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Evaluation of a Worksite-Based Small Group Team Challenge to Increase Physical Activity

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Abstract

Purpose: To investigate whether participants in a small group team challenge had greater completion rates in an institution-wide step-challenge than other participants.

Design: A quasi-experimental, post-test only design with a comparison group was used to evaluate group differences in completion rates.

Setting: A large university system provided the opportunity to participate in a physical activity challenge.

Participants: The study was limited to employees who participated in the physical activity challenge.

Intervention: Two institutions offered participants the chance to compete as smaller groups of teams within their institution. These team-challenge participants (N=414) were compared to participants from the same institutions that did not sign up for a team and tracked their steps individually (N=1,454).

Measures: Participants who reported 50,000 steps per week for 5 out of the 6 weeks were classified as challenge completers. We also evaluated total step count and controlled for several potential covariates including age, gender, and body mass index.

Analysis: Logistic regression was used to model the dichotomous outcome of challenge completion.

Results: Team-challenge participants were more likely to complete the physical activity challenge than other participants. Team-challenge participants had 1,922 more steps per day than

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Conflicts of Interest

individual participants. However, at an institution level, overall completion rates were not higher at institutions that offered a team challenge.

Introduction

Between rising healthcare costs¹ and lost productivity²⁻⁴, employers have many reasons to invest in worksite health programs. Physical activity is a key element of worksite health programs given its impact on some of the most costly chronic diseases⁵⁻⁷. Consequently, worksite physical activity challenges are gaining popularity; see calls from The Wellness Council of America (WELCOA) and the Bipartisan Policy Center. However, little research exists on which program elements improve success.

Various physical activity challenges have been implemented⁸⁻¹⁰ typically incorporating multiple behavior change tools including: self-monitoring, reinforcement, performance feedback, contingent rewards, goal-setting, and social comparison¹¹⁻¹³. Recently, team-based competitions where participants form smaller team units to compete against each other have been promoted¹⁴⁻¹⁸. Small group team challenges (“team challenges”) may provide additional behavior change tools such as social support, and importantly, social comparisons that allow team members to see their own activity levels in relation to their teammates and competing teams. Allowing employees to join teams also adds a group-based incentive, which has been shown to be an effective behavioral change tool¹⁹. Group-based incentives can further motivate behavior change by introducing elements such as competition, loss aversion, winning, and anticipated regret¹⁹. Given the popularity of team-based challenges, program organizers need to know which behavioral change tools have value to maximize program impact.

This study evaluated whether team-challenge participants performed better compared to non-team-challenge participants. Our primary hypothesis was team-challenge participants would have a higher completion rate than non-team-challenge participants from the same institution. We also examined whether hosting a team challenge provides added value for an institution. Specifically, we asked if overall challenge completion rates at team-challenge institutions would be higher than institutions without team challenges.

Methods

Study Setting, Design, and Overview

This study setting was a large university system. The evaluation used a quasi-experimental, post-test only design with a comparison group. Four datasets provided by the University System (‘System’) Office of Employee Benefits were linked using a unique identifier: 1) the 2015 physical activity challenge dataset containing challenge completion information and weekly step counts; 2) the 2015 health assessment dataset containing general health variables; 3) the 2015 physical activity challenge baseline survey dataset containing other health behavior variables, which was a voluntary survey administered to all challenge participants prior to the physical activity challenge; and 4) the 2014 physical activity challenge dataset to include a variable about past participation.

Program Description

The physical activity challenge was a voluntary program organized and implemented by the System at all institutions by institution wellness managers. The challenge began May 1, 2015 and ended June 12, 2015.

The System-wide physical activity challenge goal was 50,000 steps/week for five out of the six-week challenge. While 10,000 steps/day is a common goal²⁰⁻²², to reduce participant burden, System administrators did not require participants to enter steps on non-working days. Participants who wanted to log steps for the weekend could retroactively enter steps as a part of their weekly goal. This resulted in a modified daily step goal of 7,143 steps/day. This goal was acceptable given that health improvements have been reported with as few as 7,000-8,000 steps/day²⁰. Each institution competed collectively against similar institutions classified by size (small, medium and large). The System provided: an interactive participant dashboard to log steps; a marketing plan including email scripts and social media recommendations; and, challenge incentives at key points. Employees were provided with a pedometer and a step log upon challenge enrollment. All participants who logged steps for the first three weeks were provided a System challenge T-shirt. Finally, participants received a picnic blanket with the System logo upon challenge completion.

