HOSPITALIZATION AMONG NATIVES AND MIGRANTS. THE CASE OF LOMBARDY, 2010-2019

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Abstract. The usage patterns of healthcare services differ significantly between the native and migrant populations. Using the administrative health database of the Lombardy Region, we compared the hospitalization rates of natives and migrants from 2010 to 2019. Migrants were categorized into two groups: those from countries with high emigration rates (HMPC) and those from other countries (HDC). Standardized hospitalization rates decreased between 2010 and 2019 for both men and women across all groups (Italians, HMPC migrants, and HDC migrants). Women exhibited higher hospitalization rates compared to men due to childbirth and pregnancy-related complications. Among women, HMPC migrants had the highest standardized hospitalization rates throughout the study period, though the gap with natives has recently narrowed. Among men, HMPC migrants had the lowest standardized hospitalization rates, with the disparity between natives and migrants remaining consistent over time. Poisson and negative binomial regression models were used to analyse the crude hospitalization rate as the dependent variable to highlight the differences among geographic groups and sex across years. Age plays a key role, with younger women and those under childbearing age showing lower hospitalization rates. Additionally, we calculated crude and standardised rates for avoidable hospitalization and access to the Emergency Department.

1. Introduction

The usage patterns of healthcare services differ significantly between the native and migrant populations. Overall, migrants tend to underutilize preventive services (Rimoldi and Terzera, 2022) and face greater barriers in accessing healthcare (Allegri *et al.*, 2025). These challenges often lead to delays in medical visits and treatments and may result in a higher reliance on Emergency Departments for non-urgent conditions (Trappolini *et al.*, 2020), ultimately increasing the risk of avoidable hospitalization compared to natives (Allegri *et al.*, 2022).

Usually, migrants exhibit better health outcomes than natives upon arrival, largely due to the 'healthy immigrant effect', a selection process favouring the emigration of those who are healthier (Sander, 2007). This could result in lower rates of hospitalization and poor health needs for the young pioneers. However, as the length of stay in the destination country increases, migrants' health tends to

deteriorate, a phenomenon known as the 'exhausted migrant effect' (Bollini and Siem, 1995). Over time, healthy and selected migrants often reunite with other family members who are non-selected (primarily children and spouse, and occasionally parents) and eventually age in place. The cumulative impact of declining health throughout the migration experience, barriers to healthcare access (both formal and informal), limited preventive care, and the ageing process among longer-term migrants lead to increasing and diversified needs for healthcare.

This study focused on hospitalization in the Lombardy Region as an indicator of healthcare access. The Lombardy Region serves as a particularly relevant case study: as of January 1, 2025, the Lombardy Region hosted 1,230,362 foreign citizens, representing 22.6% of the resident foreign population in Italy. Lombardy, due to the attractiveness of its labour market, has a longstanding migration process with an increasing share of long-term migrants. Additionally, we observed hospitalization rates for a long period, from 2010 to 2019, which predated the COVID-19 pandemic. Therefore, analyzing hospitalization trends may provide some insight into the evolving health needs among migrants and indicate whether their healthcare patterns are converging with those of the native population.

An essential analysis of the population assisted by the Regional Health Service (RHS) shows that migrants are overrepresented in the RHS, accounting for 19.2% of the assisted population, compared to 12.7% in the Istat resident population in Lombardy, by country of birth. This overrepresentation is particularly pronounced among women: in the most recent year of observation, they constitute 25% of women assisted, while they represent only 13.0% of the female resident population. This discrepancy is largely attributable to the exclusion of individuals aged 65 and over from the RHS dataset, a demographic group that is predominantly among Italians.

When focusing on the migrant subpopulation, and specifically the top ten nationalities, only a few appear to be underrepresented in the RHS compared to their share in the resident population. These include Egyptians (3.4% vs. 3.6%) among women, and Romanians (9.2% vs. 9.9%), Chinese (3.8% vs. 4.1%), and Filipinos (3.3% vs. 3.4%) among men. These differences may indicate lower utilization of the RHS among specific groups or the presence of social or cultural barriers limiting access to healthcare services (Allegri *et al.*, 2025).

Using the administrative health database of the Lombardy Region, we aimed at comparing the standardized hospitalization rates of natives and migrants and studying their trends, considering the period from 2010 to 2019. For analytical purposes, we categorized migrants into two groups: those from countries with high migration pressure (HMPC) and those from other countries (HDC).

