The Northern Michigan Diabetes Initiative is a collaborative community effort designed to reduce the prevalence of diabetes and improve the care of people with diabetes.

Northern Michigan Diabetes Initiative (NMDI)

2017 Regional Survey

MUNSON MEDICAL CENTER

Report Prepared by:

CS Research & Consulting, LLC

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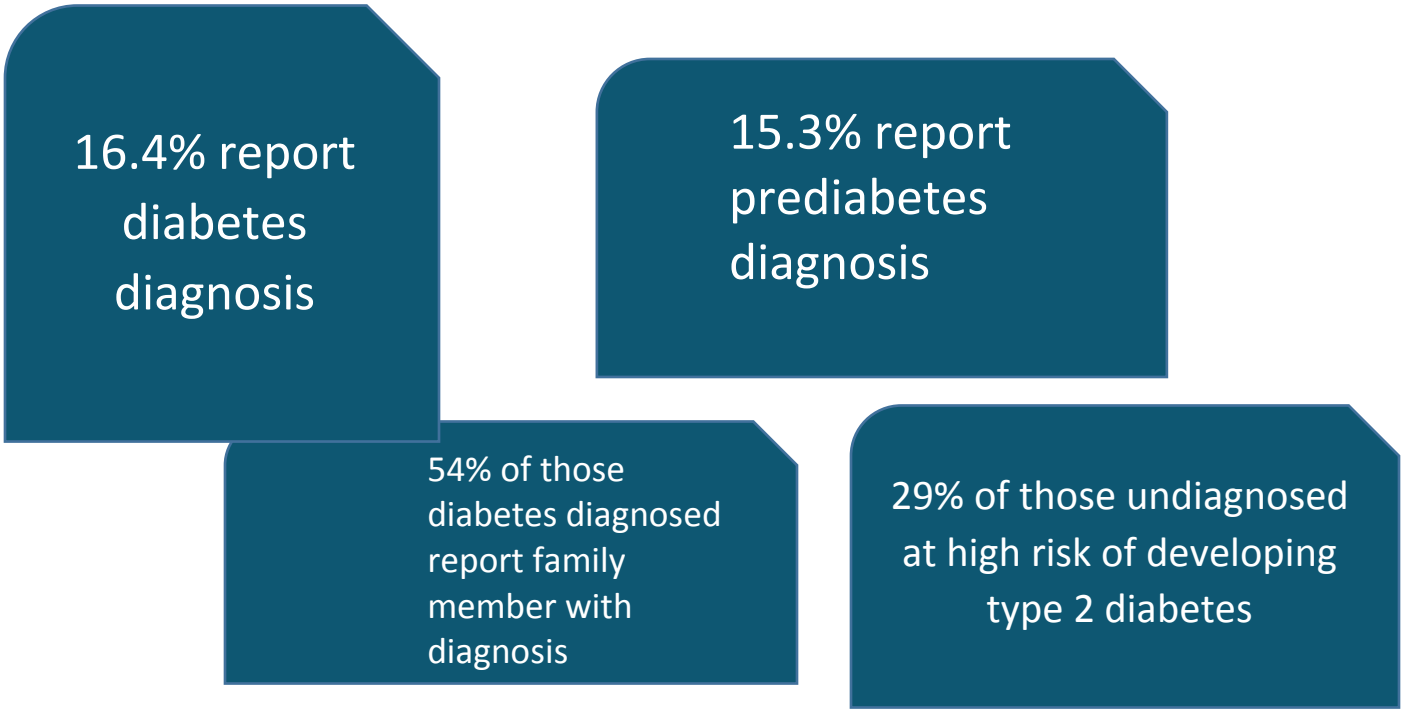
Northern Michigan Diabetes Initiative – 2017 Regional Survey

I. Executive Summary

The Northern Michigan Diabetes Initiative (NMDI) is a collaborative community effort designed to reduce the prevalence of diabetes and improve the care of people with diabetes. The 2017 NMDI survey sample consists of 1,000 adult respondents 18 years of age and older. Key demographic characteristics of survey respondents, along with significant survey results, are highlighted below.



Survey Respondents:

- 50.3% female; 49.7% male
- 36% 18–44 years of age, 39% 45-64, and 26% 65+
- 94.4% non-Hispanic White
- 55.2% married
- 80.3% homeowners
- 32% indicate children under 18 in the household
- Nine in 10 adults (90.5%) indicate high school diploma or higher
- 43.2% on government-assisted insurance, among those, majority (64.2%) 65 years of age or older
- Among those uninsured, one fifth (20.2%) never insured or not insured in last three years
- One in 10 (10.6%) indicated they did not visit a health professional when needed, due to cost, in the last year
  - Among these, 50.3% 45-64 years of age and 42.2% on government-assisted insurance
- The majority (91.2%) not hindered by cost in the last year when it came to taking medication
- Among those who did not take medication due to cost in the last year, 28.1% 65 years of age and older and more than half (54.2%) on government-assisted insurance.

Survey results indicate the regional prevalence estimate for prediabetes is 15.3%, while the prevalence estimate for diabetes is 16.4%. With approximately one-third (32%) of survey respondents reporting a diabetes or prediabetes[1] diagnosis, the scope of this northern Michigan health issue is emphasized. Additionally, approximately 11% of female respondents reported having been told they had gestational diabetes.

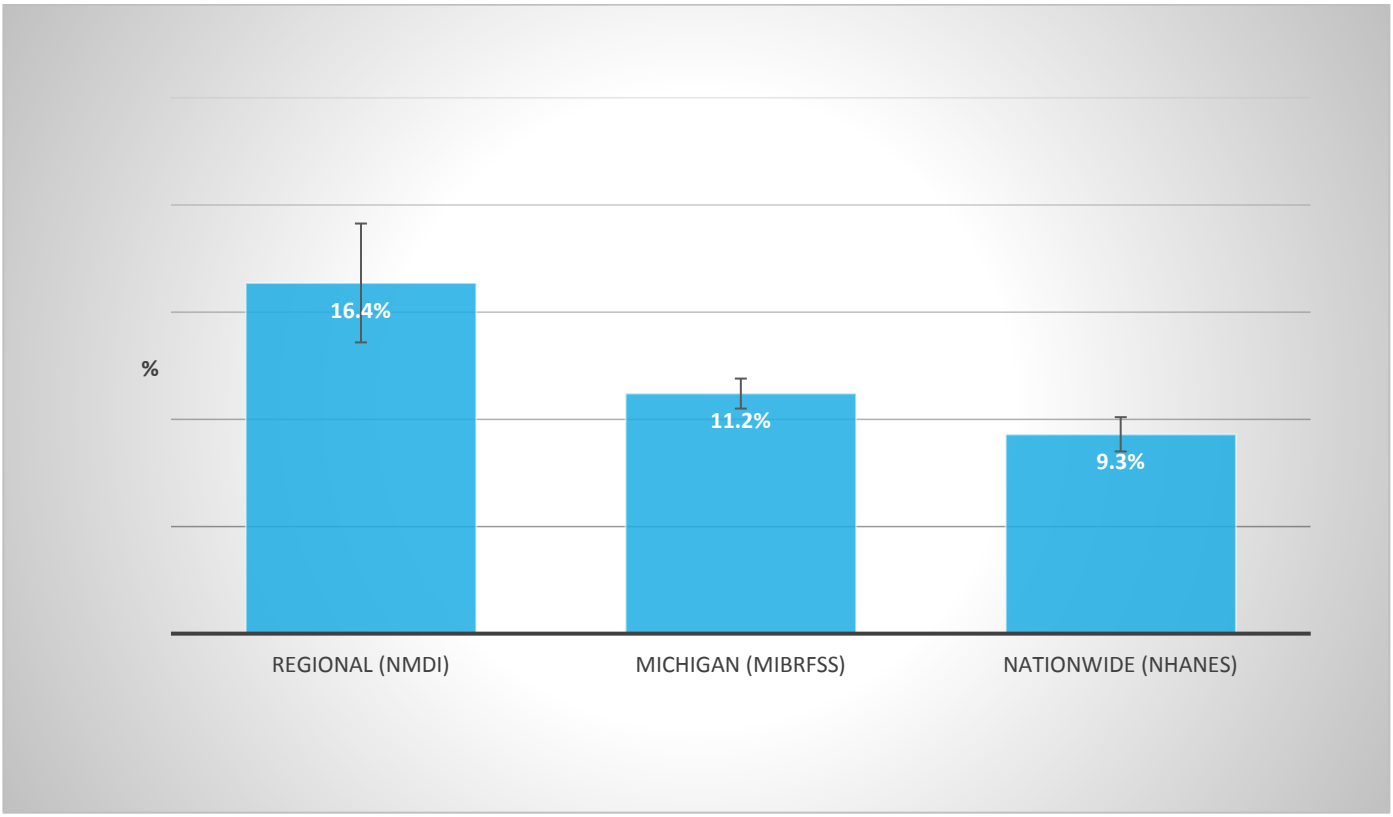
Diabetes Conditions

Diabetes Conditions: Summary	n	%	95% CI
Diabetes	195	16.4	(13.6, 19.1)
Prediabetes (Excludes Diabetes)	158	15.3	(12.5, 18.1)
Gestational Diabetes (Includes Diabetes)	39	10.6	(6.7, 14.4)

Prediabetes (Excludes Diabetes) – respondent told by health professional they had prediabetes or one of other five terms/conditions – including impaired fasting glucose, impaired glucose tolerance, borderline diabetes, high blood sugar, and high risk for diabetes - but did not report having been told they had diabetes; Gestational Diabetes (Includes Diabetes) – respondent told by health professional they had gestational diabetes, including those who also reported being told they had diabetes

In comparison to the 2016 state diabetes prevalence estimate of 11.2%, and the 2011-2014 nationwide estimate of 9.3%, the regional estimate of 16.4% is notably higher.

Diabetes Prevalence Estimates: Regional, Statewide, and Nationwide

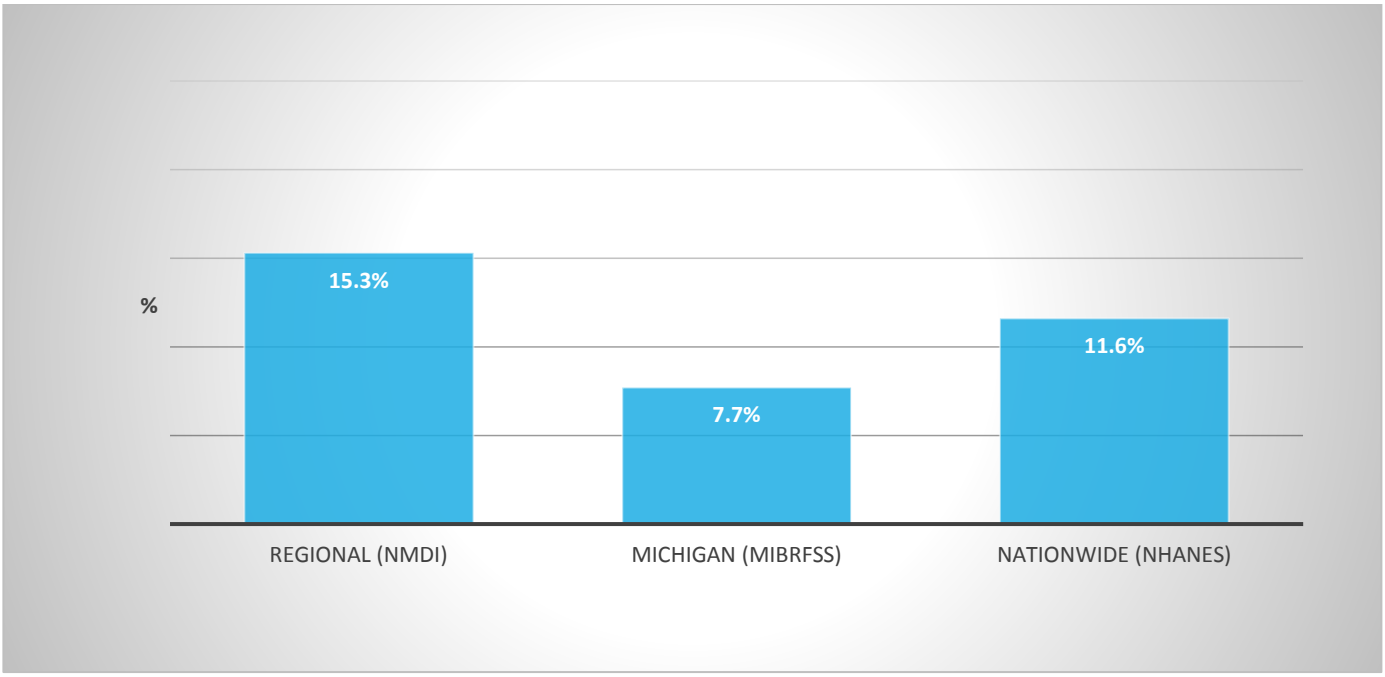


Regional – 14 Northern Michigan Counties, NMDI - Northern Michigan Diabetes Initiative Survey (2017); MiBRFSS - Michigan Behavioral Risk Factor Surveillance System (2016); NHANES National Health and Nutrition Examination Survey (2011-2014)

[1] Prediabetes (Excludes Diabetes) – respondent told by health professional they had prediabetes or one of other five terms/conditions – including impaired fasting glucose, impaired glucose tolerance, borderline diabetes, high blood sugar, and high risk for diabetes - but did not report having been told they had diabetes

Regarding prediabetes, the 2012-2014 state prediabetes estimate is 7.7% and the 2011-2014 nationwide estimate is 11.6%, demonstrating that, as is the case with diabetes regional prevalence estimates, the regional prediabetes estimate is comparatively higher.

Regional, Statewide, and Nationwide Prediabetes Prevalence Estimates[2]



Regional – 14 Northern Michigan Counties; NMDI - Northern Michigan Diabetes Initiative Survey (2017); MiBRFSS - Michigan Behavioral Risk Factor Surveillance System (2012-2014 combined); NHANES National Health and Nutrition Examination Survey (2011-2014)

People with diabetes have high rates of risk factors that further jeopardize their health generally, and put them at increased risk for cardiovascular disease in particular. Survey results find that approximately 14% of respondents overall reported they are not physically active, 34% reported having ever been told they have high blood pressure, and 30% are overweight. Based upon American Diabetes Association (ADA) defined risk factors – including being a member of a racial or ethnic minority group, being over age 45, being obese or sedentary, and having a family history of diabetes - approximately 29% of undiagnosed (diabetes or prediabetes) survey respondents are at risk of developing type 2 diabetes. The combined prevalence rate of adults diagnosed with prediabetes or diabetes, along with those at risk but not diagnosed, constitutes over half of the adult population, pointing to the need for ongoing education.

Concerning risk factors, survey results indicate the majority of respondents overall were able to name two key strategies for reducing cardiovascular risks - a healthier or better diet (67%) and exercise (52%). However, results suggests lower awareness of managing blood sugar, losing weight, taking medication, and lowering cholesterol as important strategies (25%, 14%, 14%, and 3%, respectively).

[2] **Note that Prediabetes source definitions vary as follows:**

NMDI and NHANES – respondent told by health professional they had prediabetes or one of other five terms/conditions – including impaired fasting glucose, impaired glucose tolerance, borderline diabetes, high blood sugar, and high risk for diabetes - but did not report having been told they had diabetes; MiBRFSS – respondent told by health professional they had prediabetes or borderline diabetes - but did not report having been told they had diabetes

Regarding those with a diabetes diagnosis, the majority reported they had received all three primary ADA-recommended preventive services (two A1cs tests, annual eye and foot exams). A significant finding of the survey is that respondents with diabetes who reported receiving diabetes education (71.7%) were highly likely to be aware of primary ADA recommended preventive care services and to have actually received these services. With note to the fact that 28% of those with diabetes indicated they had not received diabetes education, these findings again highlight the importance of increased education and systems of care which are more effective at delivering secondary prevention services.

Survey findings related to general public knowledge and awareness of key diabetes-related facts suggest a high level of awareness regarding U.S. childhood obesity and diabetes rates and the fact that some forms of diabetes can be prevented (88% and 83%, respectively). However, significantly fewer respondents reported awareness of general diabetes screening recommendations, rate of undiagnosed diabetes and the high prevalence of prediabetes (52%, 51% and 42%, respectively).

Survey findings reveal the most commonly reported sources for general health information are health care provider (57%), Internet/Facebook (46%), and TV (sources included News, Commercial, Health Shows) (38%). Findings specifically related to awareness of community diabetes education opportunities suggest that health care providers come to mind most frequently (53%), followed by local hospitals (17%), though 41% indicated they did not know if their local hospital offers diabetes education. Regarding interest in the topic of diabetes, less than one-third (31%) of all respondents reported that they follow diabetes news stories very closely or somewhat closely.

Reported prevalence of diabetes and prediabetes, combined with reported rates of an immediate family member diagnosed with diabetes, indicates the majority of families in the region are impacted. The sheer magnitude of diabetes, along with the human and societal toll that this disease takes, makes the need for quality, cost-effective systems of care all the more urgent.

