SUMMARY FOR HEALTH WORKERS

Identifying which Eeyouch are at risk of diabetes[*]

Capsule summary

The study looked at how well various measures of obesity predict insulin resistance among Eeyouch. It found that:

- The BMI threshold for obesity (BMI ≥30) is a fairly good predictor of insulin resistance in both men and women. Health workers in Eeyou Istchee should continue to use BMI as a measure of diabetes risk.
- Waist circumference is a good predictor for men, but not for women
- The standard thresholds for waist-to-hip ratio don't seem to work well for either men or women in Eeyou Istchee.

Purpose

Compare the various thresholds for obesity (WHO, International Diabetes Federation, etc), to see which best predicts risk of Type 2 diabetes in Eeyouch.

Background

To lower rates of Type 2 diabetes, it's important to catch people while they are still at the early stages of insulin resistance. At this stage, changes in diet and lifestyle can keep people from going on to diabetes. This means we need a way to quickly predict who is most likely to become insulin resistant or diabetic.

To predict risk, health staff use measures such as a patient's Body Mass Index (BMI), waist circumference, and waist-to-hip ratio. But some of these measures seem to work differently in different ethnic groups. For instance, research has found that the BMI threshold for obesity should probably be set at 27 instead of 30 for Asian people, because at 27 they're already showing signs of risk. There's also evidence that we might need different thresholds for Aboriginal people. And within Eeyou Istchee, some health workers question the usefulness of BMI for predicting diabetes. They wonder if a BMI over 30 is simply "normal" for Eeyouch, rather than an indication of higher risk.

This study used data from the *Nituuchischaayihtitaau Aschii* survey to test how well some of the standard measures predict insulin resistance among Eeyouch. The researchers did separate analyses for men and women.

Which measures did the study look at?

The researchers looked at how well the following test measures predict insulin resistance (defined as a HOMA-IR level over 2[1]):

- The BMI threshold for obesity (BMI >30)

- The BMI threshold for overweight (BMI >25)

- The waist-circumference thresholds established by the Expert Panel on High Blood Cholesterol in Adults (88 cm for women and 102 cm for men), and the ones established by the International Diabetes Federation (80 cm for both Asian and European women; 90 cm for Asian men; 102 cm for European men).

- The WHO thresholds for waist-to-hip ratio (>.85 for women and >.90 for men)

The analysis was based on 783 adults (age 18+) from the *Nituuchischaayihtitaau Aschii* study who had complete data for the relevant measures.

How do we assess how well a measure works?

What does it mean to say that a test —such as "Is this person's BMI over 30?" — works well to predict insulin resistance? A perfect test would pick up all of the insulin-resistant people (sensitivity of 100%), and none of the ones who *aren't* insulin-resistant (no false positives—specificity of 100%). In practice, we're usually looking for the best trade-off between these two aspects. The researchers used a series of statistics to assess each test, some of which measure this trade-off. They also used a statistical technique called Receiver Operating Analysis (ROC) to identify the threshold that provides the best trade-off for each measure. They looked at:

Sensitivity	What % of the people who are insulin-resistant does the test correctly identify?
Specificity	What % of the people who are *not* insulin-resistant does the test correctly identify?
Positive and Negative Likelihood Ratios	These two ratios measure the trade-off between identifying as many insulin-resistant people as possible vs wrongly classifying healthy people as insulin-resistant.
Positive Likelihood Ratio (PLR)	The likelihood that the test will correctly classify an insulin-resistant person as insulin-resistant, divided by the likelihood that it will *incorrectly* identify a healthy person as insulin-resistant. A PLR over 10 indicates that the test adds a lot of predictive value. PLRs of 5-10 indicate moderate predictive

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[1] HOMA-IR stands for Homeostatic Model Assessment of Insulin Resistance. The researchers also performed the tests using a HOMA-IR level of 2.7, but since those results didn't materially affect the conclusions, they are not presented here.

	value, and anything less suggests small value.
Negative Likelihood Ratio (NLR)	The likelihood that the test will *incorrectly* identify an insulin-resistant person as healthy, divided by the likelihood that the test will correctly identify a healthy person as not insulin-resistant. An NLR is considered strong at values below 0.1, moderate at .01-.02, and weak at .02 to .05.

Results

How well does Body Mass Index predict insulin resistance?

Checking whether a person's BMI is over 30 (the threshold for "obesity") turned out to be a reasonably good way of predicting insulin resistance, for both men and women. It correctly identified over 70% of the people who were insulin-resistant. And it correctly identified over 86% of those who were not at risk.

If we use the BMI threshold for overweight (BMI >25) instead of obesity, we pick up more of the insulin-resistant people, but at the cost of more false positives (i.e., identifying healthy people as "insulin-resistant"). It seems that for the group of Eeyouch included this study, the ideal cut-off point for predicting insulin resistance would in fact be at BMI =28.5. Two previous studies that included Aboriginal people reached rather different conclusions about the best cut-off point for BMI. This suggests that the ideal threshold may differ from one Aboriginal group to the next.

How well does waist circumference predict insulin resistance?

In women, none of the existing waist circumference thresholds worked very well. The measures were good at picking up the women at risk, but did poorly at identifying people *not* at risk.

In men, the results were somewhat better. The ideal point for distinguishing between men at risk and those not at risk seems to be a waist circumference of 102 cm. This is very close to the value recommended by the Expert Panel on Cholesterol (101 cm).

How well does waist-to-hip circumference predict insulin resistance?

The WHO thresholds for waist-to-hip ratio (.85 for women and .90 for men) were poor predictors of insulin resistance. The results were also unimpressive for the thresholds that the ROC analysis suggested were optimal (.87 for women and .98 for men). It seems that we'd need to set the thresholds higher for this measure to be useful.

Table 1 below summarizes the results for the various thresholds.

Table 1: Properties of various thresholds for detecting insulin resistance among Cree									
	BMI thresholds			Waist circumference thresholds (cm)				Waist-to-hip ratio	
	WHO - obesity	WHO - overweight	ROC-derived	Expert Panel	Int'l Diab Fed - Asians	Int'l Diab Fed - Europeans	ROC-derived	WHO	ROC-derived
Women	**≥ 30**	**≥ 25**	**≥ 28.5**	**≥ 88**	**≥80**	**≥80**	**≥98**	**0.85**	**0.87**
Sensitivity (%)	79	96	87	97	99	99	87	92	87
Specificity (%)	86	52	86	48	29	29	81	48	81
PLR	5.56	2.01	6.11	1.86	1.39	1.39	4.55	1.76	4.55
NLR	0.24	0.08	0.15	0.05	0.02	0.02	0.16	0.16	0.16
Men	**≥ 30**	**≥ 25**	**≥ 28.5**	**≥ 102**	**≥ 90**	**≥ 94**	**≥ 101**	**0.90**	**0.98**
Sensitivity (%)	70	95	81	82	97	94	85	94	65
Specificity (%)	91	47	88	82	36	47	80	42	84
PLR	7.51	1.80	6.99	4.64	1.50	1.75	4.27	1.62	4.17
NLR	0.33	0.10	0.21	0.21	0.09	0.14	0.18	0.15	0.42

This is a simplified version of Table 2 from the original report.

Conclusions

The researchers conclude that, in this group, having a BMI over 30 is indeed a moderately good way to predict a person's risk of being insulin-resistant. Health workers in Eeyou Istchee should continue to use BMI as a measure of diabetes risk.

Having a waist circumference over 101 cm also seems to be a good predictor for men. For women, waist circumference doesn't work as well.

Finally, the standard thresholds for waist-to-hip ratio don't seem to work well for either men or women in Eeyou Istchee.