

Pediatric Malnutrition and its Effect on Readmission Rates and Length of Stay

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**Abstract**

The goal of this project is to evaluate if pediatric patients at UF Health Shands Children's Hospital who had nutrition consultations had longer lengths of stay and 30-day readmission rates than all patients, as well as to evaluate the evidence based literature behind practices in screening, assessing for, and continuing care for pediatric malnutrition. Data was collected from a monthly report generated through Decision Support Services at UF Health Shands Hospital. The data was used to compare differences in lengths of stay and readmission rates of pediatric patients who required nutrition consultations and all patients, January through December of 2017.

On average, the length of stay for patients who needed a nutrition consultation was 7.73 days. The average length of stay for all pediatric patients was 5.16 days. 12.34% of all pediatric patients were readmitted within 30 days of discharge, whereas 24.67% of patients who needed a nutrition consult were readmitted. We can't say that pediatric malnutrition causes these rates to increase, however it is clear that this may be a factor. More research is needed to identify the specific factors contributing to the discrepancies in readmission rates and lengths of stays in these populations and ultimately improve patient outcomes.

## **Introduction**

This is a compelling time to be exploring and researching pediatric malnutrition. The American Society for Parenteral and Enteral Nutrition (A.S.P.E.N.), along with other organizations and individuals, have recently set out to reinvent the way that pediatric malnutrition is defined, diagnosed, and treated (Mehta et al., 2013.) Due to the large variability that currently exists across these domains in the United States, the nutritional status of many patients is being overlooked and ineffectively managed. Malnutrition in children in the United States and other developed countries is largely due to secondary factors such as infections, malabsorption, inflammation, and deterioration in chronic disease (Beer, Juarez, Vega, & Canada, 2015.) We know that pediatric patients who are malnourished have higher hospital costs, increased length of stays, and a greater incidence of care needed after discharge from a hospitalization (Abdelhadi et al., 2016.)

This paper will explore the way that pediatric malnutrition is identified at UF Health at Shands Children's Hospital, as well as the readmission rates and length of stays of patients under the age of 18 who needed a nutrition consultation compared to those who did not. Through evaluation of this data, we set out to understand whether pediatric malnutrition, and therefore the practices surrounding it, had any effect on readmission rates and length of stay. If so, what can be done?

## **Purpose**

This paper is intended to evaluate the effect of pediatric malnutrition on length of stay and readmission rates at UF Health at Shands Children's Hospital, and whether these variables

are any different for this particular population compared to all patients. Another goal was to study the evidence-based literature behind practices in screening, assessing for, and continuing care for pediatric malnutrition. Many of these studies have improved outcomes for pediatric patients, and we hope that through expression of the data and identification of strategic interventions in the literature, outcomes can be improved at UF Health at Shands Children's Hospital.

## **Background and Statistics**

### *Defining Pediatric Malnutrition*

Historically, "malnutrition" has been comprised of a wide variety of definitions. This ambiguity can lead to discrepancies between the reported prevalence of malnutrition in children and the accurate value, as well as the true impact it has on health and outcomes (Mehta et al., 2013.) In an attempt to lessen these discrepancies and to provide a basis for more effective future research that might, in turn, develop evidence-based nutrition practice, the American Society for Parental and Enteral Nutrition (A.S.P.E.N.) developed a working, uniform definition for malnutrition (undernutrition).

They defined pediatric malnutrition as "an imbalance between nutrient requirement and intake, resulting in cumulative deficits of energy, protein, or micronutrients that may negatively affect growth, development, and other relevant outcomes" (Mehta et al., 2013, p. 462.) Their definition pays mind to the etiology behind the incidence of malnutrition, whether it is illness related or environment/behavior related, as well as its chronicity, either lasting less than 3 months (acute) or greater than 3 months (chronic). The goal is to improve and standardize

variables surrounding pediatric malnutrition as new research presents itself and old practices prove to be outdated and inaccurate.