II. Background & Introduction to the Northern Michigan Diabetes Initiative (NMDI) and Survey

The Northern Michigan Diabetes Initiative (NMDI) is a collaborative effort of Munson Healthcare (including nine owned and affiliated hospitals), Priority Health (a non-profit health plan), local public health departments, area healthcare providers and other stakeholders from the Munson Healthcare 14-county geographic service area in northern lower Michigan. The region is mostly rural, and the percent of older adults living in the region is greater than the state percentage (Munson Medical Center, Community Health Needs Assessment 2016). In Michigan, an estimated 11.2% of Michigan adults have been diagnosed with diabetes (MiBRFSS 2016). Chronic diseases, such as diabetes and obesity, are leading health care issues across the region based on recent community health needs assessments conducted by Munson Healthcare hospitals in 2016.

The NMDI was formed with the long term goals of reducing the prevalence of diabetes and improving the care of people with diabetes. The current strategies are: 1) Improve patient outcomes through a targeted, evidence-based professional education plan based on best practices and standards for prevention and treatment of prediabetes and diabetes, including promoting the consistent use of best practices across the region; 2) Increase community exposure and increase community engagement through an NMDI media campaign; and 3) Provide evidence-based patient education targeting those at risk for developing type 2 diabetes through expansion of the National Diabetes Prevention Program (NDPP) across the 14-county region, including providing support at the local and regional level. The collaboration allows partners to work together to adopt consistent and clear messages and to develop common intervention strategies.

The purpose of the current research is to learn more about the prevalence of diabetes and risk factors, as well as to identify gaps in diabetes care and public knowledge in order to guide and inform initiative efforts. The original research in support of this initiative was conducted in 2007 via a telephone survey targeting adults 18 years of age and over in the then 11-county primary service area of the Munson Healthcare System; in 2012 the survey was replicated in the same region. The current 2017 research targeted a 14-county region using a slightly modified survey instrument and updated sampling methodology; given these modifications, the 2017 data will serve as a baseline moving forward.

The study protocol received approval from the Munson Healthcare Institutional Review Board, whose purpose is to ensure that any research conducted with Munson involvement meets ethical standards and affords adequate protection to human subjects.

III. Process and Methodology

Survey Development **-** The 2012 survey instrument served as a basis for the 2017 survey, with modifications incorporated to gauge impact of recent initiatives. When available, questions from existing standardized national survey tools were used to allow for comparison of regional results to state and national findings. Data sources used for comparative analyses include the 2016 and 2012 – 2014 combined Behavioral Risk Factor Surveillance (BRFS) results for Michigan and the National Health and Nutrition Examination Survey (2011-2014) (NHANES).

CS Research & Consulting, LLC was contracted to obtain the sample, implement the survey, and prepare the final report. Hembroff Survey Research Consulted was contracted to weight the final data following the iterative proportional fit weighting methodology, i.e., raking, currently being used by the U.S. Centers for Disease Control and Prevention for the Behavioral Risk Factor Survey System (BRFSS). Data analysis was performed by Michelle Byrd, Department of Health and Human Services Contractor. Development of this report was accomplished in part through technical assistance and support from the Chronic Disease Epidemiology Section and Diabetes Prevention and Control Program, Michigan Department of Health and Human Services.

The 2017 survey instrument is composed of four primary sections:

- Section A: Diabetes, prediabetes, and diabetes risk status (administered to all respondents)
- Section B: Receipt of preventive care and knowledge of recommendations among people with diabetes (administered only to people reporting a diabetes diagnosis)
- Sections C and D: Knowledge of key messages and facts about diabetes; awareness, perception and education needs (administered to all respondents)
- Section E: Respondent health care coverage and demographic data (administered to all respondents)

Sampling Design and Survey Implementation – The sampling design incorporated both landline and wireless records to ensure all individuals residing in the area, with phone access, had a chance to be randomly selected for participation. It should be noted that some individuals now residing in one of the targeted 14 counties may have moved there and ported their landline phone number from a previous residence elsewhere, or continued to use the cellphone number they established prior to the move; these individuals would not have had a chance to be selected. This represents an example of potential non-coverage error in the sample design. However, the number of such individuals is estimated to be small and is expected to have little to no effect on overall point estimates of the survey.

The research design targeted 1,000 adults, 18 and over, in a 14-county area; the final sample includes 1,000 completed surveys. CS Research & Consulting purchased all Random Digit Dial (RDD) and wireless sample used in the research from Survey Sampling International (SSI). The initial sample order and instructions included a request for 30,000 “screened” records. Initial sample, received 7/27, consisted of 15,339 screened records: 37% landline, 63% wireless.

Sample was divided into 14 quota regions, with most to account for 5-6% of total respondent pool; however, Grand Traverse and Wexford counties were outliers, as they account for 25% and 10%, respectfully, of final completes.

On 8/8 another round of landline and wireless sample was added due to sample exhaustion (six contact attempts), with same land/wireless distributions and sample order instructions as the first order. Total field time: 7/27 - 8/30.

Data was entered using a Computer Assisted Telephone Interview (CATI) system operated by trained telephone interviewers. Interviewers obtained verbal informed consent from each respondent before proceeding with interview questions.

Survey Analysis – The final data set was weighted following the iterative proportional fit weighting methodology, i.e., raking, currently being used by the U.S. Centers for Disease Control and Prevention for the Behavioral Risk Factor Survey System (BRFSS). The initial steps in the weighting process involve making adjustments to the final data set to correct for unequal probabilities of selection (i.e., different sampling rates across geographic strata, landline numbers vs. cell numbers, the number of phone lines reaching the selected respondent, and the number of adults reached by the selected phone number). The iterative proportional fitting methodology then makes further adjustments to the sample to match the population totals of the counties in question, and the distribution of respondents compared to the distribution of the population based on age x gender, race/ethnicity, education, marital status, sex by race/ethnicity, age x race/ethnicity, homeownership, and landline/cellphone status.

The population profiles along these dimensions for the 14 counties were based on estimates published by the U.S. Census Bureau through the American Fact Finder system at https://factfinder.census.gov. The 2016 estimated population of persons 18 years old or older in the 14 counties is based on the Annual Estimates of the Resident Population: April 1, 2010 to July 1, 2016. The estimates regarding race/ethnicity, sex, age, homeownership, education and marital status are based on U.S. Census Bureau, 2011-2015 American Community Survey 5-Year Estimates. Estimates of landline vs. cellphone status are derived from NCHS, National Health Interview Survey, 2011–2015; U.S. Census Bureau, American Community Survey, 2010–2014; and infoUSA.com consumer database, 2011–2015. The most current estimates available for geographic areas smaller than the nation as a whole are for individual states rather than counties within states and for the year 2015. Michigan 2014 estimated distribution drawn from: http://www.cdc.gov/nchs/data/nhis/earlyrelease/wireless_state_201608.pdf.

The weighting process reached convergence on weighted proportions in the cells for all cells within four iterations. There was a total of 64 marginal totals to be matched in the iterative process. After the fourth iteration, all but one marginal in the sample differed from its corresponding marginal in the population by more than 0.5% -- the difference was 0.533% -- and only four marginals differed from their respective population marginal by more than 0.25%. One variable in particular, marital status, produced half of these. However, the Census-based marginal was published regarding the marital status of persons 15 years of age or older whereas the survey only included persons 18 years of age or older. Since most of those 15 to 17 years old would be unmarried, the discrepancies in the percentages married and unmarried for the sample versus the population seemed appropriate so the match was concluded to be close enough to be representative. Overall, 59 of the 64 marginals differed between the population and sample distributions by less than 0.1%.

The final weight variable in the data file that makes all of these adjustments is LLCPWT. This is an expansion weight, i.e., it projects the weighted number of cases to the actual number in the population. If it is turned on, the weighted number of cases in the file equals 281,402, the Census-estimated number of persons 18 or older living in the 14 counties in 2016.

A second alternative final weight variable is included in the data file if the statistical package being used for analysis cannot keep track of the actual number of cases when an expansion weight is used. This weight (ACTLNWT) includes all weighting adjustments reflected in LLCPWT but results in a number of weighted cases that is equal to the actual number of interviews completed for the survey, 1000. The final working sample size is 1,000 if weighted by ACTLNWT or 281,402 if weighted by LLCPWT. The overall margin of sampling error for a sample of 1000 with the design effects of 1.7 for the disproportionate sampling involved is ± 4.1% or less. The margin of sampling error will be larger within smaller segments of the sample. All significance noted in IV. Findings at p=.05.

IV. Findings

The 2017 NMDI survey sample consists of 1,000 adult respondents 18 years of age and older. Tables 1 and 2 below provide 1) unweighted count of survey respondents and 2) weighted percentage estimates using weighted data for various population characteristics. Survey results, grouped by major content area, are presented throughout Section IV. Where relevant, findings are broken out by subgroup, with significant findings highlighted.

1. Demographic Characteristics
Unweighted Sample Sizes and Weighted Percentage Estimates

Characteristic	n	%	95% CI
Overall	1000	-	-
Gender			
Male	473	49.7	(45.6, 53.8)
Female	527	50.3	(46.2, 54.4)
Race/Ethnicity			
White, NH	943	94.4	(92.5, 96.3)
Other Race/Ethnicities	57	5.6	(3.7, 7.5)
Age Group (yr)			
18-24	73	9.2	(6.7, 11.8)
25-34	91	13.1	(10.1, 16.0)
35-44	84	13.3	(9.9, 16.7)
45-54	141	18.3	(15.0, 21.7)
55-64	213	20.4	(17.3, 23.5)
65-74	225	14.8	(12.4, 17.1)
75 or older	173	10.9	(8.9, 12.8)
Age Group (yr)			
18-44	248	35.6	(31.5, 39.8)
45-64	354	38.7	(34.8, 42.7)
65 and older	398	25.6	(22.7, 28.6)
Education Level			
Less than High School	61	9.5	(6.8, 12.2)
High School Diploma	312	33.2	(29.4, 37.1)
Some College	257	33.7	(29.6, 37.9)
At least College Degree	329	23.5	(20.5, 26.5)

n- Unweighted Sample Size; NH- Non-Hispanic; Other Race/Ethnicities -Hispanic and Non-Hispanic American Indian/Alaska Native, Asian, Black, and Other

This survey sample breakdown finds genders equally represented, race/ethnicity primarily White/Non-Hispanic, and 45 – 64 year olds the single largest age group. Regarding education level, approximately one-third report a high-school diploma, one-third report some college, and nearly one-quarter report at least a college degree.

Additionally, as highlighted below in Table 2, just over half of respondents are married, approximately one-third report children under 18 at home, and 80% are home owners. Finally, half indicate they have private insurance, while 4% cite government assisted insurance, and 7% are not insured.

2. Insurance Status and Household Characteristics
Unweighted Sample Sizes and Weighted Percentage Estimates

Characteristic	n	%	95% CI
Insurance			
Private	395	49.5	(45.4, 53.7)
Government Assisted*	506	43.2	(39.2, 47.2)
Not Insured	50	7.3	(5.0, 9.6)
Marital Status			
Married	559	55.2	(51.1, 59.3)
Never married**	173	23.1	(19.4, 59.3)
Divorced, Widowed, or Separated	231	21.7	(18.3, 59.3)
Children under 18 yrs in Household			
Yes	221	32.0	(27.7, 36.2)
No	741	68.0	(63.8, 72.3)
Home Ownership			
Owns	742	80.3	(77.4, 83.2)
Rents	175	13.5	(11.0, 16.0)
Other	83	6.2	(4.5, 8.0)

n - Unweighted Sample Size; Private – An insurance plan purchased through an employer or union (includes plans purchased through another person's employer), or a plan that you or another family member buys on your own.
*Government Assisted Insurance - Medicaid, Medicaid, Other State Program, Tricare (formerly CHAMPUS), VA, or Military; **Never married, member of unmarried couple or member of a Registered Domestic Partnership

As shown in Chart 3, when compared to 2016 Michigan Behavioral Risk Factor Surveillance System data, the 18-24, 25-34 and 35-44 NMDI age groups are slightly underrepresented, with slight overrepresentation in remaining age groups. To obtain findings which accurately represent the adult population in the 14-county target area, data was weighted following the iterative proportional fit weighting methodology, i.e., raking, currently being used by the U.S. Centers for Disease Control and Prevention for the Behavioral Risk Factor Survey System (BRFSS).

3. Age Group - NMDI VS MIBRFSS

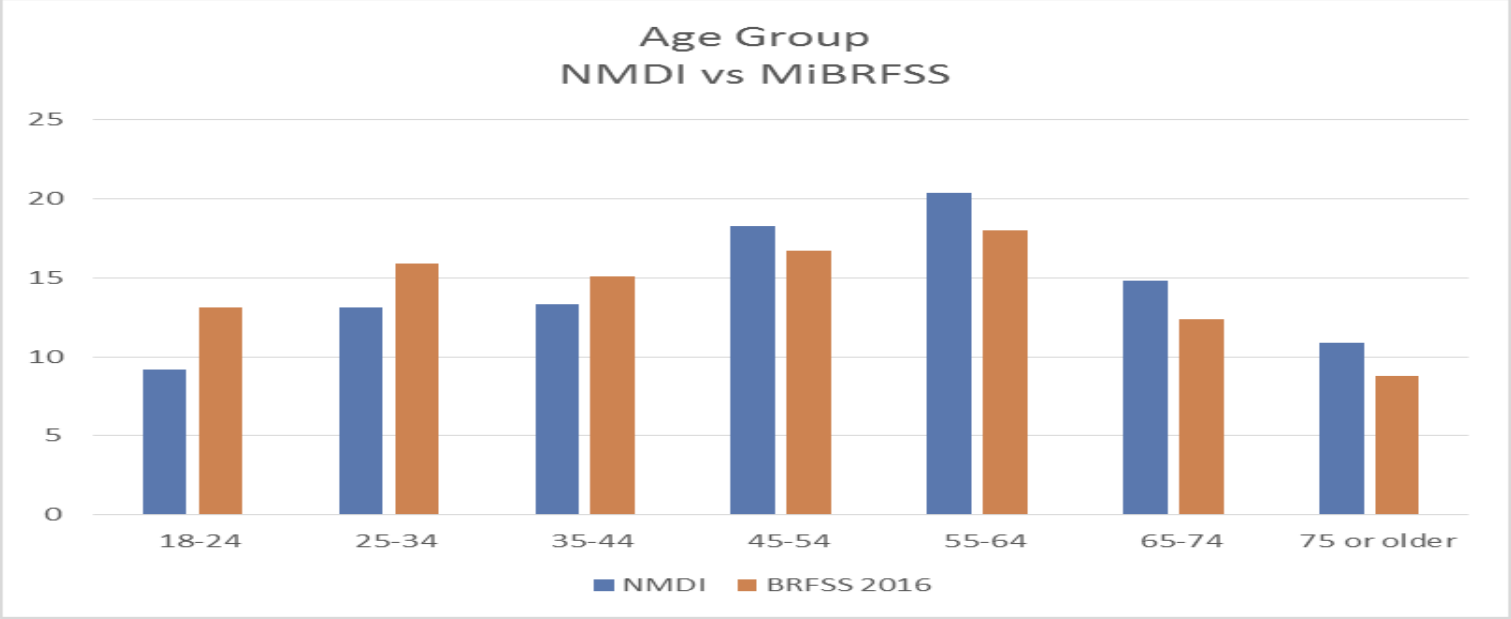


Table 4 summarizes reported rates of diabetes, prediabetes, and gestational diabetes. Diabetes and prediabetes are addressed individually below[3], with comparative statewide and national data included.

