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Health Benefits Associated with an Employer-sponsored Health Promotion Program with Device-reported Activity

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Introductions

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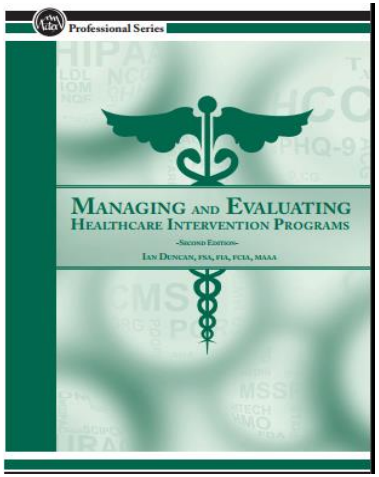
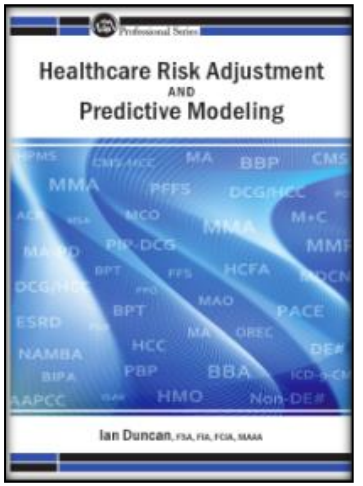
- Professor, Actuarial Statistics, University of California at Santa Barbara.
- President, Santa Barbara Actuaries Inc. Founder and former president, Solucia Consulting (now SCIO Health Analytics) and former head of Research, the Walgreen Co.
- Author of several books and a number of peer-reviewed studies on healthcare management and predictive modeling
- Former board member (2012-5), Society of Actuaries.
- Joint work with Wade Herndon PhD, UCSB.



2nd Edition 2014



Background

- This work originated in our Actuarial Masters program Research Seminar.
- Data Provided by The Vitality Group, an international health promotion program provider. Vitality collects “big data” in the form of device-reported physical activity and merges with clinical data collected from physicians and health fairs.
- Motivation: as society becomes more sedentary, obesity and life-style related diseases increase, employers look to physical activity to keep employees healthy. The US Dept. of Health and Human Services recommends 30 minutes of physical activity most days of the week. Wearable devices are becoming both a motivator and a source of potentially valuable data.
- Hypothesis: employees who exercise regularly have improved health outcomes, and there is a dose-response effect (increasingly improving outcomes with more activity).

Data

- Detailed source data were not available (privacy). Summarized data categorized as:

Table 1: Classification of Physical Activity

Device-recorded verified workouts	Light Workouts	Standard Workouts
Steps	5,000-9,999	10,000+
Calories	100-199	200+
Time at 60% Maximum Heart Rate	15 minutes	30 minutes

- Approximately 300,000 participants over 4 years; continuously reported data, including clinical data available on 8,519 participants between January 1, 2013 and August 31, 2015.

Data

- Source data were not available (privacy). Summarized data categorized as:

Table 4: Number of workouts per week

Year	Light Workouts			Standard Workouts		
	Min	Mean (SD)	Max	Min	Mean (SD)	Max
2013	0	0.86 (1.05)	6.1	0	1.75 (1.65)	7.0
2014	0	1.27 (1.29)	6.8	0	2.24 (1.84)	7.0
2015	0	1.09 (1.04)	7.0	0	1.83 (1.47)	7.0

- Other available measures include BMI, Age, Sex, Smoking status, depression status, no. alcoholic drinks per week, blood pressure and serum cholesterol level.