2. Data and methods

2.1 Data source

We used administrative data on all subjects assisted by the regional health service in the Lombardy region aged 18-65 in the period 2010-2019, which encompassed 8,259,158 subjects and provided data for research purposes. Data on each patient were extracted from the hospital discharge chart and included socio-demographic characteristics such as age, gender and province of residence, clinical information such as principal diagnosis and co-diagnosis identified by the ICD-9-CM code system, main and secondary procedures, length of stay, the ward of admission and type of discharge (e.g. death), financial information such as the Diagnosis Related Group (DRG) and hospital discharge chart reimbursement, as well as information regarding the Emergency Departments (ED). The data from these three datasets were linked using a deterministic linkage procedure, which utilized a common anonymized personal code to ensure the privacy of the subjects. The population was stratified by gender and geographic area of origin: Italians, HMPC, and HDC, based on the country classification by Trappolini *et al.* (2021). For each year, only subjects aged between 18 and 65 years old were included in the study, meaning that subjects exited the study when they reached the age of 65, and subjects entered the study only from their 18th birthday. This choice was made to avoid particular categories of subjects, such as children and the elderly, especially because of the analysis on HMPC. Age was clustered in periods of 5 years, except for the first period [18-19] and the last one [60-65].

2.1 Statistical analyses

To study the need for hospitalization services, we used hospitalization rates, calculated as the total number of hospital discharges for all subjects (considering also multiple discharges) in a year, divided by the total person-years for each geographic group, gender, and age class per 1,000 population. We computed age-standardized rates using the 2019 Italian population as the standard population provided by Istat (Italian National Statistics Institute). Thus, we estimated the mean year-to-year variation using a Poisson regression model for the standardized rates. Crude rates were initially analyzed using both multivariable Poisson and negative binomial regression models, with the number of hospital discharges per year as the dependent variable and year and age classes as explanatory variables. We fitted a model for each geographic group and gender. To prevent possible overdispersion effects, we opted to use the negative binomial model. Statistical analyses were performed within the RHS platform.

3. Results

Among the 8,259,158 considered subjects assisted by the Lombardy regional health system during the study period, 17.72% belonged to the HMPC group, while 1.52% belonged to the HDC group. Figure 1 shows the gender distribution by year in the foreign population. An increasing trend is observed throughout the entire period, with a percentage of women higher than that of men. Furthermore, from 2010 to 2019, women's rates increased more than men (4.5% versus 4.1%), showing a slight increase in the gender gap during the decade, mainly explained by the change in the origin countries and the variation in the sex composition of the new inflows related to the reunification process and the gender role in the origin countries.

Women mostly came from Romania, Albania, Morocco, Ukraine, Peru, the Philippines, and China, while men mostly came from Romania, Egypt, Morocco, Albania, India, Pakistan, and Senegal. Although minors and individuals over 65 were not included in our analysis, these main groups differed from those in the Istat resident population in Lombardy, where women, Egyptian nationals were more numerous than Moldovans, while among men, Senegalese nationals were fewer in number than Filipinos. In general, the most represented countries tend to be overrepresented in the RHS compared to the resident population, with a few notable exceptions: Egyptian women, as well as Romanian, Chinese, and Filipino men.

In Figure 2, the age distribution by geographical groups shows a clear difference, especially between Italians and HMPC, with the IT population ageing more rapidly than migrants from HMPC. There is also a higher percentage of subjects over 60 in the HDC population compared to the Italian group, and a lower percentage of young individuals.

The most frequent primary diagnoses at first hospitalization for the studied population are: diseases of the digestive system (12.1%), neoplasms (10.5%), injury and poisoning (9.8%), diseases of the musculoskeletal system and connective tissue (9.7%), diseases of the genitourinary system (9.4%), diseases of the circulatory system (8.9%), diseases of the respiratory system (5.8%). In particular, complications of pregnancy, childbirth, and the puerperium (18.6%) were prevalent among women. The median age at first hospitalization is higher among men than among women in the three groups (50 vs 43 for Italians, 40 vs 33 for HMPC, 47 vs 42 for HDC).