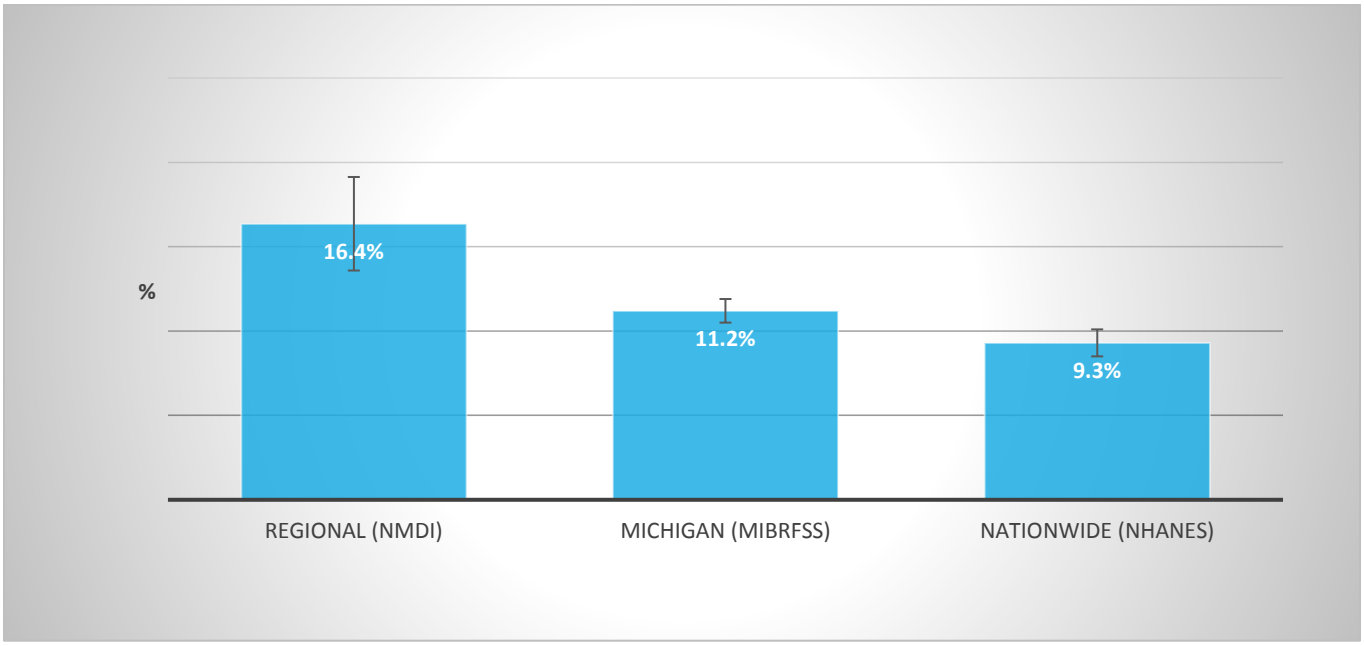
4. Diabetes Conditions: Summary	n	%	95% CI
Diabetes	195	16.4	(13.6, 19.1)
Prediabetes (Excludes Diabetes)	158	15.3	(12.5, 18.1)
Gestational Diabetes (Includes Diabetes)	39	10.6	(6.7, 14.4)

Prediabetes (Excludes Diabetes) – respondent told by health professional they had prediabetes or one of other five terms/conditions, but did not report having been told they had diabetes
Gestational Diabetes (Includes Diabetes) – respondent told by health professional they had gestational diabetes, including those who also reported being told they had diabetes

Diabetes Prevalence

Based on weighted survey results, 16.4% of adults in the 14-county region report having been diagnosed with diabetes; this is higher than the estimated statewide prevalence of 11.2% (2016 BRFSS) and the nationwide rate of 9.3% (NHANES). With a confidence interval of 13.6% - 19.1% (95%), the lower margin remains higher than the upper margin of either comparable measure. Potential explanations for this difference include a concentration of older people in the 14-county regional population and a higher incidence of risk factors, most notably obesity.

5. Regional, Statewide, and Nationwide Diabetes Prevalence Estimates



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Additional analyses were conducted to assess characteristics of those with diabetes and awareness of diabetes management strategies, as well as preventive care behavior and awareness of care recommendations among respondents with diabetes. Results of these analyses and all significant findings begin on Page 14.

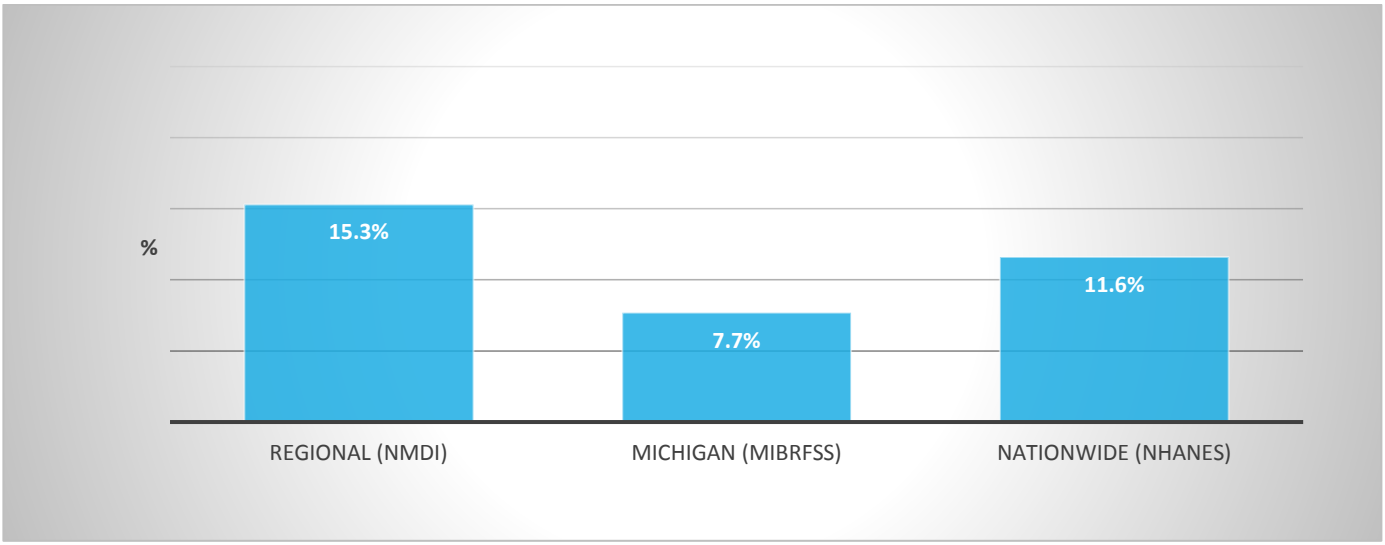
[3] Similar comparative data for rate of Gestational Diabetes not available

Prediabetes Prevalence

Prediabetes is a condition which places people at high risk of developing type 2 diabetes. The American Diabetes Association diagnosis criteria for prediabetes is a fasting blood sugar between 100 and 125 (higher than 125 is considered diabetes). A variety of medical terms are commonly used to refer to a medical diagnosis of "prediabetes," including "impaired glucose tolerance," "impaired fasting glucose," "borderline diabetes," "high blood sugar," and "high risk for diabetes." Inconsistent use of terms by health care providers, and differential recollection or confusion over terms among patients, makes estimating prediabetes prevalence difficult.

With regard to the current research, respondents were asked if a doctor/health care professional had ever told them that they had prediabetes, as well as if they had been told that they had any of several additional conditions, including: impaired fasting glucose, impaired glucose tolerance, borderline diabetes, high blood sugar, and high risk for diabetes. Based on input from currently practicing diabetes educators, and in order to estimate the prevalence of prediabetes in the population as closely as possible, the research committee chose to interpret a report of having been told by a health care provider that one is at high risk for diabetes as a diagnosis of prediabetes. Additionally, having been told that one has any of the other above mentioned conditions is interpreted as a diagnosis of prediabetes. Therefore, prediabetes, for the purposes of this report, is defined as the percentage of population who were at some point told by a doctor or health professional that they had prediabetes or one or more of the other five conditions, but does not include those reporting they had been told by a professional that they have diabetes.

6. Regional, Statewide, and Nationwide Prediabetes Prevalence Estimates[4]



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Survey results indicate the regional prevalence estimate for prediabetes is 15.3%. In comparison, the 2012-2014 state prediabetes estimate is 7.7%, and the 2011-2014 nationwide estimate is 11.6%, demonstrating that, as is the case with diabetes regional prevalence estimates, the regional prediabetes estimate is comparatively higher.

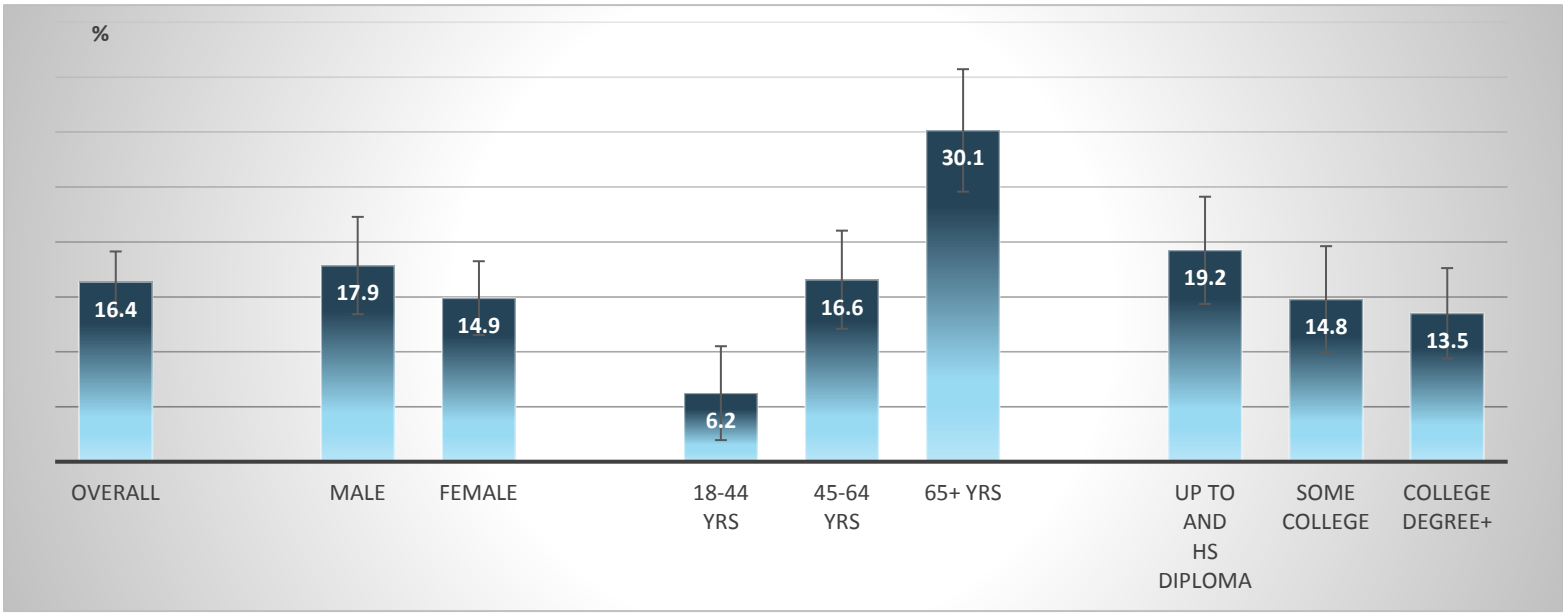
[4] **Note that Prediabetes source definitions vary as follows:** NMDI and NHANES – respondent told by health professional they had prediabetes or one of other five terms/conditions – including impaired fasting glucose, impaired glucose tolerance, borderline diabetes, high blood sugar, and high risk for diabetes - but did not report having been told they had diabetes; MiBRFSS – respondent told by health professional they had prediabetes or borderline diabetes - but did not report having been told they had diabetes

Characteristics of Those with Diabetes

A series of analyses were conducted on the sub-sample of respondents reporting a diabetes diagnosis. While these results, specific to people with diabetes, can be used to identify issues for further exploration and verification, findings should be interpreted with caution as the sample size (n=195) is relatively small.

As expected, and as highlighted below, there is a sharp increase in diabetes prevalence with age, with close to one-third of respondents 65 or older reporting a diabetes diagnosis. This observed increase with age is statistically significant. Additional analyses indicate diabetes diagnosis varies by gender, with 18% of males and 15% of females reporting a diagnosis, and by educational level, with those indicating a high school diploma or less diagnosed at a greater extent than those with some college or a college degree, those these variations are not statistically significant.

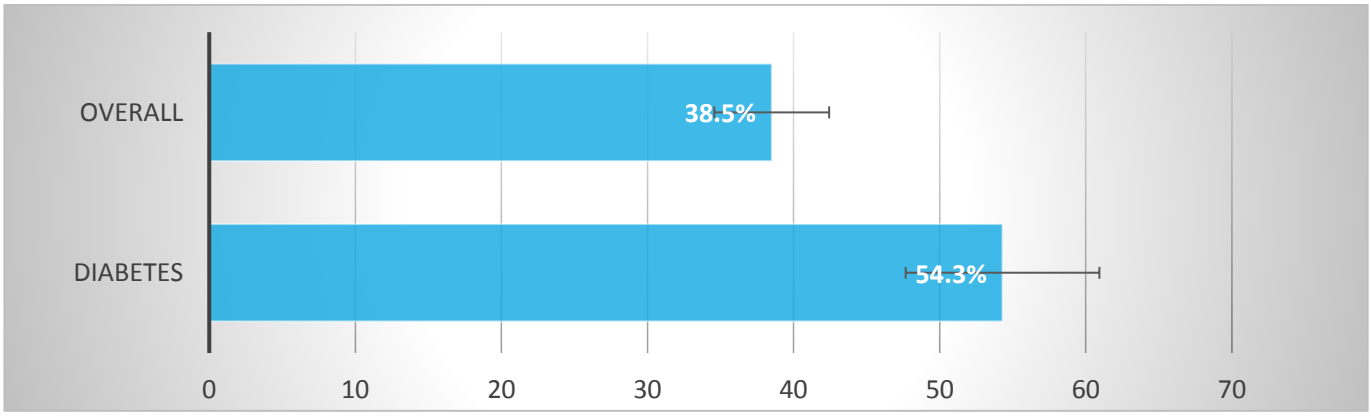
7. Diabetes Prevalence Estimates by Demographic Characteristics



†This estimate should be used with caution due to its low reliability and precision.

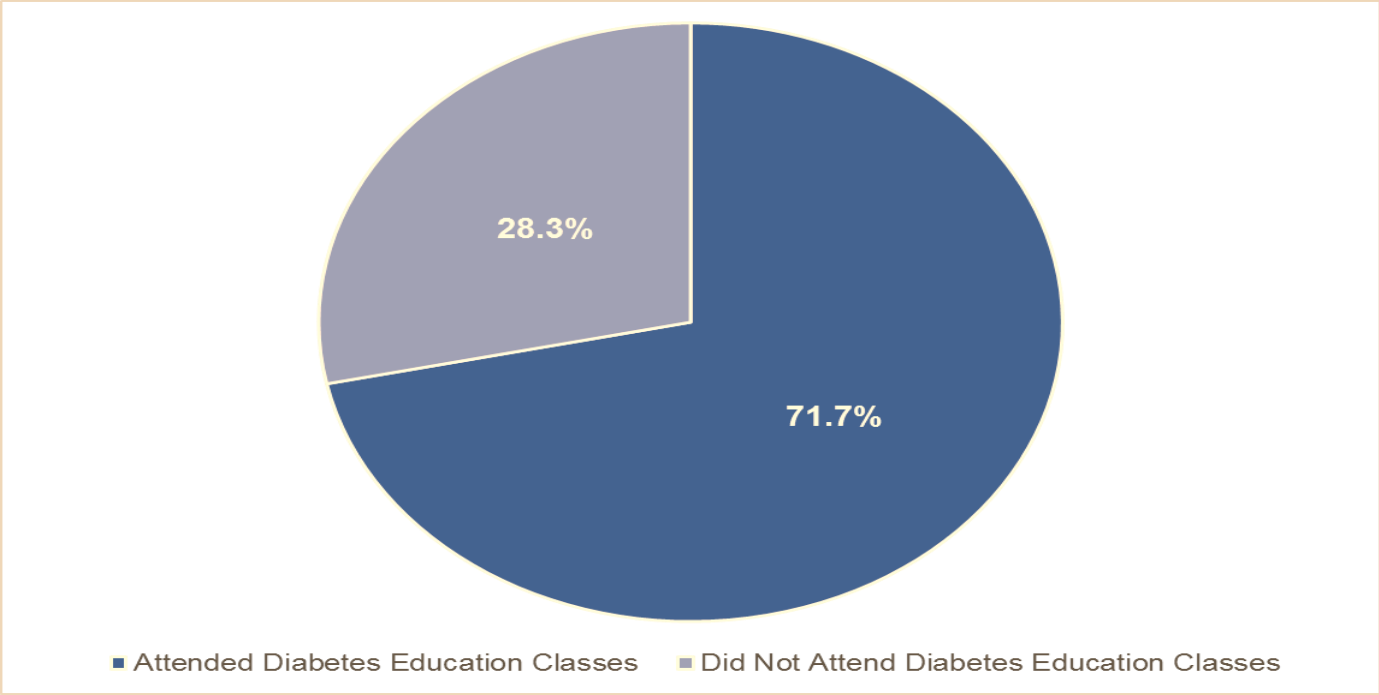
Notably, 54% of those diagnosed with diabetes reported they also have an immediate family member with a diabetes diagnosis, in comparison to 39% of the overall population.

8. Diagnosed with Immediate Family Member with Diabetes



Approximately 72% of those diagnosed with diabetes reported having received diabetes education. Education was specified as "attended a series of classes or series of meetings with a diabetes educator." This compares favorably to the Center for Disease Control reported state-wide data (2015) which found 60% of those diagnosed with diabetes had attended a self-management class[5]. Further analysis highlights the positive impact of education on preventative care awareness and compliance, as highlighted on Page 17.

