

FITNESS STAR A RULE BASED EXPERT SYSTEM

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SETTING THE RIGHT SETTING

- ▶ A healthcare organization

- ▶ Stakeholders:

FITNESS EXPERTS

PHYSICIANS

PROGRAMMERS

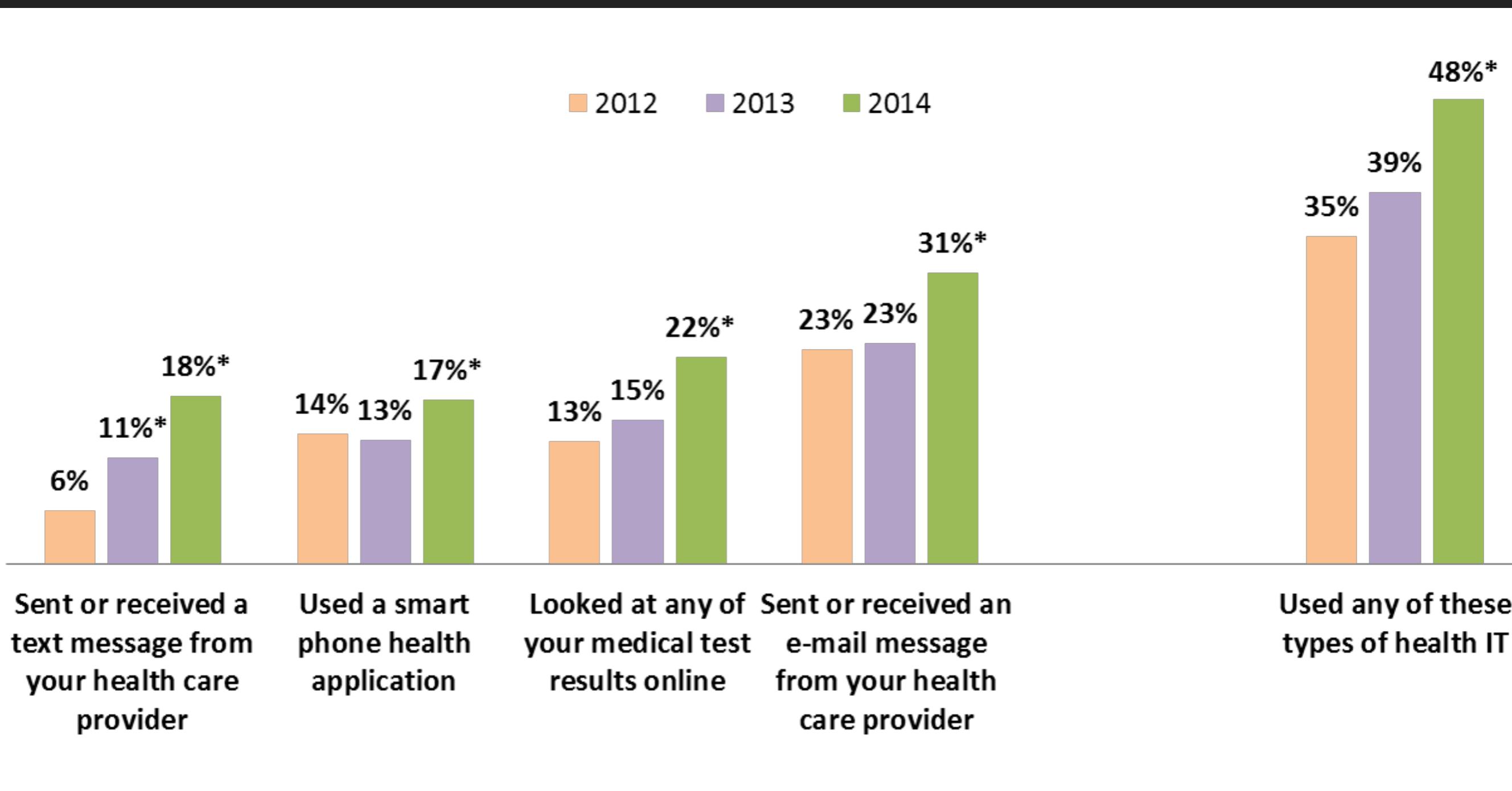
POTENTIAL
INVESTORS

- ▶ Inspired by the famous Expert System - MYCIN
- ▶ Built the prototype in JESS, developed by Sandia Corporation