Institution wellness managers were encouraged to personalize the challenge to improve recruitment, participation, and completion. For example, some institutions personalized marketing materials with their institution's logo and found novel ways to display them (e.g., on TVs throughout their hospital). Some institutions had resources to provide additional incentives.

Two institutions, hereafter named Institution A and B, offered an additional small group team-challenge opportunity advertised through emails to employees, flyers, and departmental websites. Institution A acknowledged each team's progress through a separate team-challenge website. Similarly, Institution B created a team challenge website but it also offered prize drawings for individual team-challenge participants who met weekly challenge goals. These two institutions used their own resources to offer this additional competition. Wellness managers provided feedback to participants about their team's standings throughout the challenge. The challenge website displayed total step counts rather than the challenge goal (50,000 steps for each week of the challenge) for participants, as well as total step counts of other participants at their institution and others. Teams followed their progress from System reports relayed to them through their institution's team-challenge website.

Participants

The System-wide challenge was open to benefits eligible members: employees, retirees and dependents age 18 and above. At the time of the challenge, the System consisted of nine academic, six medical, and one administrative institution (n=16 total). The Office of Employee Benefits for the System sent out emails to all benefits eligible members advertising the physical activity challenge as a competition between institutions. Retirees and dependents were excluded from this analysis to focus on the active employee population. Approximately 85,000 active employees system-wide were invited to participate.

The primary hypothesis tested whether team-challenge participants had a higher completion rate than non-team-challenge participants from the same institution. The sample included employees who participated at the two institutions offering a team challenge (Institutions A and B). As a post-hoc test, we also analyzed a second outcome, recorded step count totals between team-challenge participants and all other participants at those two institutions.

Our secondary exploratory analysis evaluated if overall challenge completion rates at team-challenge institutions would be higher than institutions without team challenges. The sample included employees who participated in the challenge from all institutions.

Measures

The primary outcome was challenge completion, created from participants' self-reported weekly step counts. Participants were considered challenge completers if they achieved 50,000 steps per week for five out of the six-week challenge. A secondary outcome was weekly step totals.

To test the primary hypothesis, an indicator variable designating whether an individual participated in the team challenge was created at the two team-challenge institutions (Institutions A and B). For our secondary research question, we contrasted the best performing institution against all challenge institutions. If one were to imagine that including a team challenge would intensify the team effects, then by contrasting the team-challenge institutions against the best performing institution the results should describe what hosting a team challenge should do on top of the standard challenge. To do this we used an indicator variable for each institution, using the non-team-challenge institution with the highest completion rate as the reference.

Given that the intervention could not be randomized, several variables were used to assess differences between groups. Age (continuous) and gender were available from the insurance eligibility records^{8,14,23}. Several additional, self-reported variables were available from the health assessment and the baseline survey: general health (good health vs. fair or poor) and BMI (continuous)⁸. The same questions were asked to assess general health and BMI on both the baseline survey and the health assessment; therefore, we supplemented any missing baseline survey information with health assessment information if it was completed before the challenge started. Finally, we created a variable for previous year's system-wide challenge participation. We excluded any variables that were missing more than 20% to preserve sample.

Statistical Analysis

All analyses were completed using STATA v. 13. A multivariable logistic regression model was used to evaluate the main effects model for the likelihood of challenge completion (50,000 steps/week for 5/6 weeks). The primary hypothesis tested whether team-challenge participants had a higher completion rate than non-team-challenge participants from the same institution by using the following model at the two team-challenge institutions (Institution A and B):

$$\text{Completion} = \beta_0 + \beta_1[\text{Participant in the team challenge}] + \beta_2[\text{covariates}]$$

The hypothesis was supported if the odds ratio for team-challenge participants was greater than one and significant as indicated by 95% confidence limits and p-value.

Covariates were added to the model to control for confounding. Model fit was assessed using the percent correctly classified as well as the Pearson, standardized Pearson, and Hosmer and Lemeshow fit tests²⁴. Variance inflation factor (VIF) and tolerances for covariates were examined and the risk of collinearity was eliminated if VIF<10 and the tolerance was close to 1²⁵.

