

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 diabetes¹
- Diabetes is an independent risk factor for CVD, and hypertension, cigarette smoking, and hyperlipidemia act as independent modifiable contributors to CVD in patients with diabetes²
- The target goal for glycemic control, as measured by HbA_{1c}, has been set at < 7% by ADA³ and < 6.5% by AACE⁴
- The target goal for hypertension has been set as < 130 mmHg systolic BP and < 80 mmHg diastolic BP by JNC 7 and ADA guidelines^{3,5}
- 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_{1c} 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/m²
- Respondents had to have a self-reported diagnosis of T2DM and hypertension and BMI ≥ 30 kg/m² 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/m² were classified into the T2DM alone group
- Respondents were asked to provide their most recent (in past 12 months) HbA_{1c} 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_{1c} (< 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_{1c} level, and 593 reported a current BP level
- 106 respondents with T2DM alone reported a current HbA_{1c} level, and 117 reported a current BP level

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

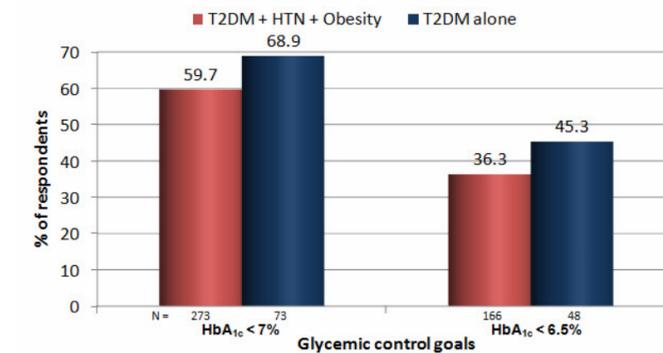
Characteristics	T2DM + HTN + Obesity (n = 593)	T2DM alone (n = 117)
Age, years, mean (SD)	61.4 (10.6)*	66.0 (12.2)
Women, %	66.4*	41.9
Race, % white	78.8	79.5
Education, % with some college or higher	75.3	73.3
Income, % ≥ \$30,000/year	66.9*	77.8

*p < 0.05

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

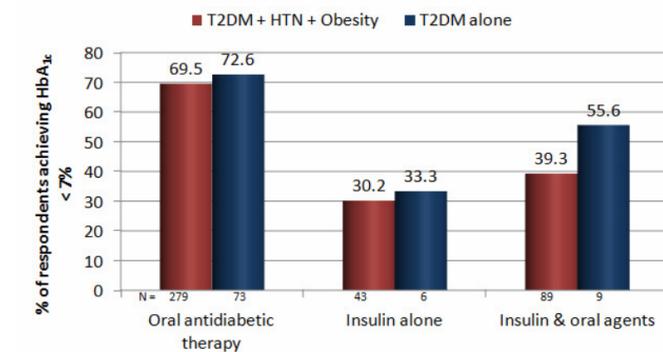
RESULTS (Continued)

Figure 1. Respondents achieving goals for glycemic control



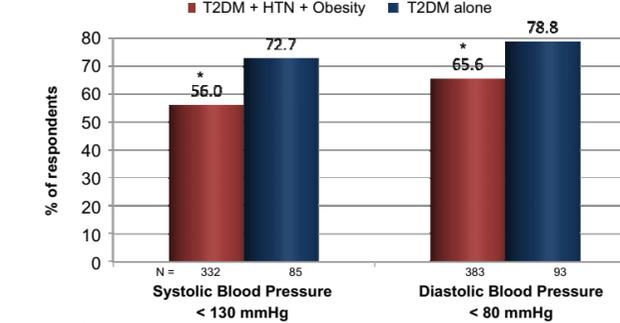
- 59.7% of respondents with the triad conditions reported having achieved the ADA HbA_{1c} goal of < 7%, and 36.3% reported achieving the AACE HbA_{1c} goal of < 6.5%
- Of the respondents with T2DM alone, 68.9% reported HbA_{1c} < 7%, and 45.3% reported HbA_{1c} < 6.5%; p = 0.10 for comparison with respondents with the triad conditions
- The rate of HbA_{1c} goal achievement is higher than that reported in the recent NHANES studies (HbA_{1c} < 7%: 57% in 2003–2004⁶ and 37.0% in 1999–2000⁷)

Figure 2. Respondents achieving HbA_{1c} < 7% by treatment regimen



- A similar proportion of respondents with and without the triad conditions reported HbA_{1c} < 7% across different diabetes treatment regimens; p > 0.05 for all 3 treatment regimens
- Fewer patients receiving insulin attained HbA_{1c} < 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

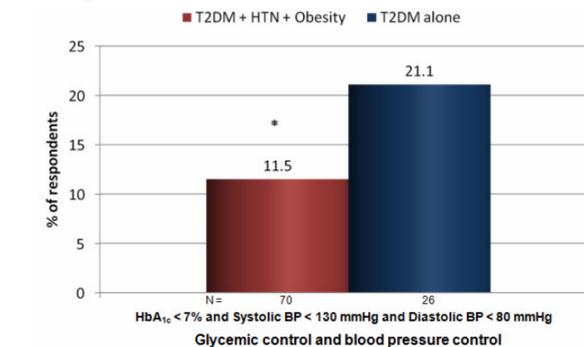
Figure 3. Respondents achieving goals for blood pressure



*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 2003–2004⁶ and 35.8% in 1999–2000⁷)

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_{1c} 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_{1c} and blood pressure measurements

LIMITATIONS

- Diagnoses of type 2 diabetes and hypertension, and HbA_{1c} 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_{1c} < 7%, and only 36% attained HbA_{1c} < 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_{1c} 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 _{1c}	Hemoglobin A _{1c}
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

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