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Dear *Journal of the Academy of Nutrition and Dietetics* Editorial Office,

We are submitting the manuscript "Self-Rated Health and Number of Hospital Admissions as Possible Confounders to Association Between Nutrition Intake and Mortality Risk" for your review. This manuscript describes recent research on predictors of mortality and their effectiveness in determining health outcomes. We believe it will be of great interest to the Journal's readership given its implications in improving the nutrition assessment's ability to assess nutritional risk factors.

Thank you for the opportunity to submit this manuscript, we look forward to your comments and suggestions.

## **Self-Rated Health and Number of Hospital Admissions as Possible Confounders to Association Between Nutrition Intake and Mortality Risk**

### **Abstract**

*Background:* Increased nutrition intake has been found to be directly associated with a reduction in the number of hospital admissions, a reduction in mortality risk, and an improvement in a patient's self-rated health. However, current literature shows that there is a negative correlation between number of hospital admissions and mortality risk.

*Objective:* To determine if there is an association between Self-Rated Health and number of hospital admissions among hospitalized Veterans.

*Design:* This was a cross-sectional study.

*Participants/Setting:* Adults over age of 18 with no cognitive impairments that would limit ability to give consent who were present in participating wards at Louis Stokes Cleveland Department of Veteran Affairs on the day of the study.

*Intervention:* Number of Hospital Admissions in 12 months prior to nutritionDay

*Main Outcome Measures:* Self-rated Health

*Statistical analyses performed:* The differences of hospital admissions in past 12 months among Veterans with different measures of self-reported health were analyzed using ANOVA. P-value <0.05 was considered statistically significant. Analyses performed using JMP version 14.0.

*Results:* Patients who reported their health as poor had the greatest average of admissions to hospital in past 12 months, with a mean of 21.1 admissions +/- a SD of 28.8. Patients who reported their health as fair had the next greatest average of admissions to a hospital in the past 12 months with an average of 13.82 admissions +/- a SD of 15.59 (p=0.126).

*Conclusions:* Despite the lack of significance in these results, current research still shows strong evidence between mortality risk and SRH. Therefore SRH should become a mandatory aspect of the nutrition assessment performed by Registered Dietitian Nutritionists in clinical settings. This will give them a better idea of which patients are at greater risk and would require nutrition support, which in turn can lead to improved health outcomes and reduced mortality risk.

## Introduction

Undernutrition is an essential public health issue that can lead to negative health outcomes in susceptible individuals; including hospitalized patients<sup>1,2</sup>. In 2009, Hiesmayr *et al*<sup>2</sup> used the data from a cross-sectional study across 25 European countries and including over 14000 patients to show that patients who only consumed a quarter of their meal (on the day of data collection) were over 110% more likely to die when compared to patients who consumed their full meals, even after adjusting for length of stay bias. These results have been seen in a number of nutritionDay analyses, including by Sauer *et al*<sup>3</sup>, who found that patients that ate nothing despite being allowed to eat were almost 6 times more likely to die when compared to patients who ate all of their meals.

Increased nutrition intake during a hospital admission has also been shown to be correlated with reduced hospital readmission rate<sup>4</sup>. By improving the presentation of food, one hospital was able to increase the patient's food intake more so than when compared to those whose food presentation remained the *same*<sup>4</sup>. This in turn led to a lower readmission rate of 13.5% compared to 31.2% of the control group<sup>4</sup>. However, previous literature has shown that an increase in the number of hospital admissions is not associated with an increase in mortality *risk*<sup>8</sup>. When looking at the trend between hospital admissions for patients with pancreatic cancer and mortality risk, researchers found that despite a 18% increase in hospital admissions for these patients, there was a 1.7% reduction of overall mortality between 2007 and 2011<sup>8</sup>.

