

Assessment of Weight and Health in the Emergency Department: A Cross-Sectional Study

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Abstract

Introduction: The prevalence of obesity and obesity-related diseases continues to rise. A key aspect of prevention and treatment of these disorders requires clear communication about weight and health between patients and healthcare providers. **Objective:** We sought to examine the prevalence rate of obesity and associated comorbid illnesses in an emergency department (ED) population. A second aim was to assess patients' perceptions of their weight and their overall health. **Methods:** This is a cross-sectional study performed in an academic tertiary-care center using a representative sample of patients (≥ 18 yr) who presented to the ED. Pregnant patients, patients who were medically unstable, cognitively impaired or who were unable or unwilling to provide informed consent were excluded. Anthropometric measurements were taken which include BMI (the ratio of a patient's weight and height expressed as kg/m^2) and waist circumference. In addition, the prevalence rates of all enrolled patients who 1) feel their health is affecting their weight and 2) who have had or recall discussions about their health and weight with their provider were examined by using a two-question validated survey. **Results:** The overall prevalence rate of obesity in this study was 38.6%. Only 71.8% (95% CI, 63.2% - 80.6%) of overweight patients (BMI = 25.0 - 29.9) and 28.4% (95% CI, 21.6% - 35.2%) of obese patients (BMI ≥ 30.0) believe their present weight is damaging to their health. Further, only 15.5% (95% CI, 8.5% - 22.6%) and 59.4% (95% CI, 53% - 67%) of those overweight and obese, respectively, recall being informed by their healthcare provider they are overweight. For morbidly obese patients (BMI ≥ 40.0), 79.6% (95% CI, 12.2 - 28.6) feel their weight is damaging their health and 83.7% (95% CI, 9.4 - 23.2) recall having a conversation about weight with their healthcare provider. **Conclusion:** Many obese and overweight patients believe their weight does not impact their health and have not had discussion about weight and health with their healthcare provider.

Keywords

Obesity, Comorbid Conditions, Health and Weight, Patient Perceptions, Emergency Medicine, Patient-Provider Communication

1. Introduction

Adverse outcomes related to obesity and its associated comorbidities are well established and include serious health complications such as cardiovascular disease, hypertension, diabetes mellitus, stroke, and premature death [1] [2]. Acute exacerbations of comorbid conditions (chest pain, motor weakness, shortness of breath, for example) may lead patients to seek emergent care [3]. Accordingly, we hypothesized there may be a correlation between BMI and obesity and obesity related diseases and emergency department visits. Based on this question, we formulated two key specific aims. The first aim was to measure BMI for a set of ED patients and stratify this group regarding existing BMI categories and preexisting medical conditions. The second aim was to explore patients' perceptions about their weight and health [4] [5] [6]. For example, some patients have a tendency to understate how their weight may impact their health [7]. This may be caused by lack of corroboration from patients' healthcare providers or it may be patients simply do not recall having a discussion their weight may be affecting their health [8]. Patient-provider communication regarding weight and health is important because patients who understand their medical problems are more likely to make life-style changes to improve their health [9].

2. Methods

Study Design. We conducted a descriptive cross-sectional study of patients in order to compare the prevalence of obesity and overweight patients presenting to a single ED with comparable rates for Florida and nationally (US) and to collect survey data regarding patients' insight into weight and health. The local Institutional Review Board approved this study, and each participant signed an informed consent prior to enrollment.

Study Setting and Population. The study was conducted at the main tertiary-care university teaching hospital in northcentral Florida with an annual ED volume of ca. 64,000 patients and serving a moderately sized urban community of 250,000. Adult patients (age ≥ 18 years) who presented to the ED over a 24-month period were eligible for inclusion regardless of ethnicity or gender. Patients who were unable to stand, follow instructions, answer survey questions or patients who were unwilling to participate or were pregnant were excluded.

Study Protocol. Every fifth patient who registered in the ED was approached for enrollment. Registration times, recorded during the triage process were used to ensure uniformity in patient selection. Demographic data were recorded (Table 1) for analysis. Based on our ED metrics, approximately two-thirds of

patients present to the ED between 11 AM through 11 PM therefore, ca. two-thirds of patients were enrolled during these hours. Each patient was enrolled only once. Demographic measures e.g., race, ethnicity, and gender, were self-reported. For select data analysis, patients were divided into age groups, under 25, 25 - 39 years, 40 - 54 years and 55 and older (**Table 1**).

