

Assessing the effect of weight and weight loss in obese persons with type 2 diabetes

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Abstract: The objective of this study was to assess specific areas of life in which obesity affects individuals with type 2 diabetes mellitus (T2DM), and changes that obese persons with T2DM experience with weight loss of varying degrees. Thirty in-depth interviews were conducted in persons identified as: age ≥ 40 years, diagnosed with T2DM for ≥ 2 years, on oral antihyperglycemic medications > 3 months, BMI 30–35 kg/m², having attempted to lose weight in the last 2 years. Participants (60% female, mean age 53 years, 53% Caucasian, mean BMI 32.2 kg/m²) agreed that 5% weight loss, while not reflective of an ultimate goal, would be meaningful and important; benefits were expected to accrue in physical functioning, self-confidence, blood glucose levels, and motivation to keep losing weight. Participants reported the greatest effect of weight loss on energy, physical activity, mobility, pain, and clothes/appearance. Participants reported weight affecting mood, with feelings of depression and frustration most commonly described. This research indicates that weight loss is likely to affect health-related quality of life in obese individuals with T2DM. Given the purported weight loss benefits of many emerging diabetic medications, it will be important to include measures of weight-related quality of life in future clinical trials of these agents.

Keywords: health-related quality of life, obesity, type 2 diabetes, weight loss, patient-reported outcomes

Introduction

Patient-reported outcomes (PROs) describe health and treatment experience from the patient perspective. Over the past 15 years the pharmaceutical industry has increasingly included PRO measured as primary efficacy or key secondary endpoints in drug therapy clinical trials (Leidy and Vernon 2008). The goal is to provide not only clinical information about new drug therapy, but also information about the effect of the drug therapy on aspects of life that are valued by patients (ie, health-related quality of life). Armed with this knowledge, a clinician is better prepared to effectively communicate to patients both the advantages, and disadvantages, of options for drug therapy, and negotiate the treatment option that will most benefit the patient.

Type 2 diabetes mellitus (T2DM) is a disorder characterized by a decreased ability of the body to use insulin, leading to the inability to regulate blood sugar. If left untreated, poor glycemic control can lead to increased morbidity and mortality (King et al 1999; Cox et al 2002; ADA 2008). PRO endpoints are particularly relevant in chronic diseases such as diabetes in which there are multiple options for treatment with similar clinical efficacy but tradeoffs in terms of symptom reduction, side effects, convenience and flexibility, and route of administration (Hayes et al 2006). Because the aim of antihyperglycemic medications is to control blood sugar, the primary endpoint of most clinical trials evaluating these agents is hemoglobin A1c (HbA1c). PRO secondary endpoints have the potential for supplementing this clinical laboratory value with patient-perceived changes in, for example, physical, emotional, and

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social functioning, as well as providing information about treatment satisfaction and/or preference, thus differentiating therapies.

New antihyperglycemic medications such as incretin mimetics have demonstrated the ability to produce not only reductions in HbA1c but also average reductions in weight of 5% to 10% (Buse et al 2004; Harder et al 2004; Kim et al 2007). Previous work has revealed that as many as 80% of individuals with T2DM are overweight or obese [Body Mass Index (BMI) 25.0–29.9 and ≥ 30 , respectively] (Ford et al 2005; Ogden et al 2006), and as such weight loss represents not only an additional clinical benefit, but also may be a measurable benefit from the patient perspective.

There are several reliable and validated obesity-specific or generic instruments available that have been used as patient-reported outcomes measures in clinical trials for obesity medications. However, these measures, for example, the Impact of Weight on Quality of Life Lite (IWQOL-Lite), tend to be sensitive to large amounts of weight loss as would more likely be seen with surgical techniques developed specifically for weight loss in the morbidly obese (Kolotkin et al 2002; Kolotkin et al 2003). More importantly, to our knowledge, none of these measures have been developed specifically in populations of patients with T2DM with moderate obesity and, therefore, may not include all domains of importance to people with T2DM who are also obese and may experience weight loss of 5% to 10% of their body weight. Therefore, the development of a measure of the effect of drug therapy that results in a 5% to 10% weight loss in addition to improved glycemic control in people with T2DM may be warranted.

