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Abstract

Histograms of push-ups and curl-ups from a sample of more than 9,000 students show periodic spikes at 5 and 10 unit intervals. This paper argues that these spikes are related to focal points, a game theoretic concept popularized by Nobel Laureate Thomas Schelling. Being focal on one test makes one more likely to be focal on the other.

Focal students (whose push-up score is a multiple of 5 and whose curl-up score is a multiple of 10) behave differently from their nonfocal peers. They are more likely athletic, older, and male. Focal students, on average, did 2.2 more push-ups, 1.7 more curl-ups, and ran the mile 15 seconds faster than nonfocal students, even controlling for these covariates of performance. By contrast, being focal on a single activity did not produce a statistically significant mile time difference. Students who systematically stop at focal outcomes appear differentially motivated toward physical activity performance.

Keywords: Goal-setting, Motivation, Age heaping, Regression analysis, Focal points

Physical Activity Performance of Focal Middle School Students

The impetus of this study was an observation that middle school students' curl-up and push-up frequency distributions contained spikes at scores that were multiples of 5 (see Figure 1A and 1B). These distributions are based on data from the fall 2009 Active Schools Program (ASP) pre-assessment instituted by the Pennsylvania Department of Health (PADoH) during the 2009-2010 school year. The spikes were even more pronounced for scores in multiples of 10, indicating that the frequency of these recorded round number scores was much greater than scores that were not round numbers (in the present context, a round number ends in 0 or 5).

Schelling (1960) argued that individuals involved in negotiations often achieve round number solutions because they are less ambiguous. He called these outcomes focal points. Although the notion of focal points, also now referred to as Schelling points, is well established within the field of game theory, but has not been explicitly examined in the field of motivational psychology.

This paper follows Schelling's lead and refers to these round number scores as *focal scores* or *focal outcomes*. The evidence suggests that focal scores arise systematically across events, and those individuals who are focal on both events share some common attributes. The ultimate goal is to discern whether those who systematically stopped at focal outcomes did so by settling for the outcome or by pushing to achieve it instead. The regression evidence suggests that the latter is more likely than the former. Focal students also appear to be able to transfer their motivation across activities.

****Figure 1 about here****

Schelling conceptualized focal points in the context of negotiation between decision-making agents. Schelling's focal outcome is a consequence of interaction among parties in the

bargain. The present context is different because an individual student's physical performance scores are not negotiated with another individual, they are earned via individual action. They are the result of one-party activity rather than the result of two-party activity. As such they are more akin to age heaping, the phenomenon in survey research in which individuals round up or down one's self-reported age to the nearest 0 or 5. Age heaping has been shown to be associated with innumeracy (A'Hearn, Baten, & Crayen, 2009). Student physical performance scores are created by the individual but recorded by the physical education teacher using the ASP protocol. Individual teachers did not appear to "score heap." Had this occurred, these patterns would have been discerned in the preliminary data cleaning. As noted below, one school was removed for such behavior. This paper argues that a student stopping at a focal score is likely to be the result of goal-setting by that student.

Many studies have shown that goal-setting is a central determinant of motivation (Klein, Wesson, Hollenbeck, & Alge, 1999; Lovejoy & Durik, 2010). Setting goals elevates motivation by making one more attentive to a task. This allows one to approach a task with more effort and persistence and to formulate a strategy that best completes the challenge (Liew, Xiang, Johnson, & Oi-Man Kwok, 2011; Locke, Shaw, Saari, & Latham, 1981; Lovejoy & Durik, 2010; Marshall & Brown, 2004; Pemberton & McSwegin, 1989). In the context of the present study, the results are consistent with the assertion that students who engage in focal behavior do so by setting their own goals. Furthermore, a self-set goal enhances and fortifies one's commitment because the goal-setter has taken responsibility for his or her personal improvement (Klein et al., 1999; Lovejoy & Durik, 2010; Pemberton & McSwegin, 1989). Klein et al. (1999) suggested this may be "because those self-chosen goals tend to have high instrumentalities and expectancies higher than warranted by their objective difficulty" (pp. 891– 892). The individual's goal was a self-

referenced perception of growth in the activity through which to evaluate his or her competence (Nelson & DeBacker, 2008).

Setting specific and challenging goals is a key to maximizing goal commitment and achieving peak performance (Klein et al., 1999; Locke et al., 1981; Marshall & Brown, 2004; Pemberton & McSwegin, 1989). The goals that are set must be realistic if students are to reach them. Students who consistently fail to achieve their goals will tend to shut down (Boyce & King, 1993; Jagacinski, Kumar, & Kokkinou, 2008). As they progress into adolescence, males are more likely than females to set realistic goals (White, Hohn, & Tollefson, 1997), are generally more competitive (Jagacinski et al., 2008; Solmon, 1996), and have a higher self-esteem than females (Mills & D'Alfonso, 2007). Research has shown that there is a decline in physical activity from sixth to eighth grade (Hausenblas, Nigg, Downs, Fleming, & Connaughton, 2002; Parish & Treasure, 2003), and a decrease in motivation in physical education as students get older (Gao & Newton, 2009).

Studies show that prior experience in athletics has significant effects on competence in middle school physical education (Scrabis-Fletcher & Silverman, 2010) and that familiarization with a task enhances one’s performance (Tsigilis & Theodosiou, 2008; Waterman, 2005). Organized athletic programs are more prevalent in older grades. Also, with maturation comes a rapid improvement in physical abilities (Nedeljkovic, Mirkov, Kukolj, Ugarkovic, & Jaric, 2007) and a greater awareness of these abilities (Xiang & Lee, 1998). The increase in performance across grades may result from maturation and because older students have had more time to participate in athletics.

Because situational interest, a significant contributor to goal commitment and personal motivation, is higher for areas of personal interest (Bamana, Tessier, & Vuillemin, 2008), one

would expect that the more physically active or involved in sports a child is, the more likely he or she is to be motivated in fitness testing (Waterman, 2005). Situational interest "occurs when a learning task gives the learner a sense of novelty and challenge, demands high attention and exploration intention, and generates instant enjoyment during the person-task interaction" (Chen & Darst, 2001). Existing research shows that athletic individuals have a higher goal commitment in physical activities, and thus have superior motivation (Chen & Darst, 2001; Klein et al., 1999). Greater skill then raises the level of effort one puts into a task, and less skill has been associated with less effort (Marshall & Brown, 2004; Nicholls, 1984).

