Prevalence and Risk Factors for Urinary Incontinence in Overweight and Obese Diabetic Women

Action for Health in Diabetes (Look AHEAD) study

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OBJECTIVE — To determine the prevalence and risk factors for urinary incontinence among different racial/ethnic groups of overweight and obese women with type 2 diabetes.

RESEARCH DESIGN AND METHODS — Cross-sectional analysis of baseline data from the Action for Health in Diabetes (Look AHEAD) study, a randomized clinical trial with 2,994 overweight/obese women with type 2 diabetes.

RESULTS — Weekly incontinence (27%) was reported more often than other diabetes-associated complications, including retinopathy (7.5%), microalbuminuria (2.2%), and neuropathy (1.5%). The prevalence of weekly incontinence was highest among non-Hispanic whites (32%) and lowest among African Americans (18%), and Asians (12%) ($P < 0.001$). Asian and African American women had lower odds of weekly incontinence compared with non-Hispanic whites (75 and 55% lower, respectively; $P < 0.001$). Women with a BMI of ≥35 kg/m^2 had a higher odds of overall and stress incontinence (55–85% higher; $P < 0.03$) compared with that for nonobese women. Risk factors for overall incontinence, as well as for stress and urgency incontinence, included prior hysterectomy (40–80% increased risk; $P < 0.01$) and urinary tract infection in the prior year (55–90% increased risk; $P < 0.001$).

CONCLUSIONS — Among overweight and obese women with type 2 diabetes, urinary incontinence is highly prevalent and far exceeds the prevalence of other diabetes complications. Racial/ethnic differences in incontinence prevalence are similar to those in women without diabetes, affecting non-Hispanic whites more than Asians and African Americans. Increasing obesity (BMI ≥35 kg/m^2) was the strongest modifiable risk factor for overall incontinence and stress incontinence in this diverse cohort.

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Urinary incontinence is a highly prevalent condition affecting nearly 50% of middle-aged and older women (1,2). It can result in psychological stress and social isolation and can also have a profound effect on quality of life (1). Increasing weight is associated with urinary incontinence (3), most likely because of increasing pressure on the bladder and straining the muscles that support the urethra (4). Other risk factors for incontinence include increasing age, parity, and prior hysterectomy (5).

One group at high risk for developing urinary incontinence is women with type 2 diabetes. Recent epidemiological evidence suggests that incontinence is associated with type 2 diabetes and is 50–200% more common among women with type 2 diabetes than among women with normal glucose levels (6,7). A likely etiology for incontinence in diabetes is microvascular damage, similar to the disease process involved in development of retinopathy, nephropathy, and neuropathy (8). Accordingly, duration of diabetes (9), insulin treatment (6), peripheral neuropathy, and retinopathy (9) have been suggested as risk factors for incontinence among women with diabetes. However, few studies have examined both the prevalence and risk factors for overall and type of incontinence (urgency and stress incontinence) among different racial/ethnic groups of women with type 2 diabetes.

We conducted a cross-sectional analysis using data from the Action for Health in Diabetes (Look AHEAD) study to examine the prevalence of incontinence, overall and by type, in a large sample of overweight and obese women with type 2 diabetes from diverse racial/ethnic groups. We also determined risk factors associated with weekly incontinence episodes both overall and by type (stress and urgency).

RESEARCH DESIGN AND METHODS

— The Look AHEAD study was started in 2001 with planned follow-up until 2012 (10). This randomized controlled trial in overweight and obese individuals with type 2 diabetes is assessing the long-term effects of an intensive weight loss program delivered over 4 years versus those of a control diabetes support and education program. The primary aim is to study the effects of the two interventions on major cardiovascular events: heart attack, stroke, and cardiovascular-related death. Secondary aims include investigating the impact of the interventions on diabetes control and complications, fitness, general health, health-related quality of life, and psychological outcomes. Individuals were recruited from a variety of sources including informational mailings, open screenings, advertisements, and referrals from health care providers. The study is being conducted in 16 clinical centers in the U.S. Eligibility criteria were age 45–74 years, which was changed to 55–74 years during year 2 to increase the anticipated cardiovascular event rate, and BMI ≥25 kg/m^2 (>27 kg/m^2, if individuals were currently taking insulin). Major exclusions included A1C ≥11%, blood pressure ≥160/100 mmHg, triglycerides ≥600 mg/dl, inadequate control of comorbid conditions, factors that may limit adherence to the intervention, and underlying disease likely to limit life span and/or affect safety of the interventions. Informed consent was obtained from all participants before screening, consistent with the Declaration of Helsinki and the guidelines of each center's institutional review board.

