

## **Type 2 Diabetes in Aboriginal peoples in Alberta: Validation of the national algorithm for identifying incident and prevalent adults with type 2 diabetes.**

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### **Introduction**

Diabetes has become a major health crisis among many First Nations populations in Canada (1). It is well recognized that the occurrence of diabetes and its complications is much higher (2-5 times) among First Nations individuals than Canadian population at large (1-5). However, current data is derived from small community-based studies and self-reported surveys, as population-based studies with primary data collection are very few and have been conducted only in limited time periods. On-going surveillance of diabetes among First Nations populations could contribute to the planning of rational health service delivery. The National Diabetes Surveillance System (NDSS) uses administrative claims data and aims to document the burden of diabetes in Canada with on-going observation. Yet, the NDSS has very little information on Aboriginal peoples. In Alberta, administrative analysis has been done by the Alberta Diabetes Surveillance System (ADSS) revealing a diabetes prevalence rate of 10% for First Nations adults compared to only 5% for the general population (6).

The current NDSS algorithm utilizing administrative data requires an individual to have either two physician visits or one hospitalization for diabetes (ICD-9 codes starting with 250 and ICD-10 codes E10-E14) within 2 years to be labeled as case of diabetes (7). ADSS uses a similar algorithm to NDSS, but differs in that NDSS excludes pregnant women that may have gestational diabetes and in that ADSS accesses the ambulatory care classification system in addition to physician and hospitalization claims (6). The NDSS algorithm to identify adult cases with diabetes has been validated (8-12). The validity of the standard NDSS or ADSS methodology in determining diabetes incidence or prevalence among First Nations in Alberta is unknown and may be limited by problems in identifying First Nations individuals in administrative databases, as well as potential barriers to mainstream health care usage such as geographic access and cultural norms.

Since 2003, the BRAID (Believing we can Reduce Aboriginal Incidence of Diabetes) (4) project has been screening the on-reserve population of a single (status) First Nation in Alberta for diabetes (70% have been screened to date). Information on all individuals seen is recorded in a clinical database. The objective of the current study was to use the clinical information in BRAID to test the NDSS standard national algorithm for identifying incident and prevalent First Nations adults with type 2 diabetes.

## **Methods**

### *Alberta Health and Wellness Administrative Databases*

Canada has a publicly funded health system with each provincial health department coordinating province-wide programs. Alberta residents are covered for health services under the Alberta Health Services Insurance Plan, which assigns each a Unique Lifetime Identifier (ULI, the personal health care number). Modest monthly premiums are paid by employers or

individuals, with the government providing coverage or subsidies for those who cannot afford premiums (premiums were eliminated starting January 1<sup>st</sup>, 2009). The database of all persons registered for insured health services, the Alberta Central Stakeholder registry, therefore, functions as a denominator. Exclusions include the military, the Royal Canadian Mounted Police and federal inmates. First Nations (status, treaty card, band members) individuals are identified as such within the database with a flag denoting the payment of their Alberta Health Care Insurance Plan premiums by the federal Department of Indian Affairs. The database is updated with regards to deaths from the Alberta Vital Statistics agency, and in the case of First Nations, based on information provided by the department of Indian Affairs. Diabetes cases (numerators) are derived from physician billing (claims) or health care facility databases. Most physicians are reimbursed on a fee-for-service basis and therefore the billing diagnostic code submitted to the Provincial Physician Service claims database can be used as surrogate for diagnosis. These databases include information on patient age, sex, date of visit, fee code, and primary diabetes diagnosis (ICD-9 codes starting with 250 and ICD-10 codes E10-E14). All members of the covered population are also eligible to receive services under the Hospital Care Insurance Program that covers medically-necessary hospital services. Data are collected from all hospitals in the province and include acute care in-patient separations, day surgeries, emergency room visits (since 1998), long-term care separations, active rehabilitation and out-of-province hospital separations involving members of the covered population.

#### *BRAID clinical database*

The BRAID screening project was a cross sectional study of a single (status) First Nation in Alberta with respect to diagnosed and undiagnosed diabetes. BRAID screened on-reserve individuals for diabetes with portable technology (methods described elsewhere; 13). A

clinical database includes demographics, ULI, anthropometrics and clinical results. The database is generated with client consent for aggregated reporting on demographic and clinical indicators. Research ethics approval from the University of Alberta Health Research Ethics Board was obtained. Criteria for classification of having diabetes at first visit include documentation of diagnosis by a physician, being on medications for diabetes (oral agents or insulin), or “nurse or investigator judgment”, with written justification. Those not meeting this criteria and who had a fasting glucose  $< 7.0$  mmol/L (fasted subjects), or a random glucose  $< 6.7$  mmol/L and an A1c  $< 5.5\%$  were considered to not have diabetes. Fasting subjects with glucose  $\geq 6.0$  and/or an A1c  $\geq 6.0\%$ , in some cases regardless of random glucose, were considered “possible undiagnosed diabetes” (14). These subjects identified as undiagnosed diabetes were asked to go for further testing in the regular health care setting. Regardless, subjects were only classified as having new diabetes diagnosed by BRAID on repeat confirmatory testing by BRAID. The clinical database contains year of diagnosis, and thus constitutes a searchable registry for patients diagnosed under or over 20 years of age.

#### *Validation of NDSS Methodology*

BRAID data for 884 subjects was provided to Alberta Health and Wellness (AHW) data analysts. Missing ULI were recovered and then validated if possible (most often by name, address and date of birth). A list of unique validated and linked ULIs was created, and all records for such ULIs from physician claims, hospital inpatient and vital statistics databases were extracted. An age flag ( $\geq 20$  years of age) and a final validation flag (for a known ULI, the date of birth and/or the gender from clinical database and AHW registry match) were then assigned. The NDSS algorithm for adults was applied (excluding pregnant women), and diabetes cases identified. Finally, ULIs were anonymized prior to data being returned from AHW.

The generated NDSS-BRAID diabetes prevalence cohort was compared to the cohort of BRAID individuals with and without diabetes generated from the BRAID clinical database. The sensitivity, specificity and positive predictive value (PPV) of the NDSS algorithm to correctly identify prevalent BRAID status individuals with and without diabetes were calculated.

## Results and Discussion

Of the original 884 subjects, 774 (87.6%) ULIs matched. From these, a total of 282 subjects met the age and final validation criteria. Comparison of the number of subjects identified with and without diabetes as per both the BRAID clinical database and NDSS-BRAID cohort is shown in Table 1. The NDSS algorithm exhibited a high sensitivity and specificity to correctly identify prevalent BRAID status individuals with diabetes, 91.8% (95% CI: 88.6-94.5%) and 92.8% (95% CI: 89.8-95.8%) respectively. A PPV of 81.7% (95% CI: 77.2-86.2%) emerged.

	Identified with diabetes as per BRAID clinical database	Not identified with diabetes as per BRAID clinical database	Total
Identified with diabetes in NDSS-BRAID cohort	67	15	82
Not identified with diabetes in NDSS-BRAID cohort	6	194	200
Total	73	209	282

The results support those of Hux et al (10), who tested the same NDSS methodology among a large non-Aboriginal sample in Ontario and calculated a sensitivity of 86%, a specificity of 97%, and a PPV of 80%. Furthermore, the present study suggests that the administrative NDSS algorithm to identify diabetes can be used to accurately determine

incidence and prevalence of diabetes among First Nations adults. Precise surveillance data is vital for government and health care organizations to translate knowledge into policy and funding decisions, as well as to plan health care delivery.

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