Motivation is an unobservable phenomenon–it cannot be measured directly. Indirect measures act as a proxy for motivation. Some studies on the subject have relied on questionnaires to infer the nature of motivation while others have used behavioral metrics such as the free-choice measure (Katz, Assor, & Kanat-Maymon, 2008; Mayer, Faber, & Xu, 2007); however, this motivation measure often fails to capture the autonomous motivation present in an activity (Katz et al., 2008). This study suggests focal score outcomes may provide another behavioral metric for autonomous motivation.

Method

Participants

PADoH launched the ASP to encourage daily physical activity in middle school students. ASP schools agreed to institute a minimum of thirty min of daily exercise and administer physical fitness assessments in physical education classes at the beginning and the end of the 2009-2010 school year. This analysis uses data from the first assessment when the daily exercise stipulation was just beginning. PADoH received fall 2009 pre-assessments from 11,932 students at 37 schools. The participants were evenly divided across gender with 49.5% being female and

50.5% being male. These students were from urban, suburban, and rural schools spanning the Commonwealth of Pennsylvania.

Procedure

PADoH provided assessment protocols to instructors. This protocol has received IRB approval. School representatives were required to participate in a webinar on assessment protocols and the reporting template in September 2009 (Pennsylvania Department of Health, 2010). This was done to ensure minimal bias in comparing results across schools. The assessment included the mile run, curl-ups, push-ups, gender, age, grade, height, and weight.

In the curl-up test, students had 60 seconds to perform as many repetitions as possible, the same time limit used by the *President's Challenge* (President's Council on Fitness, Sports & Nutrition, 2010). For the push-up test, students were instructed to do push-ups until failure. PADoH gathered data from schools using a modified version of an Excel file created by the Centers for Disease Control for use in schools (Centers for Disease Control and Prevention, 2009; Pennsylvania Department of Health, 2010).

Removing 1,914 students with missing or invalid data left 10,018 with full data. Seven schools were removed after preliminary analysis due to suspect data. Six had excessive mile times which signaled a clear breakdown in testing student abilities (35.4% of the students at these six schools took 15 to 20 min and another 16.0% took 20 min or more to run the mile compared with 10.4% and 0.7% respectively for the remaining 31 schools). The seventh school had almost 60% of the students doing 80 curl-ups, a number that represents the maximum curl-ups at that school. These seven schools were among the smallest in the ASP—removing them reduced the number of observations by 956 to 9,062. Finally, 524 students who had zero push-ups (507), zero curl-ups (46), or both (29) were removed to avoid convoluting the focal group

definition. Therefore, the analysis is based on 8,538 students from 30 schools who performed at least one push-up and one curl-up.

Students were classified according to curl-up and push-up test scores because they are whole number metrics, and mile run times were utilized to see if students exhibited consistent trends across the three physical performance tests. Since research has shown that gender, age, and grade are correlated with motivation, these variables were used as both response variables in the initial empirical analysis and as control variables in the regression analysis. Excel was used for data cleaning and SPSS for statistical tests. Exact tests were used in examining hypotheses. Large sample tests produced results of no practical difference from the exact tests. The remainder of this section explains the exploratory analysis of the observational data. The outcomes for each test described below are recorded under the corresponding heading in the Results section.

Focal Behavior on Individual Activities

If the distribution of scores was random, one would expect scores ending in multiples of 5 to be achieved 20% of the time and scores ending in multiples of 10 to be achieved 10% of the time. To examine whether round number scores for push-ups and curl-ups occurred more often than they would under a random score distribution, exact binomial p-values for one-sample tests on a proportion were calculated. The frequency of scores with remainder 0 when divided by 5, f_5, was tested against .2, H_0: $f_5 = .2$ versus H_1: $f_5 \neq .2$, and the frequency of scores with remainder 0 when divided by 10, f_{10}, was tested against .1, H_0: $f_{10} = .1$ versus H_1: $f_{10} \neq .1$, for both fitness tests.

Defining individual focal behavior. This paper defines a focal score in push-ups as having a remainder of 0 when divided by 5 and a focal score in curl-ups as having a remainder of

0 when divided by 10 because push-ups are more difficult than curl-ups; the average push-up score was 14.3 and the average curl-up score was 35.2. Each focal score definition attempts to capture a subject's decision, whether conscious or not, to stop at a round number score rather than a physical inability to make it to the first such score. Using 10 for push-ups would require the first focal outcome to occur at the average push-up score for females, 10.2, so that many would be incapable of reaching this stopping point. To observe how results may vary had different definitions of a focal subject been adopted, tests were performed on the frequency of students in the remainder 0 groups, f_{base}, using bases 4 and 6 rather than 5, and bases 9 and 11 rather than 10. The hypotheses for these tests were H_0: $f_{base} = 1/base$ versus H_1: $f_{base} \neq 1/base$.

Transferring focal behavior across activities. If students exhibiting focal behavior in one activity are <u>inherently</u> different from other students then they should exhibit a greater focal propensity for the other activity. To test this, differences between the five push-up remainder groups with respect to the percent that were focal on curl-ups, and differences between the ten curl-up remainder groups with respect to the percent that were focal on push-ups were examined. To assess whether the focal group in one performance test had a relatively higher percent of focal subjects in the other, let:

f_{0c} = frequency of remainder zero push-up students who were also focal in curl-ups

f_{p0} = frequency of remainder zero curl-up students who were also focal in push-ups

and note that:

frequency of all students who were focal in curl-ups = .198

frequency of all students who were focal in push-ups = .299.

Exact binomial one sample procedures were used to test H_0: $f_{0c} = .198$ versus H_1: $f_{0c} \neq .198$ and H_0: $f_{p0} = .299$ versus H_1: $f_{p0} \neq .299$.