Data collection

Urinary incontinence. Urinary incontinence was assessed by a series of detailed self-reported questions modified from validated questions used in previous studies (11–13). Frequency of incontinence was assessed by the question, "In the past 12 months, have you leaked even a small amount of urine?" (none, less than once per month, one or more times per month, one or more times per week, or every day). Women with weekly incontinence in the last year were also asked to recall the type and number of incontinence episodes in the past 7 days. Questions to determine type of incontinence episodes included the following: ". . . how many times did you leak urine with . . ." ". . . an activity like coughing, sneezing, lifting, or exercise?" (stress incontinence), ". . . an urge to urinate and couldn't get to the bathroom fast enough?" (urgency incontinence), and ". . . other reasons or don't know" (other incontinence). The predominant type of incontinence was coded based on whether a participant reported a higher frequency of weekly stress or urgency incontinence episodes. Mixed incontinence was coded when the frequencies of each type of incontinence episode were reported as equal.

Demographic data and medical history. Standardized interviewer-administered questionnaires were used to obtain self-reported data on age, ethnicity, menopausal status, number of urinary tract infections in the past year, oral estrogen use, parity, prior hysterectomy, claudication (i.e., "do you get pain in either leg on walking?"), chronic medical illnesses (history of myocardial infarction, stroke, coronary artery bypass graft [CABG], or percutaneous transluminal coronary angioplasty [PTCA]), arthritis, liver disease (i.e., "has a doctor or other health provider ever said that you have liver disease?"), emphysema or asthma, sleep apnea (i.e., "have you ever been told by a doctor that you had sleep apnea?"), alcohol consumption (drinks per week), smoking history (never, former, or current), and overall health status (excellent, good, fair, poor, or very poor). For the latter question, participants who rated their health status as fair, poor, or very poor were categorized as having poor overall health. Depressive symptoms were measured using the Beck Depression Inventory, which has been validated in other studies (14).

Anthropometry and blood pressure. Certified clinic staff obtained measurements of body size. Weight was measured in duplicate on a digital scale. Standing height was determined in duplicate with a standard stadiometer. BMI was calculated as weight in kilograms divided by the square of height in meters. Waist circumference was measured with subjects in light clothing with a nonmetallic, constant-tension tape placed around the body at the midpoint between the highest point of the iliac crest and lowest part of the costal margin in the midaxillary line. Seated blood pressure was measured in duplicate after rest using an automated device.

Cardiorespiratory fitness. All participants completed a maximal graded exercise test to determine cardiorespiratory fitness. The test consisted of the participant walking on a motorized treadmill at self-selected walking speeds with a 1.0% increase in grade every minute until test termination. Termination of the test occurred at the point of volitional exhaustion or at the point at which medical contraindications were observed (e.g., S-T segment changes or inappropriate blood pressure response). The level of fitness was defined as the maximal METs achieved, estimated from a standard formula that incorporates walking speed and maximal grade of the treadmill achieved during the test (15,16).

Serum measures. Blood samples were collected and processed at baseline according to the Look AHEAD protocol (17). Whole-blood samples for A1C analysis were measured by the Look AHEAD Central Biochemistry Laboratory (Northwest Lipid Research Laboratories, University of Washington, Seattle, WA) using a dedicated ion-exchange high-performance liquid chromatography instrument (Bio-Rad Variant II).