Qualitative research methods form the basis for new PRO measures or adapting of existing measures (Leidy and Vernon 2008) and the open, exploratory nature of the methodology is well suited to understanding the experiences of consumers and health professionals (Pope and Maze 1995). Accordingly, the objectives of this research were to qualitatively:

- 1) Identify the areas of life in which weight most affects people with T2DM and moderate obesity.
- 2) Identify the areas of life affected by weight loss, which these people expect to experience, or have experienced changes in, to varying degrees.
- 3) Identify those changes that are the most important and relevant to individuals with T2DM who are moderately obese.

From the results of this work we will seek to develop expected relationships among concepts that will guide selection of appropriate patient-reported outcomes measure

selection for the evaluation of diabetes drug therapies that result in weight loss.

Methods

Study design

This study was a qualitative study using in-depth interviews. An in-depth interview is a face to face conversation between interviewer and interviewee with the purpose of exploring issues or topics in detail. Interview questions are not preset but are shaped by a defined set of topics. In-depth interviews, as opposed to focus groups in which 6 to 10 people with a common attribute (eg, T2DM) are brought together to discuss their experiences with a skilled moderator, are particularly well-suited for topics that are particularly personal or sensitive (eg, sexual relations) (Leidy and Vernon 2008).

Study participants

Interviews were conducted in the US during the month of May 2007 in Raleigh (NC) and Philadelphia (PA) in an attempt to broaden participant and geographical diversity. Eligible participants were required to meet the following self-reported criteria:

- Aged 40 years or older;
- Diagnosed with T2DM for at least 2 years;
- Managing their diabetes with medication(s) for at least the past 3 months;
- Have a body mass index (BMI) between 30 and 35; and
- Attempted to lose weight in the last 2 years.

Individuals were excluded from the study if they reported a pregnancy in the last 2 years, a surgical procedure for weight loss, significant weight loss due to a major medical condition, or the use of insulin. For each round of interviews, efforts were made to recruit participants diverse in age, gender, race, and educational background.

Procedures

As part of the study, and preceding any contact with patients, the project was reviewed by an Institutional Review Board (IRB) committee. The services of a qualitative research firm, with access to a database of individuals interested in participating in qualitative research were utilized. Additionally, these firms advertise on their website to increase the pool of potential participants. Trained recruiters at each respective research facility called potential participants in their database in an effort to find individuals who were both eligible and interested in participating in the interviews. To facilitate sample selection, each qualitative research firm used

a screening form. Recruitment continued until the desired number of participants had been reached.

Prior to commencing each interview, informed consent was obtained from each participant. All interviews were conducted by 3 experienced qualitative interviewers according to a pre-established interview guide developed by the authors. The interviews were conducted face-to-face at the qualitative research firms' facilities. Two interviewers (SF, LZ) were present for each interview; one person led the interview while the other person took notes and interjected comments and/or questions as appropriate. The interviews were audio-taped in order to create transcripts and on average lasted for 60 minutes. None of the interviews were observed by a third party. As compensation for their time and travel, each participant received a cash reimbursement.

To start the interview, participants were asked a series of general, open-ended questions about their experiences with diabetes and weight and the relationship between the two. The interview continued with questions to ascertain how weight affects various areas of functioning (eg, physical functioning and mobility, work and role functioning, social functioning, and emotional functioning) independent of diabetes or other comorbidities.

At the end of the interview, participants were asked to review the Impact of Weight on Quality of Life-Lite Questionnaire (IWQOL-Lite). The IWQOL-Lite is an obesity-specific, 31-item, self-report instrument designed to assess individuals' perceived effects of their weight on their quality of life that has been used in clinical trials evaluating medications indicated for obesity (Lustig et al 2006; Di Francesco et al 2007). The IWQOL-Lite consists of 5 subscales (physical function, self-esteem, sexual life, public distress, and work). Respondents are asked to respond to IWQOL-Lite items by indicating, on a 5-point scale (1 = never true, 5 = always true), the extent to which the item describes themselves in the past week (Kolotkin et al 2001). For the purposes of this study, participants were not administered the IWQOL-Lite, but were asked to indicate which of the items were relevant to their experience with diabetes and/or being obese.