We conducted post-hoc analyses to refine the model and test out potential biases. One of the biggest concerns with a non-randomized design is selection bias. We used a subset of the population with the largest available range of variables (participants who responded to the baseline physical activity challenge) to examine the selection problem. We tested whether age, gender, good health status, BMI, Stage of change towards physical activity (being in action or maintenance stage vs. all others), or meeting physical activity recommendations individually (none vs. insufficient vs. meeting physical activity guidelines)^{8,23} predicted group membership in the team challenge. Additionally, we tested whether one team-challenge institution vs. another had significantly different effects by including their own identifying variable to the final model and seeing whether it was a significant predictor. Finally, we analyzed the same model (adjusted and unadjusted) using a linear regression model with actual step counts as the outcome to describe the intervention effect on an outcome to compare to step recommendations.

We completed a separate exploratory analysis including all institutions as indicator variables to examine whether team-challenge institutions had a higher completion proportion compared to those institutions without a team-challenge option. The research question model was:

$$\text{Completion} = \beta_0 + \beta_1 [\text{Institution 1}] + \beta_2 [\text{Institution 2}] \dots + \beta_x [\text{covariates}]$$

We tested the institution variables as a set to see whether they made a significant model contribution. We included the same previous covariates to adjust for institutional differences. We then compared the corresponding odds ratios for whether the team-challenge institutions had better completion odds than other institutions.

Results

A total of 9,729 employees signed up to participate across 16 institutions. At the two team-challenge institutions (Institution A and B), 1,868 employees enrolled and of those 414 (22%) signed up to compete as part of a team challenge. Using the baseline survey to supplement the health assessment, we were able to reduce the percentage missing to 15% for General health and 16% for BMI status.

Table 1 describes the sample characteristics across exposure groups. Mean age was 43 years (11.2 standard deviation (sd)). Almost a third (28%) had previously participated in a challenge. Few participants were in fair/poor health (9%) and mean BMI was 28.9 (6.9 sd). Differences among covariates across intervention and comparison groups are described in Table 1. Also, Institution A had a larger percentage enrolled in the team challenge than Institution B (39% vs. 8% enrolled in the team challenge).

Team-Challenge Effect

Team-challenge participants had a significantly greater odds for challenge completion compared to non-team-challenge participants (OR=5.08 95% confidence interval [CI]: 4.01 - 6.44; see Table 2). The model was then adjusted for the following covariates: gender, good health, being a previous challenge participant, completing the first week's challenge, BMI, and age. Adjusting for covariates decreased the odds for team-challenge participants slightly but it remained significant (OR= 3.49 95% CI 2.50 - 4.88 adjusted vs. OR=5.08 95% CI 4.01 - 6.44 unadjusted).

Collinearity was ruled out since VIF numbers were less than 10 and tolerances were close to 1. Additionally, the model correctly classified 82% of the cases and several measures indicated good model fit including Pearson ($p=0.53$), Hosmer and Lemeshow ($p=0.83$) and the standardized Pearson ($p=0.72$).

Post-Hoc Analysis

Table 3 presents the bivariate odds ratios between the potential predictors available and group membership (i.e., signing up as a team-challenge participant). Despite the strong risk of selection bias, only age was significant and being a previous challenge participant approached significance. All of the other covariates tested were not significantly related to group membership. Even the additional variables from the baseline survey, stage of change and meeting physical activity guidelines at baseline were not significantly related to being a team-challenge participant. Therefore we adjusted for the two known variables contributing to differential selection, age and previous challenge participation.

Given the difference in team-challenge enrollment and the differences between team-challenge design characteristics at each institution, we tested whether one team-challenge institution vs. another had significantly different effects by including their own identifying variable to the final model and seeing whether it was a significant predictor. The institution indicator was not a significant addition to the model (OR=1.06 95% CI 0.78-1.44).

The step count linear regression (see supplementary table 1) controlling for the same predictors as the main model (gender, age, good health, previous participation, meeting the challenge goal in the first week, and BMI) revealed significantly higher step counts among team-challenge participants ($p<0.001$). We used the adjusted model to calculate the average steps per day using each variable's mean. Per day, team-challenge participants took 8,906 steps while non-team-challenge participants took 6,984 steps. Therefore, on average team-challenge participants completed 1,922 more steps per day than non-team-challenge participants.

