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# Knowledge of Obesity and Its Impact on Reproductive Health Outcomes Among Urban Women

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## Abstract

This prospective survey study assessed the knowledge of reproductive outcomes that are affected by obesity among women in an urban community. A total of 207 women attending a community fair on the south side of Chicago participated in the study. A survey assessing knowledge of BMI and of the effects of obesity on general, cardiometabolic and reproductive health outcomes was administered. Subjects ranged in age from 18 to 70 years (mean ± SD, 48.6 ± 12.9 years) and ranged in BMI from 17.3 to 52.1 kg/m$^2$ (mean ± SD, 31.2 ± 6.7 kg/m$^2$). The following percentages of women were aware that obesity increases the risk of miscarriage (37.5%), irregular periods (35.8%), infertility (33.9%), cesarean section (30.8%), breast cancer (28.0%), birth defects (23.7%), stillbirth (14.1%), and endometrial cancer (18.1%). This study found that while women in an urban community are aware of the cardiometabolic risks associated with obesity, they demonstrate limited knowledge of the effects of obesity on reproductive outcomes. Public education is needed to increase knowledge and awareness of the reproductive consequences of obesity. Women of reproductive age may be uniquely responsive to obesity education and weight loss intervention.

### Keywords

community health; knowledge; obesity; reproduction; women

## Background

Obesity is a worldwide health epidemic and a major public health concern in the United States. It is an especially significant concern in the health of women, given that 64.1% of women in the U.S. are overweight or obese (1). The association between excess weight and cardiometabolic disease is widely recognized by the medical profession as well as the general public. There is also substantial evidence that obesity plays a significant role in the development of female-specific reproductive health issues, which have a significant impact on public health (2). Obesity is associated with increased risk of breast cancer (3) and endometrial cancer (4, 5). Obesity particularly impacts women of reproductive age, as it is associated with an increased risk of infertility (6–11) and pregnancy complications such as

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miscarriage (8, 12), stillbirth (13), birth defects (14) and cesarean section (15). Furthermore, animal and human data increasingly indicate that maternal obesity during pregnancy has a lasting impact on offspring, who are at increased risk of hyperglycemia, hyperlipidemia, increased adiposity (16, 17), and obesity (18–20).

It is essential that women understand the risks of obesity on reproductive outcomes, especially those associated with pregnancy, as the prevalence of preconception maternal overweight in the U.S. is 13.1% and preconception maternal obesity is 21.9% (21). Though there is abundant information available to the public on the effect of excess weight and obesity on cardiometabolic diseases and women's health, there are very few published studies that assess patient understanding and awareness of these risks, particularly as they pertain to women's reproductive health. A 2003 national poll conducted by Harvard University found that most Americans consider obesity to be a serious health problem, and the majority are aware of the associated increased risk of heart disease (86%), high blood pressure (86%) and diabetes (78%), whereas only 52% are aware that obesity can increase risk of some cancers, including endometrial and breast cancers (22). A study of public knowledge of obesity and cancer risks found that only 42% of women are aware that obesity increases risk of endometrial cancer and 54% are aware that it increases risk of breast cancer (23). Furthermore, an Australian study of knowledge of the association between obesity and pregnancy outcomes found that while many women are aware of the association between obesity and potential maternal complications of pregnancy, they are unaware of the potential neonatal complications (24).

To our knowledge, no published studies have assessed awareness of the effects of obesity on reproductive outcomes in a predominantly African American urban population. Assessing knowledge of these risks in an urban community population is important, as obesity disproportionately affects certain demographic groups that live in urban settings. Non-Hispanic black women have the highest rates of obesity in the U.S. (1). Lower income women are more likely to be obese than higher income women, and less educated women are more likely to be obese than those with college degrees (25). Studies have also shown that the prevalence of behaviors associated with adverse maternal or infant health outcomes varies among different populations of women, such as by age, race, ethnicity, education and income level (26). For example, younger women, women with less education and women with lower incomes are more likely to report smoking during pregnancy (26). Furthermore, it is known that women are more likely to engage in healthy behaviors during pregnancy (such as abstinence from tobacco and alcohol) and after pregnancy (such as breastfeeding) than preceding pregnancy (such as multivitamin use) (27). Thus it is essential to gain an understanding of the level of knowledge about obesity and its reproductive health consequences in diverse populations, including those in urban areas, so that opportunities for intervention can be identified.