Figure 1 – *Percentage of foreign-born (HPMC and HDC) by sex and year. Lombardy Region years 2010-2019.*
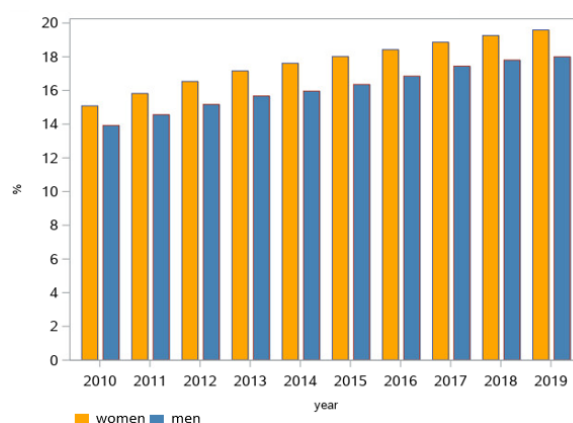

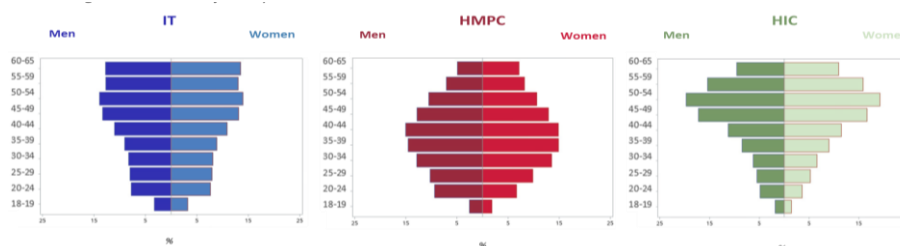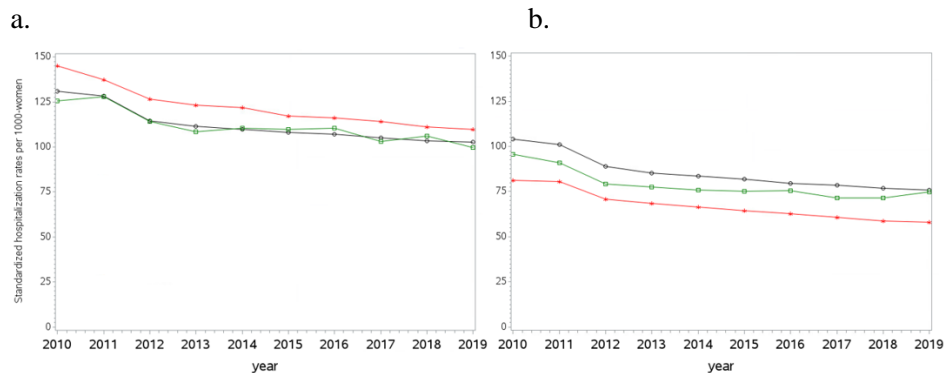**Figure 2** – *Age Pyramid by geographical group. Lombardy Region 1.1.2019.*

Figure 3 shows a slight decreasing rate in all groups, with a higher rate in women compared to men. Even though the available data are insufficient to explain this decrease fully, we can propose three plausible hypotheses. Firstly, our results do not account for the population ageing process because we could not include hospitalizations among people aged 65 and over. Secondly, the decreasing trend was not observed in hospitalizations for all causes. For example, there has been a clear decrease in hospitalization rates for pregnancy and childbirth due to a decrease in the Total Fertility Rate, even among migrant women, and an increase in adherence to antenatal care. Meanwhile, hospitalization rates related to genitourinary diseases have remained stable. Thirdly, health decision-makers promote prevention and home care instead of hospitalization when possible.