Nutrition intake has also been shown to be directly correlated with self-rated health (SRH) among patients in an inpatient setting, as seen by Lainscak *et al*<sup>5</sup>. 59% of the patients in this study reported a fair/poor SRH which was associated with a lower food intake compared to patients with higher levels of self-rated health<sup>5</sup> ( $p < 0.005$ ).

The association between nutrition intake and SRH is an important issue to address in hospital settings as there have been numerous links between a poor SRH and increased mortality risk<sup>5,6</sup>. One study determined that of the 28106 patients involved, those that reported a poor SRH and had reduced food intake on the survey day were at a 6.37 times greater risk of in-hospital mortality compared to those with a high SRH and regular food intake<sup>5</sup>.

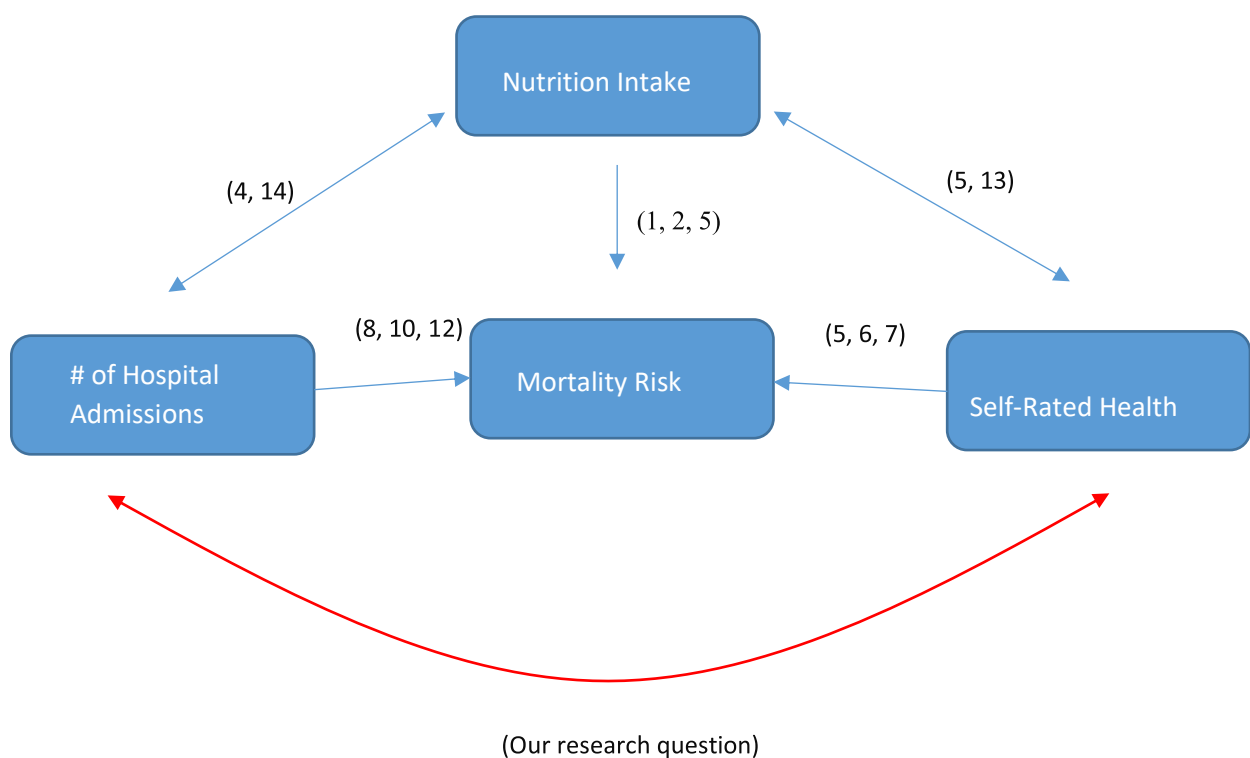
Researchers who analyzed all hospital admissions in Denmark (between 1995 to 2006) using the Danish Longitudinal Survey on Ageing found SRH to be a strong predictor of mortality<sup>6</sup> when compared to objective measures using past medical records. By comparing the correlation between SRH and mortality they were able to determine that SRH proved to be a greater determinant of mortality than the use of objective measures alone<sup>6</sup>.