### *Prevalence of Pediatric Malnutrition*

Globally, malnutrition accounts for 52.5% of pediatric deaths and is associated with a greater risk of morbidity and mortality (Tette, Sifah, & Nartey, 2015.) It is suspected that the true prevalence of pediatric malnutrition in the hospital setting in the United States is drastically unreported. This is attributed to a variety of reasons, one of them being the incomplete documentation of malnutrition after diagnosis. This was perceived to be the case in a study at a pediatric hospital in 2013, where it was noted that only 3% of patients who received a coded diagnosis of malnutrition by a registered dietitian had this medical diagnosis documented in their chart. In the years following, after further education, work with specialists, and protocols were initiated, the percentage of patients who had their diagnosis of malnutrition properly documented in their charts increased to 71% (Abdelhadi et al., 2013.) This study, alongside others, adds suspicion to the accuracy of reported pediatric malnutrition in the hospitalized setting in the US.

Another study, utilizing multiple nationally representative databases, analyzed the prevalence of pediatric malnutrition in hospitals in the United States from 2002 to 2011. Over the span of those years, the percentage of diagnoses increased from 1.9% to 3.7% (Carvalho-Salemi et al., 2018.) In 2010, approximately 80,710 hospitalized patients in the United States below the age of 17 had a coded malnutrition diagnosis (Abdelhadi et al., 2013.) A study at Texas Children's Hospital surveyed the average percentage of patients being discharged with a coded diagnosis of malnutrition, based off of codes according to International Classification of Disease (ICD) (version 9). Approximately 2% of its patients were diagnosed with malnutrition, however when patients were reevaluated to account for ideal body weight (Waterlow criteria) and z-

scores, the average number of patients discharged with malnutrition increased to include approximately 20% (Beer, Juarez, Vega, & Canada, 2015.)

### *Assessment*

Before pediatric malnutrition can be addressed and interventions can begin, it must be identified. The American Society for Parental and Enteral Nutrition (A.S.P.E.N.), through the establishment of an etiology-based definition and a consensus statement on indicators that can be used to identify and document pediatric malnutrition, intends to standardize the way we diagnose and care for this vulnerable population. Essential to the accurate diagnosis of pediatric malnutrition, is indication of the most sensitive tool for identifying it (Becker et al., 2014.) A.S.P.E.N., along with the World Health Organization, have recommended the use of z scores for evaluating anthropometric measures like weight, height, BMI, and mid-upper arm circumference (MUAC). When more than a single parameter can be used, it is recommended to also quantify weight and length velocity over time.

There are several statistical parameters used to assess and compare anthropometric values for pediatric patients, and a very commonly used method is through percentiles. Percentiles indicate where a child's measurements lie on a curve that will describe what percentage of a reference population would lie either above or below said measurements. Its ability to, at times, be ambiguous and nonspecific illustrates shortcomings to its use over other methods. To be able to diagnose pediatric malnutrition and document the true severity, a statistical measure with more precision is necessary. Z scores, using units of standard deviation or SD, describe how far a child's weight varies from the mean of others at their same height using reference charts (Mehta et al., 2013.) Z scores can be useful in determining the threshold between moderate and severe

pediatric malnutrition, and can aid health care providers in the accurate documentation of a child's condition, as well as in deciphering the best plan of care for the patient.

Z scores can yield precision for certain anthropometric measures, but there can still be drawbacks to their use. Bouma (2016) notes that monitoring for a decrease in weight-for-length z score (WHz) might lead to an unfortunate underdiagnosing of pediatric malnutrition in stunted children, as well as an inaccurate over-diagnosing in taller children. A better and more sensitive indicator in this case would be to evaluate weight-for-age z scores (WAZ), which wouldn't be influenced by the child's stature. Bouma (2016) describes a nutritional screening tool which was developed following the guidance of the paradigm shift to etiology-based definitions laid out by A.S.P.E.N. In its implementation, the "MTool" detected that the use of z scores placed the "burden of proof" on health care providers. If a pediatric patient was classified greater than 2 standard deviations below the norm, the role of the healthcare provider was then to assess thoroughly enough to show that this child is not malnourished, other than the other way around.

UF Health at Shands Hospital, which has also implemented the use of z scores based on guidelines from A.S.P.E.N., utilizes a variation of Malnutrition Screening Tool (MST) scores to identify pediatric patients who are in need of a nutrition consultation by a dietitian. This tool is comprised of 3 questions: has the patient experienced a decrease in appetite, has the patient had unintentional weight loss over the last 6 months, and are they on home TPN or tube feeds. This is not a tool used for diagnosing malnutrition, conversely a positive screening based on these questions indicates a referral for consultation from a registered dietitian. Prior research has extensively explored MST scores in their appropriateness and validity in older adult patients, however prior studies have failed to evaluate its use in pediatrics. A UF Health registered dietitian relayed that there has been discussion about the use of a different screening tool for

pediatric patients, however there were barriers to this change that included the necessity for greater nursing participation in its execution and the possibility of the change leading to inaccurate results.

