious diseases in the future, this study was essential. The objective of the present study was therefore to assess the practices of undergraduate medical students regarding PPMs against COVID-19.

## Methods

This cross-sectional study was done in January 2021 among undergraduate medical students of a private institution in Mangalore situated in south

India. The ethics committee approval was taken on December 16<sup>th</sup>, 2020 from the institutional ethics committee. The approval number was IECKMCLR-12/2020/414. Permission to collect information from students was subsequently taken from the Dean of this institution.

The sample size was calculated using the formula  $4pq/d^2$ . In a study done in Poland<sup>6</sup>, during the first wave of COVID-19, 62.8% of medical students wore face masks. Based on this proportion, at 95% confidence interval and 90% power, the sample size was calculated as 237. Adding 20% as the non-response rate, the final sample size that was targeted in the present study was 285.

A semi-structured questionnaire designed as a Microsoft form was used for data collection. It was prepared with the help of literature available online. The questionnaire was content-validated with the help of faculty members from the Department of Medical Education. It was then pilot-tested among five medical students who were not part of the main study.

The data collection tool was circulated among all medical students of this institution with the help of WhatsApp and email. The first page of the questionnaire contained the information sheet and consent form. Those participants who did not consent to participate and those below 18 years were excluded from participation. Incompletely filled questionnaires were also excluded.

The questionnaire had two sections. The first section enquired about the socio-demographic details of the participants. The second section enquired about their preventive practices since the onset of the COVID-19 pandemic. The frequency of practices was assessed on a five-point Likert scale using responses "always", "most of the time", "sometimes", "rarely", and "never".

The level of practice was assessed by assigning scores to each component of PPMs against COVID-19. The practice of wearing any recommended face mask outside the house, if reported "always" by the respondent, was scored 1, the method of wearing a face mask by covering the bridge of the nose to the bottom of the chin if

reported “always” was scored 1, the practice of preserving disposable face mask in a plastic bag for subsequent usage or disposing of it in a covered bin if reported “always” was scored 1, replacement of disposable mask if done every day was scored 1, the practice of discarding disposable masks as and when it becomes moist if reported “always” was scored as 1, the practice of using hand sanitizers to disinfect the hands if reported “always” was scored as 1, the practice of disinfecting the surfaces at the workplace if reported “always” was scored as 1, and method of washing hands by following all six steps of hygienic hand wash if reported “always” was scored as 1. The minimum and maximum possible scores ranged from 0 to 8. The scores assigned to the most essential components of practices, namely, always wearing any recommended facemask, always following the right method of wearing the facemask, always following the right method of preserving or disposing of the face mask, always practicing the right periodicity of replacement of the disposable mask, always discarding disposable masks when it becomes moist, and always using hand sanitizers totaled to 6 points. Hence, non-achievement of 6 points (or 75% of the maximum score) was considered a poor level of practice against the prevention of COVID-

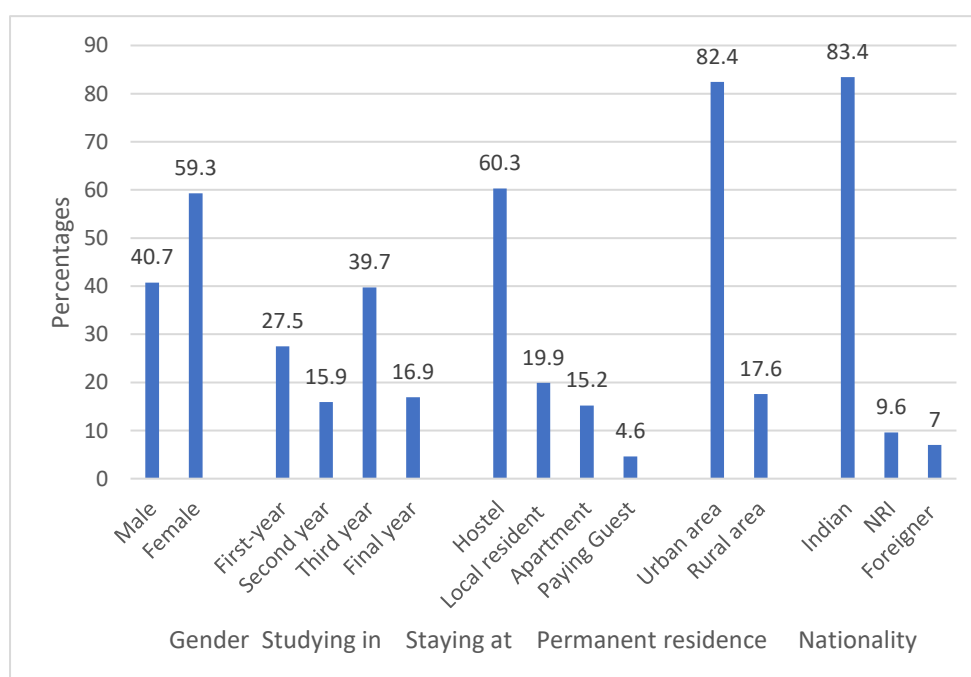
19. Achievement of 7 or 8 points was considered a good level of practice among the participants. The data was analyzed using IBM Statistical Package for Social Sciences for Windows version 25.0, Armonk, New York. Descriptive statistics like percentages, mean and standard deviation were calculated. Univariate analysis was done using the Chi-square test. All variables associated with a p-value of 0.20 or less in univariate analysis were introduced into the binary logistic regression model. p value less than 0.05 was taken as the cut-off to assess significance. The reliability of the questionnaire was analyzed. Cronbach’s alpha value was 0.903, indicating excellent internal consistency.

