

Characteristics of mask adherence in low and medium-income countries and high-income countries: Results from round II of the global COVIDiSTRESS survey

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ABSTRACT

Many studies have connected mask-wearing during the coronavirus pandemic to various characteristics and beliefs; yet much of this research has been conducted in wealthy countries in the Global North. Performing secondary analysis of the COVIDiSTRESS survey, conducted online in 137 countries between May 28th and August 29th of 2021, we find that there are important differences in the characteristics related to mask adherence in places the World Bank classifies as low and medium-income countries (LMICs) and high-income countries (HICs). Our findings suggest that: (1) identifying as a woman has a stronger impact on the likelihood of mask adherence in HICs than LMICs; (2) an increase in age only has a positive impact on mask adherence in LMICs; (3) SES (especially higher levels of education) has a much stronger positive impact on mask adherence in LMICs than HICs; (4) while a belief in conspiracy theories has a stronger negative impact in HICs than LMICs, this result is not statistically significant; and (5) acquiring of scientific information on COVID-19 is only positively correlated with an increased likelihood of mask adherence in LMICs. If there is another pandemic, we argue that this shows that research on mask adherence conducted in the Global North should not simply be applied to countries in the Global South.

Key words:

mask adherence; COVID-19; LMICs; HICs

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INTRODUCTION

As facemasks became a key non-pharmaceutical intervention against COVID-19, researchers rapidly tried to understand why some people complied with masking policies while others did not. Facemasks have been shown to significantly reduce the transmissibility of viral respiratory infections in clinical and laboratory settings and when compliance is high mask-wearing is effective at reducing the spread of SARS-CoV-2 worn by healthcare and non-healthcare workers emphasising their importance¹. While studies showed that mask adherence was related to various characteristics and beliefs, most of this research – with some exceptions^{2,3} – was conducted in wealthy nations in the Global North. Research from Australia, the United States, Canada, Britain, and EU countries found adherence was related to being female,^{4,5,6,7} being older,^{4,5,7,8,9} prosocial attitudes,¹⁰ a belief in science,^{7,11} a disbelief in conspiracy theories,^{11,12} higher levels of education,^{6,9,11} and higher levels of socioeconomic status (SES) overall.⁶

As most of this research is performed in industrialized nations in the Global North, we wondered: are the characteristics related to mask adherence the same in lower income countries in the Global South as in higher income countries in the Global North? The aim of this study is to observe whether there are any important differences in the characteristics related to mask adherence in places the World Bank classifies as either low and middle income (LMICs) or high-income countries (HICs). To examine this issue, we used round II of the COVIDiSTRESS international survey to run logistic regressions to measure the impact of respondents' demographics, SES, social attitudes, and information sources on the likelihood of adhering to mask policies. The scope of this study is thus limited to the

demographic and social characteristics related to mask adherence in LMICs and HICs included in the survey.

Our results, detailed below, suggest that there are important differences in gender and age, levels of socioeconomic status, and respondents' information sources (i.e., acquisition of scientific information on COVID-19 versus belief in conspiracy theories) between these two economic regions of the world. Our short report thus recommends that if and when there is another pandemic, research on mask adherence from HICs in the Global North cannot simply be applied to LMICs in the Global South. Instead, research-informed public health policy on masks needs to be region-specific.

METHODS

Although the entire world was impacted by COVID-19, LMICs and HICs had different experiences of the pandemic. Healthcare systems in LMICs faced significant strain due to limited resources and inadequate infrastructure. The implementation of policies was further complicated by challenges such as overcrowding and insufficient access to essential resources like clean water and sanitation.¹³ While HICs appeared to navigate the pandemic with less difficulty, they also encountered strains on healthcare services, including hospital overcrowding and difficulties faced by essential workers in ensuring their safety.¹³ And despite their relative greater capacity, higher income countries such as the United States and others – actually experienced more COVID-19 deaths per million than lower income countries in the Global South.¹⁴

This study uses data from round II of the COVIDiSTRESS survey that was conducted online in 137 countries between May 28th and August 29th of 2021 with a

total of 15,740 persons. Participants were recruited in various ways such as via word of mouth, TV advertisements, and social media and email listings. The criteria for inclusion in the survey was providing informed consent, being over the age of 18, passing the attention check, and not completing the survey under three minutes. Ethical approval was provided by the University of Salford. Full access to the survey data is available at <https://osf.io/36tsd/> and COVIDiSTRESS II Consortium¹⁵ provides a more thorough description of the survey.

