**Supplemental Digital Content 1**

**Sample hand calculations of sensitivity, specificity, PPV and NPV comparing BMI-defined obesity and obesity defined as: (a) 35% BF, (b) 38% BF, and (c) 40% BF among post-menopausal women**

**(a)**

|  |  |  |
| --- | --- | --- |
|  | **X\*=1**  **BF ≥35%** | **X\*=0**  **<35%** |
| **X=1**  **BMI ≥30 kg/m2** | *True positive (TP)*  **(n=579)** | *False positive (FP)*  **(n=7)** |
| **X=0**  **BMI <30 kg/m2** | *False negative (FN)*  **(n=1207)** | *True negative (TN)*  **(n=933)** |

Sensitivity = (Pr(X\*=1|X=1)= TP/(TP+FN)= 579/(579+1207)= 0.324

Specificity = (Pr(X\*=0|X=0) =TN/(TN+FP)= 933/(933+7)= 0.993

Positive predictive value= (Pr(X=1|X\*=1) = TP/(TP+FP) = 579/(579+7)= 0.988

Negative predictive value= (Pr(X=0|X\*=0) = TN/(TN+FN)= 933/(933+1207)= 0.436

Percent correctly classified= (TP+TN)/(TP+TN+FP+FN) = (579+933)/(579+933+1207+7)= 0.555

Percent misclassified = (FP+FN)/(TP+TN+FP+FN)= (1207+7)/(579+933+1207+7)=0.445

(b)

|  |  |  |
| --- | --- | --- |
|  | **X\*=1**  **BF ≥38%** | **X\*=0**  **<38%** |
| **X=1**  **BMI ≥30 kg/m2** | *True positive (TP)*  **(n=542)** | *False positive (FP)*  **(n=44)** |
| **X=0**  **BMI <30 kg/m2** | *False negative (FN)*  **(n=674)** | *True negative (TN)*  **(n=1466)** |

Sensitivity = (Pr(X\*=1|X=1)= TP/(TP+FN)= 542/(542+674)= 0.446

Specificity = (Pr(X\*=0|X=0) =TN/(TN+FP)= 1466/(1466+44)= 0.971

Positive predictive value= (Pr(X=1|X\*=1) = TP/(TP+FP) = 542/(542+44)= 0.925

Negative predictive value= (Pr(X=0|X\*=0) = TN/(TN+FN)= 1466/(1466+674)= 0.685

Percent correctly classified= (TP+TN)/(TP+TN+FP+FN) = (542+1466)/( 542+1466+674+44)= 0.737

Percent misclassified = (FP+FN)/(TP+TN+FP+FN) = (674+44) /( 542+1466+674+44)=0.263

(c)

|  |  |  |
| --- | --- | --- |
|  | **X\*=1**  **BF ≥40%** | **X\*=0**  **<40%** |
| **X=1**  **BMI ≥30 kg/m2** | *True positive (TP)*  **(n=486)** | *False positive (FP)*  **(n=100)** |
| **X=0**  **BMI <30 kg/m2** | *False negative (FN)*  **(n=395)** | *True negative (TN)*  **(n=1745)** |

Sensitivity = (Pr(X\*=1|X=1)= TP/(TP+FN)= 486/(486+395)= 0.552

Specificity = (Pr(X\*=0|X=0) =TN/(TN+FP)= 1745/(1745+100)= 0.946

Positive predictive value= (Pr(X=1|X\*=1) = TP/(TP+FP) = 486/(486+100)= 0.829

Negative predictive value= (Pr(X=0|X\*=0) = TN/(TN+FN)= 1745/(1745+395)= 0.815

Percent correctly classified= (TP+TN)/(TP+TN+FP+FN) = (486+1745)/( 486+1745+395+100)= 0.818

Percent misclassified = (FP+FN)/(TP+TN+FP+FN) = (395+100)/( 486+1745+395+100) =0.182

**Supplemental Digital Content 2**

**Annotated**

**Stata code**

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\* Do-File for analysis of BMI-DXA in Post-Menopausal women

\* Data from Buffalo Osteoperio study

\* Last edited: July 18, 2017

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\*Step 1: Creating variables for analysis\*

gen obesebmi=.

replace obesebmi=1 if bmi>=30 & bmi<70

replace obesebmi=0 if bmi<30

gen obese35tbf=.

replace obese35tbf=1 if pfwbody>=35 & pfwbody!=.

replace obese35tbf=0 if pfwbody<35

gen obese38tbf=.

replace obese38tbf=1 if pfwbody>=38 & pfwbody!=.

replace obese38tbf=0 if pfwbody<38

gen obese40tbf=.

replace obese40tbf=1 if pfwbody>=40 & pfwbody!=.

replace obese40tbf=0 if pfwbody<40

tab obesebmi

tab obese35tbf

tab obese38tbf

tab obese40tbf

\*Step 2: Calculating Sens, Spec, PPV, NPV\*

diagt obese35tbf obesebmi

diagt obese38tbf obesebmi

diagt obese40tbf obesebmi

\*Using pooled logistic regression to calculate confidence intervals

qui logit obesebmi obese40tbf , cluster(id)

nlcom (1)/(1 + exp(-(\_b[\_cons] + (1\*\_b[obese40tbf])))) /\*sensitivity and 95%CI\*/

nlcom [1-[(1)/(1 + exp(-(\_b[\_cons] + (0\*\_b[obese40tbf] ))))]] /\*specificity and 95%CI\*/

qui logit obese40tbf obesebmi , cluster(id)

nlcom (1)/(1 + exp(-(\_b[\_cons] + (1\*\_b[obesebmi] )))) /\*PPV and 95%CI\*/

nlcom [1-[(1)/(1 + exp(-(\_b[\_cons] + (0\*\_b[obesebmi] ))))]] /\*NPV and 95%CI\*/