Secondary Research Question

The institution with the highest completion rate (52%) was a small institution with a small number of participants ($n=23$). Therefore to improve model stability, we used the institution with the next highest completion rate (46%) and a larger sample ($n=274$) as the reference group. Table 4 lists the odds ratios for all institutions from the exploratory model (range = 0.63-2.27) with the 95% CI. The odds ratios for the team-challenge institutions were mixed (one above and one below 1) with both 95% CIs including one. Only one institution had a significant impact, and it was less likely to complete than the comparison institution ($OR=0.69$, 95% CI = 0.48 - 0.99).

Collinearity issues were eliminated with VIF numbers being less than 10 and tolerances close to 1. This model correctly classified 82% of the cases and had large p-values indicating good model fit for both measures the Pearson ($p=0.9$) and the standardized Pearson (0.6). However, the Hosmer and Lemeshow fit test indicated only moderate model fit ($p=0.4$).

Discussion:

We evaluated the performance of team-challenge participants compared to their coworkers who were participating as individuals. We hypothesized that participating in a team challenge would increase the likelihood of completing the challenge goal¹⁹. The model found that team-challenge participants were more likely to meet the physical activity goals. This may result from additional group-based incentives such as competition and loss aversion. Furthermore, we found team-challenge participants took significantly more steps per day (1,922 more steps). This is a meaningful difference both because 2,000 steps is roughly equivalent to a mile and completing an extra 2,000 steps for individuals with low step counts was associated with reductions in waist circumference and BMI.²⁶ It is unclear given the lack of power (only two institutions offered the intervention) whether hosting a team-challenge competition would increase the overall odds for individuals at institutions to complete.

Despite physical activity being a key component of worksite health and wellness programs²⁷, the literature on workplace physical activity challenges is limited.²⁸ As with previous workplace physical activity interventions, the team-challenge intervention had positive results.^{28,29} However, the intervention duration evaluated was shorter than many studies (6 weeks vs. the average of ~12 weeks⁵). Also, similar to previous work⁸, early success was a strong predictor since successful completion in week one led to 36 times greater odds of challenge completion. Despite this variable's large influence, participating in the team challenge remained significant in the model.

This research is the first study to report that a small group team challenge at an institution improved individual challenge completion. However we found non-significant odds of completion compared to the best performing institution (with enough sample for comparison, See Table 4). With only two institutions offering the experimental condition, there was insufficient power to properly test a hypothesis so we chose to describe findings. We found relatively small effect sizes (See Table 4, Institution A $OR=1.14$ and Institution B $OR=0.79$) and therefore even if we had more institutions, most likely one would find a

statistically significant but small improvement. Differences in overall institution performance may be explained by the differential proportion of people signed up for the experimental condition. For example, institution B had 8% of its participants enroll in the team challenge. Thus, promoting a team challenge will help individuals who participate but may not help institutions unless a large enough percentage of participants enroll.

There were other institutional differences in addition to differences in the number of employees who signed up for the intervention. Variables like institution size, employee job distribution (e.g., health science centers vs. academic), location, etc., could influence each institution's respective performance. We tested this for the primary hypothesis by including the institution in the final model as a post-hoc test and found that the individual likelihood of performance was not significantly influenced by the institution variable. For the secondary research question institution size became an issue when we were unable to use the best-performing institution as the comparison because its small sample size (N=23) could cause model instability. Therefore in Table 4 that institution, Institution 2, stands out with the largest odds ratio with a 95% CI that includes the null.

Given the practical nature of a workplace intervention, there are several other factors that may be limitations. For example, this study was an evaluation of an existing intervention; therefore, there was no physical activity data from before the competition began available (i.e., a post-only study design). Additionally, the main outcome measures were self-reported which could be a problem since participants may be motivated to over-estimate step count given the nature of the program. Social accountability may have encouraged participants to appear to be more competitive. Finally given the non-randomized design, selection bias is the strongest potential study limitation, i.e., more physically active employees signed up for the team challenge. Therefore, the increased completion likelihood could be the result of self-selection.