Main Outcome Measures.

Anthropometric Measures: Enrolled participants had their weight, height and waist circumference directly measured and recorded. Waist circumference was measured at the umbilicus for consistency [10]. Body mass index values (underweight < 18.50, normal weight = 18.50 - 24.99, overweight = 25.00 - 29.99, obese BMI \geq 30.00 with morbidly obese \geq 40.00) were calculated as previously described and rounded to the nearest hundredth [11].

Obesity-Related Comorbid Conditions. A chart review was performed to determine comorbid conditions for which obesity and excess weight has been established as a risk factor [2]. These diseases include hypertension, heart disease, stroke, type 2 diabetes, osteoarthritis, gallbladder disease, obstructive sleep apnea, cancer, chronic obstructive pulmonary disease (COPD) and gastrointestinal reflux disease (**Table 2**). Anxiety and depression were considered part of the same spectrum of clinical entities and thus listed as a single comorbidity [12].

Table 1. Demographics and prevalence data of study population.

Patient Characteristics (N = 453)	Frequency	Percentage (95% CI)
Male	178	39.3 (34.8 - 43.8)
Female	275	60.7 (56.2 - 65.2)
Age groups (yrs)		
Under 25	124	27.4 (23.3 - 31.5)
25 - 39	164	36.2 (31.8 - 40.6)
40 - 54	108	23.8 (19.9 - 27.8)
55 and over	57	12.6 (9.5 - 15.6)
Race		
African American	149	32.9 (28.5 - 37.2)
Caucasian	238	52.5 (47.9 - 57.2)
Other	27	4.4 (3.8 - 8.1)
Unknown	39	8.6 (6.0 - 11.2)
BMI		
Underweight	11	2.4 (1.0 - 3.9)
Normal Weight	163	36.0 (31.5 - 40.4)
Overweight	103	22.7 (18.9 - 26.6)
Obese	127	28.0 (23.9 - 32.2)
Morbidly Obese	49	10.8 (7.9 - 13.7)

Table 2. Prevalence rates of select comorbid conditions based on BMI category.

Comorbid Condition	BMI < 25.0 N (% , 95% CI) ^{1,2}	Overweight ²	Obese ²	% obese ⁴	Relative risk ⁵
Diabetes	9 (5.2, 1.9 - 8.5)	6 (5.8, 1.3 - 10.4)	27 (15.5, 10.0 - 20.7)	64.3	2.9
Hypertension	27 (15.5, 10.1 - 20.9)	16 (15.5, 8.5 - 22.6)	66 (37.5, 30.3 - 44.7)	60.5	3.1
Stroke	0	2 (1.9, 0 - 4.6)	3 (1.7, 0 - 3.6)	60.0	2.4
Heart Disease	4 (2.3, 0.1 - 4.5)	3 (2.9, 0 - 6.2)	19 (10.7, 7.9 - 13.6)	73.1	4.2
Cancer	10 (5.7, 2.3 - 9.2)	6 (5.8, 1.3 - 10.4)	12 (6.8, 3.6 - 10.0)	28.6	1.2
Dyslipidemia	5 (2.9, 0.4 - 5.4)	14 (13.6, 6.9 - 20.2)	32 (18.2, 12.5 - 23.9)	62.7	2.6
Osteoarthritis	5 (2.9, 0.4 - 5.4)	3 (2.9, 0 - 6.2)	16 (9.1, 4.8 - 13.4)	66.7	3.1
Depression/Anxiety	10 (5.7, 2.3 - 9.2)	7 (6.8, 1.8 - 11.7)	25 (14.2, 9.0 - 19.4)	59.5	2.3
Sleep Apnea	3 (1.7, 0 - 3.7)	10 (9.7, 4.0 - 15.4)	20 (11.4, 6.7 - 16.1)	60.6	2.4
Gall Bladder Disease	13 (7.5, 5.1 - 9.9)	13 (12.6, 9.5 - 15.7)	21 (11.9, 8.9 - 14.9)	44.7	1.3
GERD/PUD	5 (2.9, 0.4 - 5.4)	9 (8.7, 3.3 - 14.2)	20 (11.4, 6.7 - 16.1)	58.8	2.2
COPD	5 (2.9, 0.4 - 5.4)	3 (2.9, 0.4 - 5.4)	11 (6.3, 2.7 - 9.8)	57.9	2.2

¹Percentages and CI are based on the total number of patients with a comorbid condition within their BMI category. ²BMI categories as defined in the text. ³Total population with a specific comorbid condition. ⁴Percentage of patients with a specific comorbid condition with BMI > 30.0. ⁵The relative risk value is calculated based on the percentage of exposed patients (BMI > 30.0) versus the percent not exposed (BMI < 30.0) for each comorbid condition.

