

HOMA-IR electronic nomogram (e-nomogram)

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Background

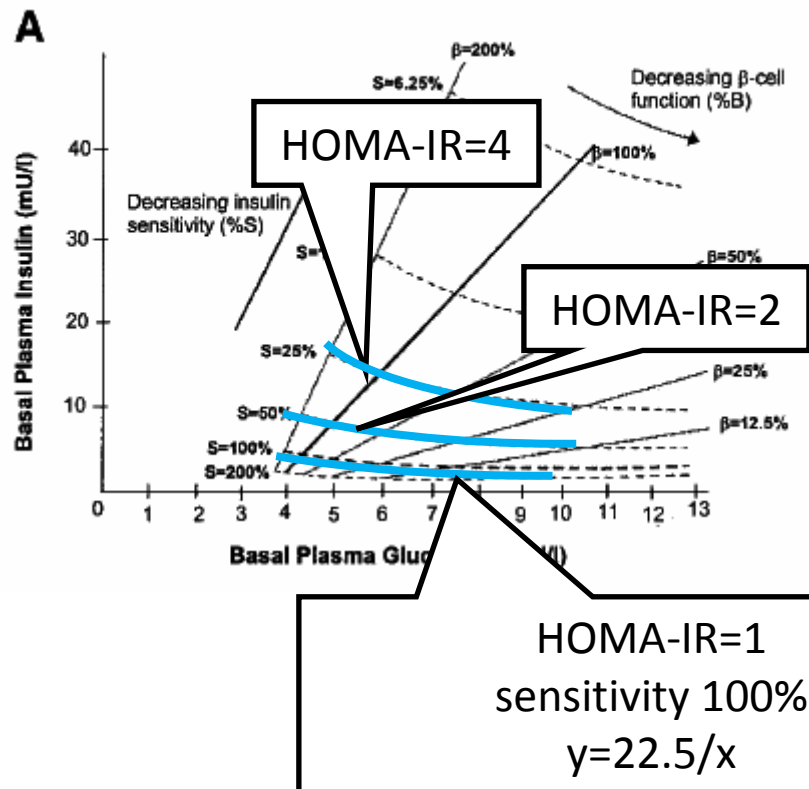
- HOMA models are widely used to assess insulin resistance and β -cell function. The process to calculate HOMA-IR or HOMA-% β is, however, tedious, and the revised model, HOMA2, needs specific HOMA calculations which are not convenient in daily practice.

Objective

- The purpose of this study is to invent an electronic device which makes the calculations of HOMA-IR fast and be without keyboard-related procedures, controlled by the human mind and visualized.
- The same method could be applied to the calculation of HOMA-% β and %S and %B of HOMA2.

HOMA-IR

- HOMA-IR
=fasting plasma glucose
x plasma insulin/22.5
- The contours of
 $c = \text{HOMA-IR}$ are
hyperbolics.



from "Use and abuse of HOMA modeling"
Diabetes Care vol.27 p.1489

Methods

- Enter the command as below into MATLAB.

```
[x,y] = meshgrid(0:0.1:13,0:0.1:40);
```

