

Healthcare Math: Weight Management Calculations



Industry: Healthcare

Content Area: Mathematics

Core Topics: Converting measurements, using formulas, solving algebraic equations, computing percents, performing operations with decimals

Objective: Students will be able to convert body measurements to metric units, use a formula to calculate body mass index (BMI) and goal weight, and compute the percent of change for weight loss.

Materials included:

Instructor's notes
Scenario: Medical Assistant
Student worksheets
Quiz
Answer Keys

Industry Overview:

According to the U.S. Department of Labor, the healthcare industry is expected to generate over 20% of all new jobs created in the U.S. economy between 2012 and 2022.* The healthcare industry is comprised of a vast array of jobs, ranging from nursing assistants to physicians. Mathematics and literacy skills are essential for students who plan to pursue a career in this field. Healthcare professionals, including medical assistants, must have the ability to convert units of measurement between the metric and US customary systems. They must also be able to use formulas and perform accurate calculations with percents.

* Source: <http://www.bls.gov/news.release/ecopro.t06.htm>

Instructor's notes:

- The purpose of this module is to help students develop and apply math skills in a healthcare workplace setting. The learning activities were designed to be incorporated throughout multiple instructional periods as math concepts are taught in a healthcare context.
- After completing the module, students should be able to:
 - Convert body measurements to metric units
 - Calculate body mass index (BMI) using the BMI formula
 - Use the BMI formula to calculate goal weight
 - Compute the percent of change for weight loss
- **Setting the stage:** Provide students with background information about the typical responsibilities of a medical assistant. You may want to have students use the occupational outlook handbook, O*NET and/or other relevant websites to research the job responsibilities, educational/training requirements, salary, etc. for this position. In addition, you could have students view a YouTube video depicting the typical responsibilities of a medical assistant. (See links below)

Bureau of Labor Statistics – Occupational Outlook Handbook:

<http://www.bls.gov/ooh/>

Occupational Information Network (O*NET)

<http://www.onetonline.org/link/summary/31-9092.00>

A day in the life of a medical assistant

<http://www.youtube.com/watch?v=6jbS5bLzQoU>

- **For Activity 1:** Explain the steps for converting body measurements into metric units. Work the first example as a class. Have students work the second example independently. Provide additional practice as needed. Answers to practice problems: **131.8 kg; 1.78 m**. Have students complete **Worksheet 1**.
- **For Activity 2:** Explain how to calculate body mass index (BMI) using the BMI formula. Work the first scenario example with the class. Have students work the second example independently. Provide additional practice as needed. Answers to the practice problems: **41.6; Obese class III (very severely obese)**. Have students complete **Worksheet 2**.
For Activity 3: Demonstrate how to use the BMI formula to calculate goal weight. Work the first example with the class. Explain how to calculate the percent of change from original weight to goal weight. Work the first example with the class. Have students work the second example independently. Provide additional practice as needed. Answer to practice problems: **76.1 kg; 167 lb; 123 lb; 42.4%**. Have students complete **Worksheet 3**.
- **Assessment: Quiz – Converting measurements, calculating BMI, goal weight, and percent of change**

Workplace Scenario:

You are a medical assistant working at a clinic specializing in weight management. Most of your clients are referred to the clinic by their primary care physicians because they have health problems related to being overweight. You are responsible for collecting data on your patients and monitoring their progress over the course of their enrollment in your program. Your responsibilities often include making accurate mathematical calculations for assessment and recordkeeping purposes.

Activity 1: Converting body measurements

When clients enroll in your program, you are responsible for gathering and recording data, such as age, gender, weight and height. You also convert each client's weight into kilograms and height into meters. These metric measurements are used to calculate body mass index (BMI). BMI is just one of many tools used to help your clients develop a safe and healthy weight management plan. For example, Mary K is a 32 year-old female patient in your program; she is 62 inches tall and weighs 216 pounds. You use the following conversion chart to help you convert Mary's weight into kilograms and height into meters.