MOTIVATION – THE SITTING DISEASE



MOTIVATION - EVER INCREASING USE OF IT IN HEALTHCARE



Fitness

Nutrition

Wellbeing

AUTOMATED PERSONAL FITNESS ASSISTANT

- DECREASED COST OF FITNESS PLANNING FOR PATIENTS
- INCREASED REVENUE FOR THE FIRM DUE TO LARGER USER BASE

WORKFLOW OF THE MODEL

INPUT PHASE



TERMINOLOGY

Body Mass Index

- Basic Fitness Measure
- Calculated on the basis of weight and height of the person

Basal Metabolic Rate

- Most accurate measure to calculate the calorie needs
- Uses Harris Benedict equation

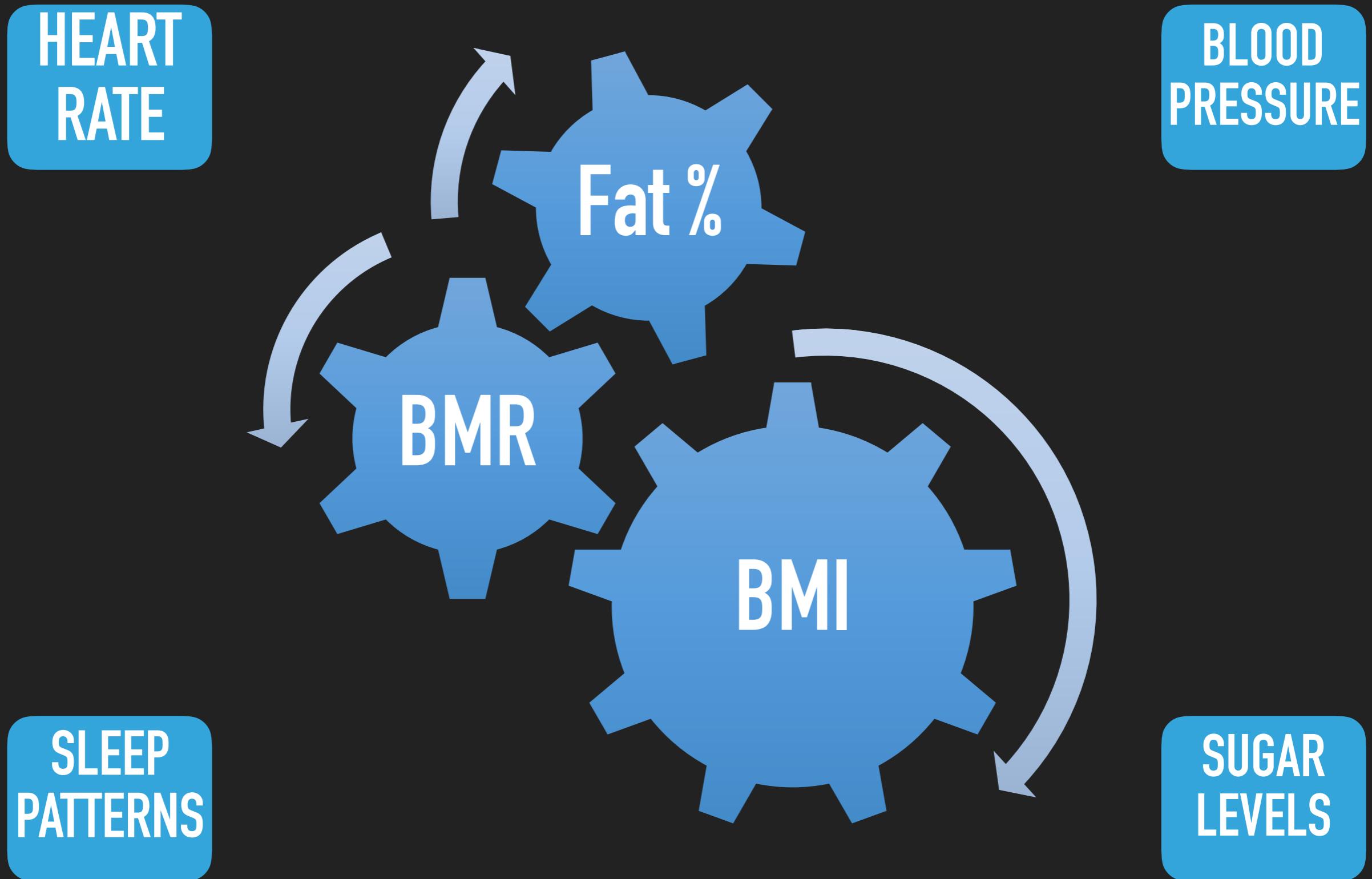
Fat Percentage

- Percentage of person's weight made of body fat
- Uses BMR as the primary parameter instead of other costly methods