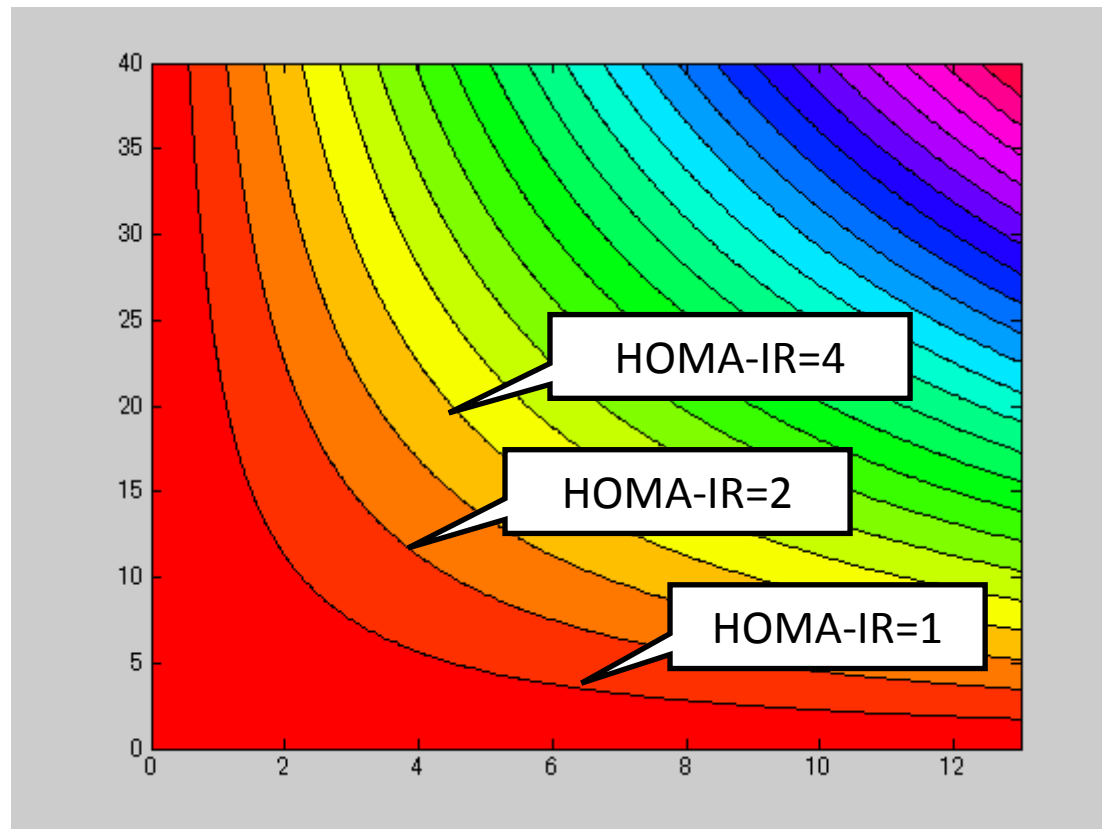
```
fxy = x .* y./22.5;
```

```
contourf(x,y,fxy,[0:1:24]);
```

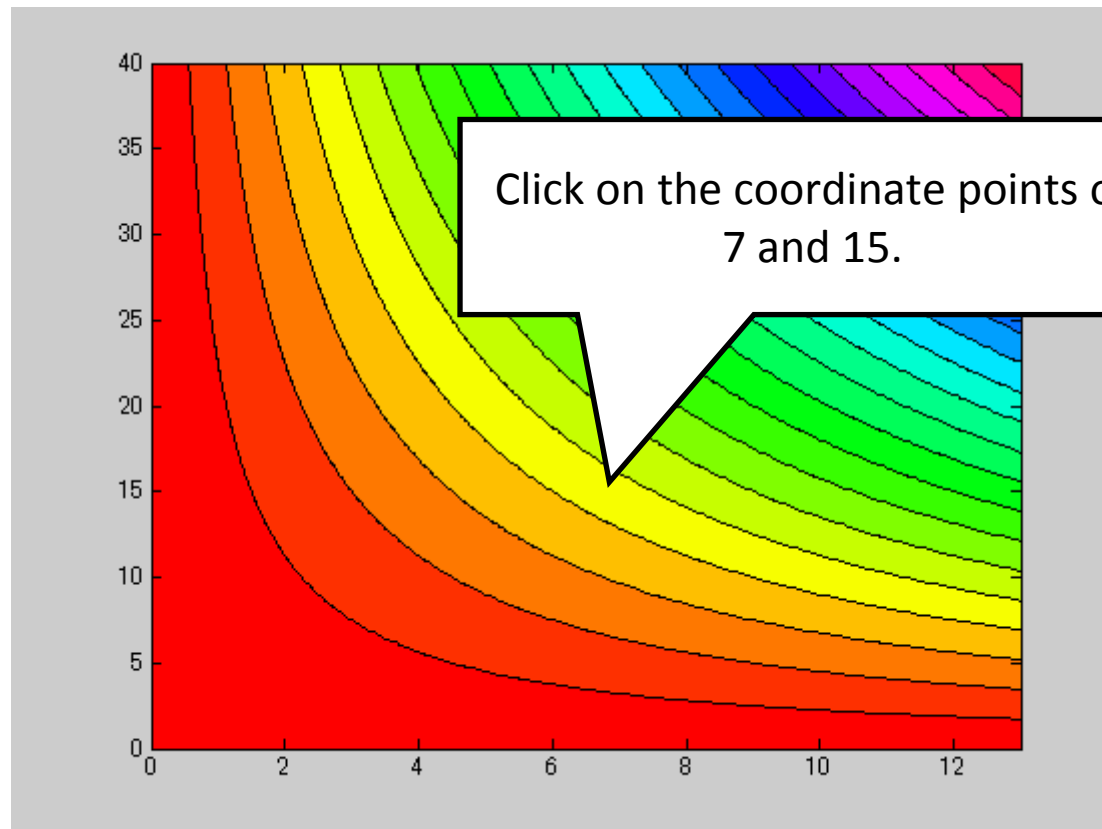
```
colormap HSV;
```

```
datacursormode on;
```