### Results

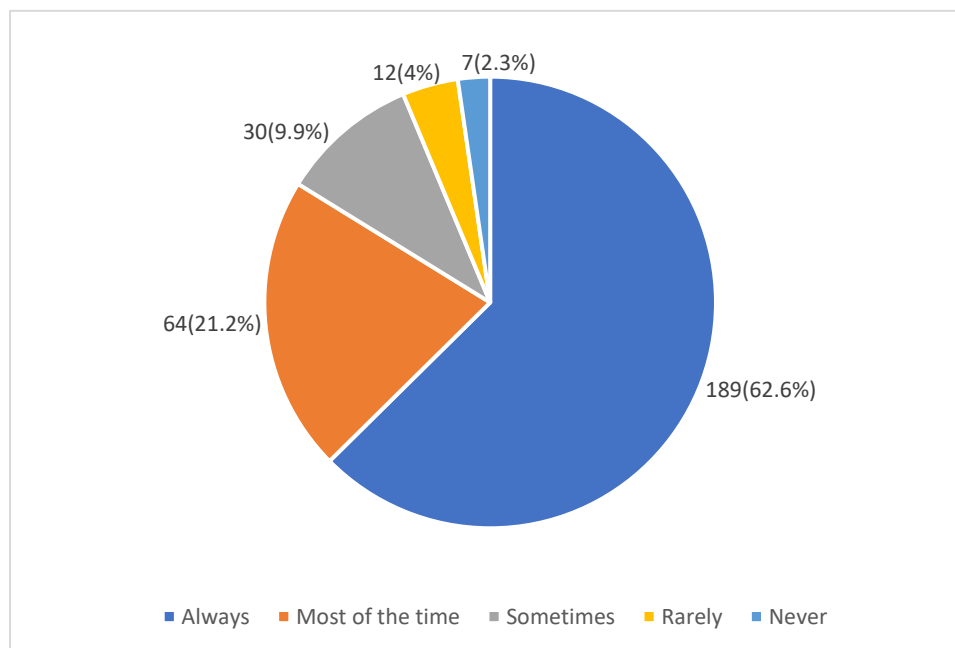
A total of 340 participants consented to take part in this study. However, filled questionnaires were submitted by only 302 of them giving a response rate of 88.8%.

The mean age of the participants was  $21.2 \pm 1.6$  years and it ranged from 18 to 25 years. The majority were females 179 (59.3%), and a majority of them were permanent residents of urban areas 249 (82.4%) as shown in Figure 1.

The face mask was worn by 295 (97.7%) participants as shown in Figure 2.



**Figure 1:** Socio-demographic distribution of the study participants (n=302).



**Figure 2:** Frequency of wearing face masks outside the house among the participants (n=302)

**Table 1:** Practices of using face masks against COVID-19 among the participants since the onset of the COVID-19 pandemic (n=302).