This was also seen in a study by Shunquan Wu<sup>7</sup> who also looked to determine the effectiveness of SRH as a determinant of health status. Health-related risk factors for variety of chronic illnesses (including cardiovascular disease, mental illnesses, diabetes mellitus, etc.) were associated with a poorer SRH, which in turn was associated with an increased risk of mortality<sup>7</sup>. Therefore they concluded that SRH can be used as an equally effective measure of health status compared to more objective measurements of health<sup>7</sup>.

While increased nutrition intake has been found to be directly associated with a reduction in the number of hospital admissions, a reduction in mortality risk, and an improvement in a patient's SRH, little to no evidence exists that finds any association between the number of hospital admissions and SRH. Further research on this relationship is essential, as despite the relationship between improved nutrition intake and mortality risk, current literature shows that there is negative correlation between mortality risk and the number of hospital *admissions*<sup>8,10</sup>. Studies involving a number of chronic diseases (including pancreatic cancer and congestive heart failure) saw that despite an increase in the

number of hospital admissions for patients with these diseases, there was a decrease in overall *mortality*<sup>8,10,12</sup>. Further research into these relationships can give healthcare providers a better overview on which risk factors serve as better predictors for mortality. Therefore we examined if there was a difference in the number of hospital admissions in the past 12 months among Veterans at the LSCVAMC with either very poor, poor, fair, good, or very good general self-rated health.

*The following flow chart gives a visual representation of the main study question and associated factors:*



## Methods

### *NutritionDay in general*

NutritionDay was created in 2004 to increase the awareness of the prevalence of malnutrition in healthcare institutions across the globe. It is a 1-day cross-sectional audit that collects data on hospitalized

patients regarding their food intake and overall well-being. Currently, nutritionDay is performed in 64 countries worldwide and involves over 240,000 patients among over 7000 healthcare institutions. The large amount of data it provides gives healthcare providers data on malnutrition risk and relationships between food intake and health outcomes amongst hospitalized patients <sup>1</sup>. It has been important in increasing the awareness of the association between mortality and nutrition intake.

#### *Data collection at local site*

NutritionDay (ND) was performed at the Louis Stokes Cleveland Department of Veteran Affairs Medical Center (LSCDVAMC) on October 31<sup>st</sup>, 2019. A waiver of HIPAA authorization and consent was obtained from the IRB beforehand to access patient's medical records prior to consent to obtain height, weight, DOB, sex, and their date of admission. We then identified whether the patients in the ward were able to consent or whether they had a potential cognitive impairment that would limit their ability to provide consent. Criteria of patients to be included in the study were the following; Adults over the age of 18, were present in participating wards on ND, had no cognitive impairment, and were therefore able to give consent in an ethical manner. The patients that fell under these criteria were then divided among the research assistants tasked with obtaining the appropriate data. Research assistants were provided with a VA research consent script and visited each of the identified patients that met the criteria to obtain verbal consent using this script as well as a signed HIPAA authorization.

Data was collected from patients using questionnaires and chart reviews in five separate parts:

1. Unit organization and structure: The unit structure sheet was filled out by the PI and it included structural information about the unit.
2. Hospital capacity and staffing: This contained information about the structural information and capacity of the hospital and it was filled in by the PI.