Currently, nurses at UF Health perform this adapted MST evaluation upon a patient's admission. If a patient is referred for a nutrition consult, the registered dietitian has 48 hours to complete the consult, although they are normally completed sooner. This particular hospital's policy is to follow-up within 14 days of the consult, however depending on the severity of the patient, the registered dietitians will attend to this within 7 days or sooner. The dietitians are able to create a schedule that assists them with identifying which patients need to be seen and when. There are not currently any protocols in place regarding follow-up after discharge (K. Kisilewicz, personal communication, February 18, 2018.)

There are several avenues by which a pediatric patient might be referred for a nutrition consultation. As stated above, the MST score which is performed is just one method for identifying pediatric patients who will receive a nutrition consult. Another avenue would be through a physician's referral. This is based on physician preference and might occur when a patient has a certain etiology such as cystic fibrosis, a congenital heart defect, short gut, etc. A nutrition consult may also be initiated as a result of a registered dietitian's screening, such as a review of newly admitted patients to see if they are small or have poor weight gain, as well as if they receive tube feeds or TPN at home. The current practice for screening for malnutrition (post-admission) is not systematic, and is as variable as it is dependent on individuals' approaches and provider behavior.

Prior studies have substantiated the appropriateness of MST scores for use in adult populations, and it has been reported that nurses perceive the MST as "straightforward",

“simple”, and “good.” These views, although affirmative, have not always guaranteed increased adherence to routine malnutrition screening. This same study that features nursing perceptions of MST scores identified that on a particular unit, only 4% of patients had MST scores completed. Although the tool was appraised as easy to use, this study broaches the issue that there are wide ranging barriers to adherence in completing and documenting a screening tool. Poor prioritization of a nutrition assessment, high workload, skill, level of support, and education were some of the factors attributed to this low rate of completion (Raja et al., 2008.) In a setting which relies on this tool as a preliminary nutrition screening, noncompliance could be detrimental to the health of patients who get overlooked. Nutrition assessments are a routine part of a patient’s admission at UF Health Shands Children’s Hospital, so adherence to completing the screening might not be a problem. Nonetheless, this study advances the importance of recognizing barriers and weaknesses to implementing a different nutritional screening tool, and exposes how essential nursing perceptions and overall support are in the execution of these tasks.

Equally important to identifying malnutrition in a hospitalized pediatric patient, and intervening early, is ensuring that patients admitted for extended periods are not becoming malnourished throughout their stay. Research by Joosten and Hulst (2008) suggests that longer lengths of hospital stay lead to increased likelihood of developing serious nutritional deficiencies. A lack of a valid and universal pediatric malnutrition screening tool is partially accountable for the fact that routine screening for malnutrition is seldom performed (Joosten & Hulst, 2008.) A.S.P.E.N. has given particular emphasis to the necessity of performing serial z scores on children who have longer hospital length of stays (Mehta et al., 2013.) Their consensus statement establishes that as soon as the diagnosis of malnutrition in a pediatric patient is made, the frequency of subsequent nutrition assessments must also be determined (Becker et al., 2014.)

The association between longer length of stay and weight loss has been well documented in adults, however studies on this topic in pediatric patients are much more limited. (Braunschweig, Gomez, & Sheean, 2000.). A study investigating pediatric nutrition screening tools reported that out of hospitalized pediatric patients who had a length of stay of at least 4 days, 35% lost weight. This study corroborates the notion that assessing pediatric patients for malnutrition solely on admission might overlook a considerable number of patients who may develop nutritional deficits throughout their hospital stay (Hulst, Zwart, Hop, & Joosten, 2010.)