The aim of this study was to assess knowledge of BMI and knowledge of the cardiometabolic, general, and reproductive health risks associated with obesity in a predominantly African American urban population of women. We hypothesized that women are aware that excess body weight increases the risk for cardiometabolic diseases but are less aware of the effect of excess body weight on reproductive outcomes.

## Materials and Methods

### Subjects

This study was reviewed and approved by the Northwestern University Institutional Review Board. Verbal informed consent was required and obtained from all study participants.

A convenience sample of women present at a community fair on the south side of Chicago in August 2011 was recruited for the study. Approximately 2,000 men and women were present at the fair and 207 women participated in the study. Participation was restricted to English-speaking women between the ages of 18 and 70 years.

### Surveys

Subjects completed a questionnaire on the health risks of obesity. This survey was developed by investigators based on current literature and terminology from the World Health Organization and current data on the effects of obesity on reproductive outcomes. Subjects who consented to participate in the study received hard copy of the questionnaire (available from authors). Demographic data including weight, height, age, race, education level, household income per year, employment status, health insurance status, primary care physician status and last time seen by a doctor was collected. Health literacy was assessed using the validated method established by Chew et al (28) and Wallace et al (29). Subjects were asked "How confident are you filling out medical forms by yourself?" Response choices included "extremely," "quite a bit," "somewhat," "a little bit," and "not at all." Participants choosing one of the first two answer choices indicated adequate health literacy (greater than $9^{th}$ grade reading level), whereas choosing one of the latter three indicated marginal health literacy ($7^{th}$–$8^{th}$ grade reading level) or limited (less than or equal to $6^{th}$ grade reading level) health literacy (28, 29).

The questionnaire then assessed knowledge of BMI and knowledge of the effects of obesity on general, cardiometabolic, and reproductive health outcomes. BMI knowledge was assessed by asking "What percentage of women in the United States do you think weigh more than they should?", "Have you heard of BMI?", "Do you know your BMI?", and "Which BMI range is considered ideal?" Participants' knowledge of the effects of excess weight on various health outcomes was assessed by asking, "Does excess body weight (weighing more than you should) increase the risk of the conditions listed below?" Response choices included "yes," "no," and "not sure." Conditions not associated with obesity, such as eczema, lactose intolerance, and tuberculosis were added as distractors. Participants who responded "yes" (that excess weight increased the risk of the condition) were considered as having knowledge that obesity is associated with increased risk of that condition.

The BMI of each participant was calculated from self-reported height and weight and then used to categorize participants into BMI groups based on the WHO classifications (30).

Survey results were manually entered into a database and data entry was then confirmed by random review of 20% of the entered surveys by a study investigator (MB).

### Statistical Analysis

All demographic and clinical measurements are reported as mean ± SD. The Chi-square test was used to determine the interaction between the demographic variables and patients' knowledge of the effect of obesity on specific conditions, as well as the interaction between patient BMI classification and knowledge of the effects of obesity. A $P$ value of $<.05$ was considered to be statistically significant. All statistical analyses were performed in SPSS (PASW version 18) software.

## Results

### Demographics

A total of 207 women participated in the study. Detailed demographic data is summarized in Table 1. Briefly, the study population ranged in age from 18 to 70 years with a mean age of

48.6 ±12.9 years. The BMI of the study population ranged from 17.3 kg/m$^2$ to 52.1 kg/m$^2$, with an average BMI of 31.2 ± 6.7 kg/m$^2$. Of the participants, 17.9% were normal weight, 28.5% were overweight (but not obese) and 53.6% were obese. Most (99%) of participants identified themselves as African American. 75% of participants had at least some college education, and 85.4% of participants reported a total annual household income per year of less than $75,000. 51.9% of participants are currently employed and 78.6% have health insurance. 83.8% of participants have a primary care doctor and 87.3% have seen a doctor within the last year. 86.1% of participants qualified as having adequate health literacy.