Among women, rates for HMPC are higher than those for IT for all years, while the reverse is observed among men. The mean year-to-year variation of these rates estimated through a Poisson model shows a decreasing trend that is higher for men

compared to women (IT: −3.44% vs −2.60%; HMPC: −3.82% vs −2.88%; HDC: −2.79% vs −2.33%).
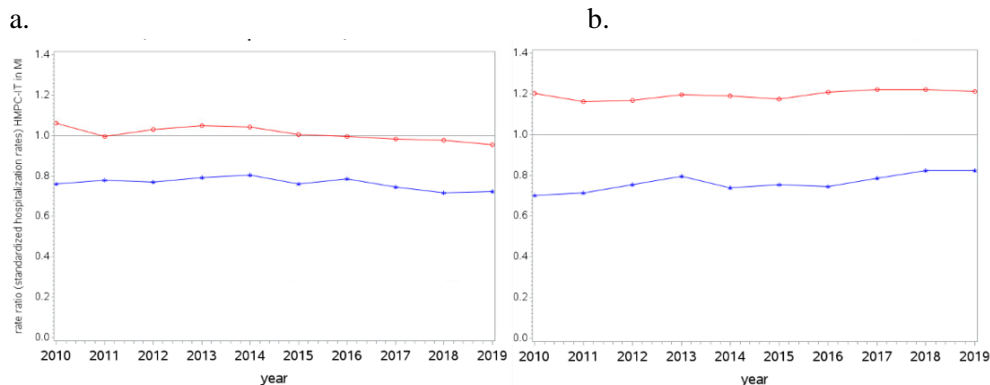
Figure 3 − *Standardized hospitalization rates per 1000 population. Years 2010-2019. Black: IT, red: HMPC, green: HDC. a. women; b. males.*

When stratifying by province, a clear difference emerged between Milan and the other provinces, particularly in the trend of standardized hospitalization rates among women. Indeed, Milan is a big city, more attractive to workers and with a higher cost of living than the other Lombardy provinces, which are more attractive for families. Figure 4 illustrates the ratio of standardized rates for HMPC versus IT in the provinces of Milan and Lecco, which is the most representative among all other provinces.

Looking into the cause-specific hospitalization rates, the HMPC group has higher rates than Italians only for pregnancy and childbirth complications and diseases of the digestive system (among women) and infectious and parasitic diseases (both among women and men).

Since the AICs were lower in all multivariable negative binomial models compared with those from the corresponding Poisson regression models, we used the former ones to analyse the trend of crude hospitalization rates. Results are illustrated in Table 1 (estimates and significance levels). A model was run for each sex and geographical group, including age classes as categorical (with the reference class set to the 40-44 age class) and year as a continuous variable. The association between year and hospitalization rate was negative and significant in all models. Among women, a positive association is observed in childbearing ages, while among men, it is observed in those over 45 years old. Italian women show a positive association from the age class 30-34, while HMPC shows a positive association from the age class 20-24.

Figure 4 – *Rate-ratio: rate HMPC/rate IT. Years 2010-2019. a. Milan; b. Lecco.*

a.   b.

Regarding cause-specific hospitalization rates, we focus on the trend of complications of pregnancy, childbirth, and puerperium. When considering all codes (ICD-9-CM 630-679), the trend decreased, and the HMPC women's rates were higher than the Italian ones. The results of the model for the crude rates exhibit negative estimates for the effect of year, with some significant differences among geographic areas (IT: $\beta = -0.011$, *p*-value= 0.0019; HMPC: $\beta = -0.033$, *p*-value<0.0001; HDC: $\beta = -0.012$, *p*-value=0.0037). The effect of age varied among geographic areas, with an increasing rate in Italians from 25 to 39 years old. In contrast, the rate increased from 18 to 39 in the HMPC group and from 20 to 39 in the HDC group. Moreover, the estimates for the 25-29 age-class effect were β=0.748 for the IT group, β=1.592 for the HMPC group, and β=0.832 for the HDC group; all the estimates have a significant *p*-value less than 0.0001.

Then, crude and standardized rates of overall access to Emergency Departments (EDs) were calculated. The standardized ones showed an increasing trend from 2010 to 2013, with a clear gap between the HMPC population and IT among both women and men (Figure 5). The mean year-to-year variation in these rates shows an increasing trend, which is higher among women than among men (IT: 6.37% vs 5.50%; HMPC: 6.25% vs 5.35%; HDC: 6.46% vs 5.72%). A clear difference emerges when the rates are analysed by triage. Indeed, while white and green triages (i.e. not or less critical) shown an initial increasing trend, with the white triage decreasing from 2013 on (when a copayment was introduced for non-urgent visits), yellow and red triages (i.e. mild or high critical) shown an increasing trend, with the IT and HMPC groups close for women and men in the red triage and men in the yellow one.

