1.a. Full Title: Association between obesity and hospitalizations

b. Abbreviated Title (Length 26 characters): Obesity and hospitalizations

2. Writing Group:
Writing group members:
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I, the first author, confirm that all the coauthors have given their approval for this manuscript proposal. __DT__ [please confirm with your initials electronically or in writing]

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3. **Timeline:** Dataset preparation and analysis will start immediately upon approval. We anticipate submitting the manuscript in about one year.

4. **Rationale:**
Given the association between obesity and numerous comorbidities (cardiovascular disease, hypertension, diabetes, several types of cancer) it is reasonable to suspect that obese individuals would be at a greater risk for hospitalizations. This increased risk of hospitalization would be assumed to contribute to the costs of obesity. Given the current concern about both obesity and rising health care costs, it is surprising that very few studies have examined the association between obesity and hospitalization. Further, the available studies provide mixed results.

Among the few studies available, some found an increased risk for hospitalization among obese individuals, while others found no association or even a negative association. The two largest studies that found a positive association were limited to homogenous samples within single geographic regions—one was a cross-sectional study of 17,118 HMO members, 76% of whom were white, in Northern California; the other was a cohort study of 17,643 adults, 87% of whom were white, in Chicago. To our knowledge, no study has specifically looked at the effect of obesity on hospitalizations among African-Americans. Considering that this population has been found to have higher obesity prevalence, greater risk of hospitalization due to certain comorbidities, and more all-cause nights in a hospital, it is very possible that obesity is an even greater cause of hospitalizations among African-Americans.

We know of no studies conducted in the United States that have examined whether associations between obesity and total number of hospitalizations differ by gender. Women represent a greater percentage of hospitalized patients nationwide, but this is largely attributable to pregnancy-related conditions. One study that looked at all-cause hospitalizations by gender found that women beyond childbearing years were less likely to be hospitalized than men. In contrast, a paper coauthored by one of us (JS) showed that in North Carolina women were much more likely than men to seek surgery as a treatment for obesity. It is obvious that more work is needed to understand how gender may impact obesity-related hospitalizations.

We know of only one study that has examined associations between obesity and specific causes of hospitalization. This study, by Luchsinger et al., was restricted to individuals ages 65-100. They found that obesity was associated with hospitalization for CVD, but they found no significant association for nine other causes examined (infectious disease, malignancy, endocrinological disease, hematological disease, central nervous system disease, respiratory disease, gastrointestinal disease, genitourinary disease and musculoskeletal disease) examined. Studies conducted in Europe and Australia have examined associations between obesity, chronic disease and hospitalizations with mixed results. Of course these findings from European countries may not be generalizable to the United States.

The purpose of this study is to conduct a longitudinal analysis to determine if obesity is associated with increased hospitalizations. We will examine admissions for all-causes and cause-specific admissions. The major causes of hospitalizations that we will examine include, but are not limited to:
<table>
<thead>
<tr>
<th>First listed diagnosis</th>
<th>ICD-9 codes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heart disease</td>
<td>391-392.0, 393-398, 402, 404, 410-416</td>
</tr>
<tr>
<td>Cerebrovascular disease</td>
<td>430-438</td>
</tr>
<tr>
<td>Respiratory disease</td>
<td>460-519</td>
</tr>
<tr>
<td>Infectious and parasitic disease</td>
<td>001-139</td>
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<tr>
<td>Malignant neoplasms</td>
<td>140-208, 230-234</td>
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<tr>
<td>Endocrinological disease</td>
<td>240-279</td>
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<tr>
<td>Mental disorders</td>
<td>290-319</td>
</tr>
<tr>
<td>Digestive disease</td>
<td>520-579</td>
</tr>
<tr>
<td>Genitourinary disease</td>
<td>580-629</td>
</tr>
<tr>
<td>Musculoskeletal disease</td>
<td>710-739</td>
</tr>
<tr>
<td>Injury and poisoning</td>
<td>800-999</td>
</tr>
</tbody>
</table>

In addition, we will be able to examine whether these relationships differ between African-Americans and Whites, as well as between men and women. This will build upon previous studies by utilizing data from a longer time frame, representing a more diverse sample, and analyzing data by cause of hospitalization.