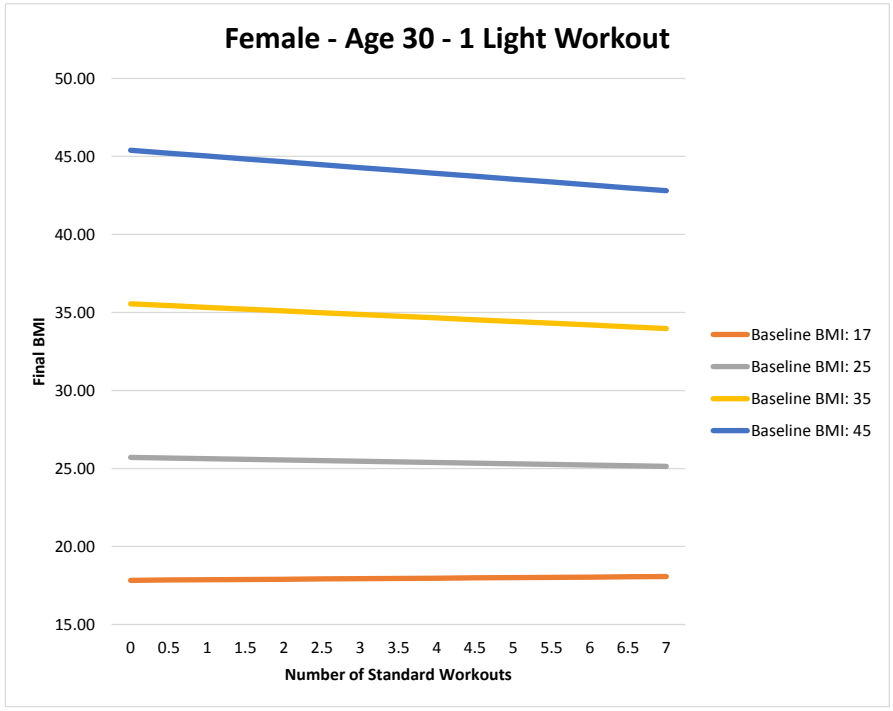
Model 1: BMI

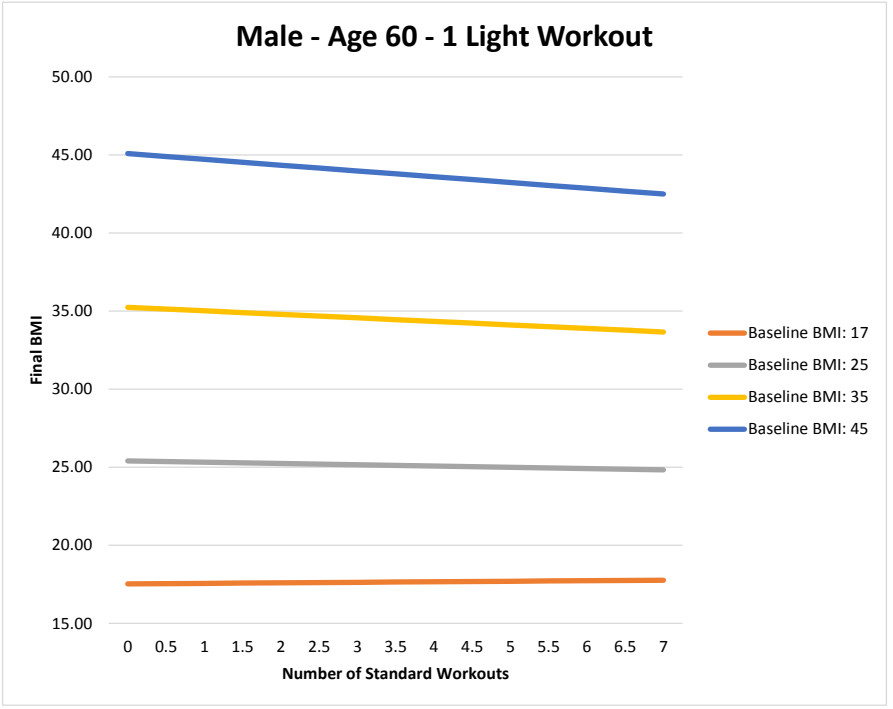
Table 6: Predicted 20-month BMI Measure for Two Sample Participants

Sample Participant	Baseline BMI Level			
	17	25	35	45
30-year old Female; 3 std./1 light w/out weekly	17.94 (5.5)	25.46 (1.9)	34.87 (-0.4)	44.30 (-1.6)
60-year old Male; 5 std./ 1 light w/out weekly	17.70 (4.1)	24.99 (0.0)	34.11 (-2.5)	43.23 (-3.9)

Model 1: BMI

Figure 2: Effect of Exercise Levels on BMI for selected participants





Model 2: Cholesterol

Table 7: Baseline Cholesterol Levels

Low-density Lipoprotein Level		High-density Lipoprotein Level			
LDL Level	Number	HDL Level	Female Number	HDL Level	Male Number
<3.0 (Normal)	5,339 (63%)	< 1.5 (High risk)	1,971 (41%)	< 1.3 (High risk)	2,130 (57%)
>3.0 (High)	3,009 (35%)	> 1.5 (Normal)	2,762 (57%)	> 1.3 (Normal)	1,551(42%)
N/a[e]	171 (2%)	N/a	81 (2%)	N/a	24 (1%)
Total	8,519	Total	4,814	Total	3,705