## **Methods**

A search through the literature was done using Health Science Databases, Pubmed, and internet searches to gather recent evidence on the prevalence, identification, and consequences of pediatric malnutrition in the hospital setting, and its effect on length of stays and readmission rates. Some key search terms were “pediatric malnutrition prevalence”, “pediatric malnutrition in hospitals”, “assessment of pediatric malnutrition in hospitals”, and “documentation of pediatric nutrition”. Studies published within the last 10 years were included, and studies that noted prevalence of malnutrition were refined to ones conducted only in the United States. I met and communicated regularly with my research mentor, Dr. Sandra Citty, through the entirety of the project.

We evaluated data from a report that is generated monthly from Decision Support Services at UF Health Shands Hospital. The reports were generated each month from January 2017 to December 2017, and the data includes patients age 18 years and under. The reports are titled “Monthly Readmit Rate for Discharged Patients Who needed Nutrition Consult”, “Monthly Readmit Rate for Discharged Peds Patients”, “Monthly Readmit Rate for Discharged Patients

Who needed Nutrition Consult by Discharge Unit”, and “Monthly Readmit Rate for Discharged Peds Patients by Discharge Unit”. These reports also included average length of stay for each month, for the populations at whole and separated by unit. These were used to compare differences in lengths of stay and readmission rates of pediatric patients who required nutrition consultations and those who did not. Further, an interview was conducted with a UF Health Pediatric Dietitian, in person and via email, to discuss current practices and protocols for pediatric malnutrition at UF Health Shands Children’s Hospital. This initial evaluation of malnutrition impact on quality indicators, such as readmission, was submitted to the QIPR registry for UF Health.

## **Results**

The results were based off of 10,336 pediatric discharges from January of 2017 through December of 2017. A total of 6,878 of these pediatric patients required nutrition consultations.

According to the data that we evaluated, the 30-day readmission rates for all pediatric patients in 2017 was 12.34%. The average length of stay for all pediatric patients was 5.16 days. The 30-day readmission rates for pediatric patients who needed a nutrition consult in 2017 was double that for all patients, at 24.67%. The average length of stay for patients who needed a nutrition consultation was 7.73 days. The mortality rate for patients who required a nutrition consult was higher than the rate for all patients, at 2.30% and 0.98%, respectively.

We also evaluated the data above for each pediatric unit separately. For all pediatric patients on unit E the 30-day readmission rate was 14.76% and the average length of stay was 22.46 days. On the same unit, patients who required a nutrition consultation had a 30-day readmission rate of 25% and an average length of stay of 47.40 days.

For all pediatric patients on unit D, the 30-day readmission rate was 17.74% and the average length of stay was 6.78 days. Patients on unit D who needed a nutrition consultation had a 30-day readmission rate of 32.43% and an average length of stay of 9.59 days.

For all pediatric patients on unit C, the 30-day readmission rate was 53.20% and the average length of stay was 4.89 days. Patients on unit C who needed a nutrition consultation had a 30-day readmission rate of 60.26% and an average length of stay of 11.08 days.

For all pediatric patients on unit B, the 30-day readmission rate was 8.80% and the average length of stay was 2.87 days. Patients on unit B who needed a nutrition consultation had a 30-day readmission rate of 30.69% and an average length of stay of 5.96 days.

For all pediatric patients on unit A, the 30-day readmission rate was 10.43% and the average length of stay was 3.44 days. Patients on unit A who needed a nutrition consultation had a 30-day readmission rate of 26.09% and an average length of stay of 6.52 days.

Table 1				
<i>30-day Readmission Rates (%) and Length of Stay (Days) by Population</i>				
All Patients and Patients Who Required Nutrition Consultations				
<u>Unit</u>	<u>30-day Readmission Rate, All Patients</u>	<u>30-day Readmission Rate, Nutrition Consult</u>	<u>Length of Stay, All Patients</u>	<u>Length of Stay, Nutrition Consult</u>
A	10.43%	26.09%	3.44	6.52
B	8.80%	30.69%	2.87	5.96
C	53.20%	60.26%	4.89	11.08
D	17.74%	32.43%	6.78	9.59
E	14.76%	25.00%	22.46	47.40

**Discussion**

Across all units, readmission rates and average length of stay were consistently higher, and in cases double the amount, for pediatric patients at UF Health Shands Children’s Hospital

who needed nutrition consultations compared to pediatric patients as a whole. The average length of stay was 2.57 days longer for those who needed a nutrition consultation, and they were readmitted to the hospital within 30 days of discharge at twice the rate. We cannot say that pediatric malnutrition causes these rates to increase, however it is clear that this may be a factor. There are evidenced based interventions in the literature that could help to improve screening of, diagnosis, and management of pediatric patients with malnutrition. These changes could help to reduce 30-day readmission rates and length of stay and notably decrease hospital costs, but even more importantly, improve quality of life for these patients, and improve health outcomes.

