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*Practitioners talking with practitioners*

# Anthropometric Change in the US Army: Using the 2012 Army Data for Civilian Design

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# Overview

- Sources of anthropometric data
  - Why use Army data?
- Anthropometric differences between Army and civilians
- General approach and cautions
- Trends over time:
  - Army and civilians
- What to do now

# Data Sources

- CAESAR
  - Summary statistics published; data for purchase
- SizeUSA
  - Available for purchase
- NHANES
  - Government funded; free download
- ANSUR I, ANSUR II
  - Summary statistics published; ANSUR I data available

# NHANES Measurement List (Adult)

- Weight
- Standing height
- Upper leg length
- Upper arm length
- Mid-upper arm circumference
- Waist circumference
- Sagittal abdominal diameter

# Army Measurement List

- 132 dimensions (ANSUR I)
  - Additional head and hand dimensions
- 94 dimensions (ANSUR II)
  - 3D scans
- All design focused

# Comparing Army to Civilians

- Limited entry criteria
  - Weight, Height
- Physical fitness requirements
- Age distribution
- Racial/ethnic distribution

# One Approach

- Army-based (ANSUR I) regression equations – estimate civilian data
- General form:  
$$\textit{chestcirc} = \textit{stature} * -.242 + \textit{weight} * .622 + 92.8$$
- Use for individual civilian values
- *Then* calculate summary statistics

# Cautions

- Regression equations population-specific
  - Mitigate by separate ethnic equations
- Tend to estimate towards the mean
  - Minimizes variability
- Can provide a good *estimate* of civilian, better than using Army data directly

