

# Disease Control Among Adults with Type 2 Diabetes Mellitus, Hypertension, and Obesity

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## BACKGROUND

- More than 23 million Americans (7.8% of the population) have diabetes<sup>1</sup>
- Diabetes is an independent risk factor for CVD, and hypertension, cigarette smoking, and hyperlipidemia act as independent modifiable contributors to CVD in patients with diabetes<sup>2</sup>
- The target goal for glycemic control, as measured by HbA<sub>1c</sub>, has been set at < 7% by ADA<sup>3</sup> and < 6.5% by AACE<sup>4</sup>
- The target goal for hypertension has been set as < 130 mmHg systolic BP and < 80 mmHg diastolic BP by JNC 7 and ADA guidelines<sup>3,5</sup>
- Limited information regarding glycemic and blood pressure control is available for individuals with the triad comorbid conditions of type 2 diabetes mellitus (T2DM), hypertension, and obesity

## OBJECTIVE

- Evaluate self-reported glycemic control and blood pressure control among adults with T2DM alone and those with T2DM plus hypertension and obesity

## METHODS

### Study Design

- Study to **Help Improve Early** evaluation and management of risk factors **Leading to Diabetes** (SHIELD), a population-based survey conducted to better understand the risk for the development of diabetes, as well as disease burden
  - Based upon a screening questionnaire mailed to 200,000 nationally representative households, responses were obtained for 211,097 adults from 127,420 households (64% response rate)
  - A baseline survey was sent to 22,001 selected individuals derived from the screening respondents. Since 2005, annual SHIELD surveys have captured self-reported information on health status, attitudes and behaviors, anthropometry, and medication use from this representative sample of the US population
  - The 2008 survey collected information on self-reported HbA<sub>1c</sub> and BP levels and had a response rate of 71% (n = 14,921)

- Cross-sectional analysis of individuals with T2DM, hypertension, and obesity versus those with T2DM alone using the 2008 survey respondents

### Study Population

- Respondents were 18 years of age or older
- Self-reported diagnosis of T2DM based on being told by a healthcare professional that the individual had T2DM

## METHODS (Continued)

### Study Measures

- Respondents reported a diagnosis of hypertension based on being told by a healthcare professional that they had high blood pressure or hypertension
- Obesity was defined as a body mass index (BMI) ≥ 30 kg/m<sup>2</sup>
- Respondents had to have a self-reported diagnosis of T2DM and hypertension and BMI ≥ 30 kg/m<sup>2</sup> to be included in the triad condition group. Respondents with a self-reported diagnosis of T2DM and no self-reported diagnosis of hypertension and BMI < 30 kg/m<sup>2</sup> were classified into the T2DM alone group
- Respondents were asked to provide their most recent (in past 12 months) HbA<sub>1c</sub> value and BP measurement, if they were aware of them

### Statistical Analyses

- Proportions of respondents who reported achieving the ADA and AACE goals for HbA<sub>1c</sub> (< 7% and < 6.5%, respectively) and the JNC 7 goal for blood pressure (< 130/80 mmHg) were estimated
- Comparisons between those with the triad conditions (T2DM, hypertension, and obesity) and those with T2DM alone were made using chi-square tests

## RESULTS

- There were 457 respondents with the triad conditions of T2DM, hypertension, and obesity who reported a current HbA<sub>1c</sub> level, and 593 reported a current BP level
- 106 respondents with T2DM alone reported a current HbA<sub>1c</sub> level, and 117 reported a current BP level

**Table 1. Characteristics of SHIELD respondents with triad conditions (T2DM + HTN + Obesity) or T2DM alone**

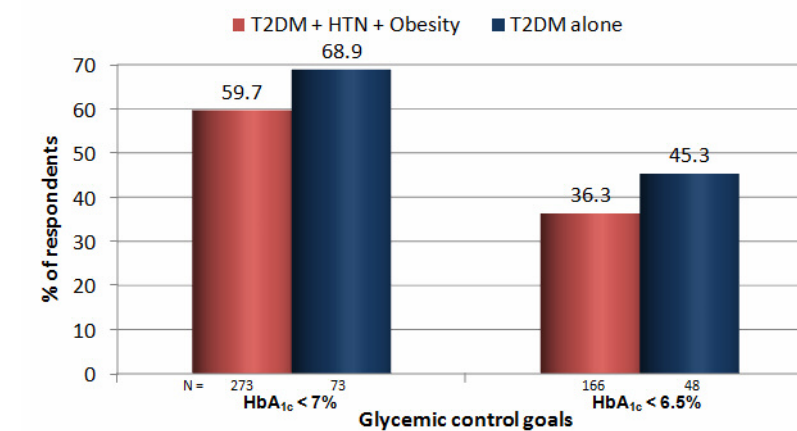
Characteristics	T2DM + HTN + Obesity (n = 593)	T2DM alone (n = 117)
Age, years, mean (SD)	61.4 (10.6)*	66.0 (12.2)
Women, %	66.4*	41.9
Race, % white	78.8	79.5
Education, % with some college or higher	75.3	73.3
Income, % ≥ \$30,000/year	66.9*	77.8