The chart shows that 1 kg = 2.2 lb. You can divide Mary's weight in pounds by 2.2 to find her weight in kilograms. Round your answer to the nearest tenths place, if necessary.

$$216 \div 2.2 = \underline{98.2 \text{ kg.}}$$

The chart shows that 1 m = 39.37 in. You can calculate Mary's height in meters by dividing her height in inches by 39.37. Round your answer to the nearest hundredths place, if necessary.

$$62 \div 39.37 = \underline{1.57 \text{ m}}$$

Conversion Chart
1 kg = 2.2 lb
1 m = 39.37 in

John S. is a 61 year-old client. John's weight is 290 pounds and his height is 70 inches. Convert John's weight and height into metric measurements and record this information in the chart below.

John weighs _____ kg

John's height is _____ m

Name	M/F	Age	Weight lb	Height in	Weight kg	Height m
Mary K	F	32	216	62	98.2	1.6
John J	M	61	290	70		

Worksheet 1: Converting body measurements

Name _____

Recently, you began working with the following group of clients at the clinic. You need to convert each person's body measurements into metric units. Round weight to the nearest tenths place and height to the nearest hundredths place, if necessary. Record all the information for each client on the intake chart provided. The first one has been started for you.

Sam A. Male, age: 42, weight: 304 lb, height: 73 in

Rodney B. Male, age: 61, weight: 248 lb, height: 70 in

Kim C. Female, age: 40, weight: 158 lb, height: 60 in

Keisha D. Female, age: 49, weight: 173 lb, height: 63 in

Alex E. Male, age: 43, weight: 193 lb, height: 66 in

Lashonda F. Female, age: 54, weight: 165 lb, height: 62 in

Pam G. Female, age: 47, weight: 175 lb, height: 65 in

Demarcus H. Male, age: 52, weight: 265 lb, height: 66 in

Juan I. Male, age: 58, weight: 290 lb, height: 71 in

Name	M/F	Age	Weight lb	Height in	Weight kg	Height m
Sam A.	M	42	304	73		

Activity 2: Calculating body mass index (BMI)

One of the tools you use to help clients set healthy weight loss goals is body mass index (BMI). BMI is a measure of an adult's weight in relation to his or her height. It is calculated by dividing a person's weight in kilograms by the square of his or her height in meters. The chart below shows BMI classifications.

Category	BMI range – kg/m ²
Very severely underweight	less than 15
Severely underweight	from 15.0 to 16.0
Underweight	from 16.0 to 18.5
Normal (healthy weight)	from 18.5 to 25
Overweight	from 25 to 30
Obese Class I (Moderately obese)	from 30 to 35
Obese Class II (Severely obese)	from 35 to 40
Obese Class III (Very severely obese)	over 40

Source: http://en.wikipedia.org/wiki/Body_mass_index

The formula to calculate BMI:

$$\text{BMI} = \frac{\text{Weight (kilograms)}}{\text{Height (meters)}^2}$$

Example 1:

Mary K weighs 98.2 kilograms and her height is 1.57 meters. Use the formula to calculate Mary's BMI. Round your answer in the last step to the nearest tenths place, if necessary.

$$\text{BMI} = \frac{\text{Weight (kg)}}{\text{Height (m)}^2} = \frac{98.2}{1.57^2} = \frac{98.2}{2.46} = \underline{39.9}$$

According to the BMI chart, Mary would be classified as Obese Class II (severely obese).

Example 2:

John J weighs 131.8 kilograms and is 1.78 meters in height. Use the formula to calculate John's BMI. Round your answer in the last step to the nearest tenths place, if necessary.

$$\text{BMI} = \frac{\text{Weight (kg)}}{\text{Height (m)}^2}$$

John's BMI is _____ According to the BMI chart, John would be classified as _____.

Use the formula to calculate the BMI for each of your clients from worksheet 1. Complete the intake chart with the required information and answer the questions.

$$\text{BMI} = \frac{\text{Weight (kg)}}{\text{Height (m)}^2}$$

Name	M/F	Age	Weight lb	Height in	Weight kg	Height m	Intake BMI
Sam A.	M	42	304	73	138.2	1.85	
Rodney B.	M	61	248	70	112.7	1.78	
Kim C.	F	40	158	60	71.8	1.52	
Keisha D.	F	49	173	63	78.6	1.6	
Alex E.	M	43	193	66	87.7	1.68	
Lashonda F.	F	54	165	62	75	1.57	
Pam G.	F	47	175	65	79.5	1.65	
Demarcus H.	M	52	265	66	120.4	1.68	
Juan I.	M	58	290	71	131.8	1.8	

Use the BMI classification chart to help you answer the following questions.