### Knowledge of BMI

When asked, "What percentage of women in the United States do you think weigh more than they should?", only 39% of subjects correctly identified the range of 61%–80% (Figure 1A). Of the 203 participants who answered the question, 151 (74.4%) had heard of the term "BMI." Of these, 42 (22.2%) thought they knew their own BMI, and of these 42, 17 (48.6%) of these women actually correctly knew their own BMI within ± 1 kg/m$^2$ (Figure 1B). Therefore, only 8.4% of all participants actually knew their own BMI. When asked "Which BMI range is considered ideal?", only 21.8% were able to identify the correct range of 18.5–24.9 kg/m$^2$ (Figure 1C).

### Knowledge of the effects of obesity on general health and cardiometabolic outcomes

We asked, "Does increased body weight increase the risk of these conditions?", and for each condition listed, the participants gave the answer "yes," "no," or "not sure." Figure 2 shows that the following percentages of women were aware that obesity increases the risk of diabetes (79.1%), high blood pressure (74.2%), heart disease (73.3%), and arthritis (45.0%). The following percentages of women incorrectly thought that obesity increases the risk of osteoporosis (38.8%), early menopause (27.4%), iron deficiency anemia (26.4%), cystic fibrosis (21.3%), lactose intolerance (20.3%), eczema (14.3%), and tuberculosis (8.1%).

### Knowledge of the effects of obesity on reproductive outcomes

We asked, "Does increased body weight increase the risk of these conditions?", and for each condition listed, the participants gave the answer "yes," "no," or "not sure." Figure 2 shows that the following percentages of women were aware that obesity increases the risk of miscarriage (37.5%), irregular periods (35.8%), infertility (33.9%), cesarean section (30.8%), breast cancer (28.0%), birth defects (23.7%), stillbirth (14.1%), and endometrial cancer (18.1%).

### Correlation of demographics with knowledge

Having less than four years of college education was associated with knowledge of the effect of obesity on diabetes (P=.001), heart disease (P≤001), and hypertension (P=.006) but was also associated with a lack of knowledge regarding the risk of obesity on miscarriage (P=.006), cesarean section (P=.017), birth defects (P=.12), breast cancer (P=.009), endometrial cancer (P=.008), and irregular periods (P=.028). Adequate health literacy was associated with having knowledge of the effects of obesity on diabetes (P=.006) and heart disease (P=.010) but a lack of knowledge about the risk of cesarean section (P=.012). Also of note, we found no statistically significant correlation between being overweight and knowledge of any of the health outcomes (general, cardiometabolic, or reproductive) affected by obesity. However, being obese was associated with a lack of knowledge of the effect of obesity on miscarriage (P=.046), cesarean section (P=.015), birth defects (P=.017), endometrial cancer (P=.017), and stillbirth (P=.006).

## Discussion

This study aimed to assess the knowledge of BMI and the effects of obesity on reproductive outcomes among women in a predominantly African American urban population. The unique aspect of this study is the direct comparison of participants' knowledge of cardiometabolic risks, general health risks, and reproductive risks, including pregnancy outcomes and cancer. Despite the majority of women in this population having adequate health literacy and at least some college education, there was little knowledge of the effects of obesity on reproductive outcomes. However as predicted, the majority of women were aware of the cardiometabolic health risks of obesity.

Our results are consistent with those of previous studies (22–24) in that most women are aware of the cardiometabolic risks of obesity but are not aware of the association with breast or endometrial cancer or of the potential adverse neonatal outcomes. Of note, when these results were compared with submitted results from Northwestern University assessing knowledge of the effects of obesity on reproductive outcomes among women seeking care in an infertility clinic, the same pattern of knowledge was found (awareness of the cardiometabolic risks but lack of knowledge of the reproductive consequences), however the overall percentage of women who were aware of the risk of each adverse outcome (cardiometabolic and reproductive) was higher in the infertility population (31). This may be due to the fact that these women are actively seeking pregnancy and thus more aware of their health and its effects on reproduction. It is also possible that the higher knowledge of the effects of obesity on all health outcomes in this population results from a disparity socioeconomic status or education level, however more research is needed to draw this conclusion.