Focal Behavior on Paired Activities

Defining Focal00 behavior. Each student had a pair of remainders, one for push-ups and one for curl-ups. The digit pairs 00 - 49 described the 50 possible *pc* remainder pairs where the 10s digit stood for *p*ush-up remainder and the 1s digit stood for *c*url-up remainder. Because the analysis of systematic behavior is of interest, define a focal subject, *Focal00,* as one with remainder pair 00. Pearson's χ^2 test for the goodness of fit for the model of equal frequencies, f_i, across the 50 remainder pairs, testing H_0: $f_i = .02$ for all $i = 0, 1, \ldots, 49$ versus H_1: $f_i \neq .02$ for some $i = 0, 1, \ldots, 49$ was performed. As a follow-up, exact one-sample tests on the hypotheses H_0: $f_i = .02$ versus H_1: $f_i \neq .02$ for remainder groups of interest were performed.

Focal00 behavior by gender and grade. To better classify focal and nonfocal behaviors, attributes that Focal00 students share were examined. Frequency distributions of remainder pairs by gender and grade were examined**,** then the Mantel-Haenszel test was used to test for equal frequencies of focal students across the Gender × Grade partition, H_0: $f_{ij} = .167$ for all $i = 0, 1,$ and $j = 6, 7, 8$ versus H_1: $f_{ij} \neq .167$ for some $i = 0, 1,$ and $j = 6, 7, 8$. This preliminary test determines whether gender and Focal00 are independent, having controlled for grade. A significant Mantel-Haenszel M statistic identifies the combined effect of gender and grade as significant predictors of whether an individual will be in the Focal00 group.

To further investigate how gender and grade relate to Focal00, numerous gender and grade contrasts were examined to make inferences about the types of students who are most likely to be Focal00. Since many comparisons were performed, Scheffe's method was used to control the experiment-wise error rate. These tests were of the form H_0: $c_6f_{06} + c_7f_{07} + c_8f_{08} + c_{16}f_{16} + c_{17}f_{17} + c_{18}f_{18} = 0$ versus H_1: $c_6f_{06} + c_7f_{07} + c_8f_{08} + c_{16}f_{16} + c_{17}f_{17} + c_{18}f_{18} \neq 0$ where c_i, $i = 6, 7, 8, 16, 17, 18$, are constants whose sum is zero. For instance, the test of whether six grade

females have the same frequency of focal students as eighth grade males requires $c_6 = 1$, $c_7 = c_8 = c_{16} = c_{17} = 0$, and $c_{18} = -1$ to get the test H_0: $f_{06} - f_{18} = 0$ versus H_1: $f_{06} - f_{18} \neq 0$.

Focal00 behavior by athleticism. One method of categorizing students as athletic or nonathletic is to base that categorization on their gender- and grade-adjusted performance on activity tests. A three-way partition according to athleticism was created by utilizing two fitness tests. The mile run test was chosen because it was the most challenging test and push-ups was chosen because the protocol did not include an artificial stopping point. Students were defined as *Athletic* if they had above median performance for their gender and grade on push-ups and mile run and *Nonathletic* as the reverse. *Mixed Athletic* students had above median performance on one activity but not the other.

Regression Analysis

Finally, linear regression was used to determine the conditional effect of the focal variable on athletic activity performance having accounted for meaningful covariates. Although activity performances are correlated, the pairwise correlations are not strong enough to invoke fears of multicollinearity. The strongest correlation between activities was between push-ups and curl-ups $r = 0.43$, $p < .001$. In addition, the variance inflation factor associated with each explanatory variable was close to 1 for all of the regression models, providing further reason to believe that multicollinearity was not a concern in the analysis.

Results

Focal Behavior on Individual Activities

Scores in multiples of 5 occurred significantly more frequently than .2, for push-ups, $f = .299$, $p < .001$, 95% CI [.289, .309], and for curl-ups, $f = .325$, $p < .001$, [.315, .335]. Scores in multiples of 10 occurred significantly more frequently than .1, for push-ups, $f = .169$, $p < .001$,

[.161, .177], and for curl-ups, $f = .198$, $p < .001$, [.190, .207]. Students are more likely to achieve scores in multiples of 5 and 10 than other scores for both push-ups and curl-ups.

Defining individual focal behavior. When multiples of 4 or 6 rather than 5 for the push-ups base, or 9 or 11 rather than 10 for the curl-ups base were used, the results were quite different. With all four of these alternative bases, the remainder 0 group frequency was less than 1/base; two of these differences were significant. For base 4 push-ups, $f = .247$, $p = .52$, 95% CI [.238, .256], for base 6 push-ups, $f = .144$, $p < .001$, [.137, .152], for base 9 curl-ups, $f = .108$, $p = .41$, [.102, .115], and for base 11 curl-ups, $f = .074$, $p < .001$, [.068, .079].

Transferring focal behavior across activities. In each instance, the focal group in one performance test had the highest percent of focal subjects in the other. The remainder 0 curl-up group had significantly more focal push-up subjects, $f = .338$, than the complete sample, $f = .299$, $p < .001$, 95% CI [.316, .362], and the remainder 0 push-up group had significantly more focal curl-up subjects, $f = .224$, than the complete sample, $f = .198$, $p = .001$, [.208, .241]. None of the remainder 1, 2, 3, or 4 push-up groups had a greater proportion of focal curl-up subjects than the complete sample. For curl-ups, 5 was the only other remainder group that had a greater proportion of focal push-up subjects, $f = .328$, than the complete sample, $f = .299$, $p = .045$, [.300, .355]. Of course, the remainder 5 group for curl-ups was notable because it would have represented a focal outcome had curl-ups been defined in sets of five rather than ten. These results provide evidence that being focal on one test makes one more likely to be focal on the other.

Focal Behavior on Paired Activities

Defining Focal00 behavior. Figure 2 shows the *pc* remainder pairs frequency distribution. This distribution has a readily discerned pattern based on focal solutions. Tests

produced strong evidence of unequal proportions of focal students, $\chi^2 = 1977.73$, $p < .001$. Focal00, at $f = .067$, dominates the other *pc* remainder pairs and is significantly greater than the average of .02, $p < .001$, 95% CI [.062, .073]. All of the above average pairs had either remainder 0 for push-ups, 0*c*, or 0 or 5 for curl-ups, *p*0 or *p*5, with one exception. The exception, *pc* = 22, at $f = .0209$, was not significantly different from .02, $p = .58$, [.0198, .0220].

****Figure 2 about here****

Focal00 behavior by gender and grade. The panels in Figure 3 indicate clear differences in Focal00 proclivity between genders as well as grades. A horizontal comparison shows that Focal00 behavior is more prevalent in males than females. A vertical comparison shows more students become Focal00 with age.