To examine which characteristics are related to mask adherence, we used the following survey question as our dependent variable: “Many countries have issued guidelines for staying safe during the COVID-19 pandemic. Think about the last month, to what extent do you agree with the statements about what you did? Wore a face covering in public when indoors (e.g., in a supermarket or cafe)?” Originally coded on a seven-point scale from “strongly disagree” to “strongly agree,” we transformed this into a binary variable. “Adhered to mask policies” was coded 1 and includes “slightly agree,” “agree,” and “strongly agree” responses to the above statement. “Did not adhere to mask policies” was coded 0 and includes all other responses to the above statement.

The main independent variables in our analysis are gender, age, SES, prosocial attitude, belief in conspiracy theories, and acquisition of scientific information on COVID-19. Response categories for all variables are listed in Table 1. Age is a continuous variable measured in years and self-identified gender was recorded as a binary variable of “male” and “female” as there was only a very small number of responses other than this. To measure SES, we used respondents’ (a) employment status (“unemployed” as the reference category), (b) highest level of education (“12 years of education” as the reference category), and (c) respondents’ perception of their position within their nation’s economic hierarchy

(examined as a continuous variable along a nine-point scale).

The prosocial attitude was measured by observing whether respondents agreed (i.e., “slightly agree,” “agree,” and “strongly agree”) with the statement that “Compassion for those who are suffering is the most crucial virtue.” Belief in conspiracy theories was assessed by whether the respondent agreed (same categories as above) with the statement that “Big events like wars, recessions, and the outcomes of elections are controlled by small groups of people who are working in secret against the rest of us.” Acquisition of COVID-19 scientific information was based on a question that asked the respondents whether they used “scientific journals or websites” to gain information about COVID-19. We also controlled for relationship status, whether the respondents had dependents, and whether respondents believed they had ever had COVID-19.

To observe the characteristics related to mask adherence we used logistic regression analysis. This technique observes the impact of an independent variable on achieving a certain outcome for a binary dependent variable while controlling for other variables. We used this technique to examine the impact of the above independent variables on the likelihood that a respondent will adhere to the masking policies of their nation as measured by the survey question for the dependent variable.

To observe whether characteristics related to mask adherence varied between the Global North and Global South, we observed the impact of the independent variables on the likelihood of mask adherence in three models: respondents from (a) all countries in the survey and then in regions the World Bank in 2021 (see data.worldbank.org/) classified as either (b) High income or (c) Low and middle-income countries. Following a method described by social science statisticians,¹⁶ when there are differences in the same coefficients in the HIC and LMIC models

that are both statistically significant, we test whether this difference is itself statistically significant by creating an interaction term in the “all countries” model for the variable

in question and whether the respondent resided in a HIC or LMIC location. We report the results of these tests below.