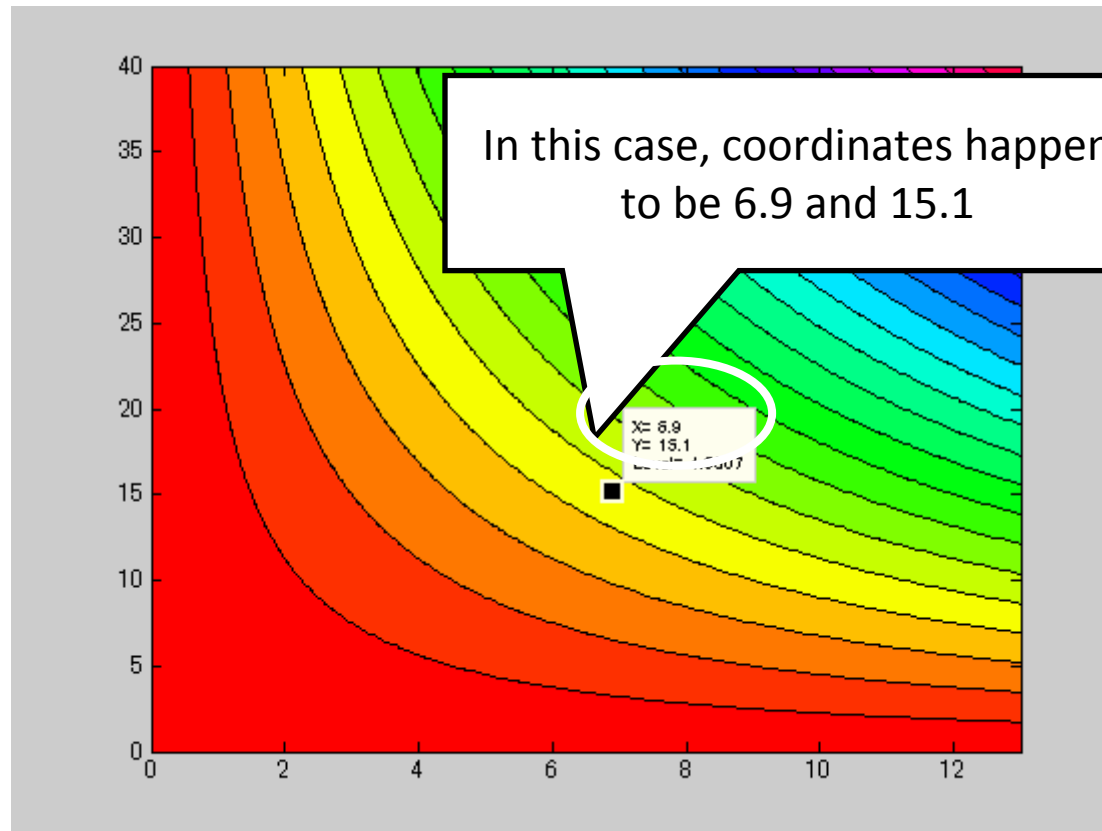
Contour graph of HOMA-IR will be displayed.