Patient Perceptions of the Effect of Weight on Health: All patients were verbally asked “Do you believe your present weight is damaging to your health?” Response category was yes/no (**Table 3**).

Patient Recall of Provider Communication of the Effect of Weight on Health: All patients were verbally asked “Has a doctor or other health professional ever told you that you are overweight?” Response category was yes/no (**Table 3**).

Patients who declined to answer or who answered, “I do not know”, for example, were excluded from the analyses.

Data Analysis and Statistical Methods.

Data analysis includes calculations of the prevalence rates of existing cases of obesity and overweight in our total sample and within subgroups based on age, gender and race. Prevalence rates include the number of existing cases meeting the criteria and definition of obesity and overweight divided by the total sample or select subgroups within the sample multiplied by 100. Final analysis includes only those individuals who provided demographic data, completed the survey questions, and had their anthropometric data recorded.

It was possible to compare the prevalence rates of obese and overweight cases with regard to comorbid conditions with those of normal weight and thus calculate relative risk values to assess associations between obesity and comorbidity. Regarding the survey questions, data were parsed based on the total number of participants within select subgroups and BMI categories.

Table 3. Survey question results based on selected demographic criteria.

Variable	Q1 = Yes		Q2 = Yes	
	Frequency	Percent (95% CI)	Frequency	Percent (95% CI)
Overall	169	37.3 (32.8, 41.8)	125	27.6 (23.5, 31.7)
Female	117	42.5 (36.7, 48.4)	89	32.4 (26.8, 37.9)
Male	52	29.2 (22.5, 35.9)	36	20.2 (14.3, 26.1)
Caucasian	97	40.8 (34.5, 47.0)	72	30.3 (24.4, 36.1)
African American	57	38.3 (30.4, 46.1)	43	28.9 (21.6, 36.2)
Hispanic	8	38.1 (17.2, 58.9)	4	19 (2.2, 35.9)
Under 25 yr	25	20.2 (13.1, 27.2)	19	15.3 (9, 21.7)
25 - 39 yr	68	41.5 (33.9, 49.0)	46	28 (21.1, 35)
40 - 54 yr	47	43.5 (34.1, 52.9)	34	31.5 (22.7, 40.3)
55 yr and Over	29	50.9 (37.8, 63.9)	26	45.6 (32.6, 58.6)
Not Overweight	14	8 (4.0, 12.1)	3	1.7 (0.0, 3.7)
Overweight	29	28.2 (19.4, 36.9)	16	15.5 (8.5, 22.6)
Obese	87	68.5 (60.4, 76.6)	65	51.2 (42.5, 59.9)
Morbidly Obese	39	79.6 (68.3, 90.9)	41	83.7 (73.3, 94.1)
Waist > 100 cm = No	34	13.8 (9.5, 18.1)	14	5.7 (2.8, 8.6)
Waist > 100 cm = Yes	135	65.5 (59.0, 72.0)	111	53.9 (47.1, 60.7)
	Q2 No = 74	22.6 (18.0, 27.1)	Q1 No = 42	14.8 (10.7, 18.9)
	Q2 Yes = 95	76 (68.5, 83.5)	Q1 Yes = 86	50.9 (43.5, 58.3)

3. Results

Prevalence Data. There were N = 458 surveys administered and five were excluded due to incomplete or missing demographic information. The average height and weight for all women was 163.2 cm (95% CI, 162.4 - 164.6 cm) and 79.9 kg (95% CI, 76.8 - 83 kg), respectively. For men, the average height and weight was 175.8 cm (95% CI, 174.6 - 177.0 cm) and 89.4 kg (95% CI, 85.7 - 93.1, kg). Our measured mean height and weight values for both genders are consistent with US averages (74.7 kg) [13]. No statistically significant differences in average height, weight, age, and waist circumference amongst race were observed.

