Virtual Umra: An Interdisciplinary Faith-Based Pedometer Intervention for Increasing Steps at School

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Background: Curriculum interventions aimed at increasing physical activity in schools may prove useful in contexts where changes in policy/environment are not feasible. Design/evaluation of interventions targeting minority groups is important in light of well-publicized health disparities. Religious minorities represent a special subset that may positively respond to interventions tailored to their unique beliefs, which to date have been relatively underreported.

Methods: Muslim American youth (n = 45) attending a parochial middle school participated in a religiously- and culturally-tailored 8-wk, interdisciplinary pedometer intervention. School-time ambulatory activity was quantified using a delayed multiple-baseline across subjects ABA design. Visual analysis of graphic data as well as repeated-measures ANOVA and ANCOVA and post hoc contrasts were used to analyze step counts including the moderating effects of day type (PE, no-PE), gender, BMI classification, grade, and time. Results: The intervention elicited modest increases in males’ steps only with effect decay beginning midintervention. BMI classification and grade were not associated with changes in steps.

Conclusions: Full curricular integration by affected classroom teachers, staff modeling of PA behavior, and alternative curriculum for girls’ PE classes may further potentiate the intervention.

Keywords: physical activity, early adolescence, religion, Islam

In the U.S., the Muslim American population is rapidly growing due to immigration, high birth rate, and conversion. A guide for its adherents’ health behavior can be traced to scriptural admonitions for dietary moderation and regular exercise, and it is believed that “on the Day of Judgment, God will ask what [Muslims] did with their bodies and their health” (p. 285). Still, concern over Muslim American morbidity is warranted. Muslim American university students averaged only 8911 steps/d over 1 week of monitoring and only 29.5% averaged ≥ 10,000 steps/d. Based on mortality records, California’s first-generation Middle Easterners are at increased risk for colorectal cancers, diabetes, and heart disease with stable or slightly attenuated risk in the second generation. These morbidities are inversely associated with physical activity, which when habitually performed in youth is associated with carryover into adulthood and a decreased risk of hypokinetic morbidity.

Physical activity can be measured in multiple ways, and pedometers offer a valid, objective, and affordable means of measurement in youth. As part of an intervention, pedometers can play roles in motivating and promoting physical activity through their feedback and cueing functions in combination with record keeping. Children respond more strongly to pedometer interventions than any other age demographic (mean ES 0.78), and the most effective pedometer interventions in youth incorporated self-monitoring and goal setting strategies.

As youth spend the predominance of the day in school settings, interventions aimed at increasing physical activity during this time seem appropriate. Although few in number, pedometer studies focusing on step accumulation over the entire school day have identified a range of steps and percentages of daily steps taken at school for boys (6700–7600; 42–49%) and girls (4900–6100; 41–47%).

School-based physical activity interventions that incorporate/integrate subject matter content may confer multiple ancillary benefits (eg, building goodwill, classroom teacher reciprocity) yet only 1 such intervention has included pedometers. Centered on the theme of a virtual walk around New Zealand, pedometers were used to measure entire-day weekday and weekend steps in grades 5 and 6 while incorporating English, social studies, mathematics, statistics, and homework. Results indicated that only low-active children significantly increased daily steps from baseline through intervention.

In light of the literature reviewed, we were interested in identifying the quantity of physical activity accumulated by Muslim children during the school day and the effects of an interdisciplinary religiously-themed intervention on steps. The following research questions guided the study: 1) How many steps do Muslim middle school students accumulate during school hours? 2) Do step counts change as a result of an intervention and its
subsequent withdrawal? 3) Are there differences based on gender, grade, and BMI classification?

Methods

Context

The Crescent School of Southern California (CSSC), which shares its campus with a large masjid, has been in existence since 1992 and at the time of the study enrolled 150 K–8 students and employed 20 female staff. Currently, the CSSC is the only Islamic day school in San Diego County with the next closest school over 80 miles away in an adjacent county. Given the school’s geographic isolation from its peer institutions and the need for the authors to be on site daily (described below), we had no choice but to limit the intervention to the students at hand, thus no a priori power analysis was performed. At the middle school level, academic classes are coeducational except for physical education (PE), which is scheduled twice weekly for 50-min blocks and taught by nonspecialists. Campus space is severely restricted: morning assembly to classrooms = 50 steps; classrooms to the outdoor lunch area = 85 steps; and the perimeter of the only outdoor play space = 75 steps. A 10-min nutrition break/recess and a 30-min lunch are offered outdoors at midmorning and midafternoon, respectively. There is no gymnasium, therefore PE is conducted at a park that is walked to and is ≈ 250 steps from campus. In inclement weather PE is conducted in a low-ceilinged multipurpose room or is suspended.

Intervention Underpinnings

The Virtual Umra (VU) intervention was intended as a self-regulated adjunct to regular school-day steps. VU was conceptualized as a religious and cultural transformation of the Sport Play and Active Recreation for Kids (SPARK)14 Map Challenges, which takes students on virtual trips to various destinations as a means of increasing physical activity motivation. Activities integrate geography and math concepts and students convert laps or minutes traveled to progress on a map.