Analysis

Standard qualitative data collection and analysis methods, including researcher neutrality and systematic process, were used to analyze the qualitative data. Data were systematically collected in the form of field notes and audiotapes for each individual subject interview. Following the conclusion of the interviews all audiotapes were transcribed and prepared for analysis. A thematic analysis approach was then used to

evaluate and summarize the information contained within the interview transcripts. Thematic analysis focuses on identifiable themes and patterns of living and/or behavior (Grbich 2007). Using this approach, key points were identified within each interview and then compared across the results of the other interviews by 2 researchers (SF, LZ) to generate themes and elucidate patterns in the way subjects described the effect of their weight on their functioning. A frequency distribution (relevant? Yes = 1) was calculated for the 31 IWQOL-Lite items.

Results

Participant characteristics

Twelve men and 18 women between the ages of 40 and 76 years (mean 53.3 years) with a mean BMI of 32.2 kg/m² participated in the study. Across interviews, the sample was predominantly white, female, and educated (at least some college). Characteristics of the participants are presented in Table 1. All participants reported currently using 1 or more

Table 1 Participant characteristics

Characteristic	n	%
Age		
40–49 years	10	33
50–59 years	16	53
60 + years	4	14
Gender		
Female	18	60
Male	12	40
Education		
High school or equivalent	4	13
Some college but no degree	9	30
Associate degree	2	7
College degree	11	37
Graduate degree	4	13
Race/Ethnicity		
White	16	53
Black	14	47
Time since diabetes diagnosis (years)		
More than years and less than 6 years	15	50
Between 6 and 10 years	12	40
More than 10 years	3	10
Body mass index (kg/m ²)		
30	4	13
31	6	20
32	6	20
33	6	20
34	6	20
35	2	7

medications for the treatment of their diabetes. Table 2 provides the frequency of diabetes medication use.

General discussion of diabetes and weight

While several participants indicated that they did not experience symptoms of diabetes prior to diagnosis, most experienced symptoms typically associated with diabetes such as feeling thirsty, frequent urination, fatigue, and blurry vision. Many reported a family history of diabetes. When asked to describe the hardest thing about living with diabetes, the vast majority of participants talked about the difficulty of managing diet, particularly avoiding foods they enjoyed. For example, one participant responded:

...I watch my carbs more than I do my sugars because everybody tells me, "Well you can't have sugar." And I look at them like, huh? Forget that, that's not what all the books say...I eat basically what I want. But I just don't eat a whole lot of it...if you watch the scale every day you get [disheartened].

(Female, 55 years, BMI 32 kg/m²)

In a general discussion of the hardest things about being overweight, many participants expressed that weight negatively affected their energy levels, stamina, breathing, flexibility, comfort levels, and overall physical ability. Some participants indicated that being overweight lowered self-esteem while others reported that the only negative consequence to being overweight was the difficulty they experienced finding clothes that fit, were comfortable, and that looked nice.

Table 2 Frequency of medication use among participants

Brand name of drug	Generic name of drug	Number of users
Actos	pioglitazone	2
Actoplus met	metformin + pioglitazone	1
Amaryl	glimepiride	3
Avandamet	rosiglitazone + metformin	3
Avandia	rosiglitazone	4
DiaBeta	glyburide	2
Glucophage	metformin	20
Glucotrol	glipizide	4
Glucotrol XL	xl glipizide (long-acting)	2
Glucovance	metformin + glipizide	2
Januvia	sitagliptin	2

Relationship between diabetes and weight

Each interview flowed into a discussion of the relationship between diabetes and weight. Approximately half of the participants reported that some aspect of their diabetes either made them gain weight or made it harder for them to lose weight. Another common theme was that diabetes "caused an increase in appetite" and increased "cravings for certain foods" which led to an increase in weight. A few participants went on to note that if they lost enough weight they may be able to control their diabetes without the use of medications.

After discussing the relationship between diabetes and weight, moderators asked participants which was more important to them, controlling blood sugar or weight. Without exception all participants expressed the importance of both blood sugar control and a 5% to 10% weight loss. Many participants indicated that controlling blood sugar was a priority because of the medical complications associated with diabetes. As one participant commented,

Controlling the blood sugar [is most important] definitely. I mean that's what's gonna kill me, you know what I mean? If that shoots out of control, that's what's gonna put me in the hospital and cause all the other side effects of diabetes. Weight is important to me, but it's not gonna kill me, at least not right away.