Diabetes treatments and complications. Diabetes medication and insulin use were obtained by self-report and verified by having participants bring their prescription medications to the clinic. Peripheral neuropathy was assessed using the 15-item Michigan Neuropathy Screening Instrument, which has been validated in previous studies (18); the self-reported presence of ≥6 symptoms (e.g., numbing, burning, or soreness) was coded as neuropathy. Albumin and creatinine concentrations were measured from spot urine samples, and microalbuminuria was defined as an albumin-to-creatinine ratio >30.0 μg/mg. Retinopathy was assessed using a standard self-reported question (i.e., being told by a physician that diabetes had affected the eye).

Statistical analysis

All analyses were performed using SAS (version 9.1; SAS Institute, Cary, NC). Bivariate relationships between potential risk factors and the prevalence of urinary incontinence were assessed with χ^2 tests for categorical variables and Student's *t* tests for continuous variables. Logistic regression with a backward elimination variable selection method was used to obtain a subset of risk factors that had independent ($P < 0.10$) relations with weekly or more frequent urinary incontinence. Then, the same procedure was used to separately select risk factors for weekly or more frequent (versus less than weekly) stress incontinence and weekly or more frequent (versus less than weekly) urgency incontinence. No analyses were conducted for mixed incontinence because of the limited number of partici-

Table 1—*Frequency of urinary incontinence in the past year by race/ethnicity among women with type 2 diabetes at baseline: Look AHEAD trial*

Urinary incontinence frequency	Non-Hispanic white	African American	Hispanic	Native American/ Alaskan Native	Asian	Mixed/other*	Total
n	1,635	595	466	201	33	64	
Daily	209 (13)	42 (7)	56 (12)	24 (12)	0 (0)	13 (20)	344 (11)
Weekly	306 (19)	64 (11)	46 (10)	38 (19)	4 (12)	10 (16)	468 (16)
Monthly	331 (20)	104 (17)	73 (16)	32 (16)	7 (21)	11 (17)	558 (19)
<1 per month	402 (25)	119 (20)	75 (16)	41 (20)	10 (30)	13 (20)	660 (22)
None	387 (24)	266 (45)	216 (46)	66 (33)	12 (36)	17 (27)	964 (32)

Data are *n* (%). $N = 2{,}994$. *Includes 6 women who did not report race/ethnicity.

pants in this category. Clinic site was included as a covariate. Waist circumference and BMI were highly correlated ($r = 0.70$). However, results were similar when waist circumference and BMI were entered in separate models or simultaneously; here we report results from the simultaneous models. Other predictors were not strongly intercorrelated (generally, $r < 0.40$), indicating limited collinearity. Interactions between race and each of the other risk factors were examined. Results are presented as odds ratios (ORs) and 95% CIs.

We chose weekly or more frequent incontinent episodes as our primary outcome because of the clinical significance of this factor and use in previous research (6). We selected less than weekly as the reference group, which included less than monthly, monthly, and no incontinence episodes. We performed additional analyses to investigate whether differing levels of incontinence (none, less than monthly, monthly, or weekly) were associated with similar risk factors. In general, increasing frequency of incontinence was associated with worsening risk factor values. Because similar risk factors were identified in analyses using different reference groups (i.e., monthly, less than monthly, or none), here we only present results from the multivariate logistic regression models using weekly or more frequent incontinence as the outcome and the combined less than weekly incontinence as the reference group.

RESULTS — Of the total of 5,145 participants enrolled in Look AHEAD, 3,063 (59.5%) were women. We excluded 29 women who did not answer the urinary incontinence self-reported questions and 40 women who answered that they had weekly incontinence in the last year but none in the last week, leaving a total of 2,994 women for our analysis. The mean ± SD age of participants in the analytic sample was 58.0 ± 6.8 years (range 45–76 years).