9. Diabetes Education Status



Additional presentation of results by diabetes status can be found throughout the report in content specific areas, including Prevalence of Risk Factors for Diabetes (Pg. 18) and General Population Knowledge of Diabetes (Pg. 22).

[5] CDC Diabetes Report Card, 2017

Preventive Care/Awareness of Care Recommendations among Those with Diabetes

ADA guidelines affirm the benefit of a wide range of medical, psychosocial and educational services for people with diabetes. Official ADA treatment plan recommendations include ten "core" preventive care services. The following should be monitored regularly: hemoglobin A1c (every 3-6 months), blood pressure (every visit), cholesterol (annually), nephropathy (annually), weight (every visit), foot exam (annually), neuropathy (annually), thyroid stimulating hormone (annually), retinal (dilated) eye exam (annually), and immunizations (annually). Because state and federal population level data is available on A1c monitoring, as well as foot and eye exams, these three services, sometimes considered the "primary" preventive care services, were chosen for focus in the current research.

For each of the three services, respondents were asked 1) if they had received the service in the past 12 months; 2) if they were aware they needed that service; and 3) if they had not received the service, what were the main reasons why not. Analysis by individual service type revealed high rates of awareness (81% - 90%), with the recommendation for at least two A1c tests per year recognized least often; 74% of respondents reported awareness of the recommendation for all three preventative services annually.

Analysis by individual service type revealed fairly high rates of service receipt (74% - 82%), with the recommended eye exam at lowest compliance and the A1c presenting the highest. The slight majority, at 51%, reported receipt of all three services, as compared to 44% at the state level.[6] Though a comparatively positive result, it does suggest a substantial number of regional diabetics are not receiving the comprehensive care recommended by the ADA.

10. Preventive Care Behavior

	n	%	95% CI
At Least Two A1C Tests	126	81.9	(75.3, 88.5)
Dilated Eye Examination	144	73.8	(65.7, 81.9)
Foot Examination	160	81.2	(74.1, 88.4)
All Three Preventive Services	86	50.8	(40.8, 60.8)

PWD – Persons with Diabetes

11. Preventative Care Awareness

	n	%	95% CI
At Least Two A1C Tests	146	80.5	(75.0, 86.1)
Dilated Eye Examination	168	90.0	(85.3, 94.6)
Foot Examination	165	87.8	(82.6, 92.9)
All Three Preventive Services	129	74.4	(67.6, 81.1)

PWD – Persons with Diabetes ADA - American Diabetes Association

As highlighted in Table 12, below, diabetes education notably interacts with both receipt of service and awareness of recommendation on one each of the three services assessed. Specifically, respondents reporting they had received diabetes education reported engaging in the recommended dilated eye exams and/or were aware of the ADA recommendation with regard to foot exams, at a higher rate than those who had not received education. Although findings are statistically significant for care awareness regarding foot exams only, and must be interpreted with caution due to small sample size, for practical purposes, education is shown to have a positive effect.

[6] MiBRFSS - Michigan Behavioral Risk Factor Surveillance System (2011-2013 combined)

12. Preventative Care and Awareness by Diabetes Status

Preventive Care	Diabetes Education			No Diabetes Education			
	n	%	95% CI	n	%	95% CI	p-value
At Least Two A1C Tests	98	83.1	(75.6, 90.5)	-	-	-	N/A
Dilated Eye Examination	109	78.2	(69.9, 86.6)	34	62.1	(44.7, 79.6)	0.067
Foot Examination	124	87.2	(80.4, 94.1)	-	-	-	N/A
All Three Preventive Services	72	60.9	(50.4, 71.4)	-	-	-	N/A
PWD – Persons with Diabetes							
- This estimate was suppressed due to it having a denominator of less than 50 and/or a relative standard error of greater than 50%							
N/A – Not Applicable							
Prevalence Estimates of ADA Recommendations by Diabetes Education Status, Unweighted Sample Counts and Weighted Percentage Estimates, Adult PWD (18 yrs and older), 14 Northern Michigan Counties, 2017							
Preventive Care Awareness	**Diabetes Education**			**No Diabetes Education**			
	n	%	95% CI	n	%	95% CI	p-value
At Least Two A1C Tests	108	82.3	(76.1, 88.5)	-	-	-	N/A
Dilated Eye Examination	126	91.4	(86.5, 96.3)	-	-	-	N/A
Foot Examination	125	91.4	(86.5, 96.3)	38†	78.3†	(65.3, 91.3)†	0.024†
All Three Preventive Services	97	76.5	(69.0, 83.9)	-	-	-	N/A
ADA - American Diabetes Association							
† This estimate should be used with caution due to its low reliability and precision.							
-This estimate was suppressed due to it having a denominator of less than 50 and/or a relative standard error of greater than 50%							
N/A – Not Applicable							

Prevalence of Risk Factors for Diabetes

The most significant risk factors for diabetes are age, weight – along with unhealthy eating and sedentary lifestyle - and family history. Table 13 provides unweighted counts of survey respondent risk factors and behaviors, along with weighted percentage estimates, for the survey population as a whole.

13. Factor/Behavior or Condition	n	%	95% CI
Smoking	199	23.0	(19.5, 26.6)
Not Physically Active	161	14.1	(11.5, 16.7)
High Blood Pressure	392	34.1	(30.3, 37.9)
Cholesterol	365	29.5	(26.1, 32.9)
BMI Classification			
Underweight	69	6.7	(4.6, 8.8)
Normal Weight	284	29.2	(25.4, 33.0)
Overweight	308	30.1	(26.4, 33.8)
Obese	339	34.1	(30.2, 37.9)
Overweight and Obesity Combined	647	68.7	(64.7, 72.7)

Survey results find that approximately 14% of respondents overall reported they are not physically active, 34% reported having ever been told they have high blood pressure, and 30% are overweight, with overweight and obese factors combined representing 69% of the population.

People with diabetes present especially high rates of these risk factors, further jeopardizing their general health, and creating increased risk for cardiovascular disease in particular. Table 14 highlights these conditions by diabetes status, confirming increased rates of obesity, high cholesterol, and high blood pressure, in addition to higher rates of physical inactivity.

14. Risk Factor/Behavior and Chronic Conditions by Diabetes Status

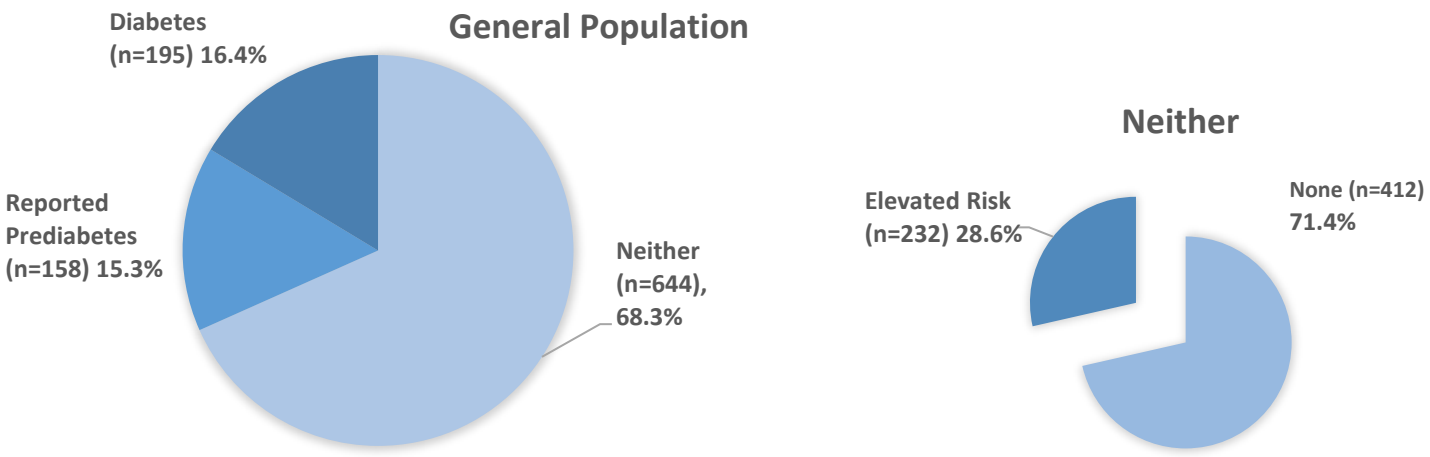
	Diabetes		Prediabetes		Neither	
Factor/Behavior or Condition	**%**	**95% CI**	**%**	**95% CI**	**%**	**95% CI**
Smoking	16.2	(9.5, 22.9)	37.9	(28.0, 47.7)	21.3	(17.0, 25.7)
Not Physically Active	22.2	(15.4, 29.1)	16.9	(9.9, 23.9)	11.6	(8.6, 14.5)
High Blood Pressure	68.0	(59.7, 76.4)	37.9	(28.6, 47.2)	25.1	(20.8, 29.5)
Cholesterol	57.2	(48.0, 66.5)	35.8	(26.7, 44.8)	21.5	(17.7, 25.3)
BMI Classification						
Underweight	7.6†	(2.7, 12.4)†	3.6†	(0.1, 7.0)†	7.1	(4.4, 9.8)
Normal Weight	11.2	(6.6, 15.9)	19.0	(10.7, 27.3)	35.8	(30.8, 40.8)
Overweight	27.9	(19.6, 36.1)	29.2	(20.4, 38.0)	30.8	(26.1, 35.5)
Obese	53.4	(44.3, 62.5)	48.2	(38.4, 58.0)	26.3	(21.8, 30.7)
Overweight and Obesity Combined	87.9	(82.8, 92.9)	80.3	(71.7, 88.9)	61.5	(56.2, 66.7)

Prediabetes = at some point a health professional told respondent they had prediabetes, impaired fasting glucose or glucose tolerance, borderline, high blood sugar, or were at high risk of diabetes. Excludes those who were ever told they had diabetes; Neither = those who neither reported ever being told they had diabetes or prediabetes.

†Estimate should be used with caution due to its low reliability and precision.

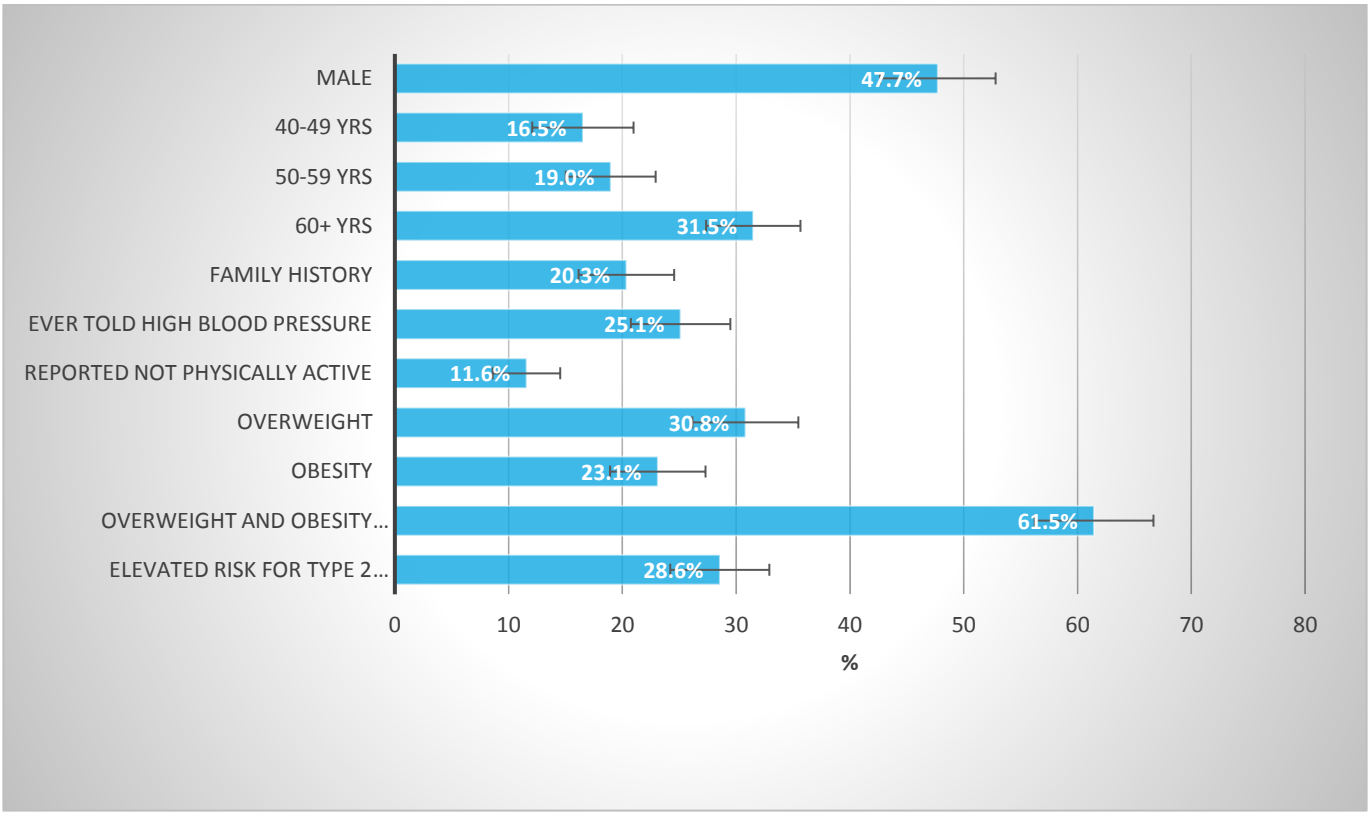
To estimate the percentage of persons not diagnosed with diabetes or "not yet diagnosed" people in the 14-county adult population who are at increased risk for diabetes, the current survey incorporated questions from the American Diabetes Association (ADA) Risk Test. Based upon the captured ADA defined risk factors - At Risk respondents were identified as those with an ADA score of 5 or more - approximately 29% of undiagnosed (diabetes or prediabetes) survey respondents are at risk of developing type 2 diabetes.

15. Elevated Risk for Type 2 Diabetes



The prevalence of reported risk factors is presented in the chart below for respondents who had neither a diabetes nor prediabetes diagnosis. Key risk factors, including family history, age (50+ years), and weight (overweight/obesity combined), present at 20%, 51%, and 62%, respectively. The combined prevalence rate of adults diagnosed with prediabetes or diabetes, along with those at risk but not diagnosed (29%), constitutes over half of the adult population, pointing to the need for ongoing attention and education.

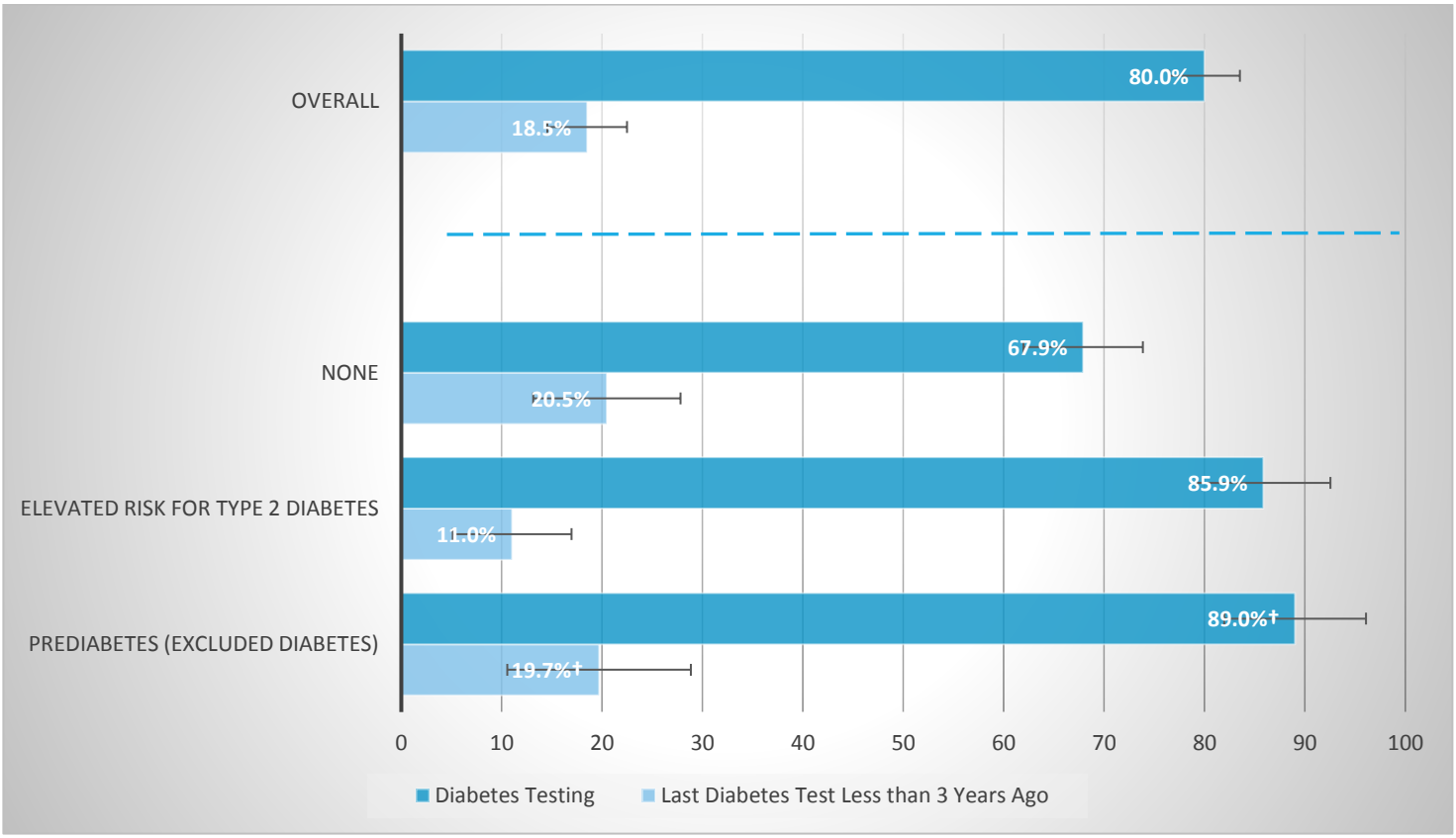
16. Elevated Risk for Type 2 Diabetes and Select Risk Factor Prevalence*



*Results exclude adults reporting prediabetes or diabetes, n=646 *Elevated risk for type 2 diabetes = score of five or more on ADA Risk Test. Overweight - 25 kg/m2 ≤ BMI < 25 kg/m2; Obesity - BMI ≥ 30 kg/m2; Overweight and Obesity Combined - BMI ≥ 25 kg/m2;

Incorporation of ADA Risk Test questions also allowed for comparison of screening prevalence by diabetes status. The following chart highlights testing behaviors of the diabetes and prediabetes populations, as well as those presenting as at high risk of developing type 2 diabetes. Results indicate that while 19% of the diabetes diagnosed, 20% of the prediabetes diagnosed, and 20% of those with neither diagnosis, report having tested for diabetes or high blood sugar in the last three years, only 11% of those specifically at high risk of developing type 2 diabetes report the same.