****Figure 3 about here****

Statistical tests verify these visual impressions. There were significant differences between the six Gender × Grade groups with respect to the proportion of focal students, Mantel-Haenszel M = 20.743, $p < .001$. The difference between proportions tests showed significant differences between the $f = .079$ of males who are Focal00 and the $f = .055$ of Focal00 females, $p < .001$. Focal00 frequencies for Grades 6, 7, and 8, were $f = .043$, $f = .066$, and $f = .083$, respectively. Each successive grade was represented by a higher frequency than its predecessor, Grade 6 - Grade 7, $p = .001$, 95% CI [-.037, -.001], Grade 7 - Grade 8, $p = .006$, [-.030, -.005]. Looking at grade differences by gender from Figure 3, the same trend emerges for males; with each grade the proportion that were Focal00 increased significantly, Grade 6 - Grade 7, $p = .027$, [-.043, -.003], Grade 7 - Grade 8, $p = .006$, [-.043, -.007]. For females, there was no significant distinction between Grades 7 and 8, Grade 7 - Grade 8, $p = .262$, [-.024, .007], but both had a higher rate of Focal00 students than Grade 6 females, Grade 6 - Grade 7, $p = .012$, [-.042, -.005],

and Grade 6 - Grade 8, $p = .001$, [-.051, -.014]. Grade 8 males were significantly higher than non-Grade 8 males, $p < .001$, [.025, .057] and both Grade 6 females, $p < .001$, [.025, .051] and Grade 6 males, [.003, .032] were significantly lower than their respective complementary sets of middle school students. By the Focal00 metric, more males became focal, almost linearly, with age. Females experienced an increase in focal proclivity after sixth grade which seemed to continue from seventh to eighth, but at a slower rate.

Focal00 behavior by athleticism. A three-way partition according to athleticism was created by utilizing gender- and grade-adjusted median performance on two physical activity tests. According to this definition, 33.8% were Athletic, 35.9% were Mixed Athletic, and 30.3% were Nonathletic (these percentages are the horizontal lines in each panel of Figure 4). Since this definition uses median partition cut-points for two activities, absent correlation across physical performances, the Athletic and Nonathletic groups would have 25% and Mixed Athletic group would have 50% of all participants. More than 25% of students were in the Athletic and Nonathletic groups because of the significant correlation between push-ups and mile run, $r = -0.40$, $p < .001$.

****Figure 4 about here****

With this performance-score-based athletic partition, Figure 4 illustrates how *pc* remainder pair membership varied by athleticism. Figure 4 compares frequency distributions for each of the 50 remainder pairs by athleticism groups. For each remainder pair, the sum of the three athleticism group percentages was 100%. The Athletic and Nonathletic panels appear to be almost inverse images of one another; the correlation between the Athletic and Nonathletic remainder pair frequencies is $r = -0.88$, $p < .001$. By contrast, the Mixed Athletic panel shows no clear pattern across remainder pairs. Particularly interesting is the high level of Athletic and low

level of Nonathletic 0*c* focal push-up students. Athletic students comprise 49% of all Focal00 students and Nonathletic students comprise 18% of all Focal00 students. These results imply that a typical Focal00 subject is most likely athletic, and least likely nonathletic.

Regression Analysis

Through graphical evidence and difference in means tests, this paper has shown that the variables age, male, and athleticism were all positive predictors of Focal00 behavior. At the extremes, 12.95% of Athletic Grade 8 males were Focal00 compared to 2.09% of Nonathletic Grade 6 females. Focal00's connection with motivation or lack thereof was not explicitly addressed despite having identified certain characteristics that are more common among Focal00 subjects. The Focal00 tendencies based on gender, grade, and athletic ability all align with the literature concerning more motivated subjects. Only by holding these contributing variables constant and examining if being Focal00 remained a significant predictor of performance, would one be able to attribute a differential effect to the Focal00 variable.

For example, showing that a Focal00 athletic Grade 8 male performs better than a non-Focal00 athletic Grade 8 male suggests that being Focal00 is its own effect—it speaks to the extra drive of a Focal00 individual compared to a similarly situated non-Focal00 individual. To view the effect of Focal00 behavior in middle school physical performance testing across the gender, age, and athletic ability spectrum, multiple linear regression was utilized.

Four regressions are presented, one for each of the three physical performance tests as a function of variables indicative of fitness level, age, gender, and Focal00 in Table 1. The final regression reexamines mile performance using individual focal variables (Focal Push-ups = 1 if the student's push-up score is a multiple of 5, else 0, and Focal Curl-ups = 1 if the student's curl-up score is a multiple of 10, else 0) rather than Focal00. With the exception of the focal and male

dummy variables, categorical variables were avoided in order to examine nonlinear, continuous trends. Performance test scores and age replaced Athletic, Nonathletic, and Grade in the regression models. Linear and quadratic terms were included to test for nonlinear effects of one activity on the other activity.

The sign of a focal coefficient provides evidence of motivation or lack thereof. Specifically, if a focal coefficient is positive for curl-ups or push-ups or negative for the mile run then focal students tended to push themselves in their performance on that activity. If focal students stopped short in their performance on an activity, then the reverse sign would hold true.

****Table 1 about here****

Activity differences. Superior performance on one activity, *x*, was expected to be associated with superior performance on another activity, *y*. Physical performances were correlated. Each activity had a significant linear coefficient with the expected sign, therefore a significant correlation was established. All quadratic coefficients were significant except curl-ups in the push-ups regression, and therefore a nonlinear relation was also confirmed. In all instances with statistically significant linear and quadratic terms for *x*, the activity level where *x* has no incremental effect on *y* occurred near the outer edge of *x*'s frequency distribution. This means that the vast majority of the students exhibited a consistent behavior pattern. A significant quadratic term implied that better performance on *x* did not have the same incremental effect on *y*. Push-ups and curl-ups had diminishing returns to increasing performance in the other activities and the mile run had increasing returns to increasing performance in the other activities. Males did significantly more push-ups and ran the mile significantly faster but did not do more curl-ups with activity differences held constant.