3. Patient's demographics and medical information: The research assistant filled in the Unit Caregiver Sheets based on retrospective chart review after patient consent. It included the following information:
  - a. Demographic profile
  - b. Diagnostic criteria based on ICD 10
  - c. Main reason for admission
  - d. Conditions/comorbidities patient has
  - e. Previous operations during this hospital stay
  - f. Planned operation during this hospital stay
  - g. Previous ICU admission during this hospital stay
  - h. Whether or not patient is terminally ill, fluid status
  - i. Number of different medications planned
  - j. Whether or not patient is identified as malnourished are at risk of malnourishment
  - k. IV fluids provided on day of survey
  - l. Number of ONS supplements planned
  - m. Nutrition intake i.e. type of diet patient is on during NutritionDay
  - n. Any lines and tubes present, complications with nutrition related lines and tubes since admission
  - o. Energy goal and energy intake the day prior
  - p. Health status since admission
4. Individual self-administered patient questionnaire: The patient filled out a patient questionnaire themselves or with assistance from the research assistant. The information it asked for included the following:
  - a. Typical dietary information

- b. Place of residency before admission
- c. Ability to walk
- d. Self-reported health
- e. Number of times in 12 months prior to admission they saw a doctor, been admitted to a hospital, and total number of nights spent in a hospital
- f. Medications taken before admission
- g. Health insurance
- h. Weight 5 years ago
- i. Change in weight in past 3 months before admission
- j. Were they aware of their hospitalization two days before admission
- k. Whether they were weighed at admission
- l. Whether they were informed about their nutrition status or nutrition care options
- m. Whether they received special nutrition care
- n. How well they were eating prior to admission
- o. Satisfaction with food provided at the VA
- p. Did they receive assistance with eating on NutritionDay
- q. Were they able to eat without interruption on NutritionDay
- r. How much hospital food they were able to consume for lunch or dinner on NutritionDay
- s. Portion size of the meal
- t. If they did not eat everything, why that was so
- u. Number of glasses/cups of drinks consumed in prior 24 hours
- v. Whether or not they consumed food from outside hospital on that day
- w. Change in food intake during current hospital admission
- x. Change in SRH since admission



y. Whether or not they were able to walk without assistance on NutritionDay

Patients were given option to consent to participate only for medical documentation portion of caregiver sheet and the individual patient outcome but refuse to fill out the individual patient questionnaire. Outcomes were then collected 1 month following ND by looking at their discharge summary in their Electronic Medical Records. This was used to see if the patients had been readmitted or if they had passed away since ND.

After collection of data, information was entered into a password protected excel file used for the storage and analyzation of LSCVAMC data. Information was then sent to an international audit database via secure server hosted by University of Vienna. Access to this site will be performed only with the use of VA computers. The data sent to the international investigators was anonymized with a 3-digit patient code and a center unit. Access to the identification key of the patients was not given to the international investigators. Only identifiable information that was sent to the international site and stored in the database were year of birth and dates of hospital admission and discharge. This information will be stored indefinitely for research to fulfill goal of determining risk factors of malnutrition and nutrition practices worldwide.

### *Analysis*

Participants with missing data were retained in the data set and included in pairwise analyses. BMI was calculated by dividing the weight in lbs by the height in inches squared and multiplying by a conversion factor of 703. Variables such as age, BMI, # of comorbidities present, length of stay, doctor visits in last 12 months, nights spent in hospital in last 12 months, and number of ONS planned for ND were described with mean and standard deviations if normally distributed, or with median and range if data are skewed. Variables such as general self-reported health rating, gender, where they lived before hospitalization, ICU stay during this admission, and health status since admission were described with

frequencies. The differences of hospital admissions in past 12 months among Veterans with different measures of self-reported health were analyzed using ANOVA. P-value <0.05 was considered statistically significant. Analyses performed using JMP version 14.0.

## Results

Of the patients recruited on NutritionDay 2019, the average number of admissions to a hospital in the past 12 months was 3.5 admissions +/- a SD of 4.7. Also, 45.4% of all these patients self-reported their health as fair while 33.3% reported their health as good.