(Male, 51 years, BMI 31 kg/m²)

In contrast, about one third of participants indicated that moderate weight loss would be more important to them than controlling their blood sugar, reasoning blood sugar levels would be controlled as a result of the weight loss, and they favored the overall benefit they would receive.

I'd probably love to lose 10 to 15 pounds. I think I'd look better in my clothes, and I'd have a better attitude about myself...I think that would help me maintain what I have to do to keep my sugars at a lower level.

(Female, 53 years, BMI 31 kg/m²)

Smallest significant weight loss

When asked to think about the smallest amount of weight loss that would be significant, some participants volunteered an amount equal to approximately 5% of their total body weight. Other participants initially gave an amount more substantial than 5% of their body weight. When probed whether 5% was significant, however, nearly all agreed that a 5% to 10% weight loss of 5% would be important, and that benefits in areas such as physical functioning,

self-confidence, blood sugar levels, and how clothes fit would be seen. In addition, several participants noted that a 5% weight loss would provide motivation to keep losing weight, a point that was repeated by participants throughout the interviews.

General effect of weight on life

Physical functioning and mobility

Of all areas of life, participants reported that weight had the greatest effect on physical functioning and mobility. Almost all participants said that weight loss directly affected (or would affect) their level of energy, their stamina, and their levels of fatigue.

I'm limited, yes. Jogging, which I used to do, was able to do years ago, but cannot do anymore and I know has nothing to do with my age, because I have a sister that's 42 and she jogs everyday.

(Female, 40 years, BMI 31 kg/m²)

Just little things like running up and down the steps. I always used to be able to run up and down stairs or skip. I have a 16-year-old daughter, and she and I used to always go running together cause she's on a track team. I can't do it anymore.

(Female, 40 years, BMI 34 kg/m²)

With extra weight, participants said they tired more easily from physical activity and felt more sluggish in general. Participants repeatedly expressed that they felt their energy levels and stamina had improved (would improve) with a 5% to 10% weight loss.

The extra weight, it just makes me feel more sluggish, I mean there are some nights I just come home, and I just sit there, and I don't move. And I know I should go do something, but I just don't have the energy.

(Male, 57 years, BMI 30 kg/m²)

I think there are 40 buildings on our base and my building is number 6. So if I park my car outside the base, walking into six buildings has become an issue. Before I walked to all of the buildings, 20, and did not feel a difference, but lately I have been feeling a difference that I have to stop a little bit and catch my breath or walk at a slower pace.

(Female, 40 years, BMI 34 kg/m²)

Mobility

About one third of participants said that mobility was negatively affected by weight gain. Day-to-day activities such as walking and climbing stairs were (or would be) easier with weight loss. In addition, breathing difficulties or shortness of breath during physical activities was reported.

I can't even walk up a flight of steps like I used to. It's just draining. Just your whole overall, the way you look, and the way you feel. I can really see how it really, it drains you.

(Female, 40 years, BMI 34 kg/m²)

Being able to breathe. You know, being able to have the physical abilities that you become accustomed to. I just tire easily. Probably a whole lot more depressed being overweight. Well, you know, I think sometimes being heavy just takes away your motivation to get out and exercise because, you know, like I said, you don't breathe as good, you don't move as good.

(Female, 59 years, BMI 32 kg/m²)

Some participants noted that their weight did not hold them back from doing physical activities, but that a 5% to 10% weight loss would certainly make those activities easier. Specifically, participants said they had (or would have) an easier time getting up and bending over with a 5% to 10% weight loss. Several participants explained that specifically the weight they carried around their midsection was uncomfortable and inhibited mobility.

It's the extra weight, and I hold mine in the middle, so that's worse. But not being able to do things like, if a bus was coming, I can't even run for the bus without being, you know, out of breath or feeling like I'm about to die.

(Female, 40 years, BMI 34 kg/m²)

Probably 'cause of the middle. It's because most of my weight is all in my middle. Um, just can't bend as much. And it also could be age or because of the weight, if I get down and get somethin' out of the lower cabinet, I can't get back up.

(Female, 52 years, BMI 30 kg/m²)

Role limitations

The majority of participants said that engaging in physical activities such as playing with children, yard work, walking, running, and other sports were not only easier with weight loss but that they were more motivated to participate in these types of activities with a 5% to 10% weight loss.