Table 1 – *Estimates for the trend of hospitalizations crude rates: Negative binomial model.*

	women			men		
	IT	HMPC	HDC	IT	HMPC	HDC
class age						
18-19	-0.713 ****	-0.121 ****	-0.645 ****	-0.028	-0.085 ***	-0.211 **
20-24	-0.559 ****	0.599 ****	-0.468 ****	-0.109 ****	-0.115 ****	-0.217 ****
25-29	-0.048 *	0.748 ****	0.008	-0.192 ****	-0.170 ****	-0.205 ****
30-34	0.458 ****	0.624 ****	0.408 ****	-0.213 ****	-0.204 ****	-0.347 ****
35-39	0.437 ****	0.412 ****	0.411 ****	-0.139 ****	-0.146 ****	-0.141 **
45-49	-0.308 ****	-0.380 ****	-0.361 ****	0.184 ****	0.192 ****	0.190 ****
50-54	-0.213 ****	-0.359 ****	-0.269 ****	0.451 ****	0.483 ****	0.459 ****
55-59	-0.097 ****	-0.277 ****	-0.206 ****	0.752 ****	0.801 ****	0.733 ****
60-65	0.103 ****	-0.086 ***	0.050	1.089 ****	1.138 ****	1.057 ****
year	-0.028 ****	-0.032 ****	-0.024 ****	-0.034 ****	-0.036 ****	-0.029 ****

*Significance level codes: **** <0.0001; *** <0.001; ** <0.01; * <0.05; ref. age class = 40-44*

The mean year-to-year variation in the rates across all triages shows an increasing trend that is higher among women than men, except for the red one (IT: 16.60% vs 17.74%; HMPC: 15.70% vs 17.81%; HDC: 15.87% vs 18.09%).

Furthermore, the mean year-to-year variation of the rates increased from white to red (women: IT from 3.67% to 16.60%, HMPC from 3.82% to 15.70%, HDC from 4.14% to 15.87%; men: IT from 3.58% to 17.74%, HMPC from 3.70% to 17.81%, HDC from 3.93% to 18.09%).

Focusing on access to ED with a subsequent hospitalization, the most frequent triages are the green and yellow, with the first one decreasing and the second increasing in percentage.

Stratifying by sex and geographic area, men's rates overlap, while a clear difference is seen between IT women and HMPC ones. Rates increased only from 2010 to 2013.

Finally, avoidable hospitalization standardized rates showed a stable trend similar to the overall hospitalization rates; however, HMPC had higher rates than IT among both women and men, and men had higher rates than women in all groups (Figure 6). Furthermore, the gap between HMPC and IT is higher among men than among women. Stratifying these hospitalizations into acute and chronic illnesses further reveals a difference between women and men (Figure 7).

Figure 5 − *Standardized rates per 1000 population of overall access to ED. Years 2010-2019. Black: IT, red: HMPC, green: HDC: a. women; b. men.*
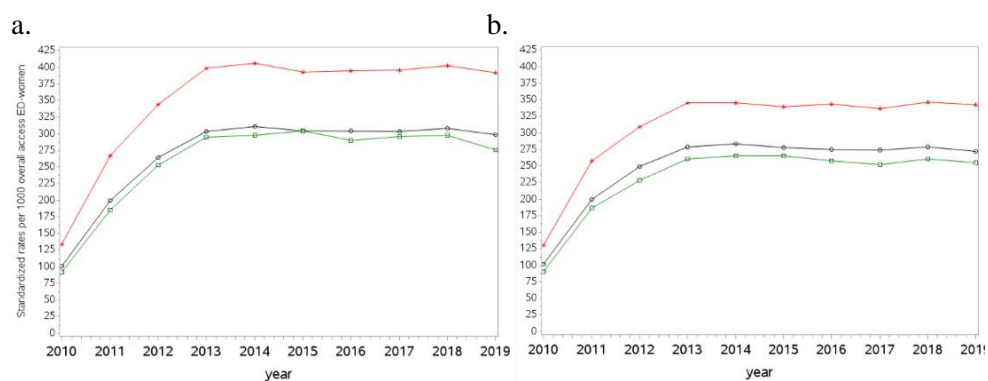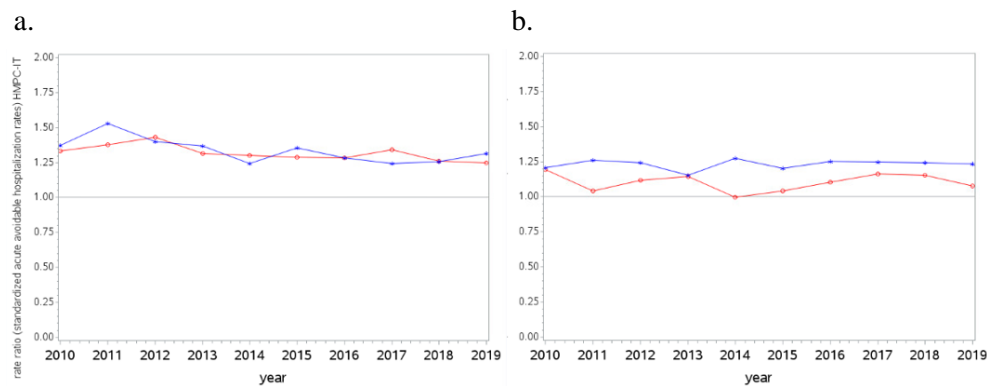