**Table 1.** Characteristics of patients recruited at LSCVAMC for NutritionDay 2019.

Characteristic	N	Mean/SD or n/%
Age (in years)	73	64.4 ± 11.2
Gender- Male	74	69 (93.22%)
BMI	71	30.3 +/- 7.3
Location Before Hospitalization	66	
Home		62(88.6%)
Nursing Home		1(1.4%)
Transferred from other Hospital		0(0%)
Other		3 (4.3%)
# Comorbidities Present		3.5 ± 1.8
Length of Stay		8.7 ± 15.7
Self-Reported Health	66	
Very Poor		2 (3%)
Poor		11(16.6%)

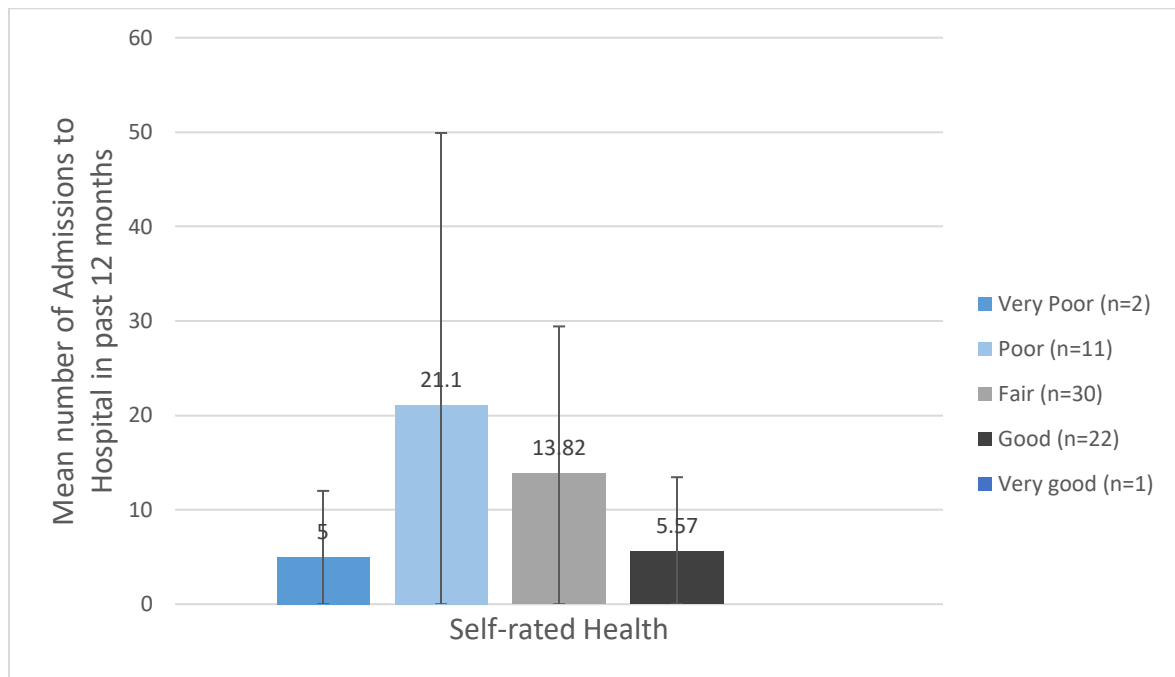
Fair		30(45.4%)
Good		22(33.3%)
Very Good		1 (1.5%)
ICU Stay During This Admission	74	
Yes		11(14.9%)
No		63(85.1%)
Admissions to hospital in last 12 months	63	3.5 ± 4.7
Nights Spent in Hospital Past 12 Months	62	11.7 ± 16.9
Number of ONS During This Admission	74	0.47 ± 1.1
Health Status Since Admission	74	
same as admission		21 (28.4%)
weaker than admission		13 (17.6%)
stronger than admission		28 (38%)
don't know		12 (16.2%)

**Table 2.** One-way ANOVA

	Very poor (n=2)	Poor (n=10)	Fair (n=28)	Good (n=21)	Very Good (n=1)	P-value
Admissions to hospital in past 12 months (mean ± SD)	5 ± 7.07	21.1 ± 28.8	13.82 ± 15.59	5.57 ± 7.88	0	0.126

Patients who reported their health as poor had the greatest average of admissions to hospital in past 12 months, with a mean of 21.1 admissions +/- a SD of 28.8. Patients who reported their health as fair had the next greatest average of admissions to a hospital in the past 12 months with an average of 13.82 admissions +/- a SD of 15.59. P-value of 0.126 indicating these results are not significant.