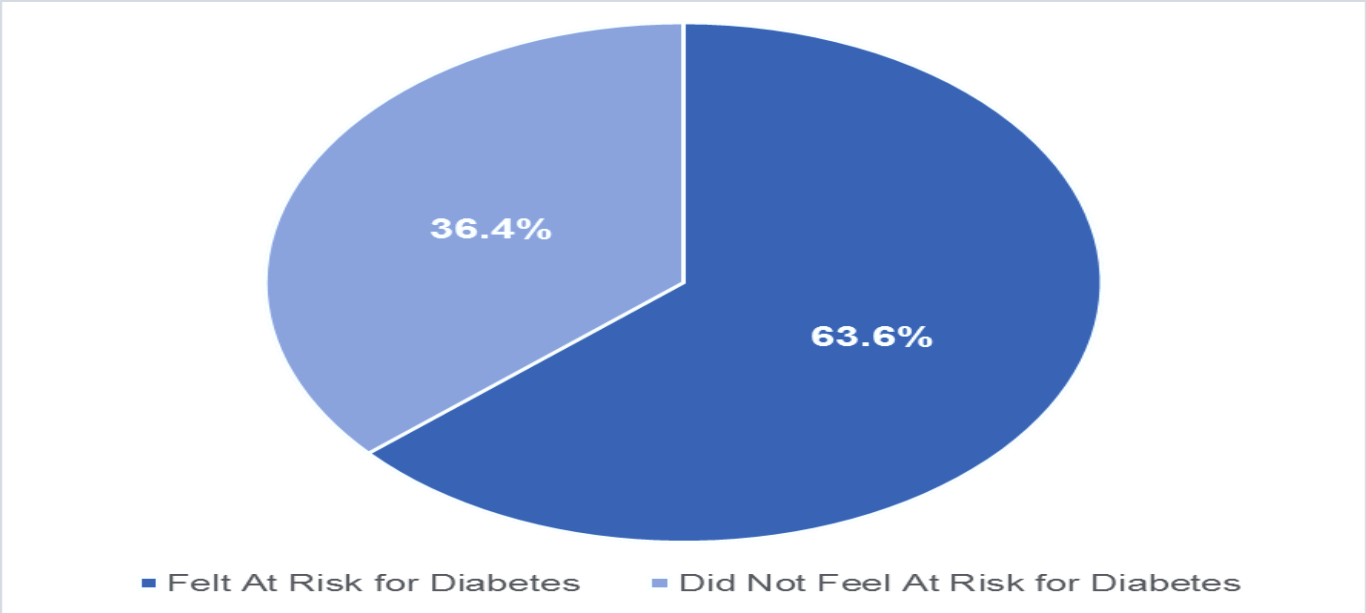
17. Diabetes Screening* Prevalence Estimates by Prediabetes Status



*Diabetes Screening = those ever tested/last Diabetes Test less than 3 years ago; Overall includes ever told diabetes population; None = those who reported never being told that they had diabetes, prediabetes, or scored less than five on the ADA Risk Test; Prediabetes (Excluded Diabetes) = those who reported ever being told they had prediabetes or other five terms excluding those who ever being told that they had diabetes; Elevated Risk of type 2 diabetes meant those with an ADA Risk Test score of five or higher; †Estimate should be used with caution due to its low reliability and precision.

When considering those with a prediabetes diagnosis, additional questioning allowed for exploration of awareness and attitudes about risk. The following chart highlights perception of risk, with 64% indicating feeling they could be at risk for diabetes, and 36% indicating they do not feel at risk.

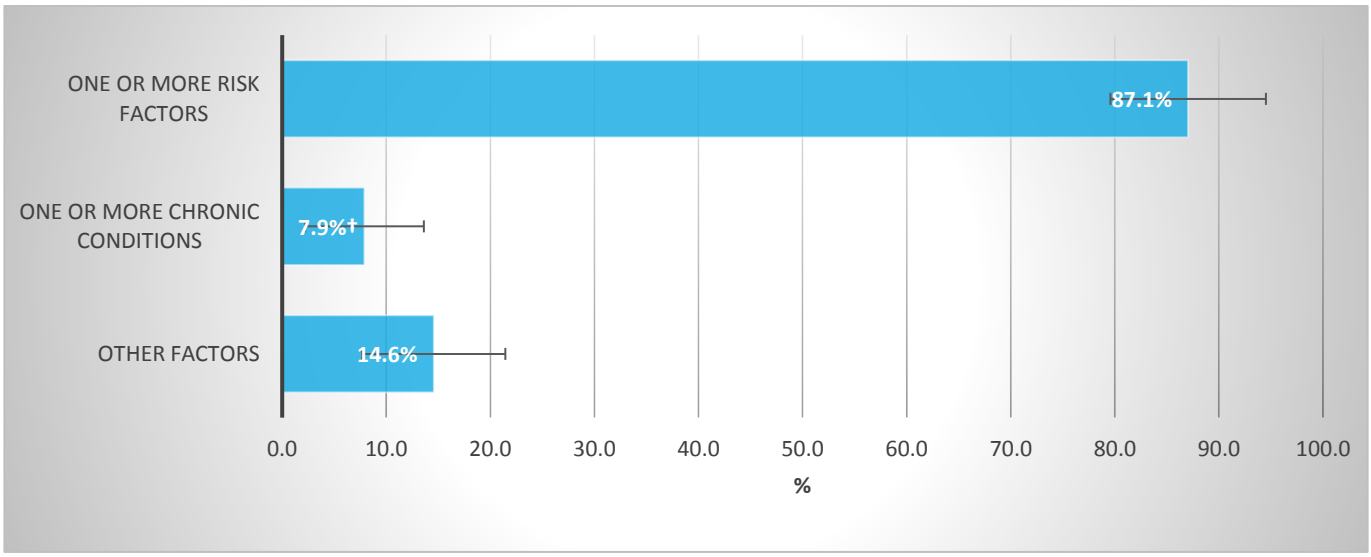
18. Those Who Feel At Risk of Diabetes among Those Reporting Prediabetes



*Excludes those who report being told they ever had diabetes; Prediabetes = at some point a health professional told respondent they had prediabetes, impaired fasting glucose or glucose tolerance, borderline, high blood sugar, or were at high risk of diabetes.

Those with a prediabetes diagnosis indicating they do in fact feel at risk for diabetes were asked to indicate why. A significant percentage (87%) identified one or more established risk factors, including family history, excessive weight, age, poor eating habits, and race, as reasons. Addtionally,8% cited one or more chronic conditions, including high blood pressure, high blood sugar, high cholesterol, and/or hypoglycemia (low blood sugar), and 15% cited other factors, encompassing experienced symptoms, diabetes risk test results and doctor warning.

19. Reasons Felt At Risk for Diabetes Among Those Reporting Prediabetes



Risk Factors included family history, weight, age, poor eating habits, and race; Chronic Conditions included high blood pressure, high blood sugar, high cholesterol, hypoglycemic (low blood sugar); †This estimate should be used with caution due to its low reliability and precision.

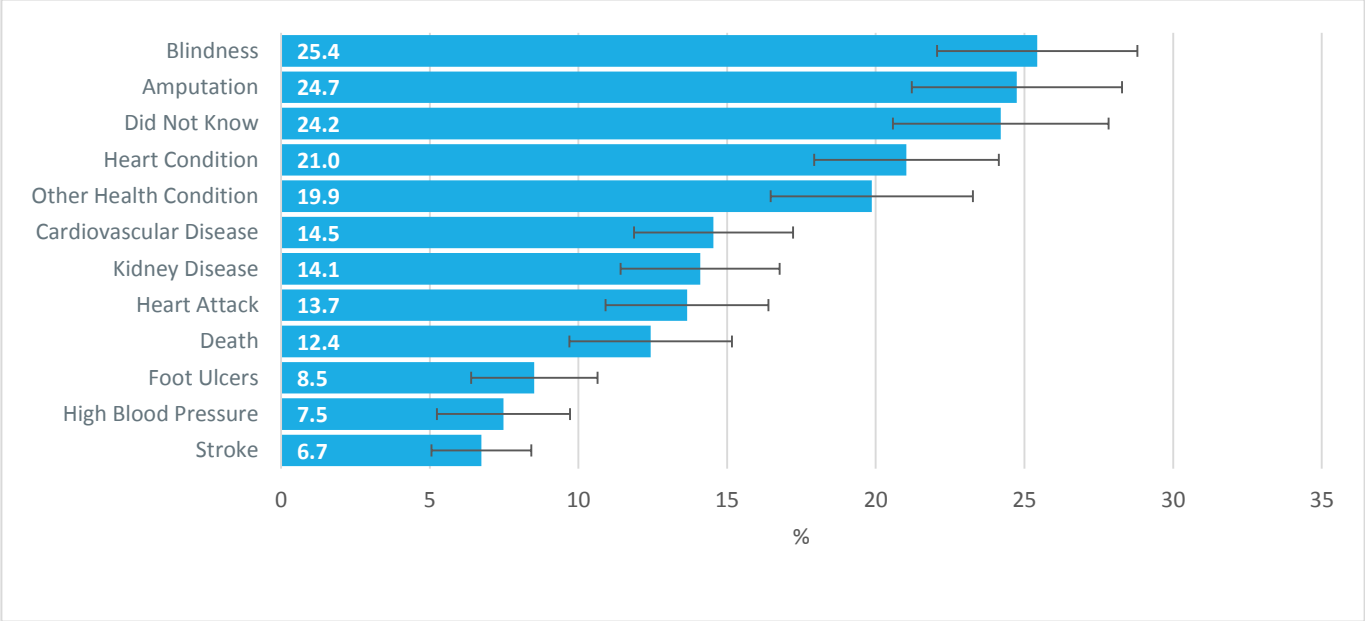
General Population Knowledge of Diabetes

This research also sought to explore the general adult population's knowledge of diabetes in order to identify public education needs. Questions addressed knowledge of resulting health problems, management strategies, perceived seriousness, awareness of key facts, as well as possible causes, complications and possible treatments.

General Population Knowledge of Diabetes: Health Problems and Management Strategies

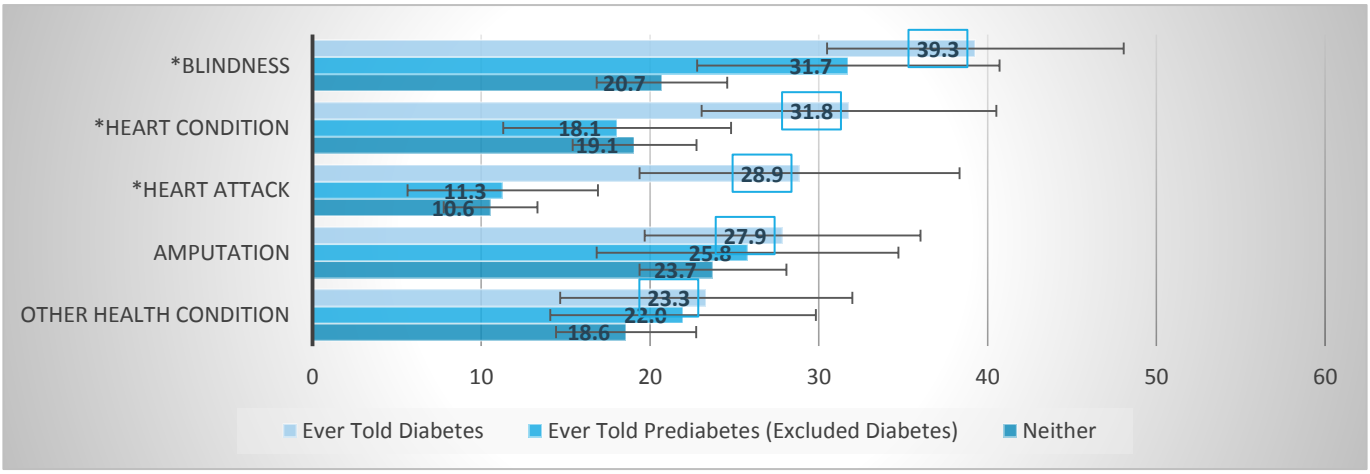
The first question asked respondents, "To the best of your knowledge, what are the most serious health problems caused by diabetes?" This open-ended question was designed to identify health problems which are foremost in the public's mind.

20. Naming Serious Health Problems Caused by Diabetes



In this unprompted format, approximately one-quarter of respondents identified Blindness and/or Amputation as the most serious health problem/s caused by diabetes, while 24% indicated they did not know. To a lesser degree, respondents identified Heart Condition/Cardiovascular Disease, with only 7% citing Stroke. Further analysis highlights significant variation in cited problems by diabetes status, as outlined below.

21. Top 5 Serious Diabetes-Caused Health Problems Named by Diabetes Status

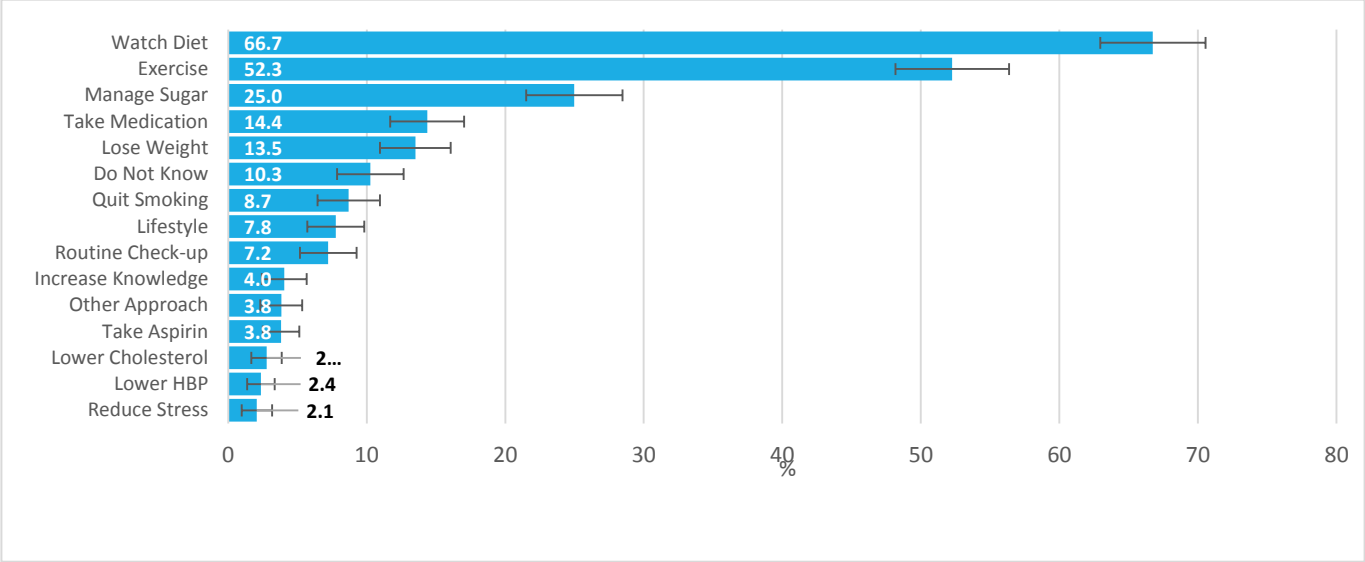


*p < 0.05

When considering results by diabetes status, respondents who had been told they had diabetes were statistically more likely to indicate Blindness (as compared to Neither), Heart Condition (as compared to Prediabetes and Neither), and Heart Attack (as compared to Prediabetes and Neither) as a serious health problem, while those that had ever been told they had prediabetes were significantly more likely to cite Blindness (as compared to Neither).