Among women in Look AHEAD, 27% reported at least weekly incontinence with 11% reporting daily episodes (Table 1). The prevalence of weekly incontinence was highest among non-Hispanic white (32%) followed by American Indian/Alaskan Native (31%), Hispanic (22%), African American (18%), and Asian (12%) women ($P < 0.001$). Of the women with incontinence symptoms in the past week, 396 (52%) reported stress-predominant incontinence, 298 (39%) reported urgency-predominant incontinence, and 64 (8%) reported an equal number of stress and urgency incontinence episodes. Fifty-four women were unable to be classified because of incomplete responses.

Women with weekly incontinence differed significantly from women without incontinence in several ways (Table 2). Incontinent women were more obese, had higher BMI and waist circumferences, and had lower average fitness levels. They were more likely to be postmenopausal, to have reported a prior hysterectomy, and to be current users of oral estrogen therapy. They were older and reported worse overall health, more frequent urinary tract infections, higher Beck Depression Inventory scores, and more frequent history of claudication, arthritis, liver disease, asthma, and sleep apnea; they were also more likely to be current or former smokers. There was little difference between women with and without urinary incontinence with respect to parity, blood pressure, or history of myocardial infarction, stroke, CABG, or PTCA.

In this middle-aged and older trial cohort of overweight and obese women with type 2 diabetes, retinopathy (7.5%) was the most prevalent diabetes-associated complication, followed by microalbuminuria (albumin-to-creatinine ratio >30 μg/mg [2.2%]) and peripheral neuropathy (1.5%) (Table 2). Fewer women with incontinence had retinopathy ($P = 0.03$), but there was little difference between women with and without urinary incontinence with respect to neuropathy, microalbuminuria, diabetes duration, diabetes control, or diabetes treatment regimen.

Risk factors for urinary incontinence overall, as well as for stress and urgency urinary incontinence, were examined in separate stepwise multivariable logistic regression models. In all three models, non-Hispanic white ethnicity, prior hysterectomy, and ≥1 urinary tract infection in the past year significantly increased the odds of weekly or more frequent incontinence (Table 3). Specifically, compared with non-Hispanic whites, African American women had a 55–70% lower odds of overall weekly incontinence and incontinence by both types. Prior hysterectomy was related to a 40–80% increase in odds of incontinence, and urinary tract infections in the past year were associated with a 55–90% increase in odds of incontinence.

For weekly or more overall incontinence, women with BMI of 35–39 kg/m^2 (OR 1.65 [95% CI 1.20–2.28]) and ≥40 kg/m^2 (1.84 [1.32–2.55]) had higher odds of incontinence than less obese women, with similar findings for stress incontinence. Other risk factors associated with weekly or more overall incontinence and stress incontinence but not urgency incontinence included liver disease, higher Beck Depression Inventory scores, and more alcoholic drinks per week.

Risk factors for overall incontinence and urgency incontinence included age >70 years (two- to threefold increased odds), sleep apnea (55–85% increased