Figure 6 − *Standardized rates per 1000 population of avoidable hospitalizations. Years 2010-2019. Black: IT, red: HMPC, green: HDC: a. women; b. men.*

Figure 7 – *Standardized rates ratio HMPC/IT of acute (a) and chronic (b) avoidable hospitalizations. Years 2010-2019. Red: women, blue: men.*

a.

b.

4. Conclusions

Our study compared hospitalization rates for natives and migrants from 2010 to 2019 using the administrative health database of the Lombardy Region.

Standardized hospitalization rates of women are higher than those for men across all three population groups considered, and show a decrease over time. However, among women, the rates for migrants from HMPC are consistently higher than those for IT nationals, while the opposite is observed among men, where IT nationals have higher rates than HMPC migrants. The analysis of the cause-specific hospitalization rates helps explain the higher standardized rates among HMPC women. Indeed, the most significant differences are observed in hospitalizations due to complications of pregnancy, childbirth, and the puerperium, where the gap between HMPC and Italian women reached 25‰ in 2019, although this difference has slightly decreased over time. A notable disparity is also observed in cases of normal delivery, with a difference of about 5‰ in 2019. This gap is largely attributable to the younger age at childbirth among HMPC women, as evidenced by regression analysis of crude birth rates by age group. The analysis highlights a higher likelihood of childbirth for HMPC women in the 20–24 to 30–34 age ranges compared to Italian women. In this context, it is worth noting that maternity care may represent a crucial point of access to the welfare system, enabling not only mothers but also other members of migrant families to engage with the healthcare system (Barsanti, 2018).

Another important finding is that both HMPC men and women have higher standardized hospitalization rates for infectious and parasitic diseases compared to

Italian nationals, confirming the greater vulnerability of the HMPC population to these conditions (Baggaley, 2022).

Our analyses also reveal that use of Emergency Departments (EDs) is significantly higher among both HMPC men and women relative to Italians. However, this increased utilization is mainly observed in non-urgent or low-priority cases—classified as green or lower colour codes upon arrival. This pattern aligns with existing literature, which identifies the ED as a primary point of access to the healthcare system for many immigrants, due to various barriers—such as irregular legal status, language difficulties, and limited health literacy—that hinder their access to other forms of care (Allegri et al., 2025; Trappolini et al., 2020).

Avoidable hospitalizations for both acute and chronic illnesses are more frequent among migrants, suggesting that they face more barriers to accessing timely and effective healthcare services than natives. The reduction of avoidable hospitalizations may substantially reduce the costs of hospitalizations.

Lastly, an interesting insight emerges from the analysis of standardized hospitalization rates at the provincial level. Among women, two distinct patterns can be observed when comparing the province of Milan to the other provinces. In Milan, no significant differences are found among the three population groups. In contrast, the other provinces consistently show higher hospitalization rates for HMPC women compared to Italian women, reflecting the general regional trend. This divergence suggests the presence of demographic, socio-cultural, or occupational condition differences between the female populations in the metropolitan area of Milan and those in the rest of the region. These differences may also be associated with variations in lifestyle, access to care, or health-seeking behaviours (Benson and O'Reilly, 2016).

Acknowledgements

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