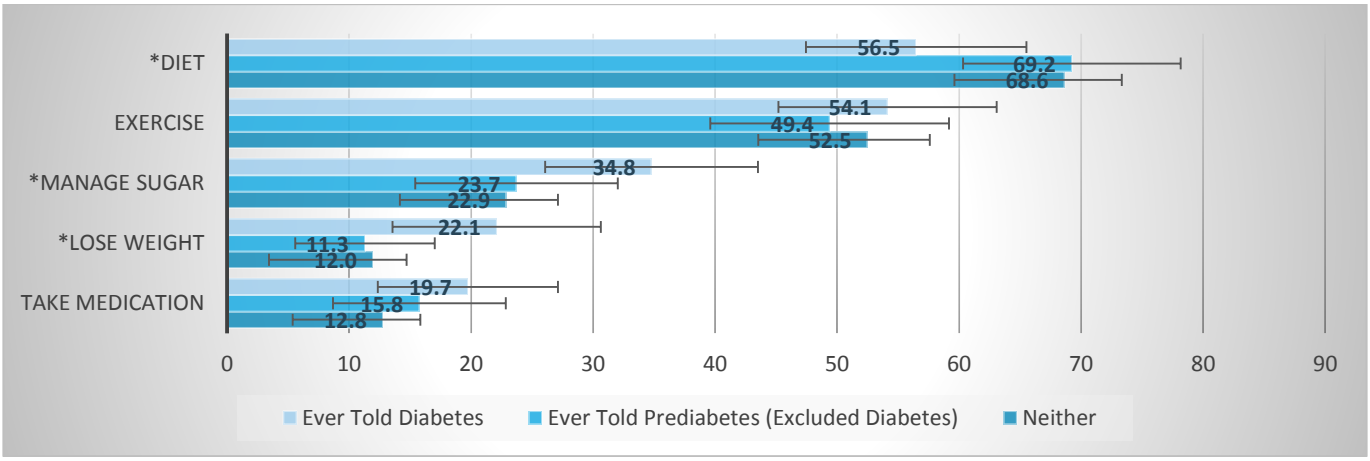
Next, respondents were asked to identify strategies a person with diabetes could employ to reduce the chance of having a heart attack or stroke, again using an unprompted, open-ended format to assess those strategies which are foremost in the public's mind. While a notable percentage of respondents reported a healthier or better diet (67%) and exercise (52%) as important, results suggest lower awareness and recognition of other key diabetes management strategies, including losing weight (14%), taking medication (14%), and lowering cholesterol (3%), though there was a slightly higher recognition of blood sugar control (25%) as an important strategy.

22. Strategies Named by General Population to Reduce Chance of Heart Attack or Stroke



Again, when considering results by diabetes status, respondents who had been told they had diabetes were statistically more likely to cite Diet (as compared to Neither), Manage Sugar (as compared to Neither), and Lose Weight (as compared to Ever Told Prediabetes and Neither) as important things a person with diabetes can do to reduce the chance of having a heart attack or stroke.

23. Top 5 Strategies Named to Reduce Chance of Heart Attack or Stroke by Diabetes Status



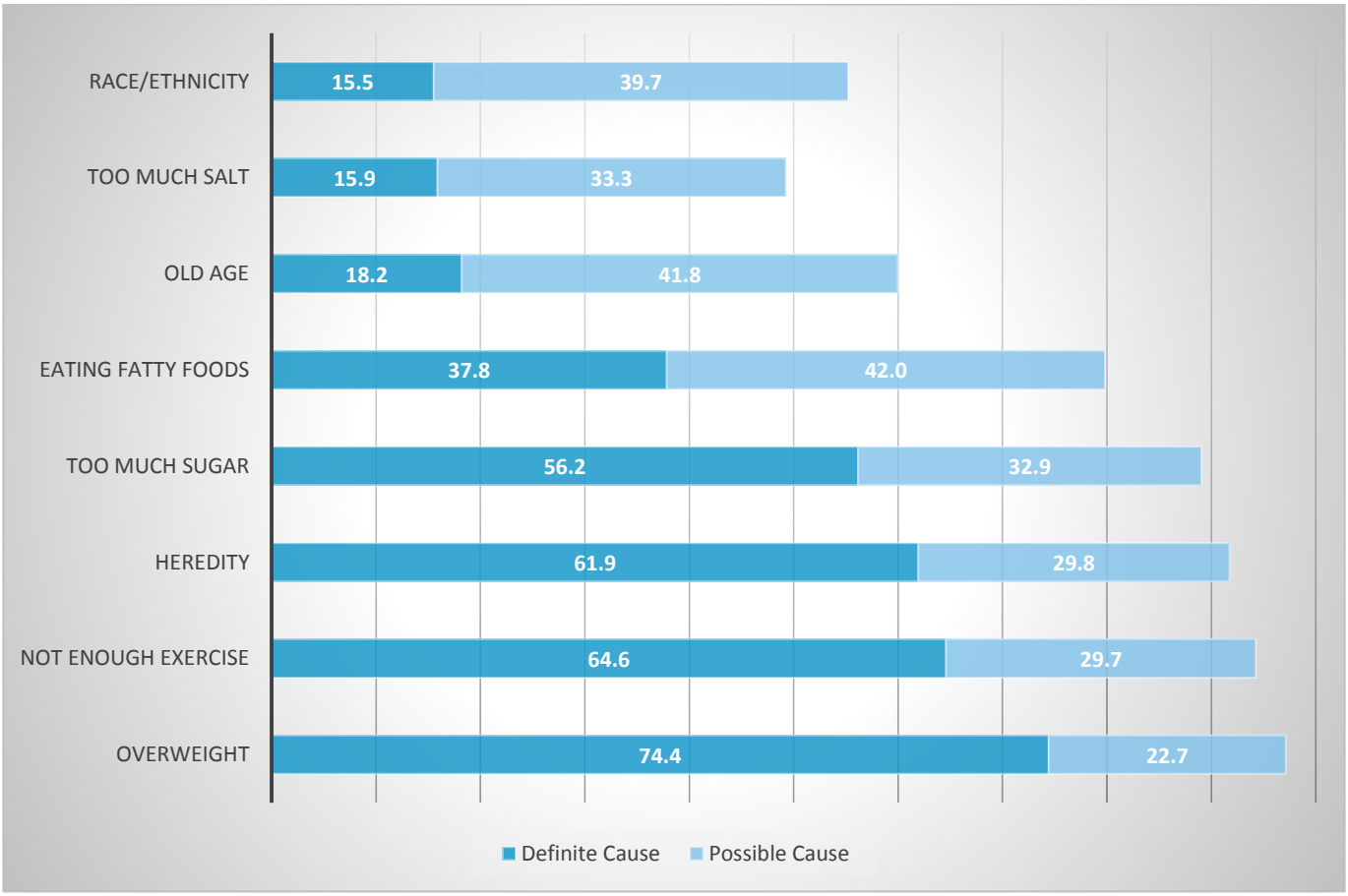
*p < 0.05

In addition to this unprompted assessment, respondents were also presented with lists of causes, complications and strategies for evaluation.

First, known causes/risk factors for diabetes, as well as several prevalent myths about dietary causes, were individually presented to respondents, who were then asked whether they felt each was a definite, possible or not a cause of diabetes. There was generally high recognition of all the leading risk factors for diabetes, with the exception of race and age; only 16% and 18%, respectively, identified each as a definite cause.

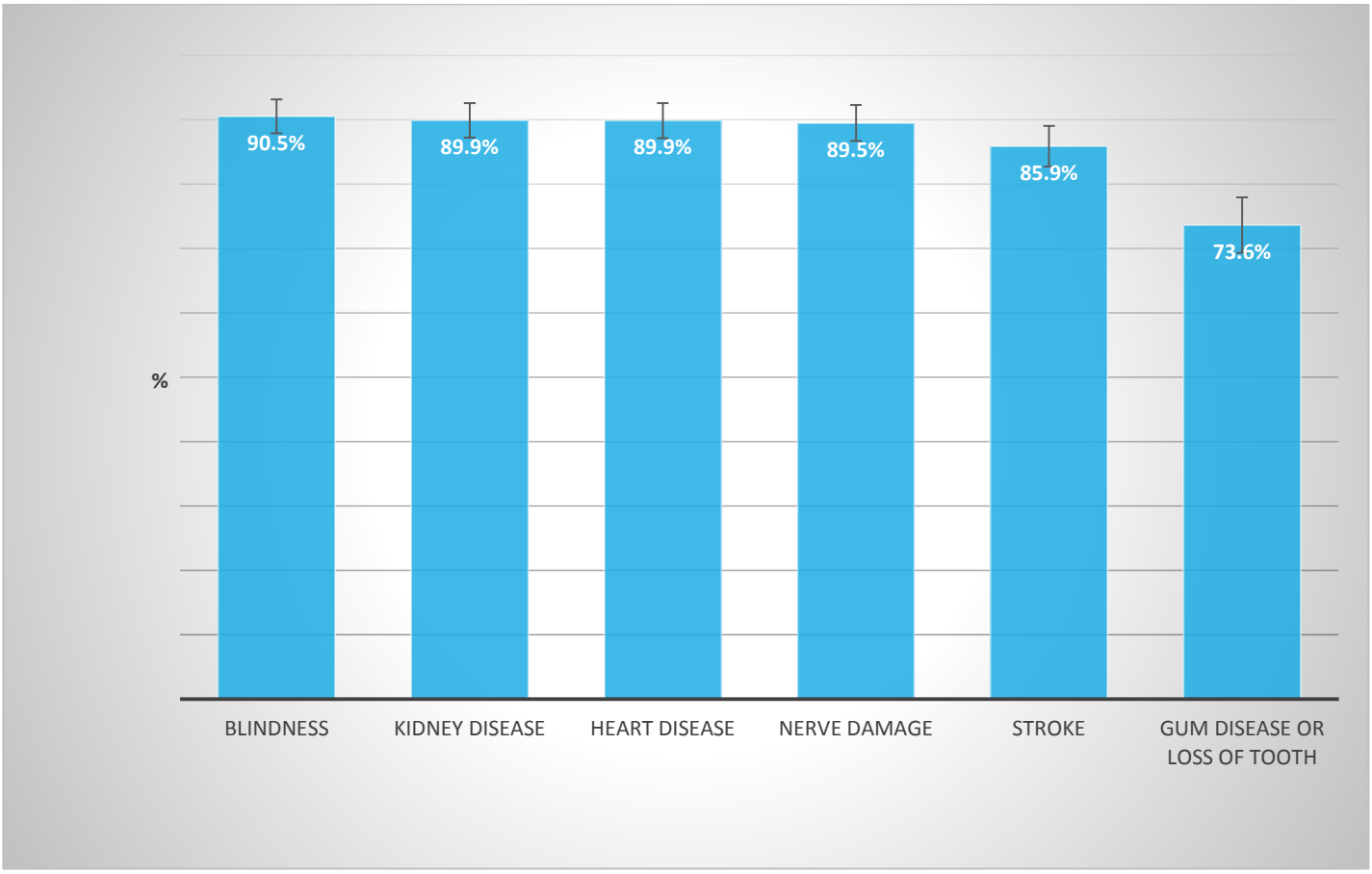
Eating fatty foods and too much sugar were cited as definite or possible causes of diabetes by the majority of respondents, despite the fact that they are not independent causes; while being overweight as a result of taking in too many calories from any source is a true risk factor, high dietary intake of sugar, salt or fat are not independently known to cause diabetes. Results highlight the need for continued public education regarding diabetes causes and risk factors, for the purpose of raising personal risk awareness.

24. Do you feel each is a definite cause of diabetes, a possible cause or not a cause of Adult Diabetes?



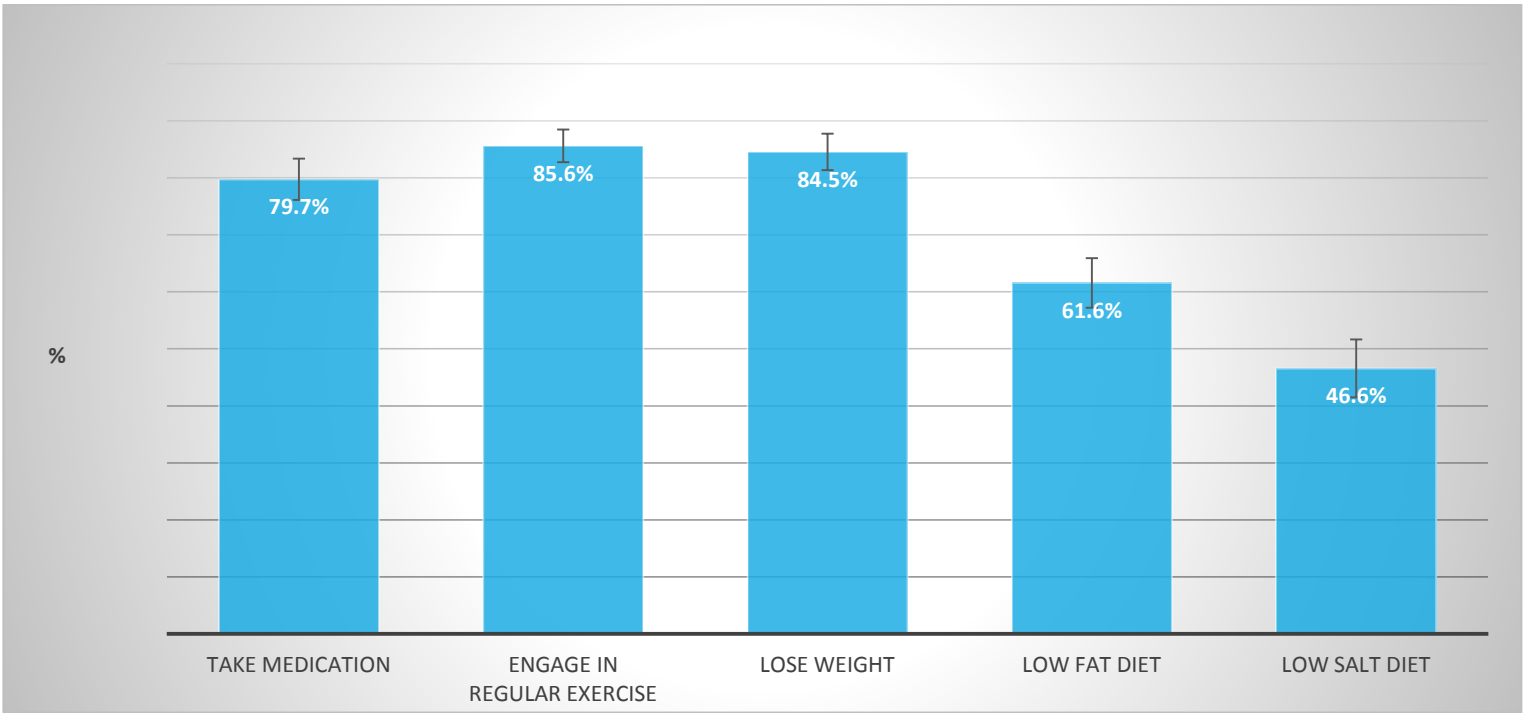
Next, respondents were presented with a list of known potential diabetes complications to assess the degree to which each is recognized as being caused by diabetes. The majority recognized each of the six as a complication, with gum disease/loss of tooth cited least frequently at 74%. Overall, results suggest a high recognition of the most common diabetes illnesses or complications.