In Arabic, umra means “to visit a populated place,” and is a voluntary pilgrimage to Mecca. Two of the three Umra rituals involve extensive walking (tawaf and sa’i). The name of the intervention was selected to reflect 1) that unlike the Hajj ritual pilgrimage, which is restricted to 5 days during the month of the same name, the Umra pilgrimage may be performed at anytime; and 2) students would not be actually going on Umra but be making a virtual pilgrimage vis-à-vis steps walked at school.

In transforming SPARK Map Challenges, the first author in consultation with the CSSC principal and several teachers, created a segmented route between San Diego, California and Mecca, Saudi Arabia. Along the westward route were 15 sequential destinations located in either Islamic countries or countries with a significant Muslim minority. The overall goal was to walk to Mecca within 8 weeks, which required 250,000 steps (see Appendix for an example).

We purposely created the journey length to be difficult to complete by physical activity alone because the authors and principal wanted students to engage in academic tasks, which if completed would earn awards of up to 11,250 bonus steps/week. Thus, for each destination the first author, with the principal’s feedback, developed 10 optional trivia questions about its natural, religious, athletic, and political history (Appendix). It was expected that students would create and share methods for accumulating additional steps beyond the regular school day (self-regulation). Beyond our initial suggestions (eg, stepping in place while standing in line, going outdoors for lunch), students subsequently reported many additional methods for augmenting steps (eg, taking longer routes around school grounds and corridors; being more active during morning recess, lunch, and PE). Students were also expected to record steps, graph progress, and answer trivia questions in a personal travelogue (self-monitoring, -recording).

Unlike SPARK, neither PE teachers nor classroom teachers were expected to implement VU during this particular study. The intervention was designed to be externally administered by the authors without infringing on classroom time. This approach was taken at the behest of the school principal and teachers who felt it might be intrusive. As such, the intervention operated peripherally to extant classroom and PE curriculum. Faculty was not involved in any aspect of the intervention except for storing a portable storage case for student travelogues in classrooms and helping locate students on school grounds when they had not returned their pedometer in a timely fashion. Despite noninvolvement by the faculty, the authors believed the intervention would succeed for the following 5 reasons. First, results of the pilot study (see below), which offered VU in a formative stage, yielded promising results. Second, it was thought that Muslim students would find the Umra intervention personally interesting, which is associated with greater motivation for physical activity tasks.15 Third, in addition to feedback from pedometers, the authors would be on site twice daily to monitor progress, encourage students, and provide suggestions for augmenting steps. The effect of feedback coupled with the provision of additional information for how to be more active was shown to increase children’s step counts at school significantly more than feedback alone.16 Fourth, prominent display of point of decision prompts (eg, signage linking steps with Umra, grade-level public posting of progress) in the main classroom corridor and playground would stimulate step-taking.17 Fifth, awards for achieving step and destination goals would acknowledge student achievement and reinforce desirable behavior.18

Pilot Study

A pilot study of the intervention was conducted with the outgoing 8th-grade class (n = 6; 4 females) at the end
of the previous school year. The primary purpose of the pilot study was to quantify steps so that realistic counts between destinations could be determined. Twenty-one days were allocated for pedometer wear with participants logging self-reported steps on most days (17.5 ± 2.3). (Missing days were due to absence or forgetfulness.) Overall, mean steps/d for males exceeded 6000 and ranged between ~3200 and ~3700 for females. The ratio of steps between PE and no-PE days ranged between 1.3:1 and 2.2:1 for males and between 0.9:1 and 1.6:1 for females.

**Participant Demographics**

Students (n = 45; 27 females; M_{age}= 12.3 ± 1.0) provided written parental informed consent and student assent for the IRB-approved study. To account for the disproportionate number of females in the study, weighting variables were created and applied to step counts in relevant analyses. Initial participation and retention rates were 98% and 85%, respectively. Ethnic identity was wide-ranging and included 16 Somali, 15 Arab, 9 South Asian, 3 Persian, and 2 mixed-ethnicity students. Height and weight were measured with a portable stadiometer to the nearest 0.5 cm and digital scale to the nearest 0.1 kg, respectively. We used the Center for Disease Control’s BMI calculator to determine the sample’s mean BMI%_{age/gender} (65.5 ± 28.1).

**Design, Materials, and Procedures**

In the absence of a control group, a 1-wk delayed multiple-baseline-across-subjects ABA design was used to ascertain the degree of positive stimulus generalization (ie, induction). Before the start of the study pedometer (W4LMVP Walk 4 Life) accuracy was checked and fell within shake (20 ± 2) and walk (50 ± 5) test limits. Wear protocol was explained and demonstrated separately to each grade during the week before the start of its baseline. At this time, participants showed the authors proper pedometer placement and handling and were assigned a single pedometer for the duration of the study. Pedometers were distributed Monday through Thursday at morning assembly and recovered at school dismissal. (Due to a shortened-day schedule, Fridays were not included.)