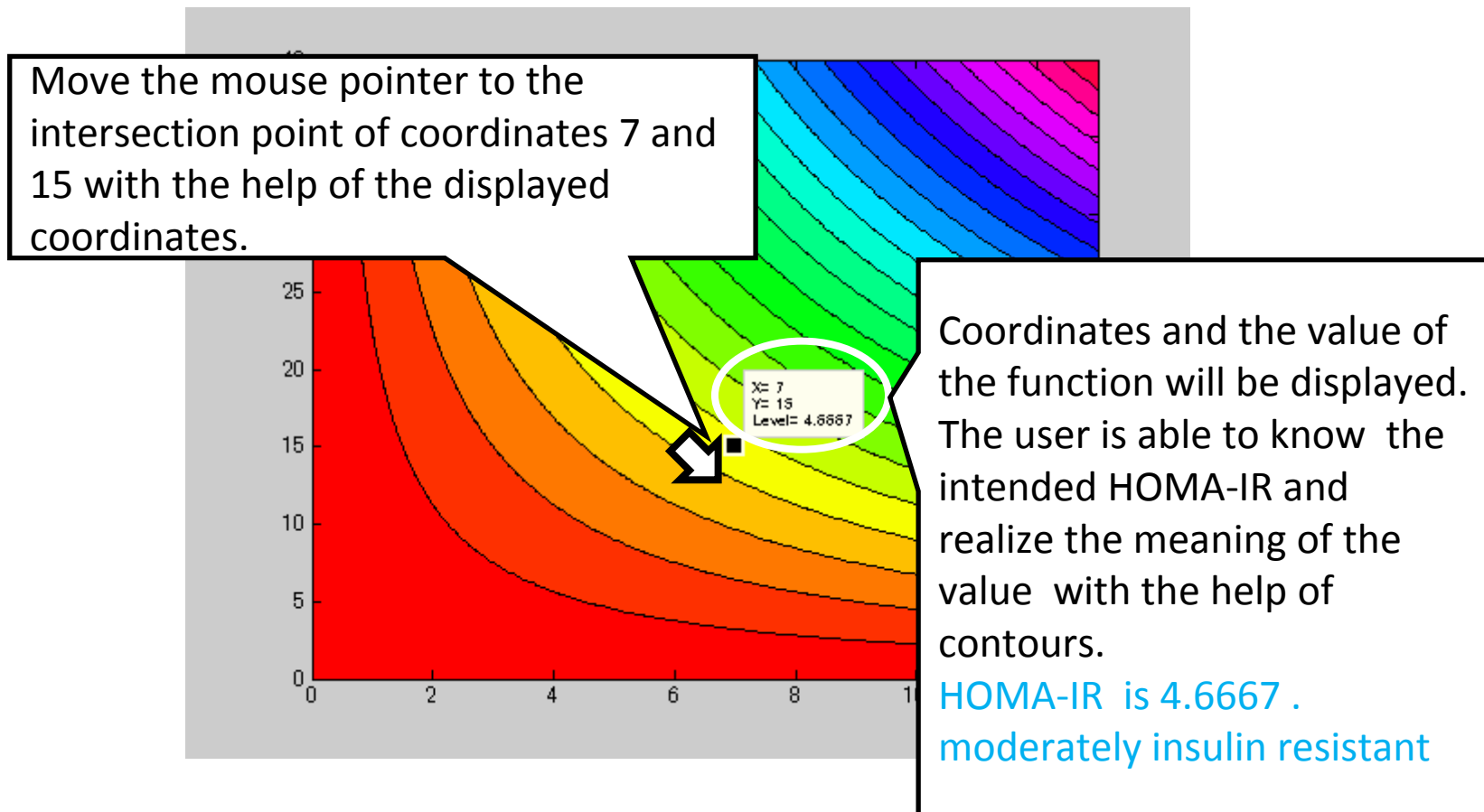
When you calculate HOMA-IR of FPG
7mmol/l and plasma insulin 15 μ U/ml.



Coordinates will be displayed Over the rainbow!