Table 2—*Baseline characteristics of Look AHEAD women by incontinence status*

	Weekly incontinence*	Less than weekly or no incontinence	*P*
n	812	2,182	
Age (years)	58.5 ± 6.9	57.7 ± 6.7	<0.01
Race/ethnicity			<0.001
Non-Hispanic white	515 (64)	1,120 (51)	
African American	106 (13)	489 (22)	
Hispanic	102 (13)	364 (17)	
Native American/Alaskan Native	62 (8)	139 (6)	
Asian/Pacific Islander	4 (0)	29 (1)	
Other	23 (3)	41 (2)	
BMI (kg/m^2)	37.5 ± 6.4	36.1 ± 5.9	<0.001
BMI			<0.001
<30 kg/m^2	91 (11)	324 (15)	
30 to <35 kg/m^2	222 (27)	731 (34)	
35 to <40 kg/m^2	252 (31)	613 (28)	
≥40 kg/m^2	247 (30)	513 (24)	
Waist circumference (cm)	112.8 ± 13.7	110.1 ± 13.3	<0.001
Systolic blood pressure (mmHg)	129.0 ± 17.8	129.0 ± 17.5	0.93
Diastolic blood pressure (mmHg)	67.2 ± 9.1	68.5 ± 9.5	<0.01
Maximal fitness (METs)	6.46 (1.63)	6.76 (1.69)	<0.001
Beck Depression Inventory	7.1 ± 5.5	5.8 ± 4.9	<0.001
Parity			0.11
0	97 (12)	320 (15)	
1	112 (14)	319 (15)	
2+	587 (74)	1,506 (70)	
Postmenopausal status	684 (89)	1,774 (85)	0.01
Hysterectomy	361 (45)	821 (38)	<0.001
Current oral estrogen use	226 (28)	523 (25)	0.03
Diabetes duration (years)	6.6 ± 6.9	6.6 ± 6.4	0.81
Therapy for diabetes			0.63
Diet-controlled only	110 (14)	296 (14)	
Oral medication only	543 (68)	1,427 (66)	
Current insulin use	146 (18)	426 (20)	
Retinopathy	47 (6)	177 (8)	0.03
Peripheral neuropathy†	17 (2)	29 (1)	0.13
A1C (%)	7.2 ± 1.1	7.3 ± 1.2	0.06
Albumin-to-creatinine ratio >30 μg/mg	20 (3)	45 (2)	0.48
Urinary tract infections in past year			<0.001
None	650 (82)	1,901 (88)	
1–2	104 (13)	220 (10)	
3+	34 (4)	36 (2)	
Myocardial infarction	25 (3)	69 (3)	0.91
Stroke	24 (3)	47 (2)	0.20
CABG or PTCA	36 (4)	93 (4)	0.83
Claudication	164 (20)	341 (16)	<0.01
Arthritis	397 (49)	944 (43)	<0.01
Liver disease	44 (5)	66 (3)	<0.01
Emphysema	13 (2)	18 (1)	0.06
Asthma	81 (10)	140 (6)	<0.001
Sleep apnea	86 (11)	139 (6)	<0.001
Overall health status			0.03
Excellent/very good	203 (25)	634 (29)	
Good	423 (52)	1,121 (52)	
Fair/poor	183 (23)	415 (19)	
Ever smoker	379 (47)	856 (39)	<0.001
Alcoholic drinks per week	0.8 ± 2.2	0.6 ± 1.7	<0.01

Data are *n* (%) or means ± SD. *N* = 2,994. *Weekly incontinence: urinary incontinence defined as ≥1 incontinent episode per week. †Peripheral neuropathy defined as ≥6 self-reported symptoms on the Michigan Neuropathy Screening Instrument (18).