Focal differences. Focal00 students performed significantly better than their non-Focal00 peers on all three tests. These regressions allow one to examine how each activity varied between Focal00 and non-Focal00 students, controlling for age and gender as well as innate differences in performance on the other activities. The Focal00 coefficients show that a Focal00 subject will, on average, perform 2.21 more curl-ups, 95% CI [1.15, 3.28], 1.66 more push-ups, [0.82, 2.49], and run the mile 0.24 min faster, [-0.45, -0.02], than a non-Focal00 peer of the same gender, age, and athletic profile. The Focal00 variable's significance in all three models provides evidence of the extra effort that Focal00 students displayed on the tests, independent of the level of performance actually achieved on those tests.

The second mile regression examines if the motivational advantage from being Focal00 is present in one-way focal subjects. Model 2 shows that, when Focal00 was replaced with one-way focal variables, being focal on one of these two tests does not have significant mile time implications.

Discussion

This paper has undertaken a sequence of statistical tests that has marshaled evidence supporting the conclusion that focal students appear more motivated in physical performance testing than their nonfocal peers. It established that student physical performance scores on tests ending in whole number quantities are not random. Scores occur significantly more often in multiples of 5 or 10. Students who are focal on one test are more likely than their peers to be focal on the other. Students who were focal on push-ups in multiples of 5 and curl-ups in multiples of 10 were labeled the Focal00 pair; the first 0 referred to the push-up remainder and the second referred to the curl-up remainder. These students behaved differently from their non-Focal00 peers. The proportion of students who were Focal00 increased with age, was greater for

males than females, and was larger for athletes than for non-athletes—all attributes identified in the literature as shared by more motivated students of middle school age.

Focal00 is a significant contributor to increased curl-up, push-up, and mile run performance, holding indicators of athleticism, age, and gender constant. Focal00's significance in all three regression models suggests that it is meaningful in predicting physical activity performance. The coefficient magnitudes of 2.21 curl-ups, 1.66 push-ups, and -0.24 mile represented a percentage increase in performance of 6.3%, 13.8%, and 2.2% based on median performances of 35, 12, and 10.75 respectively. Each coefficient represented a substantive increase in performance as a result of being Focal00.

By contrast, one-way focal variables do not adequately model a motivated student, perhaps because he or she could have been included by random score distribution. Focal00 provides a better proxy for motivation because the behavior persists across activities; this consistent behavior may well be rooted in the Focal00 student's personality and in his or her approach to undertaking challenging tasks. Perhaps focal persistence across activities is a behavioral metric of effortful persistence, which has been shown to be predictive of mile run performance (Liew et al., 2011).

The mile run regression results were particularly illuminating. First, the mile is measured as a continuous rather than a discrete variable. Focal points require clear unambiguous stopping points that are measured in discrete units. Students running the mile do not typically know if they are at 9:59, or 10:00, or 10:01 and therefore cannot exhibit the same kind of focal achieving in this activity that they can in push-ups or curl-ups. Second, it is a longer test where one can more easily notice sustained motivation or perseverance. Third, the mile was not used to define the focal variable, so there is no risk that the Focal00 variable has confounding effects on mile time.

Fourth, the mile is administered to groups of students in a setting in which each is more readily able to judge relative performance. It therefore introduces a greater possibility of ego-oriented motivation (Smith, Smoll, & Cumming, 2009).

This paper argues that the intrinsic quality shared by Focal00 members is motivation because regression analysis shows that Focal00 students push themselves harder in physical performance assessments than their similarly situated non-Focal00 peers. Even if a student did not realize that he or she was setting a goal to achieve a focal outcome, the evidence in the literature that unconscious goals can have the same effect as conscious goals on achievement makes understanding the focal mindset worthwhile (Riketta & Dauenheimer, 2003).

These tests suggest that being Focal00 means approaching the tests with superior motivation. One goal in applying these findings may be to attempt to infuse the attitude of the Focal00 group toward physical performance testing into the non-Focal00 population. It may be difficult to recreate this focal attitude in children through external influences because this attitude was brought about by an internal mechanism in Focal00 students. To do so, one would have to understand the Focal00 thought process and tailor instruction to create an atmosphere that encourages the development of this intrinsic motivation.

Under the assumption that round numbers act as motivators or checkpoints focal students strive to reach, a useful exercise for coaches may be to continually encourage children to make it to the next round number when students feel like stopping. This strategy would encourage constant resetting of goals to a higher level, a method which would produce high performance levels because it would encourage students to adopt a mastery orientation (Boyce & King, 1993). The motivational climate created by coaches can influence goal orientation. In particular,

coaches can create an environment that produces achievement-related motives in young athletes (Smith et al., 2009).

One expects that the more children are reminded to set goals and challenge themselves, the more prone they will be to adopt that mentality especially in the middle school years which are important for developing behaviors that will continue into adulthood (Gao & Newton, 2009). Encouraging students to strive for focal scores may promote this spirit of self-improvement because such scores are already familiar; our number system counts in tens, our fingers count in fives, and so do motivated middle schoolers.

The reporting of the test scores by the physical education teacher and the atmosphere created in class by the teacher during the tests were uncontrolled aspects of the analysis. Despite the directions provided by PADoH in administering the ASP assessment protocols, some teachers may have been more or less strict about what constituted a single repetition in push-ups or curl-ups. Teachers also may have offered varying degrees of encouragement to their students during the test that affected performance. There is no way of knowing how much of the students' motivation was self-generated and how much was a reflection of teacher enthusiasm. Although schools with suspicious score reporting or poorly administered tests were removed from the analysis, there still may have been a bias in the experiment created by inaccurate reports by the test proctors.

In addition, information about the history of physical performance tests at any of the schools was unavailable. If some middle schools had instituted physical performance testing in the past and others had not, then a test experience bias may have been present (Tsigilis & Theodosiou, 2008). Differences in the schools' approaches to the physical performance tests

would lead to an interesting discussion concerning how students can be motivated so that they will achieve their optimal performance.

Future research on focal tendencies would benefit from having students complete post testing questionnaires attempting to measure motivation. Understanding what motivates focal students is critical to understanding what would encourage this behavior in nonfocal students, and is information that would be useful to both physical education teachers and coaches. Researchers would also benefit from knowing whether, and how frequently, a student had participated in organized sports in school as well as outside of school. One may conjecture that focal students have simply been coached more, and, as such, they have been taught to count their results in multiples of 5. But this presupposes that students from a variety of schools across the state have been subject to focal coaching. No evidence of such coaching protocols was found and M. E. Byers of the *Pennsylvania Interscholastic Athletic Association* and *Pennsylvania Coaches' Association* confirmed that no such protocols exist within the state of Pennsylvania (personal communication, January 3, 2012). Further, to the extent that students have been involved in organized sporting activities outside of school, they are typically coached by parents without formal training in coaching pedagogy.