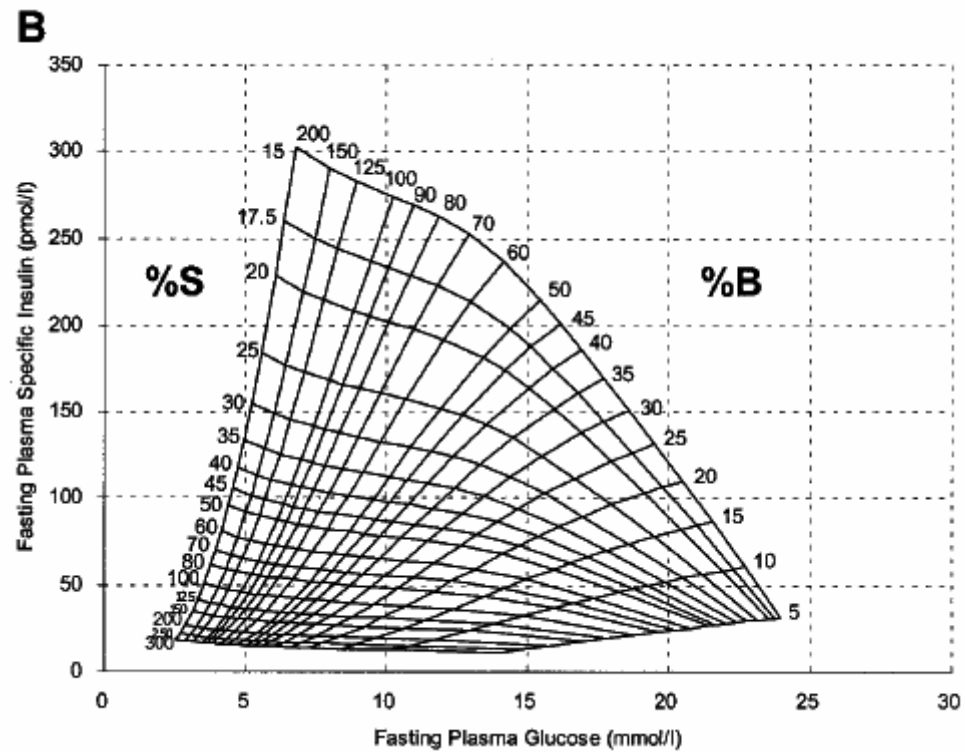
Adjust the position of the mouse pointer.



Results

- The calculation of HOMA-IR becomes fast and without keyboard-related procedures (only **one click and one drag**) using the electronic nomogram (e-nomogram).
- The user's judgment will be included in the process of the calculation, because the user compares the coordinates displayed on the computer screen with those in the user's mind.
- The user is able to know the meaning of the value of the calculation with the help of the contours.

