Effects of Predictors on Physical Activity in an Older Population

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BACKGROUND

Accelerometers provide continuous and unbiased activity observation in minute-by-minute detail over the course of several days, generating 8,000 or more observations per subject by picking up voltage signals that are proxy measures for the acceleration of the wearer (Spierer et al., 2011; Ward et al., 2005). These voltage signals are then summarized over a monitoring period known as an epoch and devised into "activity counts."

Participants in the Baltimore Longitudinal Study of Aging were fitted with Actiheart accelerometer activity monitors and the data was downloaded using commercial software to derive activity counts per minute over a period of 7 days (Schrack et al., 2014). The present research attempts to find the "best" model to predict the average physical activity based on age, sex, and BMI.

POPULATION CHARACTERISTICS

	Age						BMI						
	Min	Q1	Q2	Q3	Max	M	Min	Q1	Q2	Q3	Max	M	N
Male	33	60	66	73	93	65.8	18.3	23.0	26.0	30.0	50.3	27.1	289 (48.9%)
Female	32	62	71	78	91	68.8	19.0	24.7	26.7	29.9	45.3	27.6	302 (51.1%)
Total	32	60	69	75	93	67.3	18.3	23.9	26.5	30.0	50.3	27.4	591

METHOD & OBJECTIVES

Method:

- Conducted T-tests and Wilcoxon-Mann-Whitney tests between different age and sex groups to determine if there was a significant difference in average physical activity between them.
- Ran simple linear, piecewise, and quadratic regression models and chose the piecewise model after comparing Adj. R-Sq values.
- With the piecewise model, determined change point of age=55 after comparing models with different change point's Adj. R-Sq values.
- Evaluated the effect of BMI and Sex predictors.
- Removed 5 influential points based off of cook's distance values after comparing models with 3, 4, and 6 points removed.

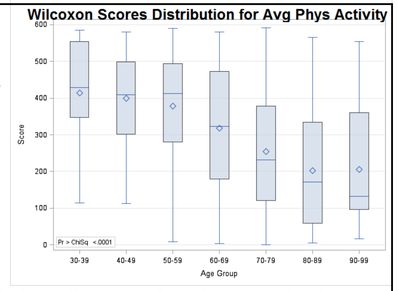
Learning Objectives:

- SAS/R Programming Skills enhancement
- Data Cleaning and Analysis
- Simple and Multiple linear regression modeling and interpretation

RESULTS

Average Physical Activity Comparisons

Comparison Group	T-Test p-value	Wilcoxon p-value
45-50 vs 85-90	0.0009	0.0002
35-40 vs 55-60	0.3992	0.2209
M vs F in 50-55	0.8419	0.5052



Model	Adj. R-Sq (Excluding BMI and Sex)
Simple Linear	0.0968
Piecewise	0.0989
Quadratic	0.0966

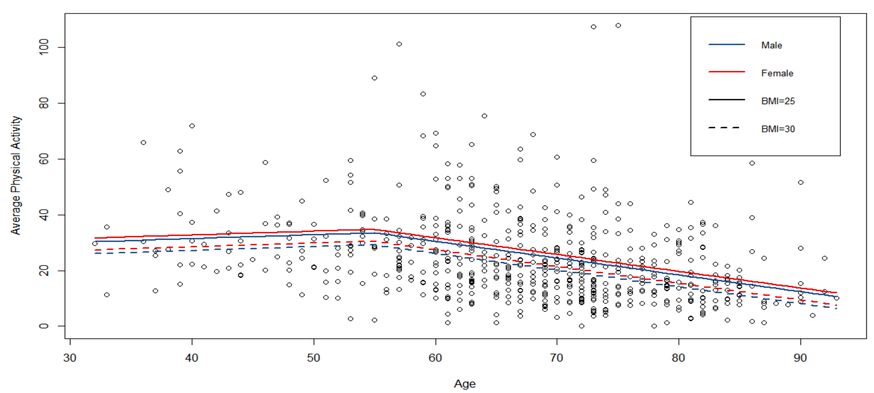
Although the Adj. R-Sq values between the three models were not significantly different, the Piecewise Linear Model was chosen as it maintained a relatively more significant association between Age and Avg. Phys. Activity versus the Quadratic while accounting for more of the data than the original Linear Model.

$$Y = \beta_0 + \beta_1 * x_1 + \beta_2 * x_2 + \beta_3 * x_3 + \beta_4 * x_4$$

Average Physical Activity

		Zero Points Removed (Adj. R-Sq=0.1578)		Five Influential Points Removed (Adj. R-Sq=0.1721)	
Variable	Meaning	Parameter Estimate	p-value	Parameter Estimate	p-value
Intercept	Value when Age=0	51.06926	<.0001	47.51611	<.0001
x_1	Age	0.11359	0.5794	0.13626	0.4386
x_2	Age Cutpoint=max[0, age-55]	-0.80301	0.0016	-0.73793	0.0007
x_3	BMI	-0.90727	<.0001	-0.86021	<.0001
x_4	Sex (M=0, F=1)	3.14401	0.0235	1.27791	0.2778

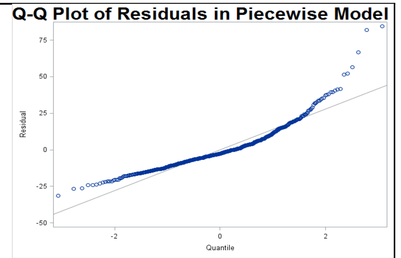
Piecewise Linear Model for Age vs Average Physical Activity

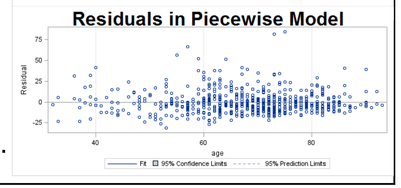


ADDITIONAL RESULTS

Age	Sex	Cook's D
57	Male	0.03026
55	Female	0.04558
50	Female	0.06000
59	Female	0.06750
70	Female	0.07007
38	Female	0.11869

Using Cook's Distance to find statistical outliers, points were removed from the set (in descending Cook's Distance) until the best model that preserved the original age parameter estimate was found.





DISCUSSION/CONCLUSION

Through regression analysis, age and BMI were each shown to have an association with average physical activity. Throughout the observed population, BMI had a significantly strong negative effect (p-value<.0001) on physical average activity. As age increased past the determined cutpoint of 55, there was a significant (p-value=.0007) negative effect on average physical activity. Before removal of the five influential points marked above (all female), sex was shown to have a significant effect on average physical activity (p-value=0.0235), such that, on average, women were observed to be more active than men across the measured population. However, upon removal of these points, the difference in average physical activity between the sexes decreased, making the effect of sex on average physical activity less significant (p-value=0.2778).

REFERENCES

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