Well, I've eliminated like, cutting the grass. We pay somebody to do it. I just don't think that I can go out with the mower, and walk behind the mower for an hour and a half to cut the grass. It's just, maybe if I lost the weight, I'd have enough stamina to take on some of the chores that I've given up, and now I pay someone to do it.

(Male, 57 years, BMI 30 kg/m²)

I watch my neighbor; my neighbor's daughter's married and they live with them, so they can save some money to get a house. The people who are our age are running around

with the kids all the time. And it's great for them, because they're watchin' the kid grow up but I don't know if I'd be able to keep up with them.

(Male, 57 years, BMI 30 kg/m²)

Pain

Pain was reported to be affected by weight. About one quarter of participants said they experienced pain in their back, knees, and/or feet that they said was (or would be) alleviated with a 5% to 10% weight loss. A few participants expressed feeling "heavy on their feet" because of extra weight, and one participant stated that his weight exacerbated the arthritis in his knee and hip.

I'd feel better, you know. I think my feet would feel better too. I have really bad wheels. Bad femoral structure; I inherited that. And I know when I lose some weight, my feet are always better. 'Cause they always hurt. My feet are always in pain. Somethin' called Charcot foot, it's hard to explain, but every time I gain weight, I can actually feel it more in my knees and in my feet.

(Female, 52 years, BMI 30 kg/m²)

Okay, like my knees, my knees, like I think from having all this weight has put, you know. Okay I stopped walking up the ole steps because it's like, it was just, you know, painful, I guess.

(Female, 57 years, BMI 30 kg/m²)

Clothes and appearance

For more than half of participants, weight affected the comfort, fit, and appearance of their clothes. Many of these participants expressed frustration over the difficulty in finding clothes that fit comfortably and looked good, and they were excited by the thought of being able to wear smaller sizes and different designs if they lost a moderate amount of weight.

I'd like to fit into all those clothes. You know, I find myself wearing Hawaiian shirts, shirts that are out, where I never wore a shirt like that before, and be, by wearing it out, it hides some of the extra weight. I have to, I just like to feel more comfortable in what I have instead of looking for something different that's gonna disguise some of the weight. See all those things will lead you to more active and to feel better about your self-esteem too, so, and then it makes you want to do other things.

(Male, 46 years, BMI 33 kg/m²)

She always tries to tell me to cover this up and wear this and wear that, but what you basically need to do is lose your stomach.....but she's 13.

(Female, 40 years, BMI 31 kg/m²)

And I'm afraid to get rid of them fat clothes. I keep them. And I also have some jeans that I haven't been able to get to in years, but I won't get rid of them. It's like I have to have that range. Is that a psychological thing? Maybe, uh, I don't know. I do have a range of stuff in the closet. So I never know, am I gonna blow up again or am I gonna get thinner, you know. I just, I have to always have something that I can wear, but I don't know if it's a fear factor or what, but yes.

(Female, 52 years, BMI 30 kg/m²)

No effect

Only a few participants reported that a 5% weight loss had (or would have) no effect on physical functioning and mobility. Some had either been heavy all of their lives or had always struggled with their weight. Thus, they were content with and not physically limited by their current weight and did not see a need for improvement. The others thought 5% weight loss might motivate them to lose more weight but would not result in a noticeable change in physical functioning or mobility.

Work and role functioning

Most participants described their jobs as "sedentary" and reported that weight had no effect on their work functioning.

I don't think that that diabetes or my weight really affects me adversely in that sense. Am I as sharp as I used to be? Probably not. Do I enjoy the workload? No. Am I so adversely affected that I can't do the work? I don't think so.

(Male, 46 years, BMI 31 kg/m²)

However, about one third of participants whose jobs involved a physical component said that weight did affect those specific physical activities. One participant, who works as a firefighter, said that with weight loss it was easier for him to carry his equipment. Another participant said that being overweight made it harder for him to climb in and out of his work truck. Other participants said that with weight loss, they were more likely to take the stairs at work or walk from one building to the next.

Some participants noted that extra weight likely made them feel more sluggish and less alert. In addition, a few participants said that their weight would affect whether or not they would apply for a new job. One participant said that if she needed to go on job interviews in the future, she would make an effort to lose weight first.