Description	N	%
<b>The practice of using a face mask</b>		
Yes	295	97.7
No	7	2.3
<b>Type of face mask used (n=295)*</b>		
Triple-layered surgical masks	164	55.6
N95 masks	155	52.5
Cloth masks	108	36.6
Single-layered surgical masks	83	28.1
FFP2	10	3.4
Handkerchief	7	2.4
<b>Method of wearing a face mask (n=295)</b>		
Covering the bridge of the nose to the bottom of the chin on most occasions	260	88.1
Covering only the mouth on most occasions	18	6.1
By placing it below the chin on most occasions	8	2.7
By strapping it around the neck on most occasions	9	3.1
<b>Number of face masks worn on each occasion (n=295)</b>		
Single	245	83.0
Double	48	16.3
Triple	2	0.7
<b>Frequency of usage of multiple masks (n=50)</b>		
Always	8	16.0
Most of the time	12	24.0
Sometimes	17	34.0
Rarely	13	26.0

\*Multiple responses

All of them were using disposable type of face masks. The most common type of face mask used was triple-layered surgical mask 164 (55.6%) among the face mask users as shown in Table 1. Non-recommended types of face masks like using cloth masks were reported by 108 (36.6%) and handkerchiefs to cover their face by seven face mask users.

Out of 295, 260 (88.1%) participants wore the mask in the right way by covering from the bridge of the

nose to the bottom of the chin on most occasions. Only 79 (26.8%) face mask users always practiced proper disposal of face masks. Periodicity of replacement of disposable type masks at least once a day was reported by 114 (38.6%) out of the 295 face mask users.

Out of 295 face mask users, 153 (51.9%) always practiced discarding disposable masks whenever they became moist as shown in Table 2.

**Table 2:** Practices of preserving, replacing, and discarding disposable type of face masks after usage among the participants using face masks since the onset of the COVID-19 pandemic (n=295).

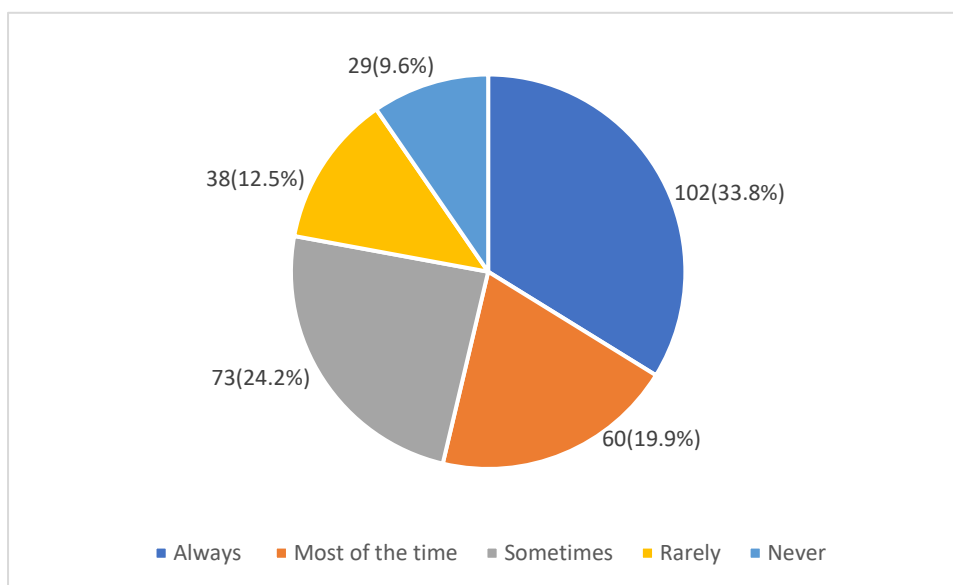
Description	N	%
The practice of preserving disposable face masks in a plastic bag for subsequent usage or disposing of the same day in a covered bin		
Always	79	26.8
Most of the time	98	33.2
Sometimes	91	30.8
Rarely	23	7.8
Never	4	1.4
Periodicity of replacing disposable face mask		
After every use	67	22.7
Once a day	47	15.9
Once in 2 days	50	17.0
Once in 3 days	50	17.0
Once a week	47	15.9
Once in 2 weeks	22	7.4
Once a month	12	4.1
The practice of discarding disposable mask when it becomes moist		
Always	153	51.9
Most of the time	112	38.0
Sometimes	27	9.1
Rarely	3	1.0
Never	0	0

Hand sanitizers were used by 273 (90.4%) participants as shown in Figure 3.