#### *Results compared to the literature*

A study in by Berry et al. (2013) assessed data from 72 children's hospitals in the United States in 2010, analyzing about 568,845 admissions over the course of a year. They found that the average unadjusted 30-day readmission rate for all hospitalized pediatric patients was 6.5%. Comparatively, this is a much smaller percentage than the readmission rates for pediatric patients at UF Health Shands Children's Hospital's rate, which in 2017 was 12.34%. It is important to note that this study excludes some populations which our data collection does not (e.g. patients on chemotherapy), and this may contribute to the difference in reported values. The data from this study is from 2010 and, if available, the national rate of 30-day readmissions for pediatric hospitals in 2017 would be a much more desirable value for comparison. The unadjusted readmission rate of the study falls short of addressing the variance in patient acuity, also considering that patients with a coded diagnosis of malnutrition are more likely to be discharged from a teaching hospital (Abdelhadi et al., 2013.) Even so, the 30-day readmission rates are notably higher, and even more so for the population of pediatric patients who needed a nutrition consultation – 24.64%.

In recent years, financial and clinical implications have dramatically shaped queries on the topic of reduction of readmission rates. Often, in the adult population, readmission rates are considered concurrent with hospital performance and quality of care. The correlation between the two in the pediatric population is currently being investigated. Research by Bardach et al. (2013) reports that pediatric readmissions which occur within a year are not uncommon, and each year these carry the cost of more than \$1 billion. It might be important to identify whether pediatric readmissions to UF Health Shands Children's Hospital are preventable, and what interventions can be implemented to decrease their frequency. Several studies agree that interventions surrounding nutrition are successful in reducing the number of unplanned readmissions (Sriram et al., 2017; Bally et al., 2016).

*What can be done to reduce readmission rates?*

A study by Dr. Sriram and colleagues (2017) illustrates application of a nutrition-focused quality improvement program that reduced readmissions by 20%. The project began with the choice of a validated screening tool and the development of an electronic medical record which would cue completion of the screening tool on admission. If the patient was identified to have been at risk of malnutrition, there were nurse-ordered oral nutrition supplements (ONS) given to the patient within 24 hours of the screening. Shortly after, the patient would receive a consultation by a dietitian. At discharge, the patients who participated in this project received coupons for the ONS, directions for ONS use at home and reinforcement for adherence to the regimen, and literature on nutrition. A transition call center nurse would reach out to the patient 48-72 hours post discharge to confirm use of ONS, and then an automated phone system would make calls 2, 3, and 4 weeks post discharge.

This project was successful in decreasing not only readmission rates, but also length of stays for patients who participated. Their conclusions evidence that the use of a validated malnutrition screening tool alongside punctual administration of oral nutrition supplements could help to decrease readmission rates and length of stay. Readmission rates were lowered by around 20% as a result of these quality improvement interventions, and length of stay was also reduced similarly. This study was performed in the adult population; however, the design of the project could be reproduced to be applied to pediatrics. It is important to note that although MST (which is used and adapted throughout UF Health at Shands Hospital) is a validated malnutrition screening tool for adults, the same can't be said for its use in pediatrics. This study is incredibly valuable in its presentation of the ability of a nutrition focused project to catalyze large scale change in values like 30-day readmission rates and length of stay.

Emphasis on and coordination of timely outpatient follow-up can also considerably influence readmission rates. When researched in pediatric patients with asthma, those who had lower access to primary care after hospitalization had increased rates of readmission, regardless of the quality of that care (Auger, Kahn, Davis, Beck, & Simmons, 2013.) Improving coordination and facilitation of care after hospital discharge might be a pivotal part of a hospital's reduction of preventable readmissions. This problem was identified by a UF Health Dietitian as a barrier to treating malnutrition. She acknowledged that many patients are discharged without plans for a follow up with a dietitian. Many will have a primary care follow up scheduled for after discharge, however a targeted follow-up with a dietitian might be more focused and effective for the malnourished patient (K. Kisilewicz, personal communication, February 18, 2018.) A.S.P.E.N. recommends that processes intended to ensure continuity of care should be established as soon as a child is diagnosed with malnutrition. Initiating this at the time

of diagnosis might help to increase the likelihood of successful coordination of care. The type of follow up care received may affect outcomes and readmissions, as well as how soon a patient receives this follow up after discharge.