This lack of knowledge is unlikely to be a reflection of either poor health literacy or low education level. The single question assessment used has been shown to be equally as effective in detecting limited or marginal health literacy as combinations of multiple questions (28, 29) and detects 83.3% of adults with limited health literacy and 76.6% of adults with marginal health literacy (29). 86.1% of participants in our study qualified as having adequate health literacy, implying they have at least a $9^{th}$ grade reading level. Therefore this lack of knowledge is not due to an inability of these women to understand educational materials but is due to a lack of public education. This is further emphasized by the fact that adequate health literacy was associated with knowledge of only cardiometabolic consequences of obesity, implying that the ability to understand patient literature is not enough to result in public awareness of the reproductive consequences of obesity, perhaps because the information isn't readily available. This lack of knowledge among urban women is also a result of inadequate education on the part of individual medical providers and the medical community, as is evidenced by our finding that the vast majority of these women had a primary care doctor and had seen a physician within the past year.

The association of less than four years college education with awareness of the cardiometabolic risks of obesity but lack of awareness of the reproductive risks suggests that the current state of public education on the subject is such that awareness of the risks of obesity on cardiometabolic outcomes is reaching even those individuals with less formal education but public education is not addressing the risks of obesity on reproductive outcomes. This discrepancy in the emphasis of public education on obesity is exemplified by the recent four-part documentary "The Weight of the Nation," a public awareness campaign by Home Box Office (HBO) based on National Institutes of Health research, which makes scarce mention of the reproductive consequences of obesity (32, 33).

It is also interesting that there was no association between being overweight and knowledge of the effects of obesity on any of the health outcomes affected by obesity. Perhaps even more alarming was the notable lack of awareness of the reproductive risks of obesity among women who are themselves obese. Given that they are personally impacted by these risks, it would be ideal if overweight and obese women had increased awareness of the risks of obesity on general and reproductive health outcomes. Our data implies that overweight and obese women are not receiving preferential education regarding the risks of obesity on health outcomes, highlighting an essential area for improved counseling by physicians and increased public education.

Because opportunities for intervention are being lost, it is essential that the medical community take advantage of the opportunity to educate their patients about BMI and the risks of obesity on reproductive outcomes. Studies have shown that women are more motivated to engage in healthy behaviors during pregnancy (34), and therefore, women of reproductive age may represent an ideal opportunity for intervention. However, despite the known risks of obesity on pregnancy, women who do seek preconception care are often not advised appropriately of the consequences of pre-conception obesity. One study found that only 23% of overweight women and 36% of obese women who visited a doctor prior to conceiving were advised to lose weight (35). Of women who were advised to lose weight prior to conception, this advice was most likely to come from their doctor as opposed to their mother, partner or a friend (35), therefore medical providers must take advantage of this opportunity for education and intervention.

Despite most women having heard the term BMI, the vast majority of women surveyed did not know the normal BMI range or their own BMI. This is an important finding, as women who do not understand BMI may not recognize their own need for weight loss intervention. In order for public education on the health consequences of obesity to have an impact, women must understand BMI classification and be able to identify themselves as overweight or obese, thereby understanding that they themselves are at risk for these adverse health outcomes. These findings highlight the importance of calculating BMI and counseling patients at every opportunity, through public education and individual physician-patient encounters.

This study is novel in that it directly compared knowledge of cardiometabolic risks, general health risks, and reproductive risks of obesity among women in an urban community. A limitation of this study is the racial homogeneity of participants, and the fact that the demographics do not parallel those of the general population of the U.S., and therefore may not be generalizable to the population as a whole. However, as previously mentioned, assessing the knowledge of the consequences of obesity in this particular population is important as obesity incidence is the highest among African American women in the U.S. (1). The singular geographic location in which this study was conducted is another limitation, as public education and therefore public knowledge of these risks may differ by community. Additional studies are necessary to assess the impact of region of the nation and urban vs. rural communities on the prevalence of this knowledge. A strength of this study is that while data was collected at a single event, it was a general community fair and not a health-specific fair, and thus our results are not likely biased towards participants who are actively seeking increased health awareness.

In summary, we found that among African American women in an urban community, there is less awareness of the effects of obesity on reproductive outcomes than the cardiometabolic consequences of obesity. This is important because this population is at high risk for being personally impacted by these consequences. This highlights an opportunity for educational intervention through public health initiatives and direct

education by physicians. Women of reproductive age may provide a unique opportunity for intervention, as they are open to behavioral modification in order to improve reproductive outcomes.