\*p < 0.05

- Respondents with the triad conditions were younger and more often female and had lower household income than respondents with T2DM alone

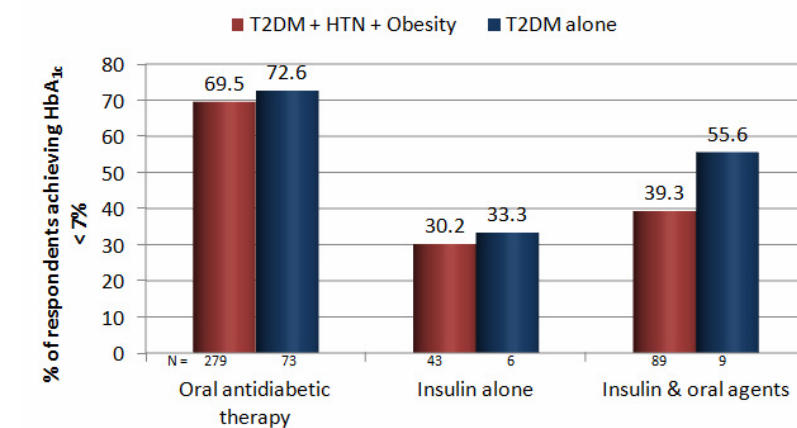
## RESULTS (Continued)

**Figure 1. Respondents achieving goals for glycemic control**



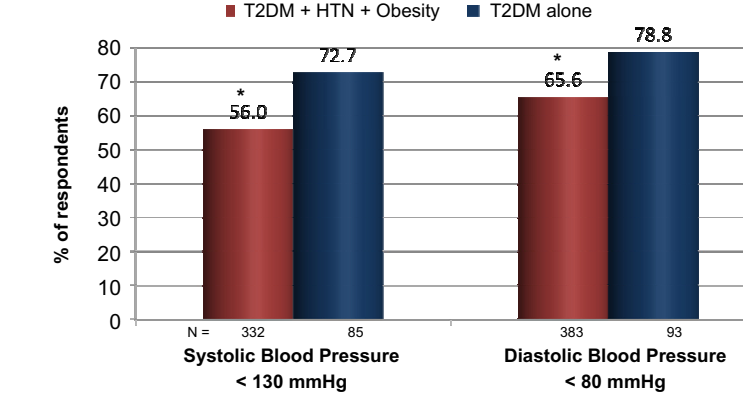
- 59.7% of respondents with the triad conditions reported having achieved the ADA HbA<sub>1c</sub> goal of < 7%, and 36.3% reported achieving the AACE HbA<sub>1c</sub> goal of < 6.5%
- Of the respondents with T2DM alone, 68.9% reported HbA<sub>1c</sub> < 7%, and 45.3% reported HbA<sub>1c</sub> < 6.5%; p = 0.10 for comparison with respondents with the triad conditions
- The rate of HbA<sub>1c</sub> goal achievement is higher than that reported in the recent NHANES studies (HbA<sub>1c</sub> < 7%: 57% in 2003–2004<sup>6</sup> and 37.0% in 1999–2000<sup>7</sup>)

**Figure 2. Respondents achieving HbA<sub>1c</sub> < 7% by treatment regimen**



- A similar proportion of respondents with and without the triad conditions reported HbA<sub>1c</sub> < 7% across different diabetes treatment regimens; p > 0.05 for all 3 treatment regimens
- Fewer patients receiving insulin attained HbA<sub>1c</sub> < 7%, compared with other therapies, which may be due to patients receiving insulin therapy having longer disease duration, or greater beta cell loss, or greater severity of diabetes