Table 1. Sample characteristics

Categorical Variables	All Countries		HICs		LMICs	
	Number	%	Number	%	Number	%
<i>Respondent's adherence to mask policies</i>						
Adhered to mask policies	10190	66.1%	6006	72.7%	4183	58.6%
Did not adhere mask policies	5219	33.9%	2258	27.3%	2960	41.4%
<i>Gender</i>						
Male	4998	32.2%	2871	34.6%	2126	29.6%
Female	10504	67.8%	5435	65.4%	5068	70.4%
<i>Respondent has a dependent</i>						
Yes	7501	48.4%	3749	45.0%	3407	47.6%
No	7989	51.6%	4582	55.0%	3750	52.4%
<i>Level of education</i>						
Up to 6 years of school	76	0.5%	57	0.7%	19	0.3%
Up to 9 years of school	341	2.2%	228	2.7%	113	1.6%
Up to 12 years of school	2430	15.5%	1537	18.3%	893	12.3%
Some University	4095	26.1%	1807	21.5%	2287	31.5%
University degree	7626	48.7%	4049	48.2%	3576	49.3%
Ph.D./ Doctorate degree	1003	6.4%	646	7.7%	357	4.9%
<i>Employment status</i>						
Unemployed	1063	7.8%	667	8.8%	396	6.5%
Student	2993	21.8%	1031	13.6%	1961	32.0%
Part-time employee	1047	7.6%	763	10.1%	284	4.6%
Self-employed	1475	10.8%	659	8.7%	815	13.3%
Full-time employee	6384	46.6%	3903	51.5%	2481	40.5%
Retired	747	5.4%	559	7.4%	188	3.1%
<i>Relationship status</i>						
Single	4997	32.6%	2380	28.8%	2616	37.0%
Dating	2349	15.3%	986	11.9%	1363	19.3%
Cohabiting	1867	12.2%	1217	14.7%	650	9.2%
Married	5245	34.2%	3190	38.6%	2055	29.1%
Separated or divorced	724	4.7%	402	4.9%	321	4.5%
Widowed	161	1.0%	93	1.1%	68	1.0%
<i>Self-diagnosis of COVID-19</i>						
Yes	3381	21.6%	1011	12.0%	2369	32.6%
No or don't know	12275	78.4%	7387	88.0%	4887	67.4%
<i>Belief in conspiracy theories</i>						
Yes	3385	26.0%	1312	18.0%	2073	36.3%
No	9629	74.0%	5996	82.0%	3632	63.7%
<i>Acquisition of scientific information on COVID-19</i>						
Yes	3541	22.6%	1940	26.5%	1601	28.1%
No	9493	60.6%	5390	85.4%	4102	71.9%
<i>Prosocial attitude</i>						
Yes	2763	21.3%	1627	22.3%	1135	20.0%
No	10214	78.7%	5666	77.7%	4548	80.0%
<i>Continuous Variables</i>						
	<u>Mean</u>	<u>Std. Dev.</u>	<u>Mean</u>	<u>Std. Dev.</u>	<u>Mean</u>	<u>Std. Dev.</u>
Age	36.36	14.33	40.78	14.19	31.23	12.67
Self-perceived socioeconomic status (1 to 9)	5.24	2.42	5.30	2.38	5.18	2.46

RESULTS

Descriptive results for the dependent variable

Results from Table 1 shows that most respondents adhered to mask policies; 66.1% of respondents from all countries adhered. Yet, the level of adherence varies

significantly between LMICs and HICs; while 72.7% of HIC respondents adhered to mask policies, this dropped to 58.6% of respondents in LMICs. In addition to this significant gap in adherence (chi-square, $p < .001$), the results below suggest that there are also significant differences in the characteristics related to adherence in HICs and LMICs.