Well, when I was working, um, that affects you a lot. Now, you see, it's one thing when you're home and you're with your family and your husband and you can be casual

and stuff. At work, you know. You need to groom yourself well. You need to be, you know, presentable, you need to be professional. And sometimes that's taken as being sloppy and so on. It really isn't. It's just things do not drape as well when you're, when you lose weight. You feel much better and you present yourself better because you have more confidence again. So it just, you know, ekes out I think.

(Female, 45 years, BMI 35 kg/m²)

Social functioning

Social activities

About half of participants said that their weight affected social activities. The majority of these participants were women who said they would be more likely to go out, in general, with a 5% to 10% weight loss. A few participants (men and women) said that non-physical activities (eg, going to the movies) were not affected but that social activities involving a physical aspect (eg, bowling, playing basketball) were affected by weight.

Yes, cause, at times I used to like to go out and socialize; if we go out to a nice little bar area of Philadelphia to different functions. I might dress in cute clothes and stuff. But at this point, it's not about the clothing but different stuff that I really don't feel comfortable. And I don't feel comfortable in my clothing, you know, So I socially, you know, don't get involved, I stay more at home and I'm more of a babysitter. Yes, I used to like go out, but I'm a very private person. But I do like to go out and socialize. But because of my weight issue and weight problem, I am very discouraged.

(Female, 40 years, BMI 31 kg/m²)

Social relationships

For the most part, discussions with participants on social relationships revealed that their relationships with friends and family members were not affected by their weight, but that with weight loss, participants are (or would be) more likely to go out and participate in social activities with those people.

You know, my friends are my friends regardless of my weight. They've known me all my life. They know my weight goes up and down, and, you know, they know it's my problem, and they don't have a problem with it.

(Male, 46 years, BMI 33 kg/m²)

However, about one quarter of participants reported some effect on social relationships.

Well, socially it's been messing with me, cause all my friends tease me now. Cause I was so small, um, and just in general, like how I feel on days. I feel like I'm old. Like I really feel old. I feel older than 40.

(Female, 40 years, BMI 34 kg/m²)

Half of these participants thought that weight affected their intimate relationships, either existing sexual relationships with a partner or their motivation to start a new intimate relationship with another person.

I just met a young lady and we're gonna be goin' out, and it's gonna be a week from now, so I'm gonna get my gym membership. I'm gonna make sure I walk three times a week, no, you know, that, I guess you look better, you feel better, or at least you might think you look better, you know. It's important.

(Male, 47 years, BMI 32 kg/m²)

One participant reported strained relationships with her sisters who were smaller than her and who put pressure on her to lose weight. Another participant said she was jealous of her "smaller" friends. Almost all of the participants who reported an effect on their social relationships were female.

Maybe in social settings, when my friend, who just looks absolutely perfect all the time, all the time. And you know, I love her and I'm glad she looks the way she does, but I think, wow, how come I can't look this? Of course, she so little, but. It would be nice to look that cute, you know. She always has everything perfect about her. She's just perfect. It depends on who I'm with I guess. It just depends.

(Female, 59 years, BMI 34 kg/m²)

Emotional functioning

About half of participants said that their self-esteem and/or self-confidence had improved (or would improve) with weight loss. One participant said she gets discouraged when she looks at herself in the mirror, and another participant said she seldom looks at herself in the mirror because she does not like how she looks. A few participants said that they would be embarrassed to be seen in a swimming suit at the beach or the pool.

In photographs. Yes! Yes! There was a new baby born in the family, some 14 days old, and they took pictures. And they put them on the computer, and I'm like, ah God, I hate that, take them pictures off there will ya. The baby was cute, she was real pretty, but it's like my God, um, am I embarrassed to be seen in? That's a no. If I was that guy on TV that does the bed, the big guys a thousand pounds, you know, uh, no.

(Female, 52 years, BMI 30 kg/m²)

Additionally, some participants who would normally describe themselves as having an outgoing personality said that their increased weight made them feel more withdrawn and less assertive.

Like, I'm the life of the party type person. And now I don't really want to go out. It's like I'll go out every now and then, but it's like pulling teeth. They have to drag me. I just have no interest. If I know it's only going to be them there, I'm comfortable. Like I could go to their houses and that's fine. But when there are other people around, especially new people I don't know, I don't want to be bothered.