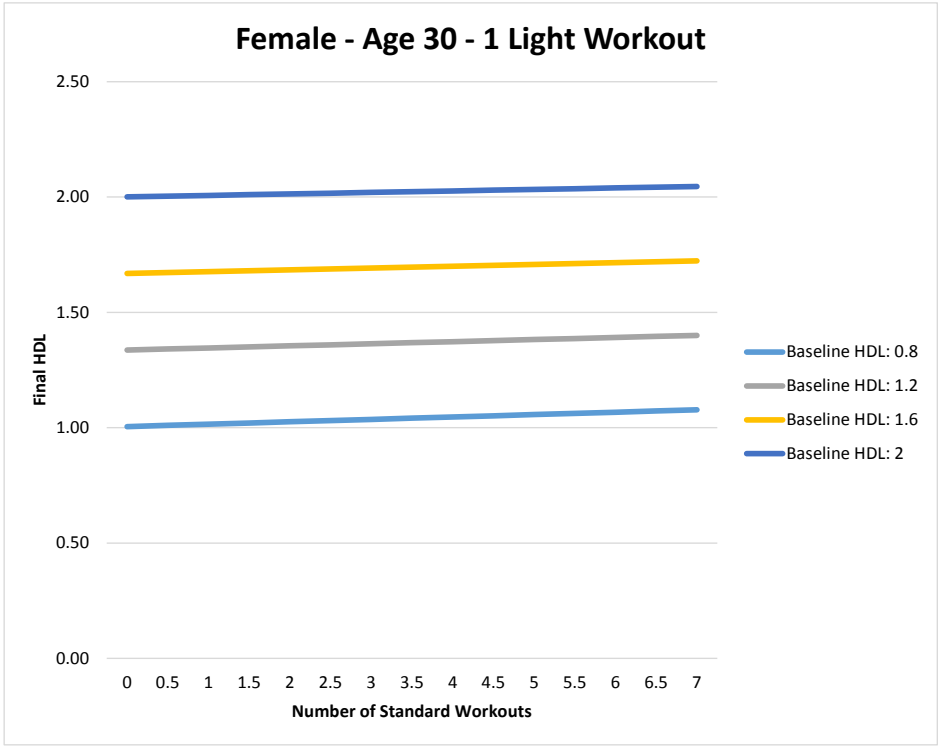
Model 2: Cholesterol

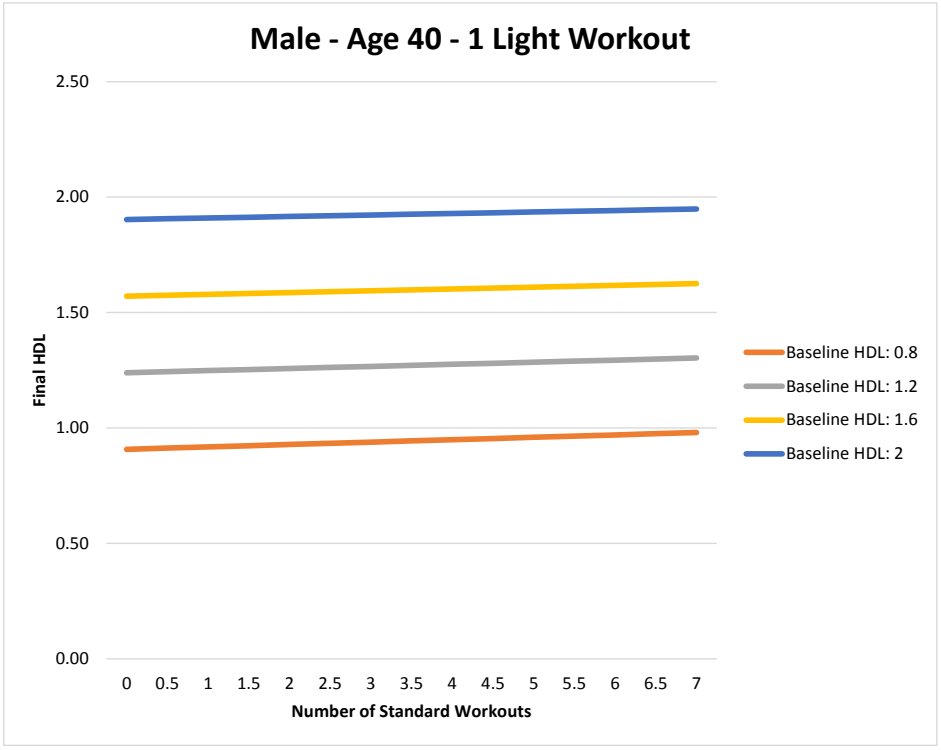
Table 10: Predicted 20-month HDL Level for Two Sample Participants

Sample Participant	Baseline HDL Level			
	0.8	1.2	1.6	2.0
30-year old Female; 3 std./1 light workout weekly	1.03 (28.9)	1.35 (12.9)	1.68 (4.9)	2.00 (0.07)
40-year old Male; 5 std./ 1 light workout weekly	0.95 (19.5)	1.28 (6.4)	1.60 (-0.1)	1.92 (-4.1)

Model 2: Cholesterol

Figure 3: Effect of Exercise Levels on HDL for selected participants





Conclusions

- Physical activity even at low levels can have positive impacts on measurable health metrics.
- Physical activity levels (light and standard) had the largest impacts on BMI and HDL cholesterol levels, but little to no effect on either blood pressure or LDL cholesterol levels.
- A measureable impact on health outcomes requires frequent, intense exercise.
- Our collaboration with the Vitality Group will continue with the addition of (at least) one further year of PA data, including a new category of more-intense workout data that may show more favorable effects of exercise.

Expressions of individual views by members of the Institute and Faculty of Actuaries and its staff are encouraged.

The views expressed in this presentation are those of the presenter.

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