We addressed self-selection bias by evaluating baseline physical activity among those who responded to the baseline survey. Post-hoc analysis found that baseline physical activity was not significantly different among team-challenge participants versus those not in the team challenge at the same institution. Additionally, there were no baseline differences for BMI and stages of change.

In addition to addressing study limitations this study has several other strengths including topic novelty. Secondly, as a result of the team challenge being offered as an option it created a natural experiment with a treatment and comparison group to test team challenges in an applied setting. Therefore, the support we find here is more about effectiveness rather than efficacy. Finding effectiveness is important since the program is similar to other programs going on in worksites all over the country. Finally, this study had several other strengths including a large sample size; multiple institutions; and statistically controlling for several covariates such as BMI and overall health status.

Conclusions:

We found that participants who signed up for a small group team challenge were more likely to complete a physical activity challenge competition. However, it was unclear whether institutions that held a team challenge would have a significantly greater completion proportion than other institutions. Future research could add a pre-intervention reporting observation for a baseline comparison. Also, future studies should evaluate how long the intervention effects last (i.e., are greater levels of physical activity sustained at 3 or 6 months out) and whether including a team component leads to longer lasting changes. This would be especially valuable given that lasting change has been a challenge for wellness programs²⁸. Including additional covariates such as baseline physical activity, job type, or institution specific characteristics that could impact physical activity challenge completion would help identify differences among this intervention and other intervention characteristics. Future literature could also explore small vs. large group team effectiveness. Finally, testing which psychosocial constructs team challenges are impacting would help coordinators maximize program effectiveness. Specifically testing whether including a team component increases the quality and quantity of peer support. These results would lead to potential interventions training team members on peer-support strategies.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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So What: Implications for Health Promotion Practitioners and Researchers**What is already known on this topic?**

Physical activity is a key component of worksite health and wellness programs. Surprisingly, relatively few published studies have evaluated team vs. individual physical activity challenge program effectiveness.

What does this article add?

This large sample post-only study found that participants who competed in worksite physical activity challenges as part of a small group were more likely to complete the challenge and had a greater number of steps compared to people not in groups.

What are implications for health promotion practice or research?

Small group team challenges provide an opportunity for wellness program coordinators to capitalize on traditionally underutilized known behavioral change best practices like social comparison. However, intervention success hinges on participant enrollment and management difficulty. Team challenges work best if the physical activity challenge vendor offers an easy to implement option of a small-group team challenge within the platform.

Table 1:

Sample Description Across Intervention Group by Potential Covariates

Variables	Team Challenge Participant (Exposure Group); N=414	Non-Team-Challenge Participants at Team- Challenge Institution (Hypothesis I Comparison Group); N = 1454	Participants at Institutions Without a Team-Challenge (Research Question Comparison Group); N = 7861	Total (N = 9729)
Gender[^]				
Male	25% (104)	24% (347)	18% (1399)	19.0% (1850)
Female	75% (310)	76% (1106)	82% (6462)	81.0% (7878)
Missing	0% (0)	0% (1)	0% (0)	0.0% (1)
General Health[^]				
Excellent, Very Good, Good	89% (368)	72% (1048)	75% (5909)	75.3% (7325)
Fair or Poor	7% (29)	7% (109)	10% (777)	9.4% (915)
Missing	4% (17)	20% (297)	15% (1175)	15.3% (1489)
Previous ChallengeParticipant[^]				
Yes	21% (85)	25% (361)	29% (2284)	28.1% (2730)
Week 1 Challenge completion[^]				
Yes	78% (321)	44% (643)	48% (3808)	49.0% (4772)
Body Mass Index^{*,^}, M (SD)	27.5 (6.1)	27.5 (6.4)	29.1 (7.0)	28.86 (6.9)
Age, M (SD)	41.7 (11.3)	40.2 (11.5)	43.5 (11.1)	42.9 (11.2)

Abbreviation: SD, standard deviation; M, mean.