Lean Body Mass

- Component of body composition
- Weight of bones and muscles

INPUTS AND INTERMEDIATES



FEATURE HIGHLIGHTS



Target weight
and number
of days to be
classified
"FIT" in terms
of BMI

Current
calorie intake
and target
calorie intake
along with
amount of
water to
consume

Workout time,
heart rate to
hit during the
workout to
achieve the
target
considering
intensity

Chances of
diabetes,
stress levels,
heart
diseases and
a motivational
quote

CODE SNAPSHOT

```
240 ; Rule 9
241 (defrule calcCalIntakeBurnQty
242     ?p <- (weightPlan {weightToBe > 0} (personName ?name))
243     =>
244     (bind ?val1 (* 0.85 ?p.NumCalToMaint)) ; a person should reduce the daily requirements by 15% only
245     (modify ?p (newIntakeCal ?val1))
246     ; 1 kg is approximately equal to 7718 calories.
247     (bind ?val2 (* 7717.75 ?p.weightToBe))
248     (modify ?p (totalCalBurntforkgloss ?val2))
249 )
250
251 ; formula for calculating calories expended by U.S. Army Fitness Manuals.
252 (deffunction calculateCalPerWorkout(?type ?weight)
253     (if (= (str-compare ?type "intense") 0) then
254         (return (* 0.1 90 ?weight 2.204))
255     else (return (* 0.079 90 ?weight 2.2014)))
256     )
257 )
258
259 ; Rule 10
260 ; assumption the person will run at 6 mph(moderate) or 10 mph(intense) and will only run upto a maximum of 90 minutes
261 ; the 90 minute mark advised by American College of Sports Medicine
262 (defrule createWorkoutPlan
263     ?p1 <- (weightPlan{weightToBe > 0} (personName ?name))
264     ?p2 <- (person {personName == p1.personName})
265     =>
266     (bind ?val1 (calculateCalPerWorkout ?p2.workoutType ?p2.weight))
267     (if (floatp ?p1.totalCalBurntforkgloss) then
268         (bind ?val2 ?p1.totalCalBurntforkgloss)
269         (bind ?targ (/ ?val2 ?val1))
270         (assert (workoutIntakePlan (personName ?name)(calBurntPerDay ?val1)(targetDays ?targ))))
271     )
272 )
```

FUNCTIONS

RULES



IRON MAN
MALE, 24
LEADS A HEALTHY LIFE STYLE
BUT EATS A LOT OF CANDY

SAMPLE RUN - A FIT PERSON WITH CHANCES OF DIABETES

```
D:\Jess71p2\bin>jess.bat
Jess, the Rule Engine for the Java Platform
Copyright (C) 2008 Sandia Corporation
Jess Version 7.1p2 11/5/2008

Jess> (batch health.clp)
TRUE
Jess> (batch input.clp)
29
Jess> (batch output.clp)

*****WELCOME TO FITNESS STAR*****
*****YOUR PERSONAL FITNESS EXPERT SYSTEM*****
Hello there. Ironman!

Below is the information you entered.
Your gender is M
Your age is 24
You regular life style is a light lifestyle
Based on your hieght and weight your Body Mass Index is 23.75
Based on your BMI you have been categorized as Normal Range
Your body fat percentage is 17.82000000000004

Based on your sugar level I diagnosed You have High chances of diabetes
I recommend you to consult your physician in order for proper medication if required.

Based on the systolic and diastolic ratings you have provided you currently are categorized as normal
Based on your blood pressure levels, sleep patterns, obesity levels and stress levels I have diagnosed your coronary heart condition as less
I recommend you to consult your physician in order for proper medication if required.

*****LETS TALK FITNESS*****
I think you are already fit!

Hope to see you again.
Thank you for using the Fitness Star!
Keep calm and Keep working out!
D:\Jess71p2\bin>
```