(Female, 40 years, BMI 34 kg/m²)

Over half of participants reported that weight affected their mood. These participants reported feelings of depression, frustration, negativity, and intolerance which they attributed to their weight. In addition, a few participants said they felt fear or anxiety because of the effect of their weight on their health.

Because before I had this weight, I never like, I suffer from depression now. And I was never sad. I was, like I said, the life of the party. Jump up, I was very optimistic about life and things, and every day was like a, "Good morning," you know. Now it's like, "I can't believe I have to live through another day being fat.

(Female, 40 years, BMI 34 kg/m²)

Yeah. I have to watch myself because my leg swells up. You know I'm worried about losing limbs and things like that, that I shouldn't have to be worrying about it. That's just a depressing thing.

(Female, 54 years, BMI 33 kg/m²)

Well, I do have a tendency to stay at home more, sit on the couch more, and stay in more. I don't know if all that's, you know, attributed to weight gain or just attitude. You know, maybe the next study they do on diabetes will be the depression. Maybe, maybe that does have something to do with it; I don't know. But, I would think so.

(Female, 59 years, BMI 32 kg/m²)

Nearly one third of participants said that weight had no effect on their mood or self-confidence. Most of these were participants who had always had weight issues and reported being happy with who they were.

At the conclusion of the interview, each participant reviewed the IWQOL-Lite and was asked to identify items that were relevant to them based on their weight and/or diabetes. The items endorsed as being relevant in each of the subscales are presented in Table 3.

Discussion

The overall goal of this qualitative study was to gain a deeper understanding of the effect of weight on individuals with T2DM and moderate obesity (30–35 BMI). Data were collected from 30 participants with T2DM and moderate obesity

through in-depth interviews conducted by professional interviewers. Although residing in either Raleigh, NC or Philadelphia, PA, the 30 participants were diverse in terms of their age, gender, ethnicity, education, duration of diabetes, and oral antihyperglycemic medications.

In a review of 100 studies pertaining to quality of life and diabetes, Rubin and Peyrot (1999) identified themes regarding diabetes treatment. They were (1) quality of life increased with better glucose control but only if decreases were not accompanied by increased treatment burden and hypoglycemia; (2) quality of life in patients with diabetes could be improved with, among other things, changes in insulin delivery systems; and (3) quality of life decreased with intensification of treatment.

These themes were consistent with the primary themes that emerged from 18 focus groups in a qualitative study designed to understand the perceptions of people with T2DM regarding their medications (Hayes et al 2006). Because many antihyperglycemic medications have similar clinical efficacy in terms of glycemic control, treatment satisfaction and preference are typically based on patient perceptions of convenience and flexibility or route of administration, not meaningful improvements in functioning.

With new antihyperglycemic medications that potentially result in a 5% to 10% weight loss, however, there is potential for a differentiator beyond convenience or route of administration. This potential will be determined by the extent to which people with T2DM perceive a 5% to 10% weight loss, in addition to improved glycemic control, as relevant.

The results of this study indicated that people with T2DM would value a 5% to 10% weight loss particularly as it applies to their physical functioning. Physical functioning was clearly the most affected by participants' weight with lack of energy or fatigue, shortness of breath, pain, and immobility as the most prevalent symptoms. Participants confirmed their comments in their review of the IWQOL-Lite items. The majority of items considered relevant by 50% or more participants came from the IWQOL-Lite physical functioning items (eg, "I have feel short of breath with only mild exertion (eg climbing a single flight of stairs" endorsed by 87%). Participants agreed that even a 5% weight loss would result in improved physical functioning, and, more importantly, would provide motivation to keep losing weight.

In clinical trials of obesity medications and interventions which have used the IWQOL-Lite, the largest one-year change effect sizes have occurred in the physical functioning domain. In contrast, Zhang et al (2007), in a systematic

Table 3 Response tallies for the impact of weight on quality of life-lite questionnaire