It would be useful to perform a controlled experiment to test the effectiveness of different motivational strategies. For example, an experiment where the instructor in the treatment group encourages students during the tests to push for the next round number could help researchers to observe the performance benefits of explicit focal instruction. It would also be helpful to see if focal behavior persists across time.

Another goal in continued research on focal behavior is to adapt the idea beyond physical performance testing. One may speculate that this behavioral trend should appear in a diverse

range of activities that allow for goal-setting and internal drive to be achieved. Since Focal00 subjects appeared to be steadfast in their approach to physical performance tasks, it would be interesting to test whether they have adopted a similar mindset in classroom tasks. If researchers identify focal variables in different arenas, they would likely be able to discover and exploit the attributes that define them and help people to achieve superior results in each respective arena. Instilling focal qualities into nonfocal individuals could change the way nonfocal students approach challenges. Even if these qualities are not transferable to nonfocal students, explicitly encouraging focal behavior may further enhance the performance of focal students.

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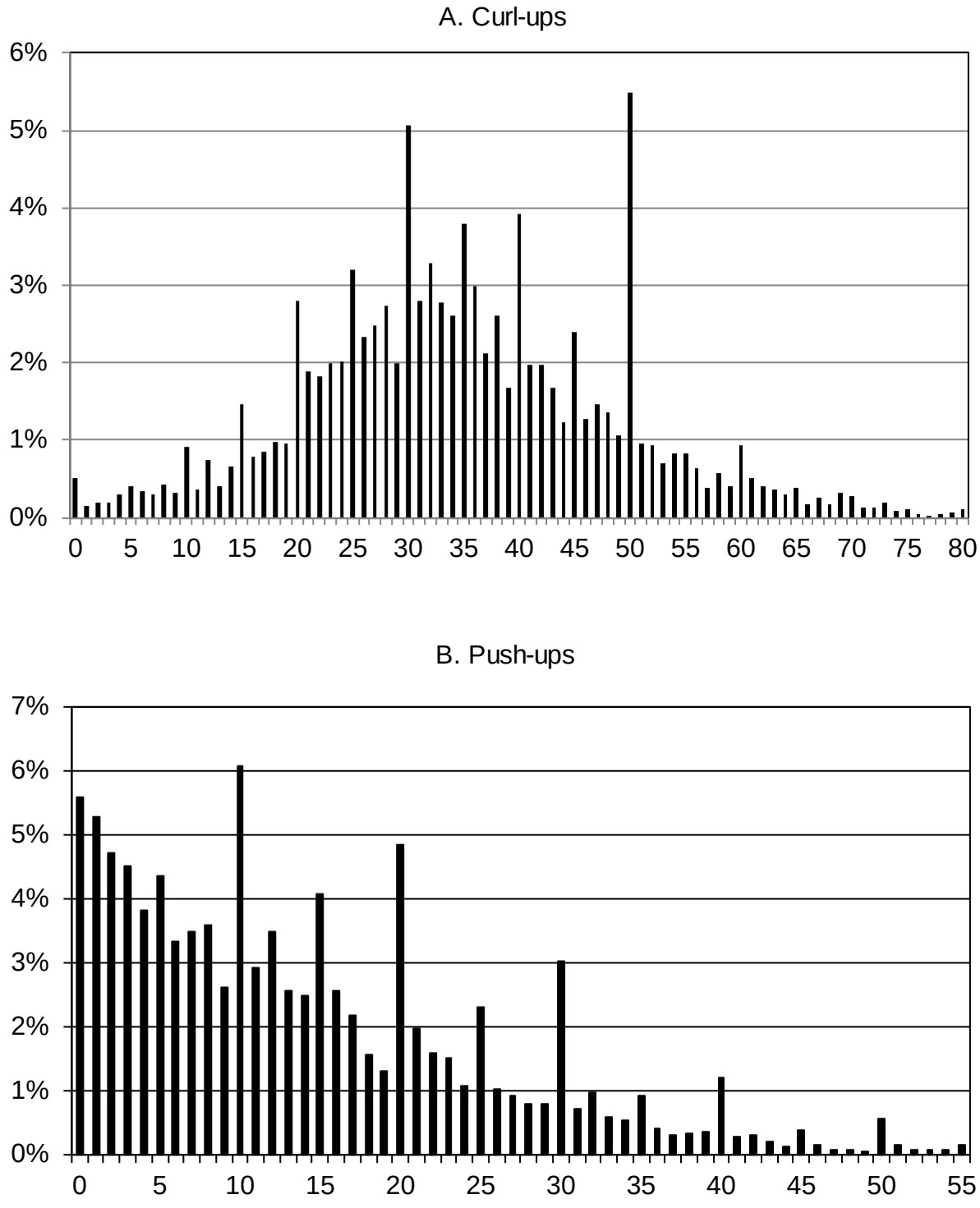

Figure 1 . Frequency distributions for two discrete physical activities. Distributions based on *N* = 9,062 students from the fall 2009 Active Schools Program pre-assessment at 30 middle schools.