Table 3—*Factors significantly associated with overall and type of incontinence*

	Overall		Stress		Urgency	
	OR (95% CI)	*P*	OR (95% CI)	*P*	OR (95% CI)	*P*
Factors associated with overall, stress, and urgency incontinence						
Race/ethnicity (ref. = white)		<0.001		<0.001		0.009
African American/black	0.44 (0.33–0.58)		0.30 (0.19–0.46)		0.44 (0.28–0.67)	
American Indian/Alaskan Native	0.51 (0.15–1.76)		0.36 (0.06–2.12)		0.52 (0.07–3.85)	
Asian	0.26 (0.06–1.14)		0.47 (0.11–2.10)		NA*	
Hispanic	0.76 (0.52–1.11)		0.98 (0.61–1.56)		0.61 (0.32–1.17)	
Other/multiple	0.93 (0.49–1.76)		0.93 (0.41–2.09)		0.90 (0.36–2.29)	
Urinary tract infections (≥1 in past year)	1.55 (1.20–2.02)	0.001	1.57 (1.12–2.18)	0.008	1.91 (1.31–2.79)	<0.001
Hysterectomy (ref. = none)	1.42 (1.17–1.73)	<0.001	1.38 (1.07–1.77)	0.01	1.83 (1.36–2.45)	<0.001
Factors associated with overall and/or stress incontinence						
BMI (ref. = <30 kg/m^2)		<0.001		0.03		
30–34 kg/m^2	1.17 (0.85–1.61)		1.12 (0.74–1.69)			
35–39 kg/m^2	1.65 (1.20–2.28)		1.56 (1.03–2.36)			
≥40 kg/m^2	1.84 (1.32–2.55)		1.64 (1.07–2.51)			
Liver disease (ref. = none)	1.54 (0.99–2.40)	0.06	1.92 (1.13–3.24)	0.02		
Beck Depression Inventory	1.04 (1.02–1.06)	<0.001	1.04 (1.01–1.06)	0.002		
Alcoholic drinks per week	1.06 (1.00–1.12)	0.04	1.08 (1.01–1.15)	0.03		
Claudication (ref. = none)			1.32 (0.97–1.80)	0.08		
Factors associated with overall and/or urgency incontinence						
Age (ref. = <50 years)						
50–54 years	1.32 (0.90–1.94)	0.07			0.94 (0.49–1.80)	0.008
55–59 years	1.46 (1.05–2.04)				1.53 (0.89–2.63)	
60–64 years	1.34 (0.94–1.92)				1.67 (0.95–2.94)	
65–69 years	1.45 (0.96–2.18)				1.59 (0.83–3.04)	
≥70 years	2.12 (1.31–3.43)				3.22 (1.59–6.54)	
Sleep apnea (ref. = none)	1.55 (1.12–2.15)	0.008			1.85 (1.17–2.93)	0.009
Asthma (ref. = none)	1.45 (1.03–2.04)	0.03			1.61 (0.98–2.64)	0.06
Smoking (ever; ref. = never)	1.27 (1.05–1.54)	0.01			1.65 (1.24–2.20)	<0.001
Diastolic blood pressure	0.99 (0.98–1.00)	0.06			0.99 (0.97–1.00)	0.08
Retinopathy (ref. = none)					0.40 (0.19–0.86)	0.02
Overall health status (ref. = excellent/very good)						0.05
Good					1.49 (1.05–2.12)	
Fair/poor					1.63 (1.03–2.56)	
Waist circumference (cm)					1.02 (1.01–1.03)	0.004

ORs and 95% CIs are derived from three separate backwards selection logistic regression models to select a subset of risk factors that had independent ($P < 0.10$) relations with weekly or more urinary incontinence and then separately for weekly or more stress and urgency incontinence, with adjustment for clinic site. *NA, not applicable: number of cases of urgency incontinence too small for estimation for Asian women. Ref., reference.

odds), asthma (45–60% increased odds), and ever smoker (25–65% increased odds). Other risk factors for urgency-predominant incontinence included poor overall health (50% increased odds) and increasing waist circumference (2% increased odds per unit increase).

To identify factors associated with incontinence that differed in African American, non-Hispanic white, American Indian/Alaskan Natives, and Hispanic women, we examined interactions between race and each predictor variable, adjusting for clinic site. No interaction reached the $P < 0.05$ level of significance.

CONCLUSIONS — Among middle-aged and older overweight and obese women with type 2 diabetes who volunteered to participate in the Look AHEAD clinical trial, we found urinary incontinence to be highly prevalent with 27% reporting weekly or more frequent incontinence. Incontinence was far more prevalent than other commonly recognized diabetes-associated complications such as retinopathy (7.5%), microalbuminuria (2.2%), and neuropathy (1.5%). Although women in this trial were volunteers, the prevalence of incontinence in this sample was similar to that in other population-based studies among women with diabetes (19) and higher than among women without diabetes (5).

In this racially/ethnically diverse clinical trial cohort, we found that non-Hispanic white women had the highest rates of weekly urinary incontinence and prevalence was lowest among African

American and Asian women both for incontinence overall and by type. The observed prevalence of 18% among African American women with type 2 diabetes in this clinical trial sample was similar to rates observed among African American women without diabetes and in population-based samples (2,5). In studies of women without diabetes, African American women have been shown to have greater pelvic muscle bulk and urethral sphincter strength relative to those in non-Hispanic white women, and this difference may explain why, even among obese women with diabetes, African American women have lower rates of incontinence and a lower risk for incontinence (20). Other research has found that waist circumference values are substantially lower in African American than in non-Hispanic white women (21), and higher waist-to-hip ratio is an independent predictor of incontinence in women (22). Although waist circumference and race did not significantly interact in predicting urinary incontinence in our study, African Americans had significantly lower waist circumference than whites (data not shown). Thus, it is possible that differences in body shape or amount of visceral adipose tissue could further explain the reduced prevalence of incontinence in African American than in non-Hispanic white women.