The prevalence rate (PR) of obesity (BMI \geq 30.0) in this study is 38.6% (95% CI, 34.3 - 43.4) with a combined overweight/obese PR of 61.1% (95% CI, 56.7 - 66.0). At the extremes, underweight patients (BMI \leq 18.5) represented 2.4% (95% CI, 1.0% - 3.9%) of enrolled patients while the prevalence rate for morbidly obese patients (N = 49, BMI \geq 40.0), was 10.8 % (95% CI, 7.9 - 13.7).

Waist Circumference Analysis. Waist circumference has been shown to correlate with BMI. As such, we measured waist circumference as part of this work to provide more complete anthropometric data. The mean BMI for patients with waist circumference \geq 100 cm was 36.9 (95% CI, 35.4 - 38.4) for women and 35.2 (95% CI, 33.5 - 36.9) for men. The overall mean waist circumference for women

was 99.7 cm (95% CI, 97.2 - 102.2 cm) and 101.2 cm (95% CI, 98.1 - 104.3 cm) for men. The average waist circumference of all overweight and obese patients was 97 cm (95% CI, 95 - 99 cm) and 119 cm (95% CI, 116 - 120 cm), respectively. Patients who report no comorbid conditions had an average waist circumference of 94 cm (95% CI, 92 - 96 cm) compared to a waist circumference of 108 cm (95% CI, 105 - 111 cm) for those with one or more comorbid condition. For comparison, the average waist circumference for patients with BMI < 25 was 89 cm.

Comorbid Conditions. Comorbid data with relative risk values (RR) for obese and overweight populations are presented in **Table 2**. For overweight and obese groups, at least one comorbidity was reported 53.5% (95% CI, 46.6% - 60.5%) and 74.7% (95% CI, 68.7% - 80.8%) of the time, respectively. Only 28.7% (95% CI, 22.0% - 35.5%) of people with BMI < 25 (not overweight) reported at least one comorbid condition. There was no statistically significant difference in comorbid condition via chart review based on gender or race. The percentage of women with at least one comorbid condition was 45.5% (95% CI, 39.5 - 51.4) compared to 41.0% (95% CI, 33.8% - 48.3%) of men. African American and Caucasian patients were found to have comorbid conditions at rates of 43.0% (95% CI, 35.0% - 53.9%) and 48.3% (95% CI, 41.9% - 54.7%) respectively.

Age and waist circumference were independent predictors of comorbidity. The PR for patients younger than 39 years who report at least one comorbid condition was 28.1 (95% CI, 20.5 - 35.7) compared to patients in the 40 - 54 age group PR = 64.8 (95% CI, 55.8 - 73.9) and the PR of those over 55 years was 82.5 (95% CI, 72.5 - 92.4). For waist circumference, less than and greater than 100 cm, the PR of having at least one comorbidity was 29.6 (95% CI, 23.8% - 35.3%) and 60.7 (95% CI, 54.0% - 67.4%), respectively.

Perceptions of Weight and Health. Subpopulation analysis of the survey questions is shown in **Table 3**. Overall, there are no differences in responses based on age or race. Overweight patients, individuals with WC < 100 cm, patients with no comorbid conditions and men were all more likely to answer no to survey questions. Only 28.2% (95% CI, 19.4% - 36.9%) and 71.6% (95% CI, 64.9% - 78.3%) of overweight and obese participants answered yes to the question “*Do you believe your present weight is damaging your health?*” whereas 15.5% (95% CI, 8.5% - 22.6%) and 59.4% (95% CI, 53.0% - 67.0%) of overweight and obese, respectively, answered yes to the question “*Has a doctor or other health professional every told you that you are overweight?*” For morbidly obese patients 79.6% (95% CI, 71.4% - 78.8%) reported they feel their weight is unhealthy and 83.7% (95% CI, 76.8% - 90.6%) recall having a conversation about weight with their healthcare provider; this same group had an average waist circumference = 134.4 cm (95% CI, 128.5 - 140.3 cm).