25. Illnesses or Complications: Do you think it can be caused by Diabetes? Yes



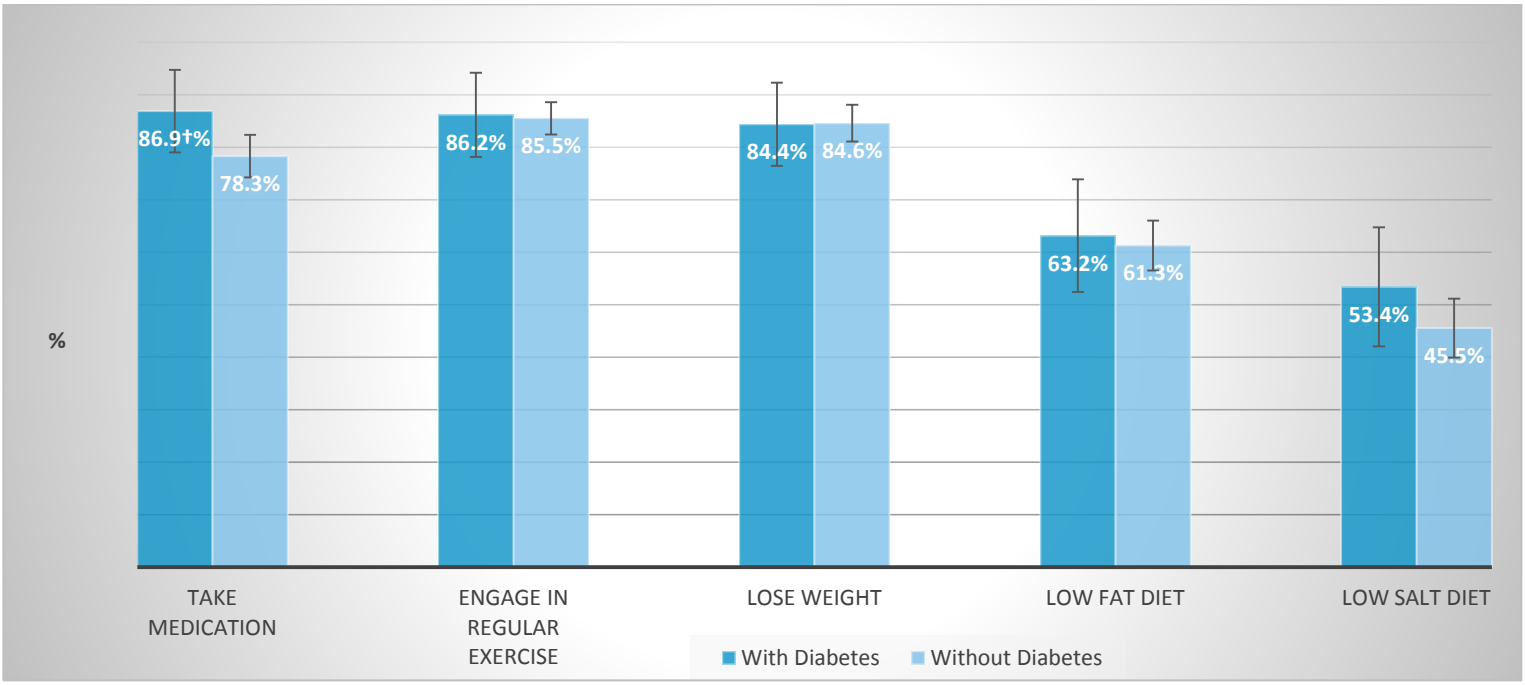
In order to explore awareness of effective treatment for adult diabetes, respondents were read a list of possible strategies for lowering blood sugar. When presented with potential strategies, there was relatively high recognition of effective diabetes management recommendations. Although it is not recognized as an effective strategy to lower blood sugar, 47% of all respondents felt that a low salt diet "would definitely help."

26. General Population Indicating an Identified Strategy "Would Definitely Help" Lower Blood Sugar



Further analysis by diabetes status indicates similar patterns in strategy recognition in respondents both with and without diabetes, with no statistically significant variation.

27. Population With and Without Diabetes - Identified Strategy "Would Definitely Help" Lower Blood Sugar



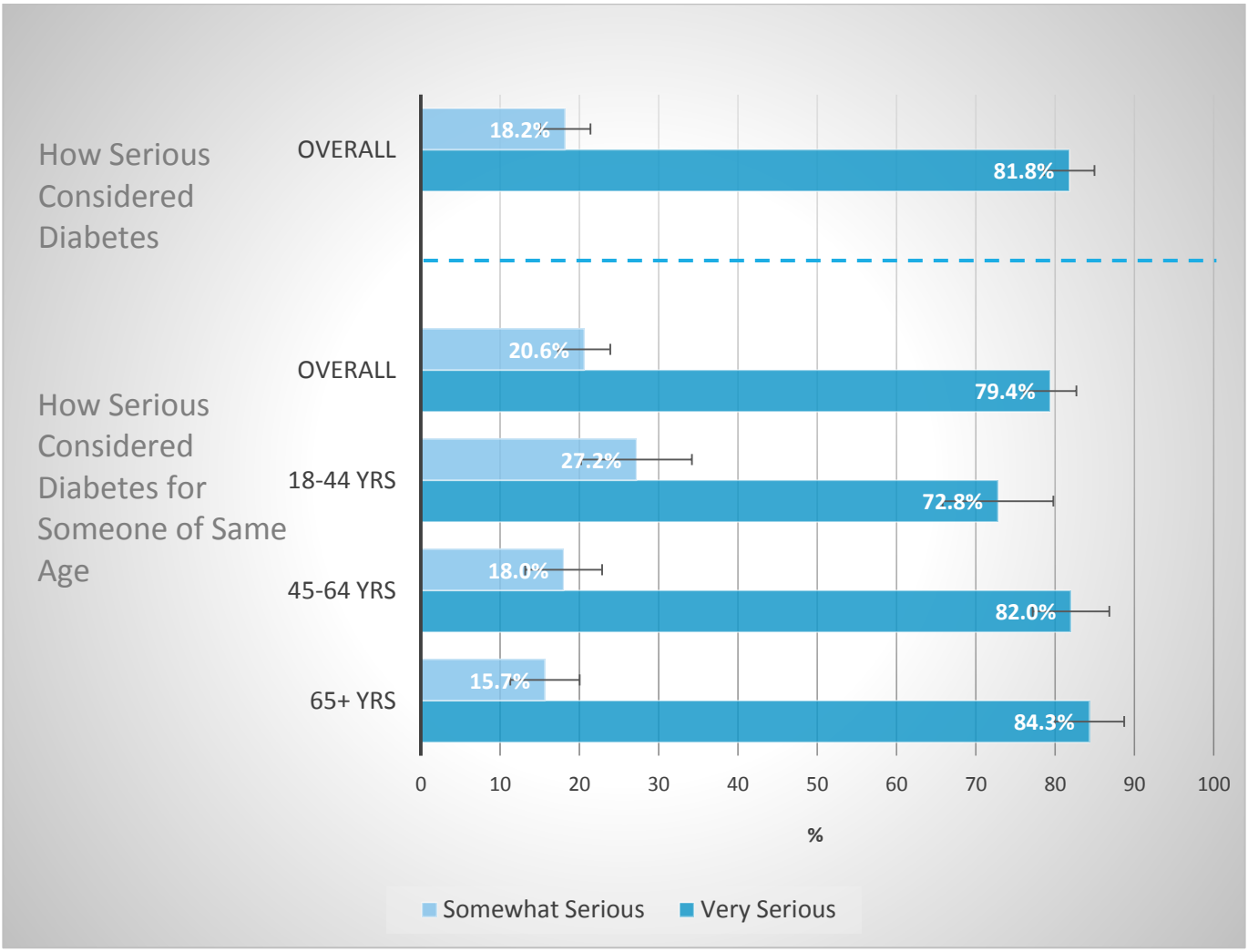
'† This estimate should be used with caution due to its low reliability and precision

General Population Knowledge of Diabetes: Perceptions Regarding Seriousness and Education Resources

When respondents were asked to rate how serious they consider diabetes to be, 100% rated diabetes as either "Very Serious" (82%) or "Somewhat Serious" (18%). A follow-up question asked how serious they thought it would be if someone their own age were to have diabetes. Again, the majority (79%) indicated "Very Serious," with 21% indicating "Somewhat Serious."

However, further analysis of perception by age does distinguish the 18 – 44 year old group; that is, though the majority in each age group assigned a "Very Serious" rating, 18-44 year olds were significantly less likely than both the 45-64 year old and 65 and older groups to assign this rating, and more likely to assign a "Somewhat Serious" rating[7].

28. How serious do you consider diabetes to be:

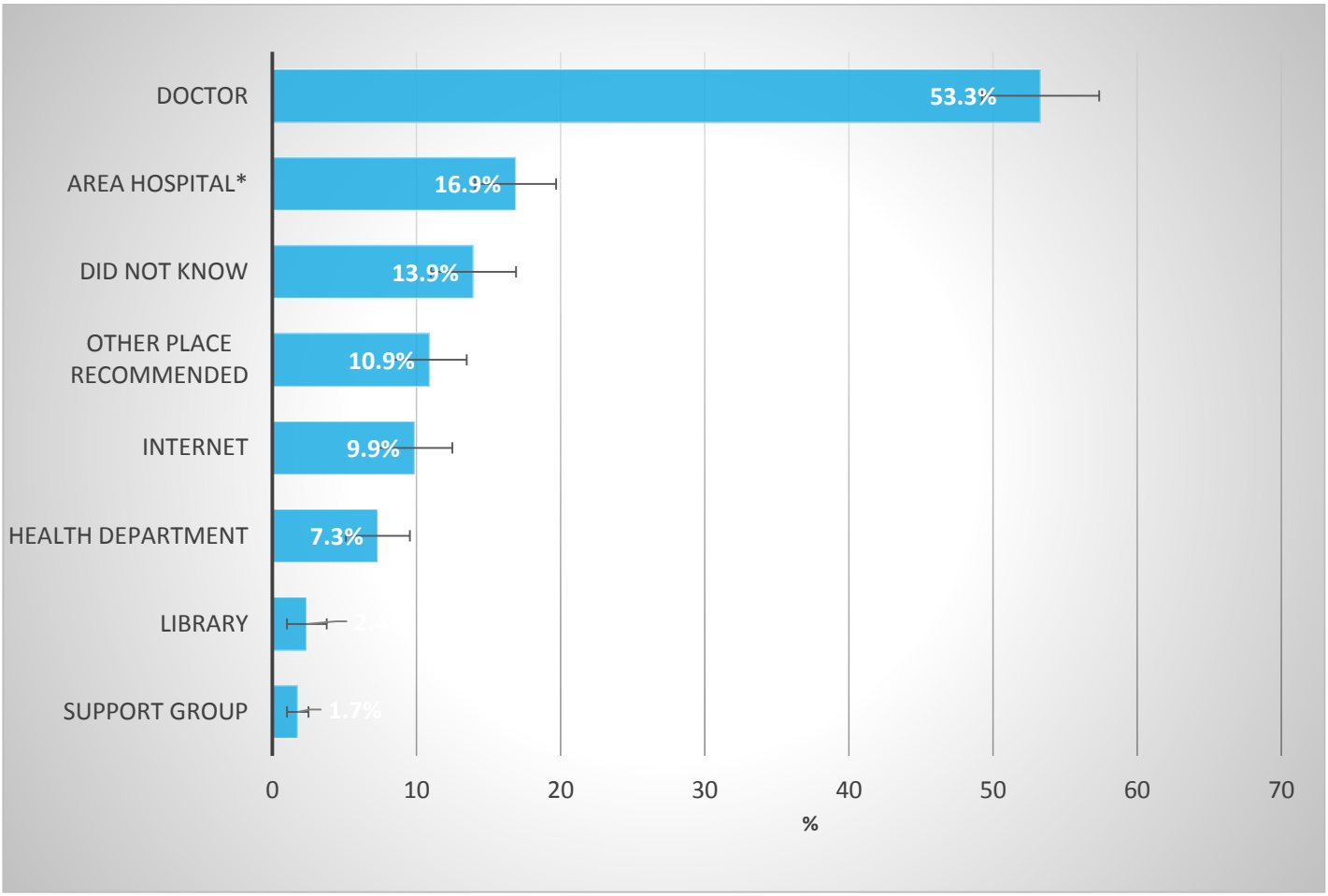


[7] p-value 0.030 p<0.05, statistically significant difference between estimate among 18-44 yrs and 45-64 yrs
p-value 0.005 p<0.05, statistically significant difference between estimate among 18-44 yrs and 65+ yrs
p-value 0.484 p>0.05, no evidence of statistical significant difference between estimate of 45-64 yrs and estimate of 65+ yrs

Diabetes education programs are a key resource for the community. A primary aim of the NMDI is to increase public awareness of resources for people with diabetes in order to engage the community in improved diabetes management. The current survey provides an opportunity to collect data gauging impact and effectiveness on awareness of local diabetes education programs.

For this purpose, an open-ended survey question asked respondents if a friend or family member were newly diagnosed with diabetes, where would they recommend they go for education. Results indicate that doctors come to mind most frequently (53%) as a resource for diabetes education, with an area hospital the second most frequently cited resource (17%); 14% indicated they did not know where they would recommend. These findings underscore the relevance and importance of healthcare providers and systems in efforts to increase diabetes awareness and access to education.

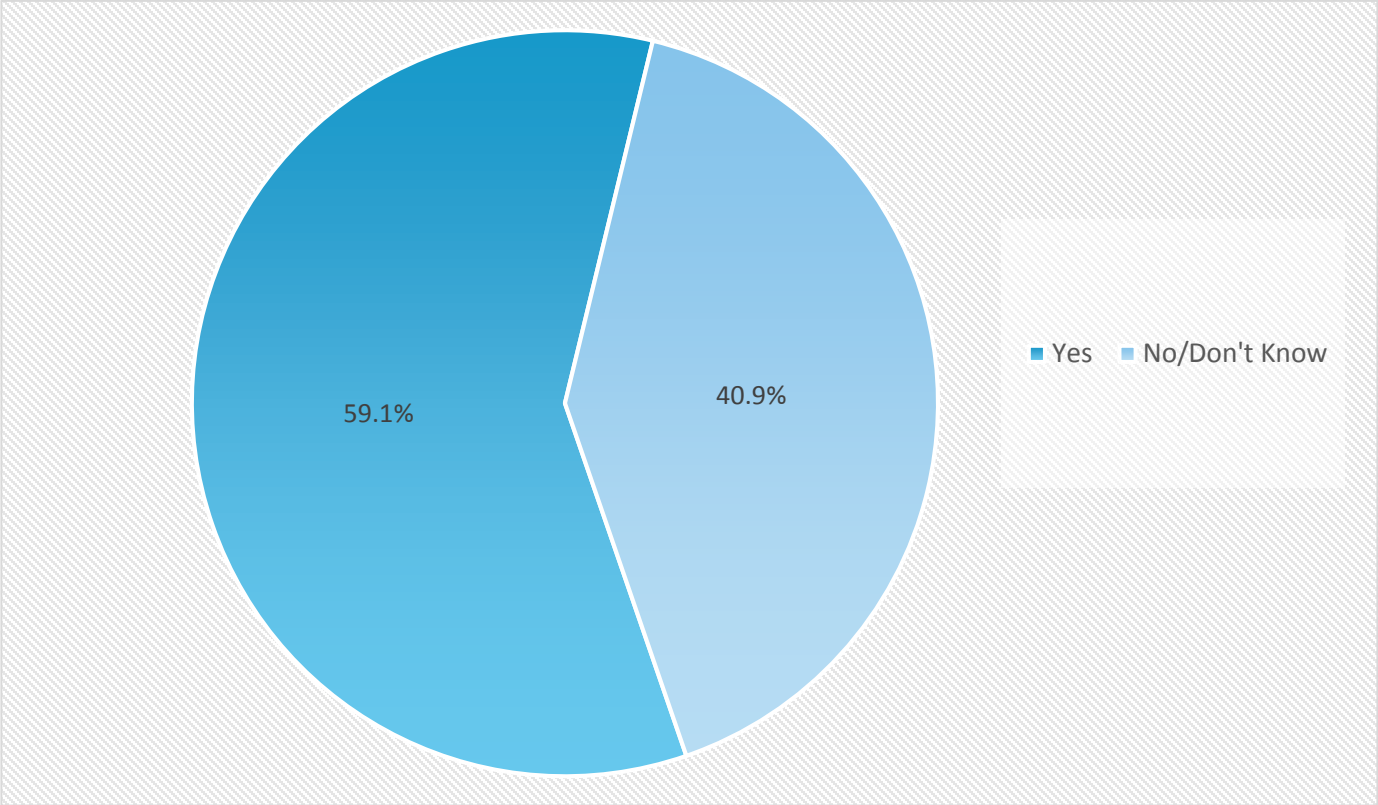
29. Place Recommended for Education to Close Family Member or Friend Recently Diagnosed with Diabetes



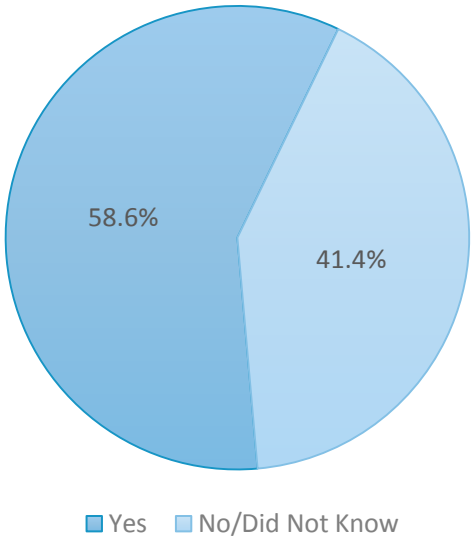
*Area Hospital collapsed to include Munson Medical Center, Paul Oliver Memorial Hospital, Kalkaska Memorial Hospital, Munson Healthcare Cadillac, Munson Healthcare Grayling, Munson Healthcare Manistee, Munson Healthcare Charlevoix, and Otsego Memorial Hospital

A follow-up question asked respondents if their local hospital, specifically, offered diabetes education. Results indicate that the slight majority (59% indicating Yes) have knowledge of local hospital programming, with 41% of respondents reporting No, or that they Do Not Know if their local hospital offers programs. As would be expected, awareness of local hospital programming is notably higher amongst those who have received diabetes education.