1. How many clients would be classified as Class I (moderately obese)? _____
2. Which clients have the same BMI? _____
3. Which client weighs the most? _____
4. Which client has the highest BMI? _____
5. Which client would be classified as Class II (severely obese)? _____
6. How many clients would be classified as Class III (very severely obese)? _____

Activity 3: Calculating goal weight and percent change

For most clients entering the program, the target BMI is set at 24. You can use the BMI formula to calculate the goal weight for the clients in your group.

Example 1:

Mary K's height is 1.57 meters. Her target BMI is 24. Use the BMI formula to calculate Mary's goal weight. Plug the target BMI of 24 and Mary's height of 1.57 into the formula. $1.57^2 = 2.46$. To solve for X, multiply both sides of the equation by 2.46. Mary's goal weight is 59 kg.

$$\text{BMI} = \frac{\text{Weight (kg)}}{\text{Height (m)}^2} \quad 24 = \frac{x}{1.57^2} \quad 24 = \frac{x}{2.46} \quad (2.46)24 = \frac{x}{\cancel{2.46}} \quad x = \underline{59 \text{ kg}}$$

Since most clients use scales that measure in pounds, you convert their goal weight from kilograms to pounds. For example, to convert Mary's goal weight in kilograms to pounds, multiply 59 by 2.2 and round to the nearest whole number. $59 \times 2.2 = 129.8 \longrightarrow \underline{130 \text{ lb}}$. If Mary's starting weight is 216 pounds, how many pounds does she need to lose to reach her goal weight? $216 - 130 = \underline{86 \text{ lb}}$.

Another task you have at the clinic is to calculate the percent of change for each client's weight loss goal. To compute the percent of change, divide the number of pounds a client needs to lose by his or her initial weight. Round your answer to the nearest tenths place, if necessary. Since Mary's initial weight is 216 pounds, and she needs to lose 86 pounds to reach her goal weight, this represents a 39.8% decrease in her weight.

$$86 \div 216 = .3981 \longrightarrow \underline{39.8 \%}$$

Example 2:

John J's height is 1.78 meters. His target BMI is 24. Use the BMI formula to calculate John's goal weight in kilograms and then convert into pounds. Next, compute the number of pounds John needs to lose and the percent of change for this weight loss.

John's goal weight in kilograms is _____ kg

John's goal weight in pounds is _____ lb

John needs to lose _____ pounds to reach his goal weight.

What percent of his weight does John need to lose? _____%

Worksheet 3: Calculating goal weight & percent of change Name _____

The supervising physician at the clinic has asked you to complete the intake data for each of the new participants in your group. It is important to make and record accurate calculations because this information will be used to help clients develop and maintain a healthy weight management plan. Complete each of the following tasks for each participant and record your answers in the appropriate column of the intake chart. The first one has been completed for you.

The target BMI for your clients is 24. Use the BMI formula to calculate the goal weight in kilograms for each of the participants in your program.

Convert the goal weight in kilograms to weight in pounds and compute the amount of weight loss needed for each person to reach his or her goal weight.

Compute the percent of change for each client’s weight loss goal.

Example: Sam A.

$$\text{BMI} = \frac{\text{Weight(kg)}}{\text{Height(m)}^2} \quad 24 = \frac{x}{(1.85)^2} \quad 24 = \frac{x}{3.42} \quad (3.42)24 = \frac{x}{3.42} (3.42) \quad x = 82.1 \text{ kg}$$

$$82.1 \times 2.2 = 180.6 \longrightarrow \underline{181 \text{ lb}} \text{ goal weight} \quad 304 - 181 = \underline{123 \text{ lb}} \text{ to lose}$$

$$123 \div 304 = .4046 \longrightarrow \underline{40.5\%} \text{ percent of weight to lose}$$