* Missing for 17% of the sample

[^] Significant at the p<0.01 level

Table 2:
Hypothesis 1 Unadjusted and Adjusted Odds of Challenge Completion (50,000 steps for 5/6 weeks)

Variables	Unadjusted*			Adjusted [^]		
	Odds Ratio	95% CI (Low)	95% CI (High)	Odds Ratio	95% CI (Low)	95% CI (High)
Team-Challenge Participation						
All Other Participants (Ref)	1.00			1.00		
Team-Challenge Participant	5.08	(4.01)	(6.44)	3.49	(2.50)	(4.88)
Gender						
Male (Ref)				1.00		
Female				0.83	(0.59)	(1.16)
General Health						
Fair or Poor (Ref)				1.00		
Excellent, Very Good, Good				1.62	(0.97)	(2.71)
Previous Participation						
All Other Participants (Ref)				1.00		
Previous Participation in a Physical Activity Challenge				1.84	(1.33)	(2.53)
Early Challenge Completion						
All Other Participants (Ref)				1.00		
Week 1 Challenge Completion				36.77	(25.52)	(52.98)
Body Mass Index (continuous)				0.97	(0.95)	(0.99)
Age (continuous)				1.01	(1.00)	(1.02)
Constant	0.45	(0.40)	(0.50)	0.05	(0.02)	(0.15)

Abbreviation: CI, confidence interval

* In total of 1,868 observations

[^] In total of 1,550 observations, 17% sample lost to missing for 'Good health' and 'BMI'

Table 3:

Any Differences in Predicting Group Membership based on Covariates?

Variables	OR	Low	High	P-value
Female	0.94	(0.73	1.20)	0.60
Good Health	1.32	(0.86	2.02)	0.20
Previous Challenge Participant	0.78	(0.60	1.02)	0.07
BMI (continuous)	1.00	(0.98	1.02)	0.99
Age (continuous)	1.01	(1.00	1.02)	0.03
Stage Of Change	1.23	(0.63	2.38)	0.55
Meeting Physical Activity Guidelines	1.00	(1.00	1.00)	0.64
Activity Level (None Reference)				0.21
Some	0.32	(0.08	1.27)	
Meeting Activity Guidelines	0.35	(0.11	1.17)	

Table 4:Adjusted Odds of Challenge Completion Across All Institutions (50,000 steps for 5/6 weeks)[^]

Variables	Odds Ratio	95% CI		p-value
		(Low	High)	
Institution Team-Challenge Participation				
Best Performing Institution That Did Not Offer Team Challenge (Ref)	1.00			
Team-Challenge Institution A	1.14	(0.77	1.71)	0.51
Team-Challenge Institution B	0.79	(0.54	1.17)	0.24
Comparison Institution 1	0.83	(0.47	1.47)	0.53
Comparison Institution 2 *	2.28	(0.56	9.23)	0.25
Comparison Institution 3	0.85	(0.53	1.37)	0.50
Comparison Institution 4	0.95	(0.58	1.57)	0.86
Comparison Institution 5	0.95	(0.42	2.17)	0.90
Comparison Institution 6	0.88	(0.55	1.42)	0.61
Comparison Institution 7	1.03	(0.54	1.96)	0.93
Comparison Institution 8	1.11	(0.76	1.62)	0.59
Comparison Institution 9	0.69	(0.48	1.00)	0.05
Comparison Institution 10	0.58	(0.30	1.11)	0.10
Comparison Institution 11	0.81	(0.51	1.30)	0.38
Comparison Institution 12	1.18	(0.81	1.74)	0.39
Comparison Institution 13	0.64	(0.39	1.03)	0.06
General Health				
Fair or Poor (Ref)	1.00			
Excellent, Very Good, Good	1.36	(1.11	1.68)	<0.01
Previous Participation				
All Other Participants (Ref)	1.00			
Previous Participation in a Physical Activity Challenge	1.29	(1.13	1.47)	<0.01
Early Challenge Completion				
All Other Participants (Ref)	1.00			
Week 1 Challenge Completion	42.91	(36.72	50.15)	<0.01
Gender				
Male (Ref)	1.00			
Female	0.81	(0.69	0.94)	0.01
Body Mass Index (continuous)	0.98	(0.97	0.99)	<0.01
Age (continuous)	1.01	(1.00	1.01)	<0.01
Constant	0.07	(0.04	0.12)	<0.01

[^] 8,216 observations, 16% sample lost to missing for 'Good health' and 'Body Mass Index'

* Best performing institution but sample size too small to use as the comparison group