DIRECT
INFERENCES

FITNESS
INFERENCES



CATWOMAN
FEMALE, 24
LEADS A SEDENTARY
LIFE STYLE
LIVES A HIGHLY
STRESSED LIFE
UNDERWEIGHT

SAMPLE RUN - AN UNDERWEIGHT PERSON

```
D:\Jess71p2\bin>jess.bat
Jess, the Rule Engine for the Java Platform
Copyright (C) 2008 Sandia Corporation
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Jess> (batch health.clp)
TRUE
Jess> (batch input.clp)
54
Jess> (batch output.clp)

*****WELCOME TO FITNESS STAR*****
*****YOUR PERSONAL FITNESS EXPERT SYSTEM*****
Hello there. Catwoman!

Below is the information you entered.
Your gender is F
Your age is 24
You regular life style is a sedentary lifestyle
Based on your hieght and weight your Body Mass Index is 15.136749023498048
Based on your BMI you have been categorized as Under-Weight
Your body fat percentage is 18.284098828197656

Based on your sugar level I diagnosed You have High chances of diabetes
I recommend you to consult your physician in order for proper medication if required.

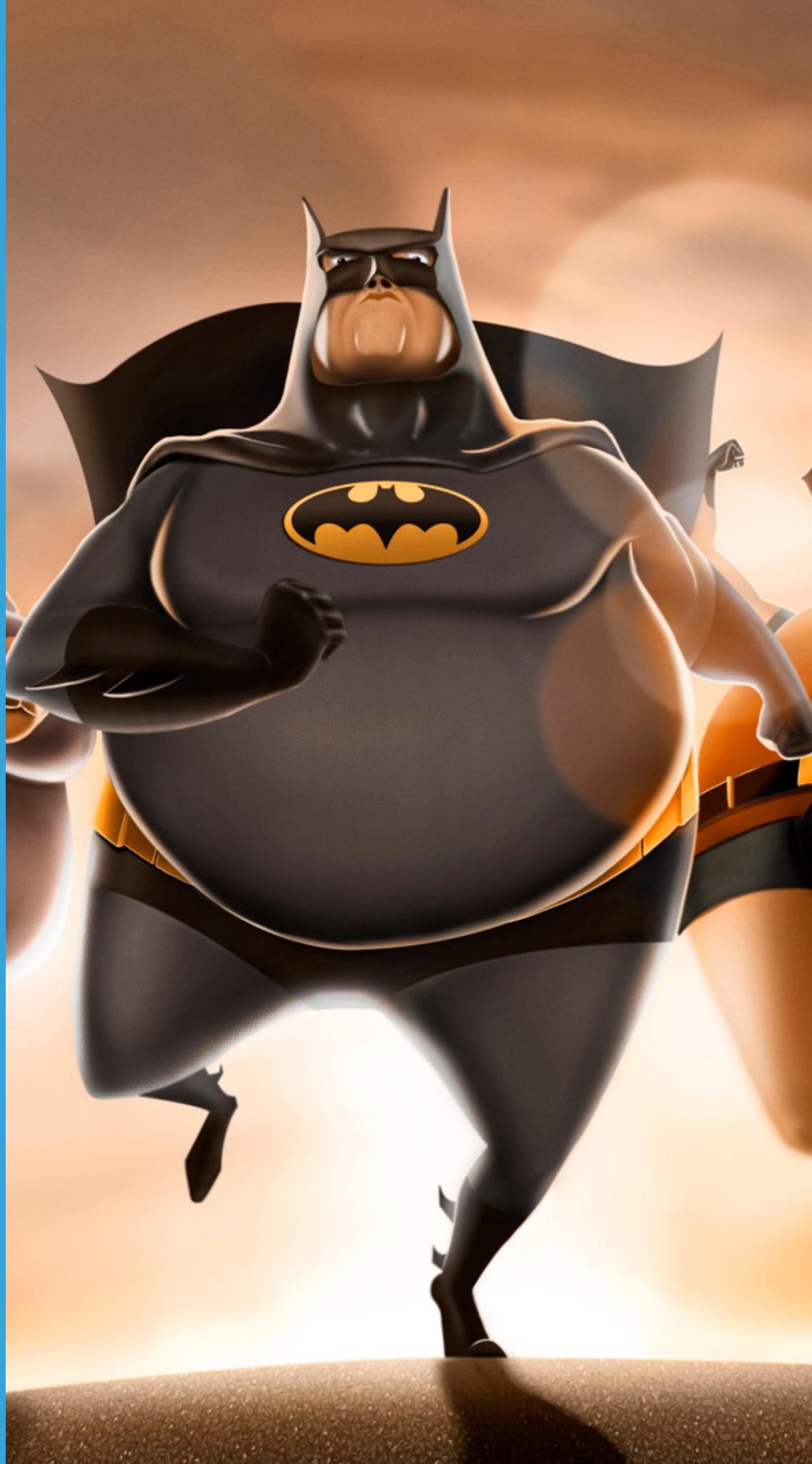
Based on the systolic and diastolic ratings you have provided you currently are categorized as prehypertension
Based on your blood pressure levels, sleep patterns, obesity levels and stress levels I have diagnosed your coronary heart condition as high
I recommend you to consult your physician in order for proper medication if required.

*****LETS TALK FITNESS*****
To be fit according to BMI index you have to gain 17 kgs.
Your Basic Metabolic Rate (B.M.R.) is 1218.808
Your current daily calorie intake is 1462
You should bring down your calorie intake to 1962
To assist proper metabolism in your body the recommended water intake each day (in ounces) is 58

Hope to see you again.
Thank you for using the Fitness Star!
Energy and Persistance conquer all things
D:\Jess71p2\bin>
```