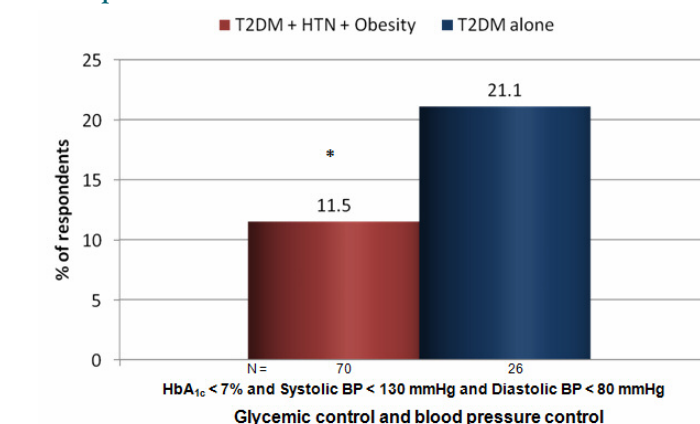
**Figure 3. Respondents achieving goals for blood pressure**



\*p < 0.01

- Fewer respondents with T2DM, hypertension, and obesity had systolic blood pressure < 130 mmHg (56%) or diastolic blood pressure < 80 mmHg (66%), compared with respondents with T2DM alone (73% < 130 mmHg and 79% < 80 mmHg); p < 0.01
- 92% of respondents with T2DM, hypertension, and obesity were receiving anti-hypertensive medication, and 48% of respondents with T2DM alone received anti-hypertensive medication
- The proportion of respondents achieving systolic blood pressure < 130 mmHg or diastolic blood pressure < 80 mmHg is higher than that reported in the NHANES studies (48.3% in 2003–2004<sup>6</sup> and 35.8% in 1999–2000<sup>7</sup>)

**Figure 4. Respondents achieving goals for both glycemic control and blood pressure**



\*p = 0.004

- Fewer respondents with the triad conditions were in control for both HbA<sub>1c</sub> and blood pressure (12%), compared with respondents with T2DM alone (21%), p = 0.004
- A total of 611 respondents with the triad conditions and 123 respondents with T2DM alone provided both recent HbA<sub>1c</sub> and blood pressure measurements

## LIMITATIONS

- Diagnoses of type 2 diabetes and hypertension, and HbA<sub>1c</sub> and blood pressure values were self-reported and were not verified by medical records
- Household panels, like the SHIELD study, tend to under-represent the very wealthy and very poor segments of the population and do not include military or institutionalized individuals

## SUMMARY

- Less than 60% of respondents with T2DM, hypertension, and obesity had attained an HbA<sub>1c</sub> < 7%, and only 36% attained HbA<sub>1c</sub> < 6.5%
- Approximately 56% of respondents with the triad conditions achieved a systolic blood pressure < 130 mmHg, and 66% achieved a diastolic blood pressure < 80 mmHg
- Glycemic control was not different between those with and without the triad conditions, even when stratified by treatment regimen
- Fewer respondents with T2DM, hypertension, and obesity were at blood pressure goal, compared with respondents with T2DM alone, despite treatment with anti-hypertensive medication
- Fewer respondents with the triad conditions were in control for both HbA<sub>1c</sub> and blood pressure, compared with respondents with T2DM alone

## CONCLUSIONS

- Respondents with the triad conditions of T2DM, hypertension, and obesity did not differ from patients with T2DM alone in terms of glycemic control, but they were more likely to have uncontrolled blood pressure despite anti-hypertensive therapy
- There is an unmet need for effective therapeutic strategies among adults with this triad of comorbid conditions despite the availability of anti-hypertensive and anti-diabetic treatments

## Abbreviations

Abbreviation	Definition
AACE	American Association of Clinical Endocrinologists
ADA	American Diabetes Association
BMI	Body mass index
BP	Blood pressure
CVD	Cardiovascular disease
HbA <sub>1c</sub>	Hemoglobin A <sub>1c</sub>
HTN	Hypertension
JNC 7	Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure 7
NHANES	National Health and Nutrition Examination Survey
SHIELD	Study to Help Improve Early evaluation and management of risk factors Leading to Diabetes
T2DM	Type 2 diabetes mellitus

## References

- ADA. 2007 National Diabetes Fact Sheet. <http://www.diabetes.org/diabetes-basics/diabetes-statistics>
- Grundy SM, et al. Circulation 1999;100:1134–1146
- ADA. Standards of Care. Diabetes Care 2010;33(Suppl 1):S11–S61
- AACE Diabetes Mellitus Clinical Practice Guidelines Task Force. Endocrine Pract 2007;13(Suppl 1):1–66.
- NHLBI JNC 7. Hypertension 2003;42:1206
- Ong KL, et al. Ann Epidemiol 2008;18:222–229
- Saydah SH, et al. JAMA 2004;291:335–342

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