4. Discussion

To our knowledge, this is the first study that has directly addressed the issue of weight and health in the ED and is the first study to measure the prevalence of

obesity in the ED population. Approximately one third of the US population is estimated to be obese [3] [4]. The prevalence rate of obesity observed in this study of 38.6% is significantly higher than the US (35.7%), Florida (26.6%) and County (21.6%) prevalence rates [14] [15]. The prevalence rate for morbid obesity in our population of 10.8% which is statistically significantly higher than US prevalence rate of 6.0% [11]. These differences could be due to several reasons. For example, overweight or obese patients have higher incidences of comorbid conditions and thus more likely to need emergent care for an acute exacerbation of a chronic medical condition. Consider, in our study only 28.7% (95% CI, 22.0% - 35.5%) of patients with BMI < 30 report any comorbid conditions as compared to 40.8% (95% CI, 31.3% - 50.3%) and 60.2% (95% CI, 53.0% - 67.5%) of overweight and obese patients, respectively. In addition, the ED population may be poorly represented in existing national healthcare studies which are largely community-based, and the prevalence of obesity may be higher than indicated by published studies which relied on self-reported of height and weight data [8].

Waist circumference was included in this work because it has been shown to be an independent predictor of obesity and dysmetabolic syndrome. Central obesity as measured by waist circumference correlates with disease states, in part because visceral adipose tissue including abdominal adipose is more metabolically active and thus more pathogenic than subcutaneous adipose tissue. In this study we observed a linear correlation of BMI versus waist circumference ($R = 0.92$). The strong correlation of waist circumference and obesity is also borne through analysis with patient comorbidity data: patients were twice as likely to have any comorbid condition with $WC \geq 100$ cm as those with a $WC < 100$ cm. Not surprisingly, relative risk values for all comorbid conditions studied herein were higher for patients with higher waist circumferences including dyslipidemia, hypertension and type-2 diabetes.

Regarding patient insight into weight and health, in a community health initiative Durant and coworkers reported 29.9% and 68.4% of overweight and obese patients respectively had a negative perception of their weight and their health [8]. Further, 18.9% of overweight patients and 55.9% of obese patients recall being told by their provider they were overweight. In our work, the prevalence rate of obese patients who answered "yes" to the question "*Do you believe your present weight is damaging your health?*" is lower in the emergency department as compared to the community health service survey. This may reflect patients' attitudes toward addressing their health and weight may be more modifiable when involved in a community health program, which may underscore the need for expansion of such programs. However, a key limitation in interpreting direct comparisons to Durant's work is their use of self-reported height and weight data which may underestimate BMI values.

In a subset of patients which included African American and Caucasian overweight and obese patients ($N = 247$), 42.5% feel their weight is not a health issue and 54.7% have never had a discussion with their health provider regarding their weight. Moreover, 41.5% of patients in this subgroup who feel their weight

is indeed damaging their health have not been told (or recall being told) by their doctor they are overweight. A direct correlation of the two questions exists in that 76.7% of patients who have been told they are overweight agree and feel their weight is unhealthy. Recognition of the issue of weight and health may be the catalyst for change for these patients. This is encouraging yet nearly one in four people who have been told by their doctor they are overweight believe otherwise.

A central issue elucidated in the study is some patients who are overweight/obese may not fully understand how their weight impacts their overall health. Further, many obese and overweight patients do not recall having discussions with their healthcare provider about weight and health. These observations point to a gap in healthcare provider communications and what patients may understand or perceive. For healthcare providers, the importance of clear, meaningful, and interpretable patient instructions is vital as we want patients to make lifestyle changes to improve their health.

Based on our study, patients who present to the emergency department may not generally understand some of their health issues may be weight related. In this regard, medical management of weight loss is no different than smoking cessation or management of chronic illnesses. Consider that nearly half of our patients with WC ≥ 100 cm responded “no” to the question “*Has a doctor or other health professional ever told you that you are overweight?*” Yet this same group has a prevalence rate of BMI > 30 of 78.2%. Furthermore, consider the observation approximately 1 in 6 patients with BMI > 40 do not recall discussing their weight with a physician. If change is to be made, it is incumbent upon the provider to educate our patients about healthy life styles and the benefits therein.

5. Limitations

Some limitations are noted. This is a single-center study with a population that is primarily African American and Caucasian. As such, populations in other centers including urban centers may differ. Also, we rely on self-reported provider communication information which is subject to recall bias and thus quantification regarding provider communication may be over or underreported. Nevertheless, our data point a potential lapse in patient understanding of health and weight and illuminate a vital aspect in our management of weight-related diseases: communication and understanding.

6. Conclusion

Herein, we have shown patients with BMI > 30 present to our emergency department in numbers relatively higher than the local population. Also, we see a trend in that patients may not understand many of their health issues may be weight related. Future work will focus on broadening our demographic to include urban and more ethnically diverse areas and assessing the specific impact on comorbid conditions based on BMI. Ultimately, we feel ED-based interven-

tions are needed to address some public-health issues identified through this work. If barriers regarding patient-provider communication and patients' understanding of how weight effects health could be more clearly delineated, community-based health services could provide better guidance and more directed interventions for those with weight-related conditions.