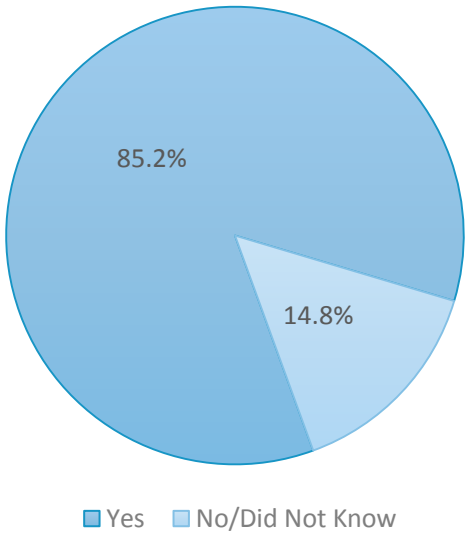
30. Do you know if your local hospital offers Diabetes Education?



31. Those Who Did Not Have Diabetes Education Classes



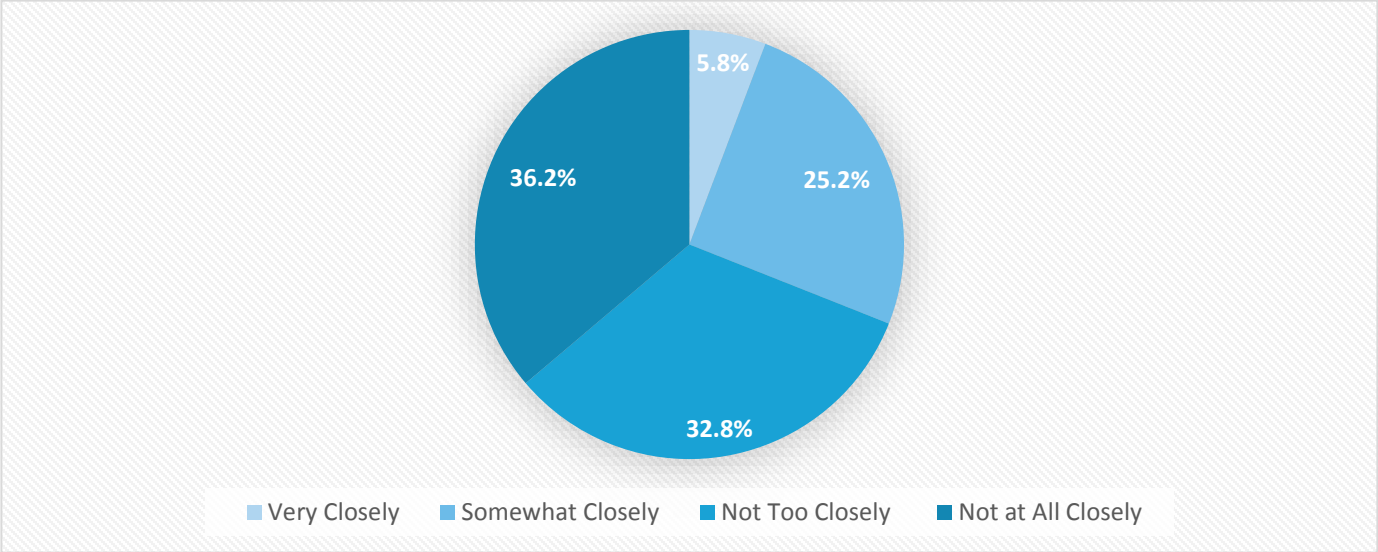
32. Those Who Had Diabetes Education Classes



Interest in Diabetes, Awareness of Key Facts, Sources for Health Information

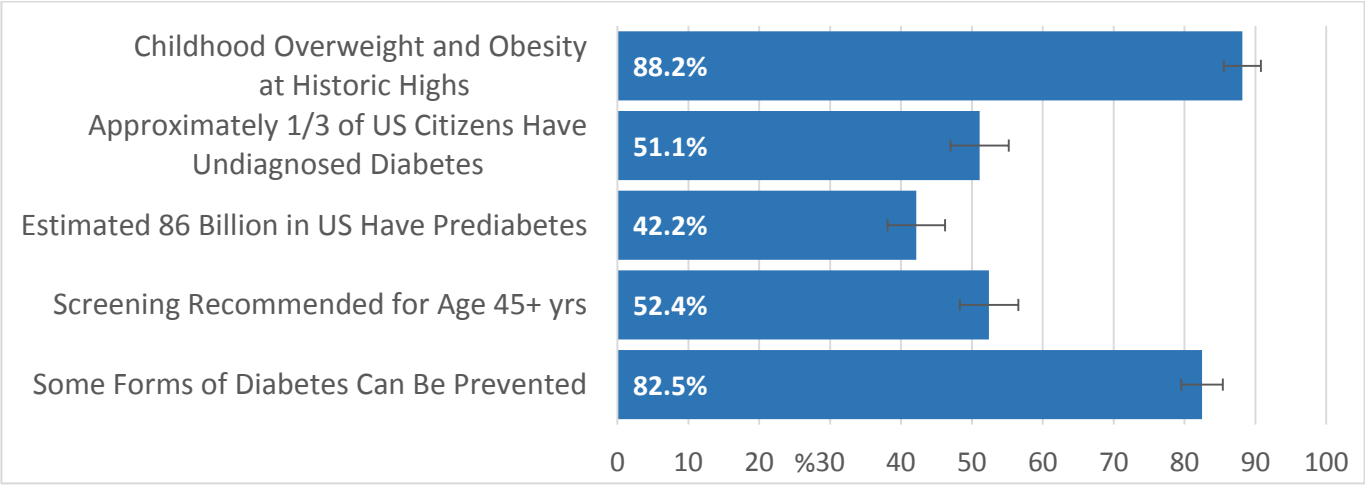
To gauge the general level of interest in the topic of diabetes, all respondents were asked how closely they follow news stories about diabetes. Overall, 31% of respondents reported that they follow news stories about diabetes very closely or somewhat closely (5.8% and 25.2%, respectively). The single largest group of respondents (36.2%) indicated they do not follow stories about diabetes closely at all.

33. How closely do you follow news stories about diabetes?



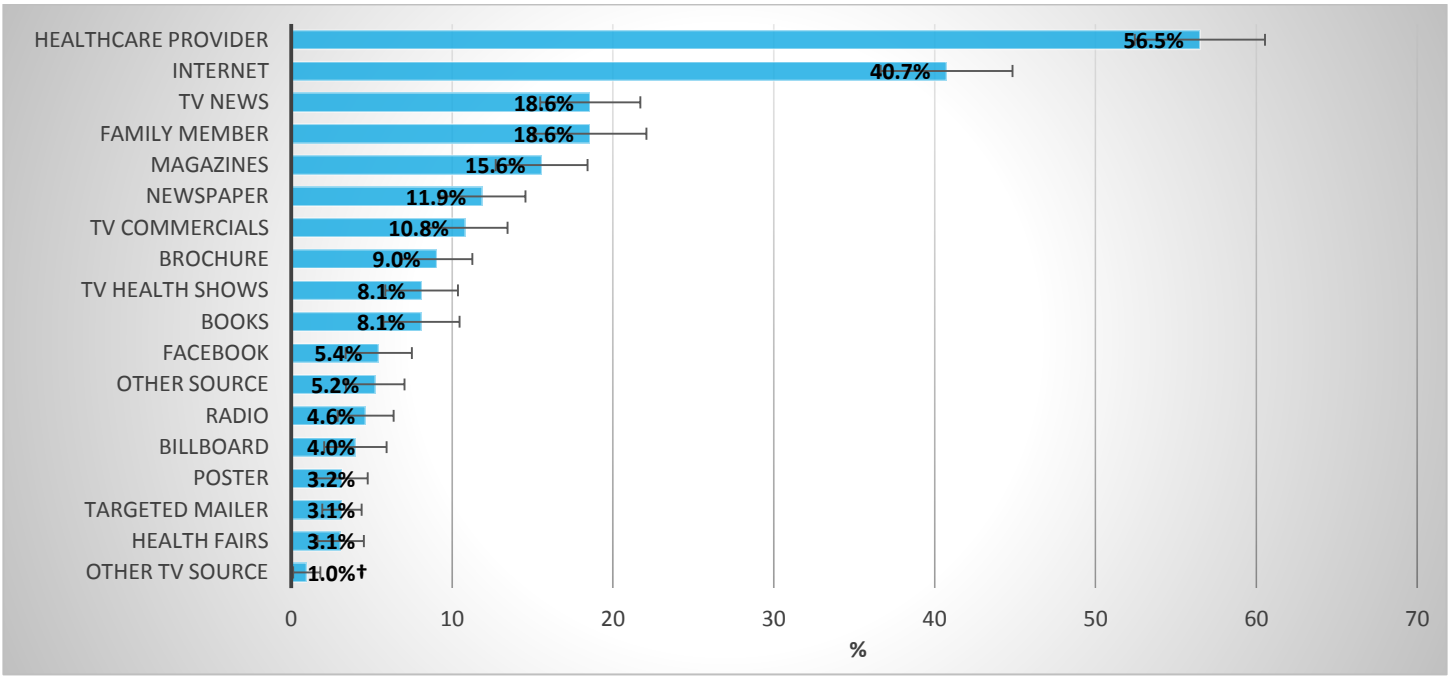
Next, survey respondents were asked if they were aware of several facts that have had wide national, regional, and in some cases local news coverage related to the magnitude of diabetes in the U.S. population. Results indicate high awareness of current historically high rates of childhood overweight/obesity and that some forms of diabetes can be prevented (88% and 83%, respectively). In addition, just over half of respondents indicated they were aware screening is recommended for those age 45 and over and that close to one-third of persons with diabetes in the United States do not know they have it (52% and 51%, respectively). Fewer respondents (42%) reported they were aware 86 million people currently have a condition called prediabetes.

34. Awareness of Current Diabetes Prevalence Facts



To explore potential effectiveness of specific media outlets for communication of diabetes-related information and key facts, respondents were asked where they typically get their information about health; a list of 17 potential sources was presented. Overall, most frequently identified sources for health information included health care provider (57%) and Internet/Facebook (46%), followed by TV News and family member, each at approximately 19%.

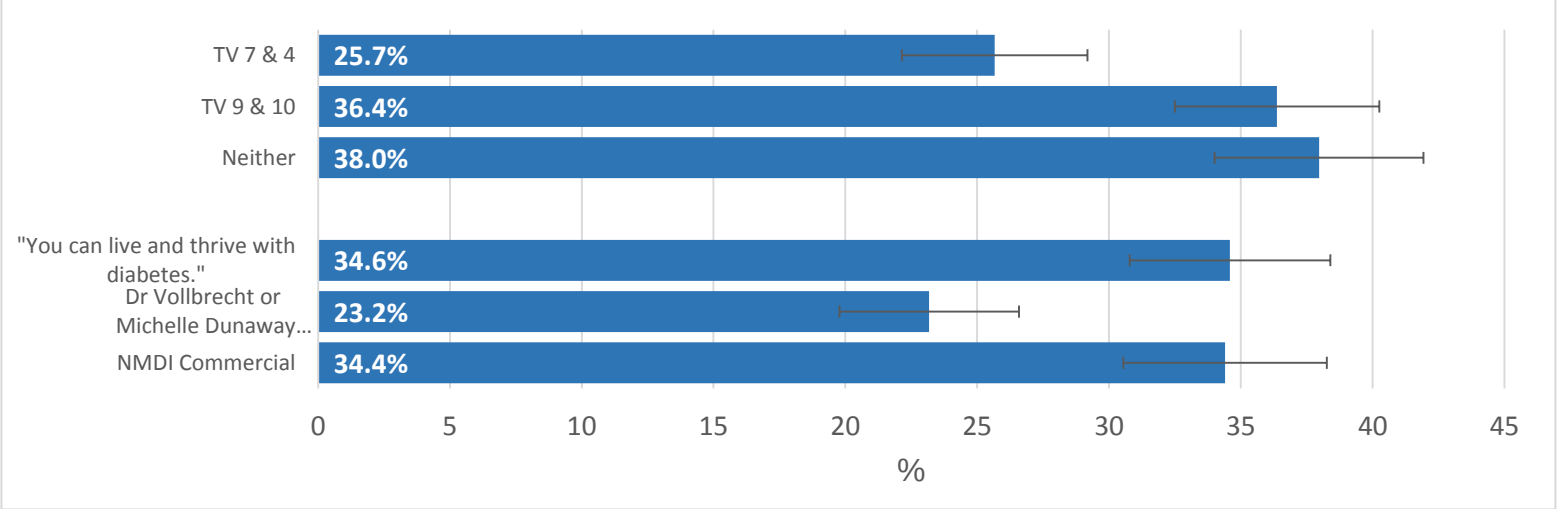
35. In general, where do you typically get your information about health?



'† This estimate should be used with caution due to its low reliability and precision.

In conclusion, to further evaluate television as a source for diabetes-related information, respondents were asked which of two primary television stations they watch, followed by a question series addressing recall of specific informational diabetes commercials.

36. Media and Messaging



Respondents most frequently reported watching TV 9&10, with 36% citing the station, as opposed to 26% citing TV 7&4. Just over one-third of respondents went on to indicate they recalled seeing/hearing “You can live and thrive with diabetes” and/or NMDI commercials; fewer respondents (23%) recalled a commercial with Dr. Vollbrecht and Michelle Dunaway.

V. Appendices

Appendix A 2017 Survey Committee Members

Amanda Woods, MPH - Community Health Coordinator, Munson Medical Center Northern Michigan Diabetes Initiative Coordinator

Cathlyn Sommerfield, Ph.D. - Principal - CS Research & Consulting, LLC

Larry Hembroff - Hembroff Survey Research Consulted (HSRC)

H.C. Michelle Byrd, PhD, MPH, Diabetes and Obesity Epidemiologist

Appendix B Additional Analyses

Appendix Prevalence Estimates of Named Strategies to Reduce Chance of Heart Attack or Stroke, Unweighted Sample Counts and Weighted Percentage Estimates

Preventive Measures	n	%	95% CI
Watch Diet	644	66.7	(62.9, 70.6)
Exercise	513	52.3	(48.2, 56.4)
Manage Sugar	254	25.0	(21.5, 28.5)
Take Medication	156	14.4	(11.7, 17.0)
Lose Weight	163	13.5	(11.0, 16.1)
Do Not Know	110	10.3	(7.9, 12.7)
Quit Smoking	82	8.7	(6.4, 11.0)
Lifestyle	79	7.8	(5.7, 9.8)
Routine Check-up	77	7.2	(5.2, 9.3)
Increase Knowledge	38	4.0	(2.4, 5.7)
Other Preventive Measure	37	3.8	(2.3, 5.3)
Take Aspirin	44	3.8	(2.5, 5.1)
Lower Cholesterol	36	2.8	(1.7, 3.9)
Lower HBP	33	2.4	(1.4, 3.4)
Reduce Stress	21	2.1	(1.0, 3.2)

n - Unweighted Sample Size

Appendix Prevalence Estimates of Named Most Serious Health Problems Caused by Diabetes, Unweighted Sample Counts and Weighted Percentage Estimates

Complication	n	%	95% CI
Blindness	269	25.4	(22.1, 28.8)
Amputation	236	24.7	(21.2, 28.3)
Did Not Know	235	24.2	(20.6, 27.8)
Heart Condition	238	21.0	(17.9, 24.1)
Other Health Condition	188	19.9	(16.5, 23.3)
CVD	160	14.5	(11.9, 17.2)
Kidney Disease	151	14.1	(11.4, 16.8)
Heart Attack	141	13.7	(10.9, 16.4)
Death	107	12.4	(9.7, 15.2)
Foot Ulcers	95	8.5	(6.4, 10.6)
High Blood Pressure	71	7.5	(5.2, 9.7)
Stroke	80	6.7	(5.1, 8.4)

n - Unweighted Sample Size

CVD - Cardiovascular Disease

Additional Statement:

Looking at health complications with the highest point estimates:
Estimates for naming amputation, kidney disease, and death were comparable among adults who reported having diabetes, reported having prediabetes at some point (excluded diabetes), and were at risk for diabetes based on the ADA risk test.

Appendix C Survey Instrument