qui logit obesebmi obese35tbf , cluster(id)

nlcom (1)/(1 + exp(-(\_b[\_cons] + (1\*\_b[obese35tbf])))) /\*sensitivity and 95%CI\*/

nlcom [1-[(1)/(1 + exp(-(\_b[\_cons] + (0\*\_b[obese35tbf] ))))]] /\*specificity and 95%CI\*/

qui logit obese35tbf obesebmi , cluster(id)

nlcom (1)/(1 + exp(-(\_b[\_cons] + (1\*\_b[obesebmi] )))) /\*PPV and 95%CI\*/

nlcom [1-[(1)/(1 + exp(-(\_b[\_cons] + (0\*\_b[obesebmi] ))))]] /\*NPV and 95%CI\*/

qui logit obesebmi obese38tbf , cluster(id)

nlcom (1)/(1 + exp(-(\_b[\_cons] + (1\*\_b[obese38tbf])))) /\*sensitivity and 95%CI\*/

nlcom [1-[(1)/(1 + exp(-(\_b[\_cons] + (0\*\_b[obese38tbf] ))))]] /\*specificity and 95%CI\*/

qui logit obese38tbf obesebmi , cluster(id)

nlcom (1)/(1 + exp(-(\_b[\_cons] + (1\*\_b[obesebmi] )))) /\*PPV and 95%CI\*/

nlcom [1-[(1)/(1 + exp(-(\_b[\_cons] + (0\*\_b[obesebmi] ))))]] /\*NPV and 95%CI\*/

\*Step 3: Determining the empirical cutpoints of BMI for differing levels of %PBF and ROC curves

cutpt obese35tbf bmi, youden

roctab obese35tbf bmi, detail

roctab obese35tbf bmi, graph graphregion(fcolor(white)) lwidth(medthick) msymbol(none) addplot(scatteri `e(sens)' `=1 - e(spec)') legend(label(3 "Cutpoint"))

cutpt obese38tbf bmi, youden

roctab obese38tbf bmi, detail

roctab obese38tbf bmi, graph graphregion(fcolor(white)) lwidth(medthick) lcolor(gs7) msymbol(none) addplot(scatteri `e(sens)' `=1 - e(spec)') legend(label(3 "Cutpoint"))

cutpt obese40tbf bmi, youden

roctab obese40tbf bmi, detail

roctab obese40tbf bmi, graph graphregion(fcolor(white)) lwidth(medthick) lcolor(gs7) msymbol(none) addplot(scatteri `e(sens)' `=1 - e(spec)') legend(label(3 "Cutpoint"))

\*Scatterplots with quadrants A-D

\*35% BF LINE

graph twoway scatter bmi pfwbody, ytitle("BMI") jitter(7) yline(30, lwidth(1)lcol(black)) xline(35, lwidth(1) lcol(black)) msymbol(x) mfcolor(gs6) mlcolor(gs6) msize(medsmall) graphregion(fcolor(white)) text(60 11 "Quadrant A", place(se) box just(left) margin(l+4 t+1 b+1) width(20) fc(white)) ///

text(60 37 "Quadrant B", place(se) box just(left) margin(l+4 t+1 b+1) width(20) fc(white)) text(13 11 "Quadrant C", place(se) box just(left) margin(l+4 t+1 b+1)width(20) fc(white)) text(13 37 "Quadrant D", place(se) box just(left) margin(l+4 t+1 b+1) width(20) fc(white)) ///

|| qfit bmi pfwbody, lwidth(.5) lcol(black)

\*38% BF LINE

graph twoway scatter bmi pfwbody, ytitle("BMI") jitter(7) yline(30, lwidth(1)lcol(black)) xline(38, lwidth(1) lcol(black)) msymbol(x) mfcolor(gs6) mlcolor(gs6) msize(medsmall) graphregion(fcolor(white)) text(60 11 "Quadrant A", place(se) box just(left) margin(l+4 t+1 b+1) width(20) fc(white)) ///

text(60 45 "Quadrant B", place(se) box just(left) margin(l+4 t+1 b+1) width(20) fc(white)) text(13 11 "Quadrant C", place(se) box just(left) margin(l+4 t+1 b+1)width(20) fc(white)) text(13 45 "Quadrant D", place(se) box just(left) margin(l+4 t+1 b+1) width(20) fc(white)) ///

|| qfit bmi pfwbody, lwidth(.5) lcol(black)

\*40% BF LINE

graph twoway scatter bmi pfwbody, ytitle("BMI") jitter(7) yline(30, lwidth(1)lcol(black)) xline(40, lwidth(1) lcol(black)) msymbol(x) mfcolor(gs6) mlcolor(gs6) msize(medsmall) graphregion(fcolor(white)) text(60 11 "Quadrant A", place(se) box just(left) margin(l+4 t+1 b+1) width(20) fc(white)) ///

text(60 45 "Quadrant B", place(se) box just(left) margin(l+4 t+1 b+1) width(20) fc(white)) text(13 11 "Quadrant C", place(se) box just(left) margin(l+4 t+1 b+1)width(20) fc(white)) text(13 45 "Quadrant D", place(se) box just(left) margin(l+4 t+1 b+1) width(20) fc(white)) ///

|| qfit bmi pfwbody, lwidth(.5) lcol(black)

\*Investigating iBMI

gen ibmi=1/bmi

graph twoway scatter ibmi pfwbody, jitter(7) msymbol(o) mfcolor(gs6) mlcolor(gs6) graphregion(fcolor(white)) || lfit ibmi pfwbody, lwidth(medthick) lcolor(black)

**Supplemental Digital Content 3**

**Scatterplot for 38% Cutpoint**