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

References

- [1] Hales, C.M., Fryar, C.D., Carroll, M.D., Freedman, D.S. and Ogden, C.L. (2018) Trends in Obesity and Severe Obesity Prevalence in US Youth and Adults by Sex and Age, 2007-2008 to 2015-2016. *Journal of the American Medical Association*, **319**, 1723-1725. <https://doi.org/10.1001/jama.2018.3060>
- [2] The GBD 2015 Obesity Collaborators (2017) Health Effects of Overweight and Obesity in 195 Countries over 25 Years. *The New England Journal of Medicine*, **377**, 13-27. <https://doi.org/10.1056/NEJMoa1614362>
- [3] Pitts, S.R., Carrier, E.R., Rich, E.C. and Kellermann, A.L. (2010) Where Americans Get Acute Care: Increasingly, It's Not Their Doctor's Office. *Health Affairs*, **29**, 1620-1629. <https://doi.org/10.1377/hlthaff.2009.1026>
- [4] Babcock, I.C., Wyer, P.C. and Gerson, L.W. (2000) Preventative Care in the Emergency Department, Part II: Clinical Preventative Services—An Emergency Medicine Evidenced-Based Review. *Academic Emergency Medicine*, **7**, 1042-1054. <https://doi.org/10.1111/j.1553-2712.2000.tb02098.x>
- [5] Axelson, D.J., Stull M.J. and Coates, W.C. (2018) Social Determinants of Health: A Missing Link in Emergency Medicine Training. *AEM Education and Training*, **2**, 66-68. <https://doi.org/10.1002/aet2.10056>
- [6] Bernstein, S.L. and Becker, B.M. (2002) Preventative Care in the Emergency Department: Diagnosis and Management of Smoking and Smoking-Related Illness in the Emergency Department: A Systematic Review. *Academic Emergency Medicine*, **9**, 720-729. <https://doi.org/10.1197/aemj.9.7.720>
- [7] Weight and Obesity in America. <http://www.harrisinteractive.com/>
- [8] Durant, N.H., Bartsman, B., Person, S.D., Collins, F. and Austin, S.B. (2009) Patient Provider Communication about the Health Effects of Obesity. *Patient Education and Counseling*, **75**, 53-57. <https://doi.org/10.1016/j.pec.2008.09.021>
- [9] Scott, J.G., Cohen, D., DiCicco-Bloom, B., Orzano, A.J., Gregory, P., Flocke, S.A., Maxwell, L. and Crabtree, B. (2004) Speaking of Weight: How Patients and Primary Care Clinicians Initiate Weight Loss Counseling. *Preventive Medicine*, **38**, 819-827. <https://doi.org/10.1016/j.ypmed.2004.01.001>
- [10] Jacobs, E.J., Newton, C.C., Wang, Y., Patel, A.V., McCullough, M.L., Campbell, P.T., Thun, M.J. and Gapstur, S.M. (2010) Waist Circumference and All-Cause Mortality in a Large US Cohort. *Archives in Internal Medicine*, **170**, 1293-1301. <https://doi.org/10.1001/archinternmed.2010.201>
- [11] Fryar, C.D., Carroll, M.D. and Afful, J. (2020) Prevalence of Overweight, Obesity, and Severe Obesity among Adults Aged 20 and over: United States, 1960-1962 through 2017-2018. NCHS Health E-Stats.

- [12] Feinstein, A.R. (1970) The Pre-Therapeutic Classification of Co-Morbidity in Chronic Disease. *Journal of Chronic Disease*, **23**, 455-468.
[https://doi.org/10.1016/0021-9681\(70\)90054-8](https://doi.org/10.1016/0021-9681(70)90054-8)
- [13] Centers for Disease Control and Prevention (2021) Body Measurements.
<https://www.cdc.gov/nchs/fastats/body-measurements.htm>
- [14] Centers for Disease Control and Prevention (2021) Adult Obesity Facts.
<https://www.cdc.gov/obesity/data/adult.html>
- [15] Florida County-Level Behavioral Risk Factors Surveillance Telephone Survey.
<https://www.flhealthcharts.gov/charts/>