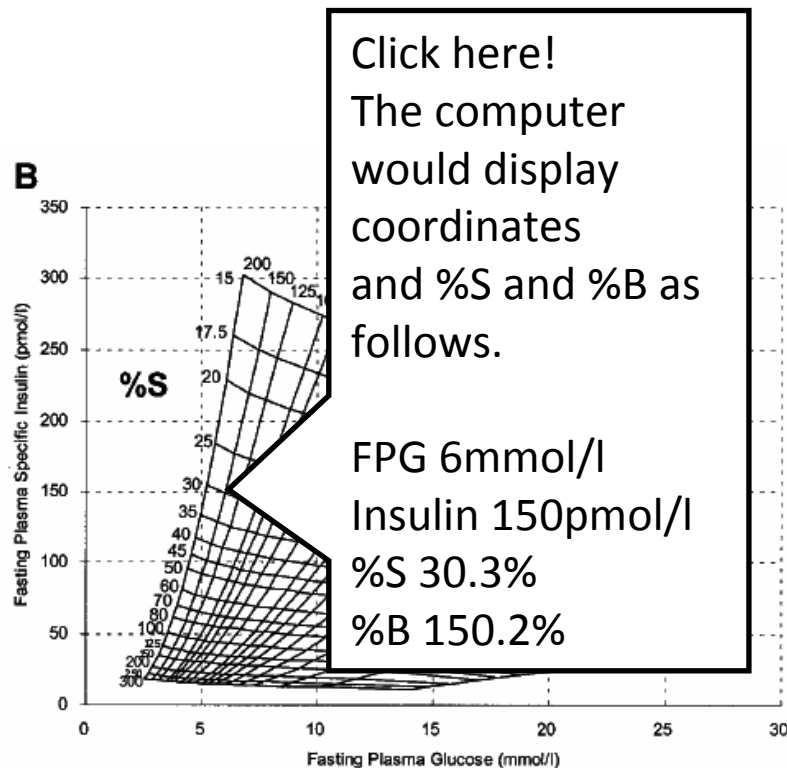
HOMA2 intersection nomogram



from “Use and abuse of HOMA modeling” Diabetes Care vol.27 p.1489

9th diabetes technology meeting 6th Nov.
2009 at San Francisco

Proposal of HOMA2 e-nomogram



E-nomogram of HOMA2

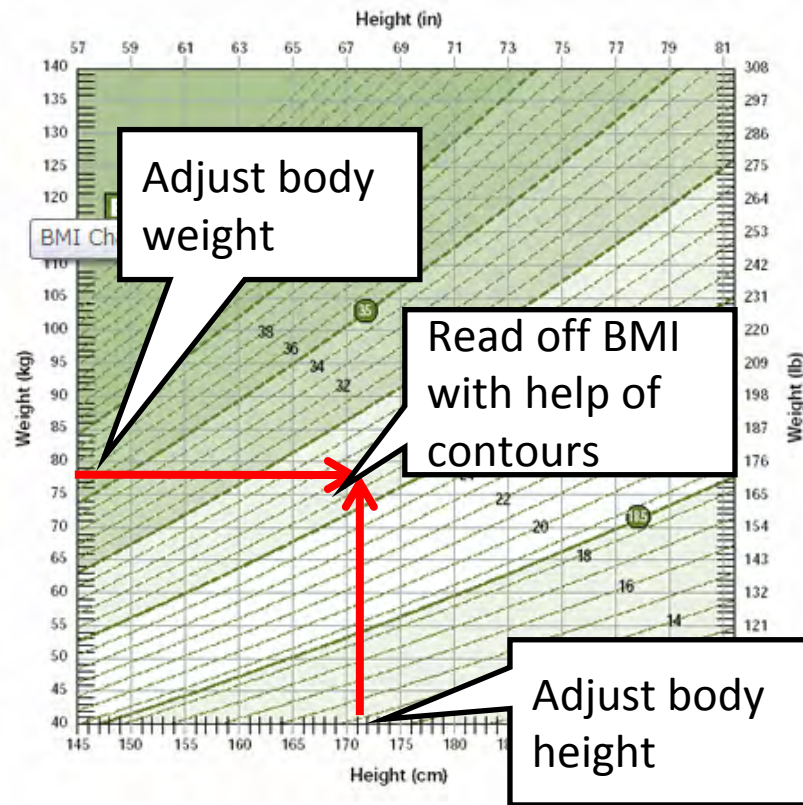
- E-nomogram of HOMA2 is also able to be produced by MATLAB.
- The data of x, y and $f(x, y)$ have to be stored previously.
- The user would be able to calculate %S and %B fast and without keyboard-related procedures.

Conclusion

- The presenter named this kind of digital graph the **electronic nomogram (e-nomogram)**, because the computer program expresses the digital graph in which the user is able to calculate the function of two independent variables.
 - Nomogram: graph that is used to calculate the function
- E-nomogram would make the calculation of HOMA-IR, HOMA-% β , %S and %B of HOMA2 be fast and without keyboard-related procedures, controlled by human mind and visualized.

Examples of BMI nomogram

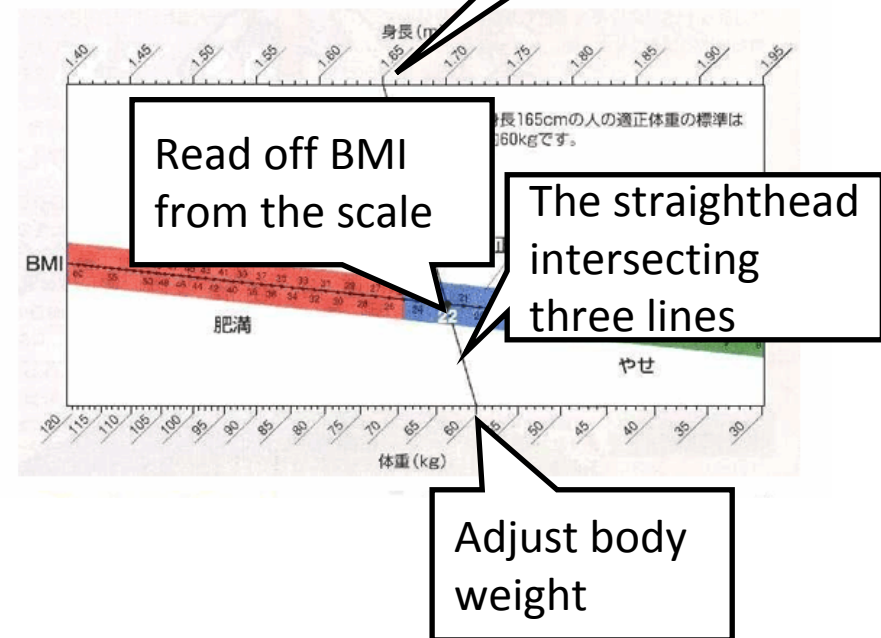
Intersection nomogram (Health Canada)