“Because of my weight....”	Number reporting this concept as relevant	
	(n = 30)	%
Physical function		
I have trouble picking up objects	19	63
I have trouble tying my shoelaces	22	73
I have difficulty getting up from chairs	17	57
I have trouble using stairs	17	57
I have difficulty putting on or taking off my clothes	7	23
I have trouble with mobility (getting around)	15	50
I have trouble crossing my legs	10	33
I feel short of breath with only mild exertion (eg, climbing a single flight of stairs)	26	87
I am troubled by painful or stiff joints	26	87
My ankles and lower legs are swollen at the end of the day	8	27
I am worried about my health	25	83
Self-esteem		
I am self-conscious	24	80
My self-esteem is not what it could be	23	77
I feel unsure of myself	13	43
I don't like myself	7	23
I am afraid of being rejected	10	33
I avoid looking in mirrors or seeing myself in photographs	13	43
I am embarrassed to be seen in public places	7	23
Sexual life		
I do not enjoy sexual activity	10	33
I have little or no sexual desire	9	30
Because of my weight I have difficulty with sexual performance	8	27
Because of my weight I avoid sexual encounters whenever possible	10	33
Public distress		
I experience ridicule, teasing, or unwanted attention	5	17
I worry about fitting into seats in public places (eg, theatres, airplanes)	7	23
I worry about fitting through aisles or turnstiles	6	20
I worry about finding chairs that are strong enough to hold my weight	5	17
I experience discrimination by others	7	23

review of interventions on health-related quality of life among persons with diabetes, found little effect of antihyperglycemic oral agents and/or insulin on physical functioning (eg, ... climbing several flights of stairs) as measured by the Short Form 36 (SF 36) (Ware 2000). Thus while, antihyperglycemic agents would not be expected to affect individuals' physical functioning, the results of this study suggest that, if indeed, the agents also produced weight loss of 5% to 10% in the moderately obese, their effect on physical functioning would be positively increased.

Zhang et al (2007) also showed that antihyperglycemic medications could have an effect on emotional functioning as measured by the SF-36, but results were inconsistent

across the six studies involving patients with T2DM. In this study, participants reported that emotional functioning was affected by moderate obesity with self-esteem being the emotional component that would most likely be affected by a 5% to 10% weight loss. The IWQOL-Lite items specifically addressing self consciousness and self esteem were endorsed as relevant by over 75% of participants. Participants agreed that even small amounts of weight loss would improve their self-esteem and confidence. Thus, emotional functioning in terms of self esteem would be important to assess in trials evaluating antihyperglycemic medications that produce even small amounts of weight loss in those people with T2DM and moderate obesity.

Social functioning appeared to be affected by the weight of only a small number of participants. This again was confirmed by the review of the IWQOL-Lite items. Although the instrument does not have a social functioning subscale, items that imply socialization such as items regarding fear of rejection, embarrassment in public, sexuality, experiencing ridicule or teasing, discrimination by others were endorsed as relevant to them by a third or less participants. Therefore, for this population, changes in social functioning are not likely to be detected as a result of small weight loss.

With regards to glycemic control, participants acknowledged the importance of glycemic control and the risks of not having good glycemic control. Consequently, if required to choose between better glycemic control and weight loss, most would choose glycemic control. This was especially true for those participants who believed that uncontrolled blood sugar made it much more difficult for them to lose weight. Yet there were a smaller number of participants who perceived the relationship between obesity and diabetes as one in which the weight loss was the priority because they believed the weight loss would bring their blood sugar under control. While the direction of the relationship may not have been clear, most of the participants appeared to acknowledge their obesity as a problem as 83% agreed that the IWQOL-Lite item, "I am worried about my health," was relevant to them.

Participants also indicated that role limitations and pain would be less with even small amounts of weight loss. As reported by participants, the decrease would be directly related to the extent to which they were able to experience an increase in physical functioning.

After their review, Rubin and Peyrot (1999) concluded that compared to people without diabetes, people with diabetes had worse quality of life, specifically in the areas of physical functioning and well-being. The results of this study suggest that some of that decrease in quality of life for people with T2DM may be as much a result of their obesity as their diabetes. In fact, decreases in physical functioning and self-esteem, as well as, increased health distress could be directly linked to their obesity and would be the aspects of their lives most likely to change with weight loss.

Conclusions

Therapeutic options are continually being improved and expanded for patients with T2DM and each has its advantages and disadvantages from the patient perspective. The results of this study indicate that therapies which improve glycemic control, but also result in weight loss have a clear advantage from the patient perspective as long as they do not

add treatment burden (ie, complexity, hypoglycemia). The challenge for the pharmaceutical industry will be to capture these advantages using reliable and valid PROs measures. It is only then that this advantage can be adequately characterized and communicated to patients.

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