Previous studies proffer great success in the effective use of health information exchange in reducing 30-day readmission rates. One method involves a way for patients to access their health record at home, to include the details of their medication regimen and much more. A study employed the use of a tele-monitoring system which aided partnered healthcare clinics and case managers in following patients at high risk for readmission. This system, with the aid of case management, was associated with a 44% decrease in readmissions within 30 days in the population which was high risk (Kash, Baek, Davis, Champagne-Langabeer, & Langabeer, 2017.) Pediatric patients with anemia or neutropenia, ventricular shunt procedures, and sickle cell anemia crisis are among some of the populations at high risk for readmission (Berry et al., 2013.) Strategies that target the use of effective health information exchange could be helpful in coordinating follow-up.

*What can be done to reduce length of stay?*

Pediatric patients diagnosed with malnutrition on average have a greater length of stay than patients who do not, and their care is costlier. Lakdawalla et al. (2014) studied a national sample of patients in the United States over 11 years, primarily patients aged 2-8. The study looked at the relationship between oral nutrition supplementation (ONS) and hospital length of stay and episode cost (the amount incurred on the hospital to deliver care). The use of ONS significantly decreased the length of stays of patients receiving ONS. In addition, ONS decreased the cost per episode of hospitalization by approximately \$1,768 – adding up to around \$57.8 million annually nationwide. These results help to confirm that the use of oral nutrition

supplementation should not be overlooked during pediatric hospitalizations, and can substantially decrease patients' length and costs of stay.

Another study conducted in Michigan which effectively reduced length of stay of pediatric patients is not as recent, although noteworthy. Researchers at University of Michigan Mott Children's Hospital (UMMCH) set out to investigate whether comparing their data to other children's hospitals from a database could help to detect areas for improvement, and if the hospital could implement clinical changes to advance those areas. They identified the opportunity to enhance care for children with asthma in their hospital, noting that their length of stay was slightly longer and the cost per case was higher than the average from the database. The researchers met with clinicians to work to target different processes for improvement – accurate documentation, standardized orders, and standardized education for patients' parents initiated on admission. Within 3 years, the cost per case, length of stay, and 30-day readmission rates have been lower than the national cohort, and this has been sustained (Sedman et al., 2004.) This study promotes that projects guided by comparison of data can manifest in less costly and higher quality care to more children.

### **Lessons learned**

Pediatric patients at UF Health Shands who needed a nutrition consultation had longer length of stay and almost double the rate of 30 day readmissions. We can't say definitively that there is a correlation, however clearly malnutrition may be a factor in these variables, and quality improvement studies in the past that target nutrition have been successful in reducing both length of stay and readmission rates in patients. This could be an effective approach, as an improvement in nutrition status in patients who are malnourished lowers the chances of recurrence of illness

after hospital discharge. A.S.P.E.N. underlines the importance of using a validated malnutrition screening tool, as well as determining how often a patient will be reevaluated as soon as the diagnosis of malnutrition is made (Becker et al., 2014.)

Screening for malnutrition is traditionally completed upon admission, and seldom after admission in patients who were not diagnosed with malnutrition, although it is evidenced that roughly 35% of patients who have a length of stay of at least 4 days experience weight loss (Hulst, Zwart, Hop, & Joosten, 2010.) Patients with a coded diagnosis of malnutrition have been shown to have a length of stay that is 2.5 times longer than patients who did not. The national average rate of 30 day readmissions for hospitalized pediatric patients in 2010 was around 6.5% (Berry et al., 2013.) At Shands Hospital in 2017, the average was 12.34% and double that, 24.64%, for patients who required a nutrition consultation. The data evaluated in this study can be used as a basis for comparison as evidence based projects for improvement are initiated in an attempt to improve outcomes and better manage malnutrition in the pediatric population. Next steps in quality improvement are needed to evaluate the causations of this increased readmission rate for this population and ultimately improve patient outcomes.

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