Table 2. Logistic Regression of mask adherence in all, HIC, and LMIC countries

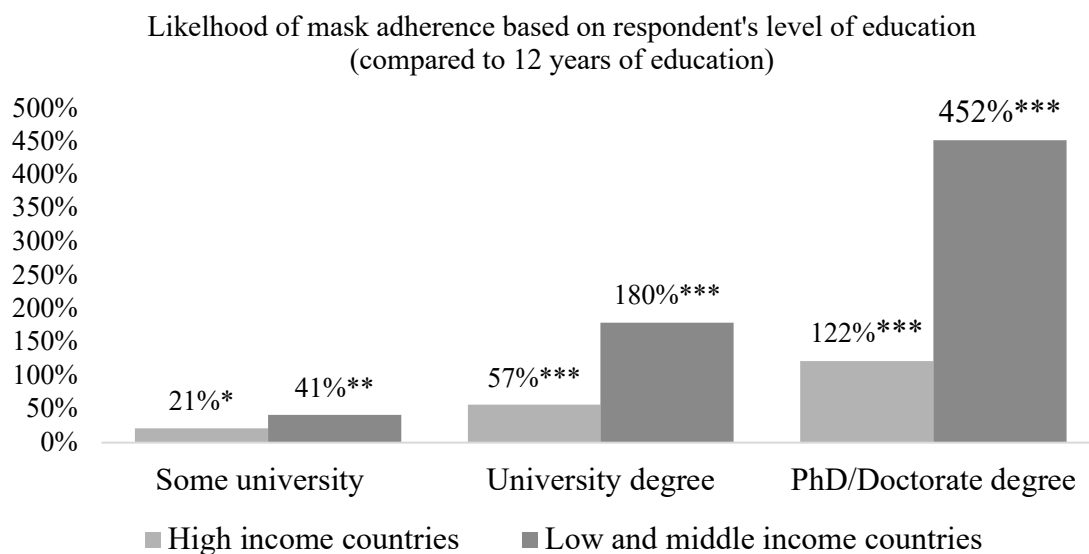
	<i>All countries</i> n = 10,525				<i>HICs</i> n = 6,126				<i>LMICs</i> n = 4,399			
	<i>b</i>	(S.E.)	Odds Ratio	% ↑↓	<i>b</i>	(S.E.)	Odds Ratio	% ↑↓	<i>b</i>	(S.E.)	Odds Ratio	% ↑↓
<i>Employment Status</i> (Reference = Unemployed)												
Student	.021	(.104)	1.022	2.2%	.382**	(.154)	1.465	46.5%	-.136	(.160)	.873	-12.7%
Part time employed	-.083	(.111)	.920	- 8%	-.019	(.136)	.981	-1.9%	-.309	(.199)	.735	-26.5%
Self-employed	-.112	(.106)	.894	-11.6%	-.087	(.143)	.917	-8.3%	-.143	(.166)	.866	-13.4%
Full time employed	-.288***	(.087)	.750	-25%	-.175	(.112)	.840	-16%	-.487	(.144)	.615	-38.5%
Retired	-.050	(.142)	.952	-5.8%	.289	(.170)	1.335	33.5%	-.317	(.272)	.728	-27.2%
<i>Highest level of education</i> (Reference = 12 yrs education)												
6 years education	-.065	(.310)	.937	-6.3%	-.368	(.362)	.692	-30.8%	.416	(.621)	1.516	51.6%
9 years education	-.137	(.146)	.872	-12.8%	-.171	(.173)	.843	-15.7%	-.209	(.296)	.811	-18.9%
Some university	.186**	(.070)	1.205	20.5%	.192*	(.093)	1.211	21.1%	.346**	(.117)	1.413	41.3%
University degree	.688***	(.062)	1.990	99%	.450***	(.081)	1.568	56.8%	1.029***	(.109)	2.799	179.9%
PhD/Doctorate degree	1.108** *	(.115)	3.030	203%	.799***	(.140)	2.224	122.4%	1.709***	(.211)	5.523	452.3%
<i>Self-perceived SES – score from 1 to 9</i> (Continuous)												
Yes	.045***	(.013)	1.046	4.6%	.038*	(.019)	1.039	3.9%	.068***	(.020)	1.07	7%
<i>Belief in conspiracy theories</i> (Reference = No)												
Yes	-.472***	(.049)	.624	-37.6%	-.507***	(.074)	.602	-39.8%	-.335***	(.070)	.715	-28.5%
<i>Prosocial attitude</i> (Reference = No)												
Yes	.628***	(.052)	1.873	87.3%	.652***	(.068)	1.919	91.9%	.640***	(.085)	1.896	89.6%
<i>Acquires scientific info on COVID-19</i> (Reference = No)												
Yes	.246***	(.049)	1.279	27.9%	.015	(.069)	1.015	1.5%	.544***	(.074)	1.722	72.2%
<i>Age</i> (Continuous)												
Yes	.016***	(.002)	1.016	1.6%	-.001	(.003)	.999	-0.1%	0.32***	(.004)	1.033	3.3%
<i>Gender</i> (Reference = Male)												
Female	.418***	(.047)	1.519	51.9%	.506***	(.064)	1.658	65.8%	.293***	(.073)	1.34	34%
<i>Relationship status</i> (Reference = single)												
Dating	.017	(.072)	1.017	1.7%	.211	(.116)	1.235	23.5%	-.138	(.096)	.872	-12.8%
Cohabiting	.088	(.080)	1.092	9.2%	.062	(.105)	1.064	6.4%	-.027	(.130)	.973	-2.7%
Married	-.017	(.066)	.983	-1.7%	.145	(.088)	1.156	156%	-.330**	(.105)	.719	-28.1%
Separated or divorced	-.199	(.113)	.819	-18.1%	.277	(.156)	1.320	32%	-.859***	(.175)	.423	-57.7%
Widowed	-.571*	(.226)	.565	-43.5%	-.130	(.296)	.878	-12.2%	-.165***	(.363)	.312	-68.8%
<i>Dependents</i> (Reference = No)												
Yes	-.316***	(.050)	.729	-27.1%	-.227***	(.070)	.797	-20.3%	-.319***	(.076)	.727	-27.3%
<i>COVID-19 self-diagnosis</i> (Reference = No)												
Yes	-.566***	(.053)	.568	-43.2%	-.568***	(.091)	.566	-43.4%	-.487***	(.071)	.614	-38.6%