Name	M/F	Age	Weight lb	Height in	Weight kg	Height m	Intake BMI	Goal weight in lb	# of lb to lose	% of lb to lose
Sam A.	M	42	304	73	138.2	1.85	40.4	181	123	40.5%
Rodney B.	M	61	248	70	112.7	1.78	35.6			
Kim C.	F	40	158	60	71.8	1.52	31.1			
Keisha D.	F	49	173	63	78.6	1.6	30.7			
Alex E.	M	43	193	66	87.7	1.68	31.1			
Lashonda F.	F	54	165	62	75	1.57	30.5			
Pam G.	F	47	175	65	79.5	1.65	29.2			
Demarcus H.	M	52	265	66	120.4	1.68	42.7			
Juan I.	M	58	290	71	131.8	1.8	40.7			

Quiz: Conversions, calculating BMI, goal weight & percent change **Name:** _____

Several new clients enrolled in your weight management program this week. Perform all the calculations listed below and complete the intake chart with the required information.

Convert each person’s weight into kilograms and round to the nearest tenths place, if necessary.

Convert each person’s height into meters and round to the nearest hundredths place, if necessary.

Use the BMI formula to calculate each client’s BMI.

The target BMI for each person in this group is 24. Use the BMI formula to calculate each person’s goal weight in kilograms.

Convert the goal weight in kilograms to weight in pounds and round to the nearest whole number.

Compute the number of pounds each person needs to lose to achieve his or her goal weight.

Calculate the percent of change for each client’s weight loss goal and round to the nearest tenths place, if necessary.

Name	M/F	Age	Weight lb	Height in	Weight kg	Height m	Intake BMI	Goal weight in lb	# of lb to lose	% of lb to lose
Mike A	M	35	250	72						
Sarah B	F	28	155	60						
Becky C	F	39	170	58						
Larry D	M	29	280	71						
Ann E	F	32	235	69						
Dave F	M	25	189	68						
Walter G	M	34	262	70						
Diane H	F	27	151	61						
Cindy I	F	38	162	65						

Worksheet 1: Converting body measurements

Answer Key

Recently, you began working with the following group of clients at the clinic. You need to convert each person's body measurements into metric units. Round weight to the nearest tenths place and height to the nearest hundredths place, if necessary. Record all the information for each client on the intake chart provided. The first one has been started for you.

Sam A. Male, age: 42, weight: 304 lb, height: 73 in

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Kim C. Female, age: 40, weight: 158 lb, height: 60 in

Keisha D. Female, age: 49, weight: 173 lb, height: 63 in

Alex E. Male, age: 43, weight: 193 lb, height: 66 in

Lashonda F. Female, age: 54, weight: 165 lb, height: 62 in

Pam G. Female, age: 47, weight: 175 lb, height: 65 in

Demarcus H. Male, age: 52, weight: 265 lb, height: 66 in

Juan I. Male, age: 58, weight: 290 lb, height: 71 in

Name	M/F	Age	Weight lb	Height in	Weight kg	Height m
Sam A.	M	42	304	73	138.2	1.85
Rodney B	M	61	248	70	112.7	1.78
Kim C	F	40	158	60	71.8	1.52
Keisha D	F	49	173	63	78.6	1.60
Alex E	M	43	193	66	87.7	1.68
Lashonda F	F	54	165	62	75	1.57
Pam G	F	47	175	65	79.5	1.65
Demarcus H	M	52	265	66	120.4	1.68
Juan I	M	58	290	71	131.8	1.80

Worksheet 2: Calculating BMI

Answer Key

Use the formula to calculate the BMI for each of your clients from worksheet 1. Complete the intake chart with the required information and answer the questions.

Name	M/F	Age	Weight lb	Height in	Weight kg	Height m	Intake BMI
Sam A.	M	42	304	73	138.2	1.85	40.4
Rodney B.	M	61	248	70	112.7	1.78	35.6
Kim C.	F	40	158	60	71.8	1.52	31.1
Keisha D.	F	49	173	63	78.6	1.6	30.7
Alex E.	M	43	193	66	87.7	1.68	31.1
Lashonda F.	F	54	165	62	75	1.57	30.5
Pam G.	F	47	175	65	79.5	1.65	29.2
Demarcus H.	M	52	265	66	120.4	1.68	42.7
Juan I.	M	58	290	71	131.8	1.8	40.7

Use the BMI classification chart to help you answer the following questions.