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Figure 1A:

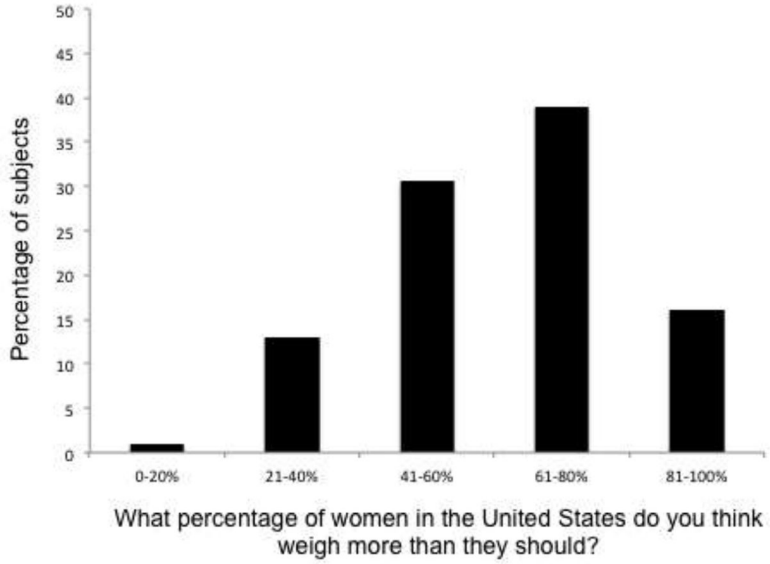


Figure 1B:

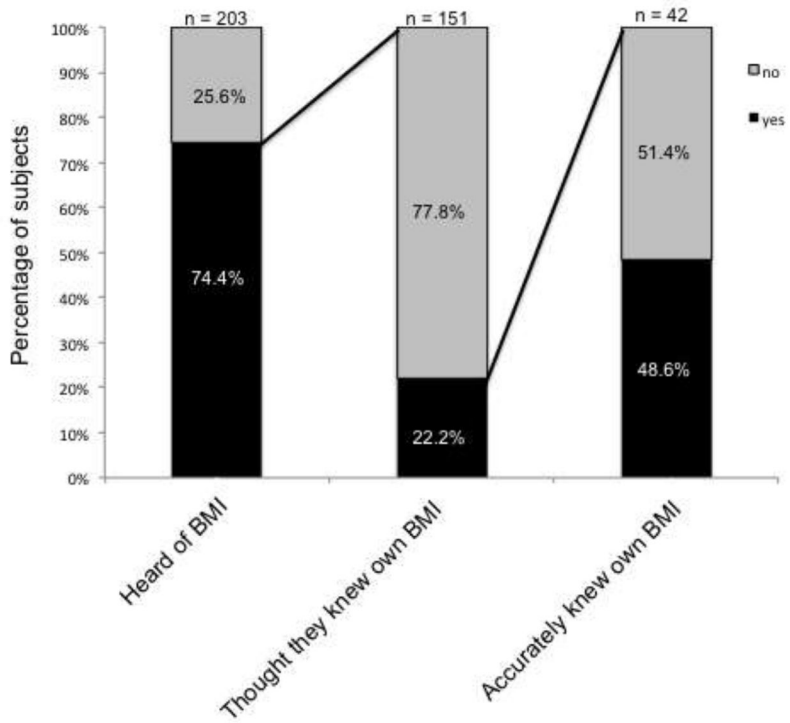

Figure 1C:

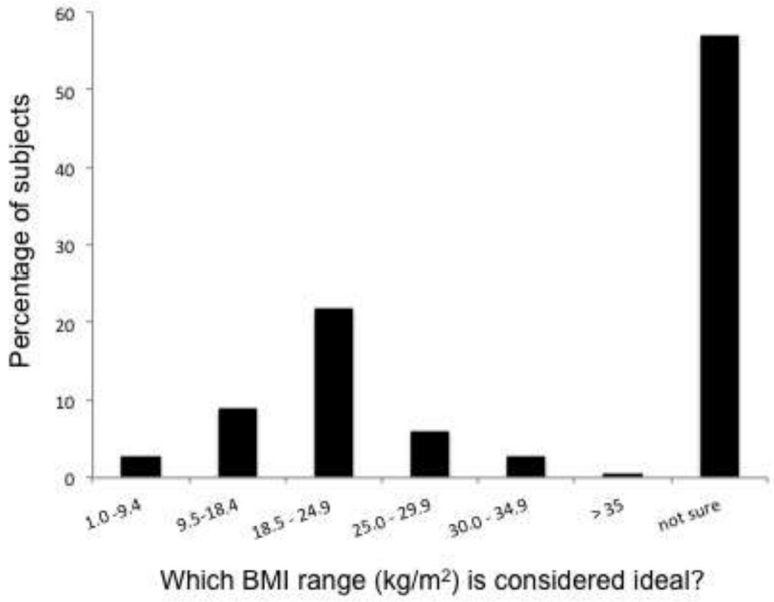


**Figure 1. Participant knowledge of BMI**

(A) Percentage of participants who selected each answer choice to the question "What percentage of women in the United States do you think weigh more than they should?"
(B) Percentages of participants who had heard of the term BMI, thought they knew their own BMI, and accurately knew their own BMI.
(C) Percentage of participants who selected each answer choice to the question "Which BMI range is considered ideal?"

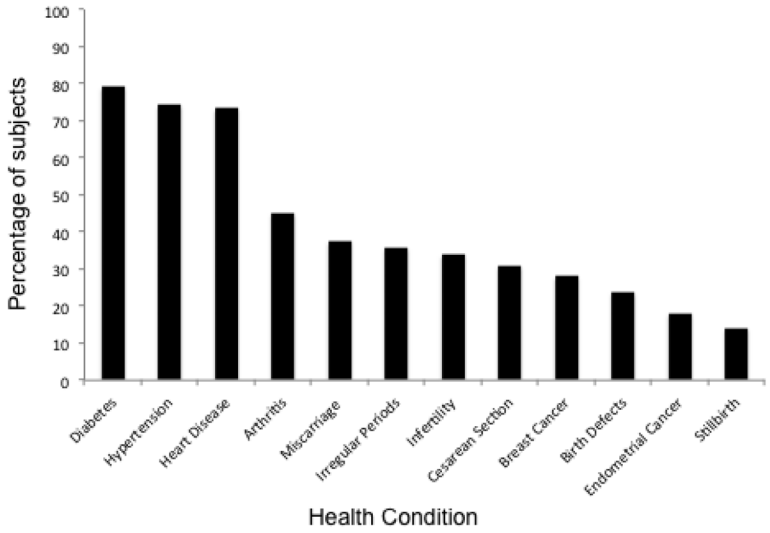


**Figure 2. Participant knowledge of the effects of obesity**

Percentage of participants who indicated they are aware that obesity increases risk of each of the specific health outcomes (n=207).

## Table 1

Participant demographics

| | Range | Mean (±SD) |
|---|---|---|
| **Age** | 18–70 | 48.6 (12.92) |
| **BMI** | 17.3–52.1 | 31.2 (6.74) |
| | | **Prevalence** |
| **Race** | | |
| African-American | | 99.0% |
| Hispanic | | 0.5% |
| Asian | | 0.5% |
| White/Other | | 0.0% |
| **Highest education level completed** | | |
| 8th Grade or Less | | 2.5% |
| High school or GED | | 22.5% |
| Some college | | 41.0% |
| 4-year college degree | | 22.0% |
| Master's degree | | 10.5% |
| Doctoral degree | | 1.5% |
| **Total household income per year** | | |
| Less than $10,000 | | 27.6% |
| $10,000 to <$25,000 | | 19.3% |
| $25,000 to <$50,000 | | 23.4% |
| $50,000 to <$75,000 | | 15.1% |
| $75,000 to <$100,000 | | 9.4% |
| $100,000 to <$150,000 | | 4.7% |
| Greater than $150,000 | | 0.5% |
| **Currently employed** | | |
| Yes | | 51.9% |
| No | | 48.1% |
| **Have health insurance** | | |
| Yes | | 78.6% |
| No | | 21.4% |
| **Have a primary care doctor** | | |
| Yes | | 83.8% |
| No | | 16.2% |
| **Last time seen by a doctor** | | |
| Within the last year | | 87.3% |
| 2–3 years ago | | 8.8% |
| 4–5 years ago | | 2.4% |
| 6–10 years ago | | 1.0% |
| Greater than 10 years ago | | 0.5% |