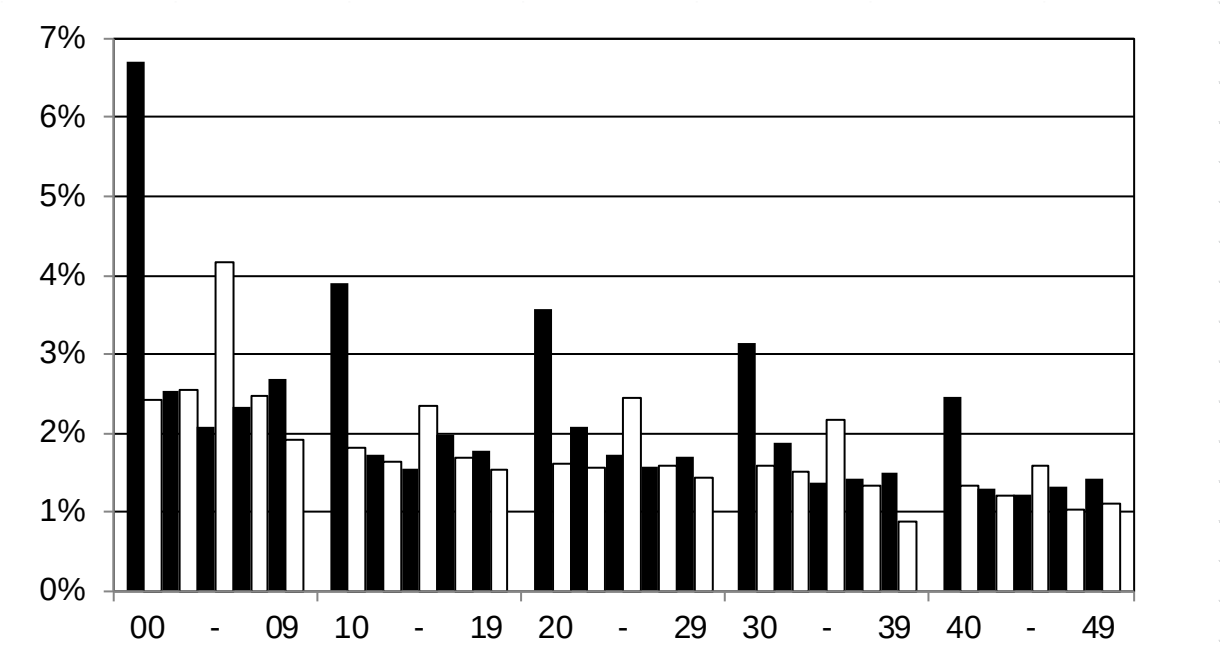

Figure 2 . Frequency distribution of *pc* remainder pairs for push-ups and curl-ups. The 10s digit is the push-up remainder when divided by 5 and the 1s digit is the curl-up remainder when divided by 10. *N* = 8,538 each with push-ups > 0 and curl-ups > 0.

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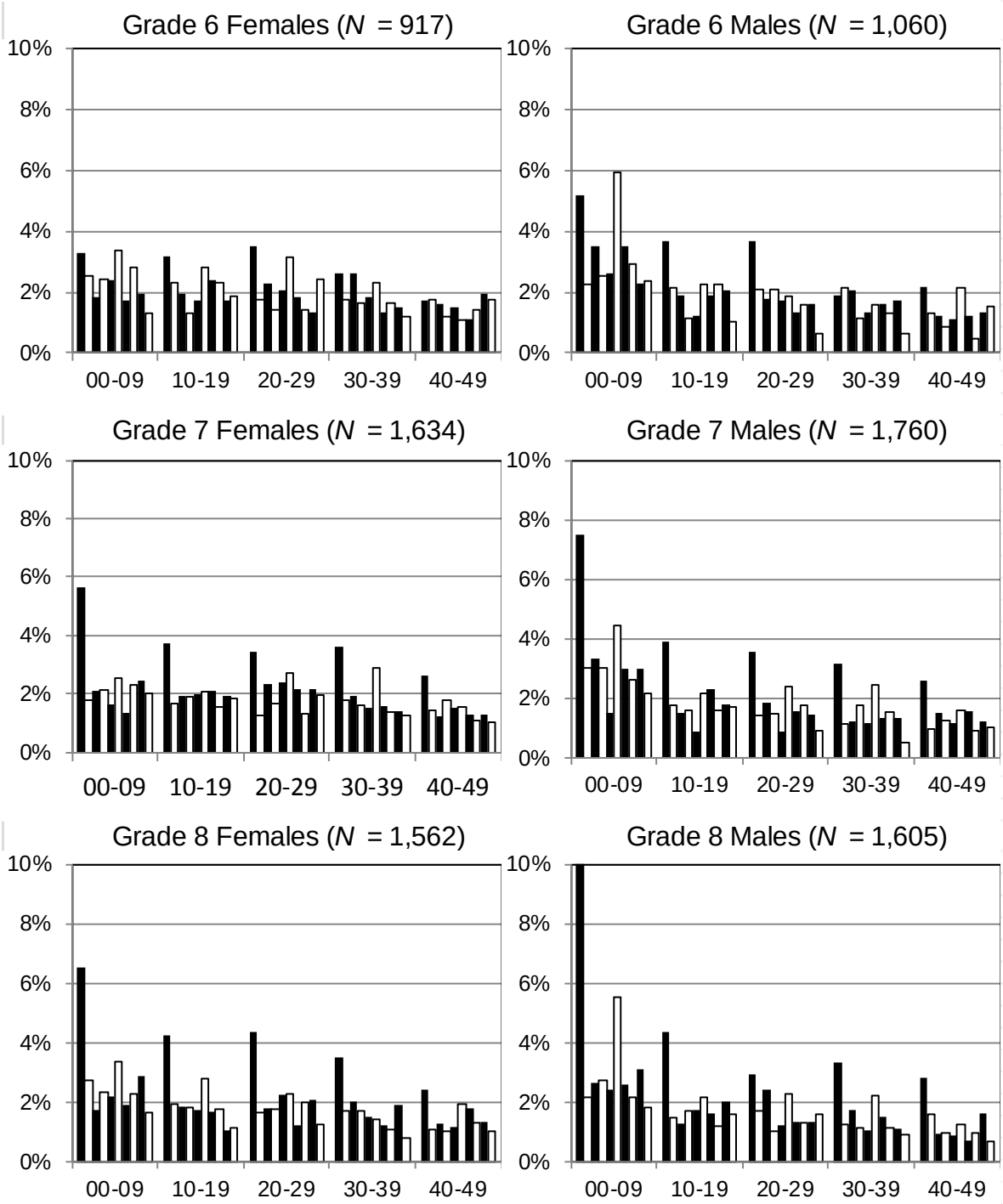

Figure 3 . Frequency distributions by gender and grade of *pc* remainder pairs. For each distribution, the 10s digit is the push-up remainder when divided by 5 and the 1s digit is the curl-up remainder when divided by 10. Sample sizes noted in each panel with push-ups > 0 and curl-ups > 0.