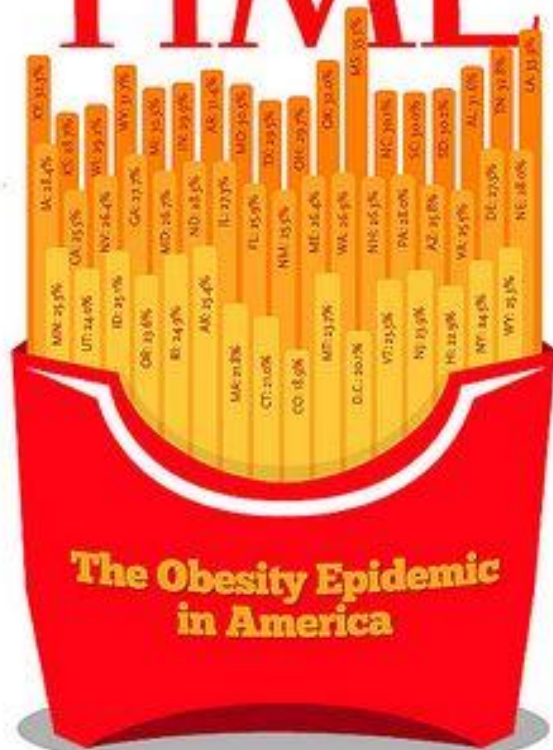


**BuT...**

**will it still**

**work?**

# TIME



**The Obesity Epidemic in America**

\*Percentage of obese adult population, 2009

# TIME



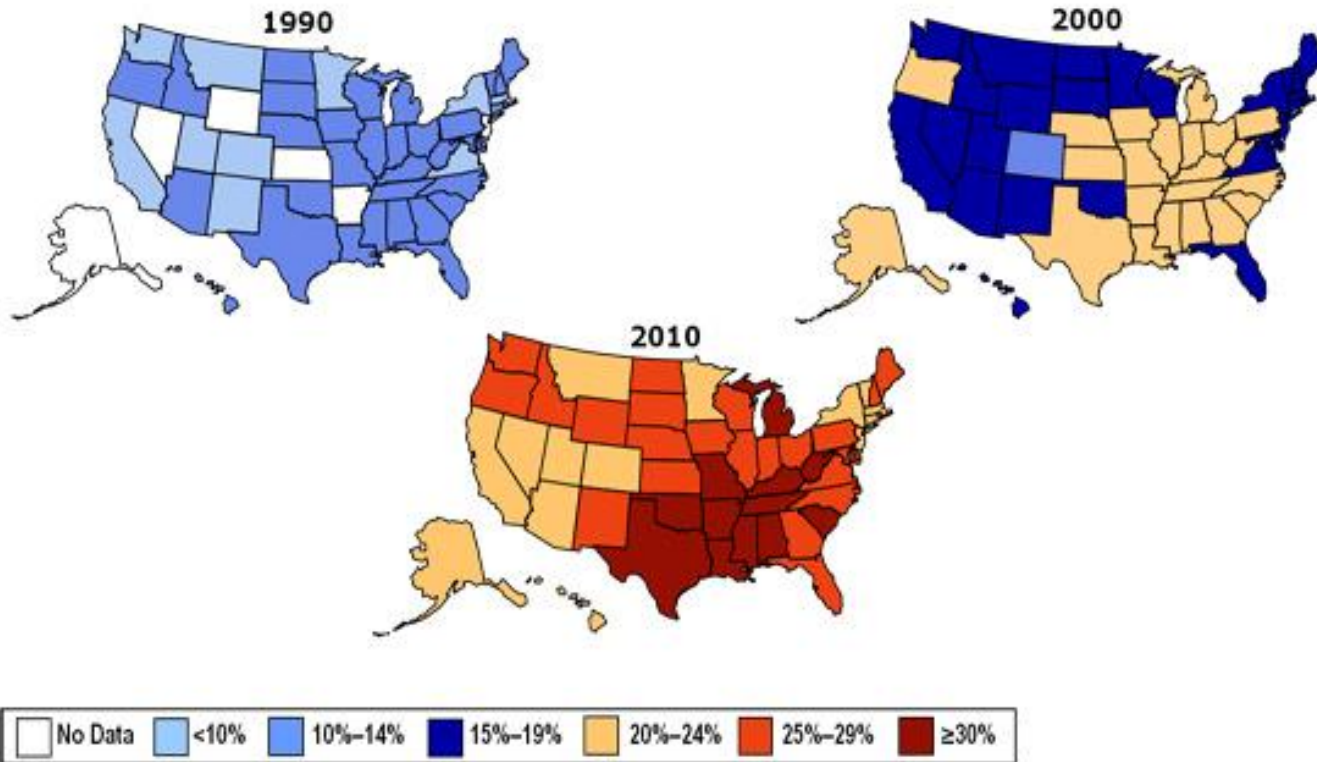
**The Obesity Epidemic in America**

# Civilian Body Size Changes

## Obesity Trends\* Among U.S. Adults

**BRFSS, 1990, 2000, 2010**

(\*BMI  $\geq 30$ , or about 30 lbs. overweight for 5'4" person)



# NHANES Males

	1988-1994				2010-2012			
	Standing Height (cm)	Weight (kg)	Body Mass Index (kg/m**2)	Waist Circ. (cm)	Standing Height (cm)	Weight (kg)	Body Mass Index (kg/m**2)	Waist Circ. (cm)
Mean	175.6	81.8	26.5	94.8	175.9	88.3	28.5	100.5
Std. Deviation	7.3	16.8	4.9	13.3	7.6	19.9	5.9	15.6
5th Percentile	163.6	59.4	20.1	75.0	163.3	61.5	20.6	77.5
95th Percentile	187.8	110.6	35.1	118.4	188.4	122.9	39.4	128.4

# NHANES Females

	1988-1994				2010-2012			
	Standing Height (cm)	Weight (kg)	Body Mass Index (kg/m**2)	Waist Circ. (cm)	Standing Height (cm)	Weight (kg)	Body Mass Index (kg/m**2)	Waist Circ. (cm)
Mean	161.9	69.0	26.3	88.4	162.0	75.5	28.8	95.7
Std. Deviation	6.9	17.1	6.3	15.3	7.2	20.3	7.4	16.4
5th Percentile	150.7	47.9	18.8	67.7	150.1	50.2	19.5	72.6
95th Percentile	173.1	102.1	38.5	116.2	173.6	114.1	42.5	126.4

# Implications - Civilian

- Stature
  - Unchanged
- Weight, BMI, Waist Circumference
  - All increased
- Design range
  - Substantial increase

# Civilian Design Range

<b>MALES</b>			
	<i>Waist Circumference (cm)</i>		
	<b>1988</b>	<b>2012</b>	
95th Percentile	118.4	128.4	
5th Percentile	75	77.5	
$\Delta$ = Design Range	43.4	50.9	7.5
<b>FEMALES</b>			
	<i>Waist Circumference (cm)</i>		
	<b>1988</b>	<b>2012</b>	
95th Percentile	116.2	126.4	
5th Percentile	67.7	72.6	
$\Delta$ = Design Range	48.5	53.8	5.3

# Army Males

	1987-1988				2010-2012			
	Standing Height (cm)	Weight (kg)	Body Mass Index (kg/m**2)	Waist Circ. (cm)	Standing Height (cm)	Weight (kg)	Body Mass Index (kg/m**2)	Waist Circ. (cm)
Mean	175.6	78.5	25.4	86.2	175.6	85.5	27.7	94.1
Std. Deviation	6.7	11.1	3.0	8.6	6.9	14.2	4.0	11.2
5th Percentile	164.9	61.8	20.8	73.5	164.7	64.4	21.4	76.7
95th Percentile	186.8	98.8	30.5	101.5	187.0	110.7	34.8	113.1



# Army Females

	1987-1988				2010-2012			
	Standing Height (cm)	Weight (kg)	Body Mass Index (kg/m**2)	Waist Circ. (cm)	Standing Height (cm)	Weight (kg)	Body Mass Index (kg/m**2)	Waist Circ. (cm)
Mean	162.9	62.0	23.3	79.2	162.8	67.8	25.5	86.1
Std. Deviation	6.4	8.4	2.6	8.3	6.4	11.0	3.5	10.0
5th Percentile	152.8	49.7	19.3	67.5	152.5	51.2	20.3	71.0
95th Percentile	173.8	77.4	28.1	94.6	174.0	87.1	31.7	104.1

# Implications – Army

- Stature
  - Unchanged
- Weight, BMI, Waist Circumference
  - All increased
- Design Range
  - Substantially increased

so, can we use the  
same regression  
equations?

# Predicted Chest Circumference (cm)

	ANSUR I Equation	ANSUR II Equation	Difference
Mean	106.3	108.1	1.8
Std. Deviation	11.6	11.5	-0.1
5th Percentile	90.4	92.5	2.2
95th Percentile	126.7	128.3	1.6

# Predicted Buttock-Knee Length (cm)

	ANSUR I Equation	ANSUR II Equation	Difference
Mean	62.0	62.0	0.0
Std. Deviation	3.2	3.0	-0.2
5th Percentile	56.9	57.0	0.1
95th Percentile	67.4	67.1	-0.3

# Take Home

- Body sizes differ between Army and civilians
- *Changes over time* are similar between Army and civilians
- If you design successfully from ANSUR I summary statistics, switch to ANSUR II
- Using ANSUR I regression equations will work sometimes; ANSUR II equations will be better

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