Results of the logistic regression analysis

Table 2 summarizes the results of logistic regression analyses for (a) all countries, (b) HICs, and (c) LMICs. Using the likelihood ratio test, we observe that each model is significant ($p < .001$) and Hosmer-Lemeshow tests show that the expected results from each model are a good fit for the observed values. To interpret the results of the logistic regression analyses, we focus on odds ratios as the beta coefficient can be difficult to interpret. Odds ratios greater than 1 indicate an increased likelihood that a respondent will adhere to mask policies, while odds ratios less than 1 indicate a decrease. Unless noted, we only report statistically significant results of the logistic regression analyses.

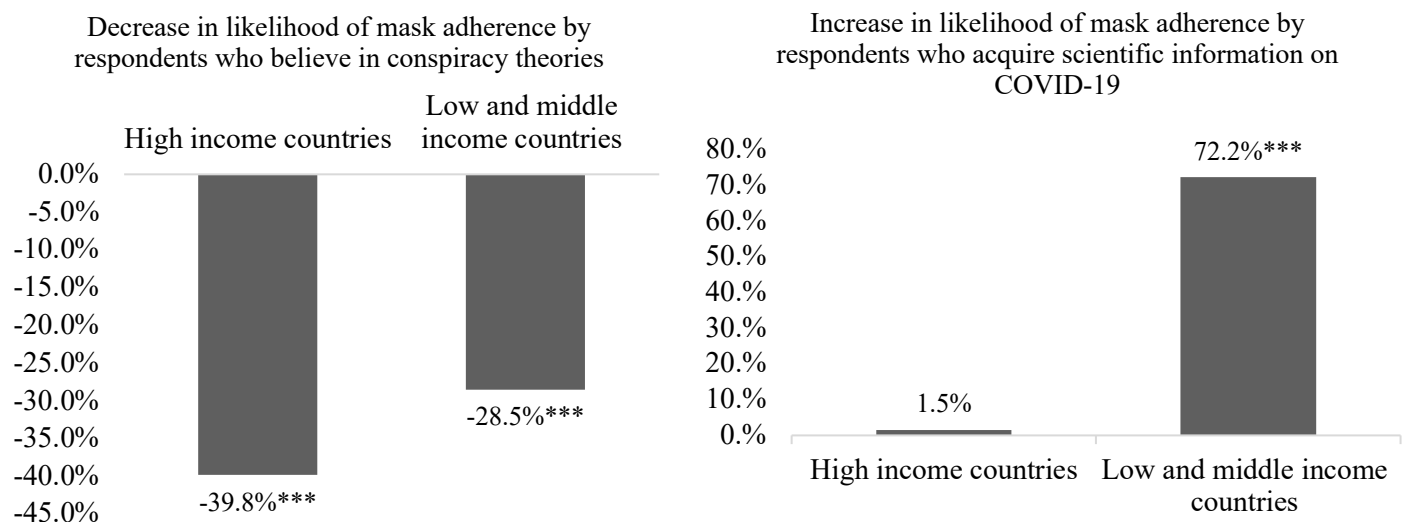
Gender and age

As seen in Table 2, results show that women are more adherent to mask policies than men across all three models. However, women in HICs are significantly more likely to adhere to mask policies than women in LMICs. In HICs, identifying as a woman rather than as a man increased the likelihood of adherence by 65.8% while it only increased the likelihood by 34% in LMICs. This difference is observed (via the method described above) to be statistically significant at the $p < .001$ level. Further, age only had a statistically significant impact on mask adherence in LMICs; there, each one-year increase in age is associated with a 3.3% increased likelihood of adherence. In HICs, age had no statistically significant impact on the likelihood of adherence.



* $p < .05$, ** $p < .01$, *** $p < .001$.