5. Main Hypothesis/Study Questions:
1. Determine the association between body mass index (BMI) and hospitalizations in middle-aged adults. We hypothesize that obesity will be associated with greater number of hospitalizations.
2. Determine the association between body mass index (BMI) and major causes of hospitalizations. We hypothesize that obesity will be positively associated with hospitalizations for heart disease, cerebrovascular disease, and endocrinological disease; and may also be positively associated with other causes of admissions.
3. Determine if association between obesity and hospitalizations and major causes of hospitalizations differ by ethnicity and/or gender. We hypothesize that associations will differ by ethnicity and gender in that obesity will be associated with more admissions in African Americans and women than in whites and men.

6. Data (variables, time window, source, inclusions/exclusions):

We will use data from the ARIC visits 1-4 and annual follow-ups

<table>
<thead>
<tr>
<th>Identification information</th>
<th>Demographics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient ID</td>
<td>Gender</td>
</tr>
<tr>
<td>Date of visit</td>
<td>Ethnicity</td>
</tr>
<tr>
<td>Field center</td>
<td>Age</td>
</tr>
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<td></td>
<td>Education</td>
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<tr>
<td>Anthropometrics</td>
<td>Employment</td>
</tr>
<tr>
<td>Weight</td>
<td>Insurance</td>
</tr>
<tr>
<td>Weight at age 25</td>
<td>Hospitalizations</td>
</tr>
<tr>
<td>Height</td>
<td>ID number (link)</td>
</tr>
<tr>
<td>Medical History</td>
<td>Discharge date</td>
</tr>
<tr>
<td>Ever been hospitalized</td>
<td>Primary Diagnosis code</td>
</tr>
<tr>
<td>Self-rated health</td>
<td>Other diagnosis codes</td>
</tr>
<tr>
<td>Prevalent CHD</td>
<td></td>
</tr>
</tbody>
</table>

5

3
Incident CHD
Prevalent cancer
Incident cancer
Prevalent stroke
Incident stroke
Prevalent diabetes
Incident diabetes

Other
Smoking status
Alcohol status
Physical activity
Medication usage

Exclusions:
Missing weight at baseline
Ethnicity other than White or African-American
African-Americans in Minnesota or Maryland

7.a. Will the data be used for non-CVD analysis in this manuscript? _____ Yes ____ X__ No

b. If Yes, is the author aware that the file ICTDER02 must be used to exclude persons
with a value RES_OTH = “CVD Research” for non-DNA analysis, and for DNA
analysis RES_DNA = “CVD Research” would be used? _____ Yes ____ No
(This file ICTDER02 has been distributed to ARIC PIs, and contains
the responses to consent updates related to stored sample use for research.)

8.a. Will the DNA data be used in this manuscript? _____ Yes ____ X__ No

8.b. If yes, is the author aware that either DNA data distributed by the Coordinating
Center must be used, or the file ICTDER02 must be used to exclude those with value
RES_DNA = “No use/storage DNA”? _____ Yes _____ No

9. The lead author of this manuscript proposal has reviewed the list of existing ARIC Study
manuscript proposals and has found no overlap between this proposal and previously
approved manuscript proposals either published or still in active status. ARIC Investigators
have access to the publications lists under the Study Members Area of the web site at:
http://www.cscc.unc.edu/ARIC/search.php

_____ X__ Yes _______ No

10. What are the most related manuscript proposals in ARIC (authors are encouraged to
contact lead authors of these proposals for comments on the new proposal or
collaboration)?

#1125: Diabetes, obesity and insulin resistance as risk factors for incident hospitalized heart
failure

There is little overlap with this proposal that focuses on the association between obesity and one
specific cause of hospitalization. No other proposals have examined any obesity-hospitalization
association.

11. a. Is this manuscript proposal associated with any ARIC ancillary studies or use any
ancillary study data? _____ X__ Yes _____ No
11.b. If yes, is the proposal

A. primarily the result of an ancillary study (list number* 2005.08*)

B. primarily based on ARIC data with ancillary data playing a minor role
(usually control variables; list number(s)* __________ __________ __________)

*ancillary studies are listed by number at http://www.cscc.unc.edu/aric/forms/

12. Manuscript preparation is expected to be completed in one to three years. If a manuscript is not submitted for ARIC review at the end of the 3-years from the date of the approval, the manuscript proposal will expire.