Out of the 273 hand sanitizer users, 218 (79.8%) used alcohol-based sanitizers, 22 (8.1%) used ayurvedic sanitizers (non-alcohol-based sanitizers) and 33 (12.1%) used both types of sanitizers. Among the 251 alcohol-based sanitizer users, the

frequency of checking its alcohol content was reported always by 21 (8.4%), most of the time by 23 (9.2%), sometimes by 39 (15.5%), rarely by 57 (22.7%), and never by 111 (44.2%) of them.

The practice of washing hands by following all six steps of hygienic hand washing was always done by 42 (13.9%) participants as shown in Table 3.



**Figure 3:** Frequency of usage of hand sanitizers among the participants (n=302).

**Table 3:** Practices of usage of other personal protective measures against COVID-19 among the participants since the onset of the pandemic (n=302).

Description	Frequency of usage									
	Always		Most of the time		Sometimes		Rarely		Never	
	N	%	N	%	N	%	N	%	N	%
The pattern of usage of face shields outside the house	12	4.0	23	7.6	38	12.6	60	19.8	169	56.0
The practice of wearing hand gloves	12	4.0	23	7.6	36	11.9	70	23.2	161	53.3
Frequency of disinfecting the surfaces at the workplace	76	25.2	65	21.5	108	35.8	31	10.2	22	7.3
The practice of washing hands by following all the six steps of hygienic hand wash	42	13.9	58	19.2	100	33.1	61	20.2	41	13.6

The pattern of handwashing was reported as and only when required by 225(74.5%), prophylactically every 30 minutes by 29(9.6%), and prophylactically every hour by 48(15.9%) participants.

The level of practice of using PPMs during the COVID-19 pandemic was found to be of a good level among 58(19.2%) participants.

In both univariate and multivariable analyses, males and first-year students significantly reported poorer practices concerning the usage of PPMs against COVID-19 infection as shown in Table 4. However, no association of the same was seen with the participant's current place of stay ( $p=0.424$ ) and permanent place of residence ( $p=0.222$ ).

**Table 4:** Association of socio-demographic variables with the level of practices of personal protective measures among the participants during the COVID-19 pandemic (n=302).

Socio-demographic variables	Good level of practice		Poor level of practice		Total	UOR (95% CI)	$\chi^2$ value, p-value	AOR (95% CI)	p-value
	N	%	N	%					
<b>Age (years)</b>									
≥20	51	21.0	192	79.0	243	1.973 (0.846-4.604)	$\chi^2=2.547$ p=0.111	1.644 (0.395-6.84)	0.494
≤19	7	11.9	52	88.1	59	1		1	
<b>Gender</b>									
Females	44	24.6	135	75.4	179	2.538 (1.322-4.872)	$\chi^2=8.185$ p=0.004	2.764 (1.422-5.373)	0.003
Males	14	11.4	109	88.6	123	1		1	
<b>Year of study</b>									
2 <sup>nd</sup> to final year	50	22.8	169	77.2	219	2.774 (1.253-6.138)	$\chi^2=6.751$ p=0.0094	3.331 (1.48-7.498)	0.004
1 <sup>st</sup> year	8	9.6	75	90.4	83	1		1	
<b>Nationality</b>									
Indians	52	20.6	200	79.4	252	1.907 (0.771-4.717)	$\chi^2=2.0$ p=0.157	2.234 (0.884-5.648)	0.089
NRIs/ Foreigners	6	12.0	44	88.0	50	1		1	
<b>Total</b>	58		244		302				

$\chi^2$ : Chi-square, UOR: Unadjusted Odds Ratio, AOR: Adjusted Odds Ratio, NRIs: Non-Residential Indians

## Discussion

In the present study, 97.7% of participants wore face masks in comparison to 62.8% reported in a study done in Poland,<sup>6</sup> 70.3% reported in a study done in Raipur, India,<sup>3</sup> and 94.9%,<sup>7</sup> and 97.5%<sup>4</sup> in studies done in Russia among medical students during the COVID-19 pandemic. Although none of the above-mentioned studies reported 100% usage, it becomes a civic responsibility to wear face masks both for personal protection and for others during the COVID-19 pandemic.<sup>7</sup>

The majority of the participants in this study used the recommended triple-layered surgical mask, which was similar to the findings of the Polish study,<sup>6</sup> where 42.4% and in a study done in Georgia,<sup>8</sup> where 80.8% medical students used the same. In the study done in Raipur, India, N95 was used by 74.5% of medical students.<sup>3</sup> This meant

that most students used the correct type of face mask during the COVID-19 pandemic. However non-recommended types of face masks like cloth type of face masks and usage of handkerchiefs as face masks were used by 36.6% and 2.4% of face mask users respectively in the present study. In the Russian study,<sup>4</sup> 27.4% and in the Polish study,<sup>6</sup> 42.9% participants too had used cloth type of face masks.