DIRECT
INFERENCES

FITNESS
INFERENCES



BATMAN
MALE,24
HIGH STRESS
OVERWEIGHT
AND EATS A LOT OF PIZZA

SAMPLE RUN - AN OVERWEIGHT PERSON

```
D:\Jess71p2\bin>jess.bat
Jess, the Rule Engine for the Java Platform
Copyright (C) 2008 Sandia Corporation
Jess Version 7.1p2 11/5/2008

Jess> (batch health.clp)
TRUE
Jess> (batch input.clp)
53
Jess> (batch output.clp)

*****WELCOME TO FITNESS STAR*****

*****YOUR PERSONAL FITNESS EXPERT SYSTEM*****
Hello there. Batman!

Below is the information you entered.
Your gender is M
Your age is 24
Your regular life style is a intense lifestyle
Based on your hieght and weight your Body Mass Index is 34.05768530287061
Based on your BMI you have been categorized as Obese Class I
Your body fat percentage is 30.18922236344473
```

**DIRECT
INFERENCES**

```
Based on your sugar level I diagnosed You have High chances of diabetes
I recommend you to consult your physician in order for proper medication if required.

Based on the systolic and diastolic ratings you have provided you currently are categorized as stage1
Based on your blood pressure levels, sleep patterns, obesity levels and stress levels I have diagnosed your coronary heart condition as high
I recommend you to consult your physician in order for proper medication if required.
```

**FITNESS
INFERENCES**

```
*****LETS TALK FITNESS*****
To be fit according to BMI index you have to lose 32 kgs.
Your Basic Metabolic Rate (B.M.R.) is 1948.6000000000001
Your current daily calorie intake is 3702
You should bring down your calorie intake to 3146
To assist proper metabolism in your body the recommended water intake each day (in ounces) is 132

Your daily target should be a workout (running) for 90 minutes.
If you hit the target everyday I deduced you could burn 1408 calories every day.
You should aim for a target heart rate of 167.2beats per minute
If you are diligent in following what I recommend I am sure you will fit in 175 days
```

```
Hope to see you again.
Thank you for using the Fitness Star!
Keep calm and Keep working out!
```

```
D:\Jess71p2\bin>
```

FUTURE

- ▶ Personal trainer plus dietician- \$50-\$70 per hour
- ▶ Premium ad free version of app - \$10 monthly
- ▶ Build interfaces to source data from wearable devices
 - Fitbit, Apple Watches and other fitness devices
- ▶ Create a Android/iOS application for the end user
- ▶ Revenue through premium account subscribers and ads
- ▶ Introduce as a trial software or premium paid version.

REFERENCES

- ▶ US Army Fitness Manuals
- ▶ Harris Benedict Equation
- ▶ Wikipedia
- ▶ Rule-Based Expert Systems: The MYCIN Experiments of the Stanford Heuristic Programming Project - Bruce G. Buchanan and Edward H. Shortliffe
- ▶ <http://life.gaiam.com/article/how-calculate-your-ideal-body-fat-percentage>
- ▶ <http://www.bmi-calculator.net/bmr-calculator/bmr-formula.php>

THANK YOU!