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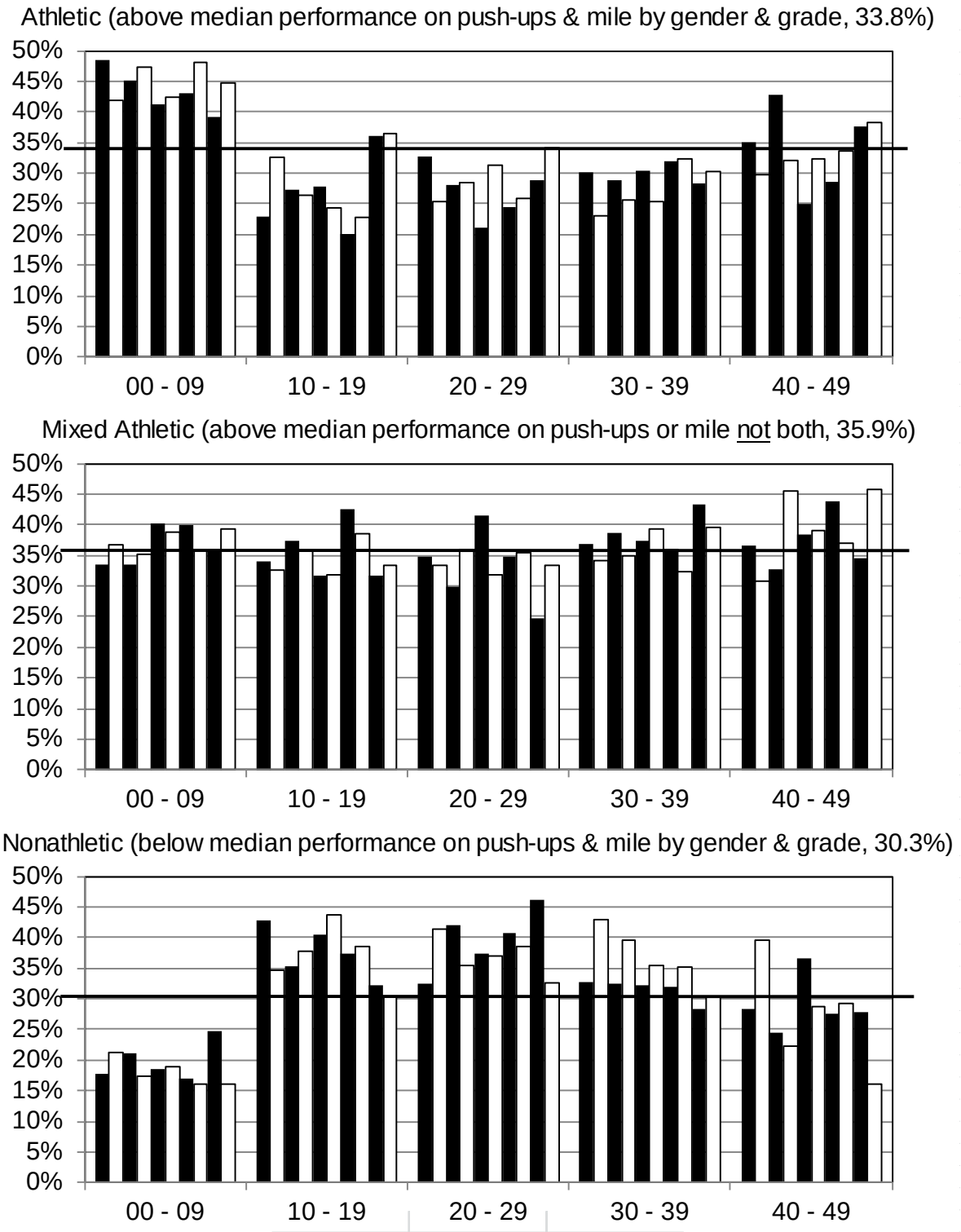

Figure 4 . Percent of each *pc* remainder pair in each part of a 3-way athletic partition. For each pc remainder pair, the sum of the three athleticism group percents is 100%. In each panel, the 10s digit is the push-up remainder when divided by 5 and the 1s digit is the curl-up remainder when divided by 10. The horizontal line in each panel is the percent of the 8,538 students in this athleticism group.

Table 1.
Regression Analysis of Performance on Three Physical Activities

Variable	Curl-ups	Push-ups	Mile	
			Model 1	Model 2
Constant	-5.24	67.03 ***	23.79 ***	23.85 ***
	(12.83)	(10.02)	(2.55)	(2.55)
Curl - ups		0.24 ***	-0.08 ***	-0.09 ***
		(0.03)	(0.01)	(0.01)
Curl-ups^2/100		0.001	0.06 ***	0.06 ***
		(0.03)	(0.01)	(0.01)
Push-ups	0.54 ***		-0.11 ***	-0.11 ***
	(0.03)		(0.01)	(0.01)
Push-ups^2/100	-0.29 ***		0.10 ***	0.10 ***
	(0.06)		(0.01)	(0.01)
Mile	-1.60 ***	-4.44 ***		
	(0.28)	(0.22)		
Mile^2/100	2.42 *	13.94 ***		
	(1.13)	(0.88)		
Age	7.26 ***	-4.87 **	-1.14 **	-1.15 **
	(1.99)	(1.56)	(0.40)	(0.40)
Age^2	-0.27 ***	0.18 **	0.03 *	0.03 *
	(0.08)	(0.06)	(0.02)	(0.02)
Male	0.14	4.95 ***	-0.35 ***	-0.35 ***
	(0.29)	(0.22)	(0.06)	(0.06)
Focal00	2.21 ***	1.66 ***	-0.24 *	
	(0.54)	(0.43)	(0.11)	
Focal Push-ups				0.02
				(0.02)
Focal Curl-ups				-0.01
				(0.01)
R^2	.23	.32	.22	.22
F	317 ***	512 ***	306 ***	272 ***

Note. For all four regressions, N = 8,538. Raw regression coefficients (with standard errors beneath each coefficient in parentheses). Focal00 = 1 if the student's push-up score is a multiple of 5 and the curl-up score is a multiple of 10, else 0. Focal Push-ups = 1 if the student's push-up score is a multiple of 5, else 0. Focal Curl-ups = 1 if the student's curl-up score is a multiple of 10, else 0.
*p < .05. **p < .01. ***p < .001.