**Figure 1.** The difference in number of hospital admissions in past 12 months among patients with different levels of self-rated health.



## Discussion

The mean number of admissions to a hospital in the past 12 months for the patients whose data was collected on ND in this study was 3.5 admissions  $\pm$  a SD of 4.7 admissions. This is important to note due to the negative correlation seen between number of admissions and overall mortality; as seen in a study performed in Aurora Saint Luke's Medical Center in Wisconsin that looked at the number of hospital admissions for patients with pancreatic cancer and mortality rate in 2007 and then again in

2011. They found that the hospital admission rate increased by 18% in this period of time, while the mortality rate decreased from 9.8% to 8.1% between 2007 and 2011<sup>8</sup>. Similar results were seen in patients with congestive heart failure in Singapore between the years of 1991 to 1998<sup>12</sup>. During this time the number of hospital admissions for the patients with congestive heart failure increased by 38%, but the rate of mortality decreased by 20%<sup>12</sup>.

The negative correlation between these factors may be due to the improved treatment options for many chronic diseases and the characteristics that a person who has increased hospital admissions may have. If they tend to have higher admissions to seek care, it is likely that they are also more likely to seek treatment earlier which could catch the disease earlier. Also, the effectiveness of treatment options today are higher than they were in the past, and more admissions can likely mean more opportunities to seek this care which may explain the decrease in mortality risk.

The patients in this study on ND were also more likely to select their health as fair or good, as 45.5% of all the patients in this study selected a fair SRH and 33.3% selected a good SRH. Much research has been conducted that has shown the correlation between SRH and mortality, with research suggesting that it can serve as an even better predictor than other objective *measurements*<sup>9</sup>. This association, however, has only been shown in males but not in females; as seen in a study conducted at the Ewha Woman's University Medical Center in Korea<sup>9</sup>. It was shown that there was actually an inverse association between cardiovascular and respiratory disease mortality and a positive SRH in women.

The mean number of hospital admissions in the last 12 months was 3.5 days, but this increased drastically when looking solely at patients who reported their health as poor or fair, with an average of 21.1 and 13.8 hospital admissions in the last year, respectively. These results do not align with the trends seen in a cross-sectional survey performed on 116 participants with COPD<sup>11</sup>. The participants in this study who reported the COPD impact on their health to be very high also had much fewer acute

hospital admissions in the year prior to the *study*<sup>11</sup>. However, this may be attributed to the increased difficulty a patient with COPD experiences in overall movement and walking. Therefore a patient who has worsening COPD may be less likely to travel to a hospital for an acute hospital admission. While the results obtained show a trend, the p-value of 0.126 indicate that the results obtained are not significant.

### **Limitations**

Certain limitations include that mortality outcome data for these patient's has not been obtained as of the time of this report, therefore we cannot determine if there is any association between number of hospital admissions and mortality. With this data missing we also cannot conduct an analysis between SRH and mortality. The analyses performed were also not adjusted for the presence of chronic diseases/ co-morbidities, which would potentially have an impact on SRH, number of hospital admissions, as well as mortality risk. The location of the study also was shown to be a limitation due to the large difference in the genders of the participants, with 93% being male. This therefore decreases the generalizability of the results to the general population.