Figure 1. Mask Adherence by education level



All results significant at *** $p < .001$

Figure 2. Mask Adherence by Information Sources

Socioeconomic status

While there was no discernible influence of employment status on mask adherence in any of the models, education and respondents' self-perception of their position within their country's economic hierarchy was relevant. Across all models, an increase in education increased the likelihood of adherence to mask policies; for example, in the "all countries" model having a university degree compared to 12 years of education increased adherence to mask policies by 99% while Ph.D. holders were twice (203.6%) as likely to adhere.

Yet, our analyses show, as seen in Figure 1, that education has a stronger impact on LMICs than HICs. In HICs, having a university degree or a Ph.D. degree, as compared to 12 years of education, increased the likelihood of adherence respectively by 56.8% and 122.4% while controlling for all other variables. In LMICs, having a university degree as compared to 12 years of education increased likelihood of adherence by 179.9% and having a Ph.D. degree increased the likelihood of mask adherence by four and a half times

(452.3%). Using the method described above, these differences are statistically significant at the $p < .001$ level.

Similarly, while in HICS a one-point increase along the nine-point scale of a respondent's self-perception of their position in the economic hierarchy of their country increased the likelihood of mask adherence by 3.9%, in LMICs it was nearly double that – a one-point increase along the nine-point scale increased the likelihood of adherence by 7%. This difference is also statistically significant at the $p < .001$ level.

Prosocial attitudes, conspiracy theories, and scientific information

We find no substantial or statistical difference between HICs and LMICs in terms of prosocial attitudes. Respondents who adopt a prosocial attitude are 87.3% more likely to adhere to mask policies in the "all countries" model, by 91.9% in HICs, and 89.6% in LMICs while controlling for all other variables.

However, we do find important differences between HICs and LMICs in terms of belief in conspiracy theories and acquisition of scientific information on

COVID-19. While Table 2 shows that for all models, believing in a conspiracy theory decreased the likelihood that a respondent would adhere to mask policies, this negative impact on adherence (see Figure 2) was greater in HICs (-39.8%) than in LMICs (-28.5%). Yet, this difference is not statistically significant. Finally, acquiring scientific information on COVID-19 only had a statistically significant impact on mask adherence in LMICs increasing the likelihood of adherence by 72.2% while controlling for all the other variables. In HICs, acquiring scientific information on COVID-19 had no statistically significant impact on mask adherence.

DISCUSSION

Only a few studies examine differences in public health behaviors between the Global South and Global North regarding COVID-19; Oladejo and Jack¹⁷ observe how citizens in the Global South experienced more state repression to enforce disease control compliance, while states in the Global North experienced greater disease control resistance from their citizenry. Similarly, Jallali¹⁸ describes how nations in the Global South have been more negatively affected economically than countries in the Global North that have focused their efforts on reducing rates of mortality. Our research uniquely highlights the divergence in characteristics of mask adherence in these two economically dissimilar regions of the world.

While women are more adherent worldwide, this gender difference is more pronounced in industrialized nations of the Global North. In contrast, an increase in age is only related to increased adherence in nations in the Global South. While higher levels of SES are associated with higher levels of adherence globally, SES – especially higher levels of education – has a greater impact on adherence in LMICs.

Finally, in terms of information sources, conspiracy theory belief has a greater negative impact on adherence in HICs, while the use of COVID-19 scientific information only has a significant positive impact on adherence in LMICs.

These differences suggest that the social forces that influence mask adherence vary depending on the region of the world; that is, characteristics that may either encourage or discourage mask adherence in countries in the Global South may not be the same in countries in the Global North. The reasons for this divergence are beyond the scope of this brief short report, but need to be better understood. Further, while this study represents only one data point, what is observed for mask adherence may be true for other disease control measures; that is, although there is not current research available, there may be similar differences between HICs and LMICs in the characteristics related to adherence to social distancing, lock-downs, vaccination, and other public health measures.

RECOMMENDATIONS

If research on adherence to disease control measures, such as mask adherence, from affluent nations in the Global North is simply crudely applied to inform disease control in the Global South, it may result in less effective policy actions. Instead, our research recommends that disease control policy should be guided by research carried out in nations in which that policy will be implemented. Tailoring mask policy to the social and economic conditions of a specific country or region of the world will ensure a higher degree of mask adherence and thus potentially reduce the spread of future epidemic diseases.

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