Importantly, we found that increasing weight (BMI $\geq$35 kg/m^2) was associated with increased risk of overall incontinence and stress incontinence. Although this effect was not observed in comparing women with BMIs between 25 and 30 kg/m^2, this trial did not include normal-weight individuals; so, it is unclear whether the risk of incontinence would be greater in women with BMIs between 25 and 35 kg/m^2 compared with those of normal weight. In a sample of patients from Kaiser Permanente, Lawrence et al. (23) examined associations between incontinence and diabetes, with or without obesity, using a reference group consisting of overweight and normal-weight women without diabetes. Interestingly, among women with diabetes, being obese (BMI $>$30 kg/m^2) was associated with an increased risk of stress incontinence compared with being nonobese. Also, diabetes was related to increased risk both with or without obesity. Although obesity and diabetes may be independent modifiable risk factors for incontinence, future research is needed to further examine the threshold above which body weight increases risk in diabetic women; such information is critical to informing future targets for treatment and prevention intervention.

Obesity and abdominal fat, in particular, may influence urinary incontinence by increasing pressure on the bladder and straining the muscles and connective tissue that support the urethra (4). Whether these mechanisms would apply to overweight remains unclear. The strong positive relationship between obesity and insulin resistance (24) suggests several other potential mechanisms linking obesity/overweight and incontinence. We will be able to determine in the Look AHEAD trial whether weight loss among overweight and obese women with type 2 diabetes results in decreased urinary incontinence, overall and by type. A recent randomized controlled trial demonstrated a significant decrease in urinary incontinence among overweight and obese women enrolled in a lifestyle intervention (25).

Interestingly, we did not find a relationship between diabetes-specific complications such as peripheral neuropathy, microalbuminuria, duration of diabetes, and A1C and risk of incontinence. Other studies have reported similar findings (9). It is possible that increasing weight may have confounded detection of effects of these measures on incontinence in this obese population. In addition, diabetes complications were uncommon in this self-selected cohort. Thus, it is possible that sampling factors may have prevented detection of relationships between diabetes complications and incontinence.

Our study participants were clinical trial volunteers who were overweight and obese with type 2 diabetes, so prevalence estimates might not be similar in population-based samples of overweight/obese women with type 2 diabetes or in women who are not overweight/obese or who do not have diabetes. Because individuals with functional limitations were excluded from the study, "healthier" diabetic subjects may be overrepresented in this sample. However, we have no reason to believe that the risk factors that we have identified would not be similar in other groups of women. Furthermore, because this study was cross-sectional, we could not examine more powerful longitudinal associations to identify the temporal sequence of the onset of various conditions. Urinary incontinence information was based on self-report. However, the reliability and validity of self-reported incontinence has been demonstrated in previous studies (11). In addition, assessment of retinopathy was based on self-report instead of more objective photographic assessments. Finally, only waist circumference and not waist-to-hip ratio was assessed in this study.

In summary, urinary incontinence is highly prevalent among overweight and obese women with type 2 diabetes in the Look AHEAD trial. Importantly, the prevalence of incontinence in this sample far exceeds that of other commonly recognized diabetes-associated complications such as retinopathy, microalbuminuria, and neuropathy. Racial/ethnic differences in incontinence prevalence are similar to those observed among women without diabetes, with non-Hispanic white women being affected more than other groups and African American women less. Physicians should be alert for incontinence among women with type 2 diabetes. Data from the Look AHEAD trial will determine whether weight loss has an impact on reducing urinary incontinence among women with type 2 diabetes.

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