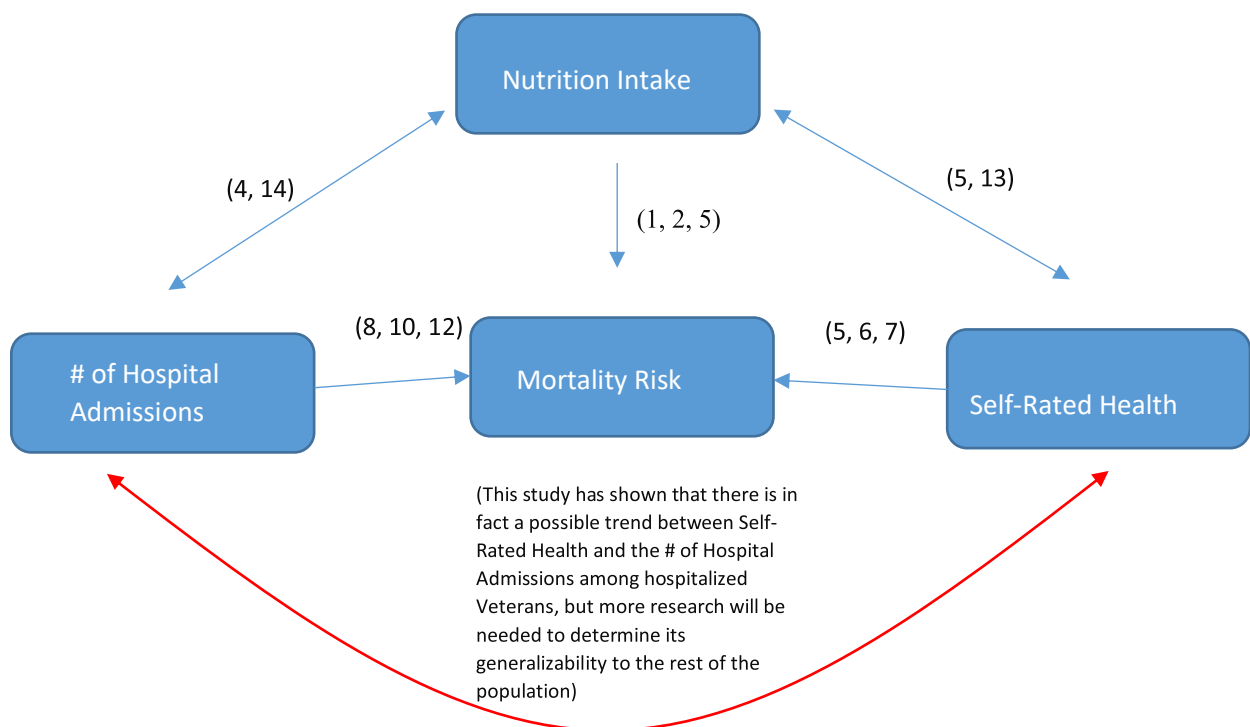
### **Implications & Next Steps**

Looking at the overall number of admissions in this population will give healthcare providers the ability to predict overall mortality risk as research has shown that despite increases in hospital admissions among different populations, there has been a steady decrease in *mortality*<sup>8,10,12</sup>. The use of SRH as an independent predictor of mortality should also be considered due to the effectiveness it has been shown to have in this regard.

To determine if there is indeed an association between SRH and number of hospital admissions, additional studies must be performed at institutions with a larger female population. This will also allow researchers to determine if the association seen between SRH and mortality risk is also seen in the

female population. This is an important issue because of the known differences in pain perception seen between males and females in clinical and non-clinical *settings*<sup>15,16</sup>.

Despite the lack of significance in these results, current research still shows strong evidence between mortality risk and SRH. Therefore SRH should become a mandatory aspect of the nutrition assessment performed by Registered Dietitian Nutritionists in clinical settings. This will give them a better idea of which patients are at greater risk and would require nutrition support, which in turn can lead to improved health outcomes and reduced mortality risk.



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