As much as 17% of the 295 face mask users in this study, reported having used multiple face masks simultaneously, as also practiced by 35.1% of participants in the Polish study.<sup>6</sup> Use of multiple masks, although may feel discomforting, is known to improve the efficacy of face masks.<sup>10</sup>

In this study, 11.9% of the face mask users had worn the face mask incorrectly, which defeats the purpose of wearing it and gives a false assurance

of protection to both users and others. Similarly in the Polish study,<sup>6</sup> 14.3% and in the Russian study,<sup>4</sup> 24.8% respondents did not cover their mouth and nose while using the face masks. The correct method of wearing a face mask is by covering the bridge of the nose to the bottom of the chin.<sup>11</sup> The correct method of wearing face masks needs to be emphasized in future training programs among medical students by demonstration and back demonstration methods.

As many as 61.4% of face mask users in this study did not replace the disposable type of face mask every day, as also reported by 58.9% of participants in a study done in Georgia.<sup>8</sup> As per the recommendations, disposable face masks need to be replaced every day.<sup>12</sup>

In the present study, disposable face masks, when moist, were not discarded on every occasion by 48.1% of the 295 face mask users. Other studies also reported that 13.6%<sup>3</sup> and 69.5%<sup>13</sup> participants continued wearing masks despite being moist. Moist face masks do not offer any protection and hence need to be discarded immediately.<sup>14</sup>

73.2% of the 295 face mask users in this study did not practice appropriate disposal of face masks on every occasion. In prior studies too, 22.9%,<sup>3</sup> 39.2%,<sup>6</sup> and 44.3%<sup>4</sup> did not practice the same. As per recommendations, disposable face masks need to be kept in a closed plastic bag after usage or, if intended to be discarded, to be done in a covered bin.<sup>12,14</sup>

Appropriate usage and disposal of face masks are crucial in avoiding the contamination of the mouth and nose by infective droplets during the pandemic.<sup>2</sup> Faulty practices will reduce the efficacy of infection control practices. These issues should therefore be addressed in future training programs for medical undergraduates.

Other gaps in practices identified among participants in this study, such as non-compliance with the six steps of hygienic hand washing recommended by the World Health Organization,<sup>15</sup> and not disinfecting the hands and other frequently touched surfaces also need to be covered in future training programs. Although

these are not known to be the predominant modes of transmission of COVID-19, these practices are however essential among medical students for preventing infections during their clinical postings.<sup>2</sup>

In the present study, females and second to final-year students had a better practice level of PPMs compared to males and first-year students. In other studies, practice scores were significantly higher among medical students with prior volunteering experiences, among females, students from private universities, and among third-year students.<sup>3,16</sup>

Through their clinical exposure during hospital postings, second to final-year students are expected to have better information and experience in using PPE and practicing other preventive measures for infection control. This may be the reason behind their practice level being significantly better than the pre-clinical students in the first year. Male students need to be motivated to exhibit greater seriousness in following preventive practices for infection control. Methods of proper usage and handling of PPEs need to be covered in the medical curriculum. Such skill training in pandemic response will enable them to be competent volunteers in assisting healthcare professionals in the fight against COVID-19 and other similar medical emergencies in the future.

## Conclusions

Several gaps in the practices of PPMs against COVID-19 were identified in this study. Face mask was incorrectly worn, recommended wearing time was exceeded, repeated use of moist disposable masks was practiced, masks were not properly disposed of, and hand sanitation practices were not followed by several participants. Dangerous practices like not wearing face masks or using handkerchiefs as face masks were reported by a few participants. Hardly one in five participants had a good level of practice of following PPMs against COVID-19. Practice level was significantly poorer among males and first-year students. These issues need to be addressed in future training programs particularly among



males and first-year students to make them better prepared to deal with medical emergencies like COVID-19 in the future. The findings of this study might help relevant stakeholders and policymakers design an appropriate medical curriculum to update and train medical students to enhance their skills in infection control.

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## Limitations

This was a unicentric study, and hence its findings may not be generalizable to all medical students.

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