1. How many clients would be classified as Class I (moderately obese)? 4
2. Which clients have the same BMI? Kim C and Alex E
3. Which client weighs the most? Sam A
4. Which client has the highest BMI? Demarcus H
5. Which client would be classified as Class II (severely obese)? Rodney B
6. How many clients would be classified as Class III (very severely obese)? 3

Worksheet 3: Calculating goal weight & percent of change

Answer Key

The supervising physician at the clinic has asked you to complete the intake data for each of the new participants in your group. It is important to make and record accurate calculations because this information will be used to help clients develop and maintain a healthy weight management plan. Complete each of the following tasks for each participant and record your answers in the appropriate column of the intake chart. The first one has been completed for you.

The target BMI for your clients is 24. Use the BMI formula to calculate the goal weight in kilograms for each of the participants in your program.

Convert the goal weight in kilograms to weight in pounds and compute the amount of weight loss needed for each person to reach his or her goal weight.

Compute the percent of change for each client's weight loss goal.

Example: Sam A

$$\text{BMI} = \frac{\text{Weight(kg)}}{\text{Height(m)}^2} \quad 24 = \frac{x}{(1.85)^2} \quad 24 = \frac{x}{3.42} \quad (3.42)24 = \frac{x}{3.42} (3.42) \quad x = 82.1 \text{ kg}$$

$$82.1 \times 2.2 = 180.6 \longrightarrow \underline{181 \text{ lb}} \text{ goal weight} \quad 304 - 181 = \underline{123 \text{ lb}} \text{ to lose}$$

$$123 \div 304 = .4046 \longrightarrow \underline{40.5\%} \text{ percent of weight to lose}$$

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Sam A.	M	42	304	73	138.2	1.85	40.4	181	123	40.5%
Rodney B.	M	61	248	70	112.7	1.78	35.6	167	81	32.7%
Kim C.	F	40	158	60	71.8	1.52	31.1	122	36	22.8%
Keisha D.	F	49	173	63	78.6	1.6	30.7	135	38	22%
Alex E.	M	43	193	66	87.7	1.68	31.1	149	44	22.8%
Lashonda F.	F	54	165	62	75	1.57	30.5	130	35	21.2%
Pam G.	F	47	175	65	79.5	1.65	29.2	144	31	17.8%
Demarcus H.	M	52	265	66	120.4	1.68	42.7	149	116	43.8%
Juan I.	M	58	290	71	131.8	1.8	40.7	171	119	41%

Quiz: Conversions, calculating BMI, goal weight & percent change**Answer Key**

Several new clients enrolled in your weight management program this week. Perform all the calculations listed below and complete the intake chart with the required information.

Convert each person's weight into kilograms and round to the nearest tenths place, if necessary.

Convert each person's height into meters and round to the nearest hundredths place, if necessary.

Use the BMI formula to calculate each client's BMI.

The target BMI for each person in this group is 24. Use the BMI formula to calculate each person's goal weight in kilograms.

Convert the goal weight in kilograms to weight in pounds and round to the nearest whole number.

Compute the number of pounds each person needs to lose to achieve his or her goal weight.

Calculate the percent of change for each client's weight loss goal and round to the nearest tenths place, if necessary.

Name	M/F	Age	Weight lb	Height in	Weight kg	Height m	Intake BMI	Goal weight in lb	# of lb to lose	% of lb to lose
Mike A	M	35	250	72	113.6	1.83	33.9	177	73	29.2%
Sarah B	F	28	155	60	70.5	1.52	30.5	122	33	21.3%
Becky C	F	39	170	58	77.3	1.47	35.8	114	56	32.9%
Larry D	M	29	280	71	127.3	1.80	39.3	171	109	38.9%
Ann E	F	32	235	69	106.8	1.75	34.9	161	74	31.5%
Dave F	M	25	189	68	85.9	1.73	28.7	158	31	16.4%
Walter G	M	34	262	70	119.1	1.78	37.6	167	95	36.3%
Diane H	F	27	151	61	68.6	1.55	28.6	127	24	15.9%
Cindy I	F	38	162	65	73.6	1.65	27.1	144	18	11.1%