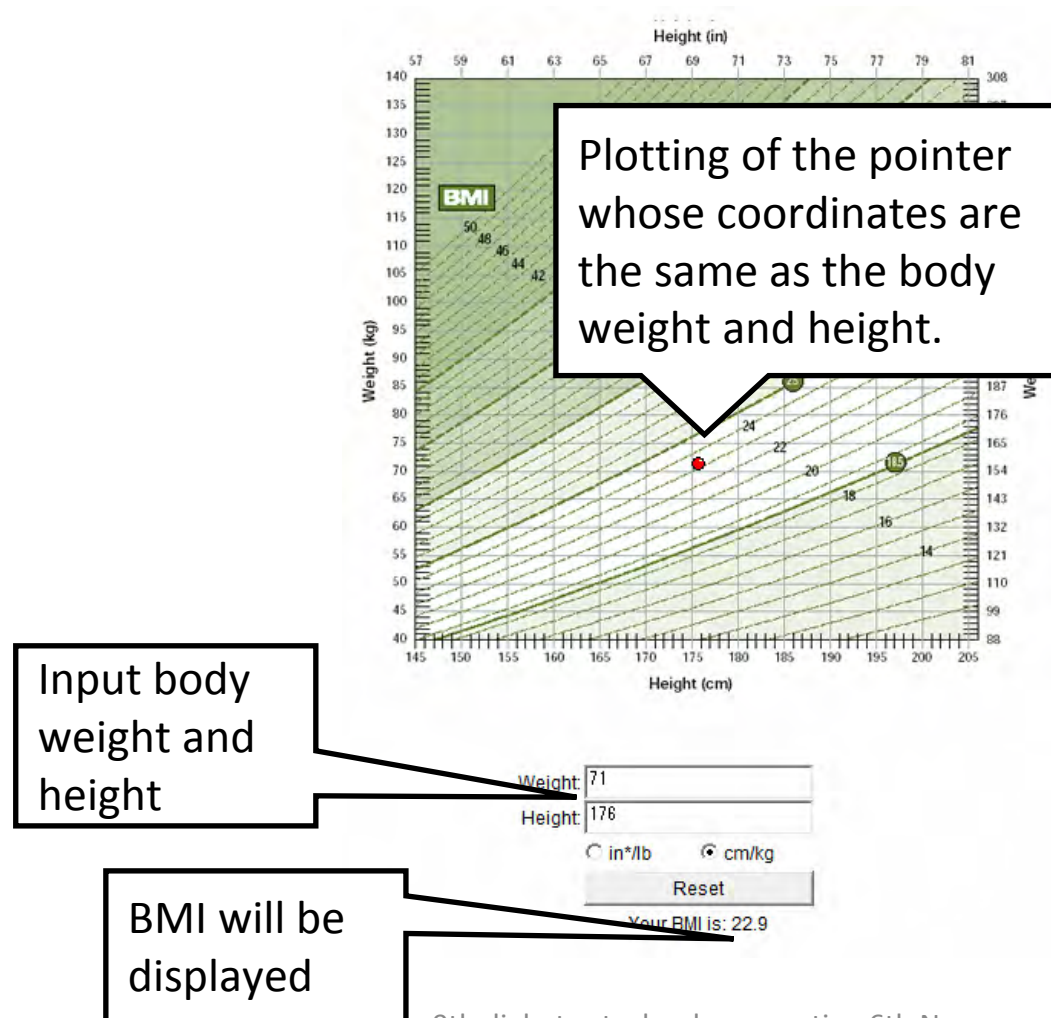
Alignment nomogram (from the dictionary of diabetes, by Dr. Mitsuhiro Noda)

》》 BMIノモグラム

BMIの細かな数値にこだわる必要はありません。下のノモグラムは、BMIを定めておけるだけで、肥満とやせが判定できます。



Health Canada BMI nomogram on the web-site



References

- Diabetes Trails Unit of Oxford University (The supplier of HOMA calculator software)
<http://www.dtu.ox.ac.uk/>
- Mathworks Inc. (The developer of MATLAB)
<http://www.mathworks.co.jp/>
- Health Canada BMI nomogram
http://www.hc-sc.gc.ca/fn-an/nutrition/weights-poids/guide-ld-adult/bmi_chart_java-graph_imc_java-eng.php
- Nakaishi Clinic homepage
<http://www.nakaishi.jp>
- Patents in submission
 - The electronic nomogram
 - The 3D electronic nomogram and the electronic inputgram
 - The electronic function graph
 - The method for inputting the numbers by using coordinates