Eighth graders began baseline by wearing sealed pedometers for 1 week followed by a second week of wearing unsealed pedometers and recording step counts in an individual ledger. Seventh and sixth graders began the same protocol 1 and 2 weeks later, respectively. Upon intervention, pedometer wear continued as before; however, participants were exposed to 1) 2 A-frame signs with religious references prompting steps, and 2) an oversized map depicting the Umra route that was updated weekly with class cumulative step total stickers affixed to the respective destinations/points reached. Each participant was given a travelogue, which included a passport page, Google map of the route, 15 destination pages, and a recording page.

Each day, the authors recorded pedometer scores into a ledger and copied the score onto a paper slip, which was subsequently given to participants for transfer to their recording sheet at a convenient time. The slip also contained written reminders to record progress and answer questions for specified bonus step awards. This procedure was followed so that data would not be lost if students did not self-record and to ensure that self-reports were not inflated.

Travelogues were retrieved from the school each Friday and weekly and cumulative totals tallied. Incentives were based on step counts (eg, 10,000 = toe token) and destinations reached (eg, each destination = flag sticker affixed on passport; destinations 1–7, 9–14 = “Dollar” store item), and distributed the following Monday morning. After an 8-wk intervention, a 2-wk post intervention phase ensued, during which baseline conditions were reestablished in reverse order.

**Data Treatment**

Step data were coded for irregularities (eg, participant absence, incomplete daily wear or temporary loss, zeroed or reset pedometer, taking a pedometer home, and suspiciously low or high scores). All irregularities except for suspicious scores were treated as missing data. Suspect step counts were analyzed in the following manner for each individual with questionable scores: 1) Means and standard deviations for phase and day scores were calculated; and 2) scores that > 1.28z were substituted with the criterion score (90% winsorization). In all, 2.4% of 2160 participant-d step counts were winsorized.

**Data Analysis**

Two approaches to data analysis were taken. To capture the temporal effects of the treatment and its withdrawal, visual analysis of graphic data were conducted. Standard analytical methods included examination and interpretation of variability, level, and trend within and across phases. Graphs depicting gender, BMI classification, and grade data for PE and no-PE days were constructed using Microsoft Office Excel 2007.

In the second approach, statistical analyses of mean phase scores were conducted, which ignored the day-to-day temporal effects considered in the former approach. Weighted descriptive statistics were calculated for BMI classification and grade (Table 1). Separate repeated measures 3 × 2 ANOVA for gender and 3 × 2 and 2 × 2 ANCOVA for BMI classification and grade, respectively, were conducted for PE and no-PE days. Huynh-Feldt corrections were applied when the sphericity assumption was violated. Post hoc contrasts included evaluation of 95% CI overlap for main effects and paired-sample t tests for interaction effects.

**Results**

**Overview**

Table 1 provides a descriptive account of accumulated steps across all 3 study phases using raw means for overall and gender scores and weighted means based on
the proportion of males to females for grade and BMI classification scores.

Because the sample was disproportionately comprised of females, graphic presentation of cohort steps is misleading. As such, graphic data are limited to gender, weight status, and grade and distinguish between PE and no-PE days (Figures 1 to 3).

Tables 2 and 3 summarize findings for PE and no-PE days, respectively, and include cohort effects over time, and gender, BMI, and grade effects and their interactions with time. Effect sizes for all statistical tests and observed power—when the $F$ statistic was significant—are reported. Post hoc statistics including paired differences in steps and contrasts between study phases are reported when initial analyses of variance were significant.

### Graphic Analysis

**Gender.** On all days, males accumulated more steps than females (Figure 1). Overall, compared with males, females demonstrated a more stable response pattern. Flat or decreasing trends were noted during intervention phases with higher variability on no-PE days (Figures 1 to 3).

Tables 2 and 3 summarize findings for PE and no-PE days, respectively, and include cohort effects over time, and gender, BMI, and grade effects and their interactions with time. Effect sizes for all statistical tests and observed power—when the $F$ statistic was significant—are reported. Post hoc statistics including paired differences in steps and contrasts between study phases are reported when initial analyses of variance were significant.

### Quantitative Analysis

Descriptive results indicated that more steps were taken on PE days than on no-PE days (Table 1). For all groups and subgroups and for both types of day, the lowest mean steps were recorded at post intervention. In addition, males took more steps than females on every day/phase combination.

**PE Days.** A significant main effect over time for the cohort was mitigated by inadequate power, thus the intervention was not successful at eliciting more steps on PE days for the entire cohort (Table 2). Analyses by subgroup revealed that students, regardless of BMI classification and grade level, did not respond differently to the intervention. A significant gender effect was observed, whereby males accumulated more steps than females overall and during every phase of the study. The greatest difference was observed at intervention when differences in steps exceeded 1000 on top of baseline differences. The magnitude of this difference was attenuated by approximately 50% at post intervention but was still nearly 500 steps more than at baseline.
Figure 1 — Steps by gender.
Faith-Based Pedometer Intervention

**Figure 2** — Steps by BMI classification.

**No-PE Days.** A significant main effect over time for the cohort was observed with baseline and intervention steps greater than post intervention steps (Table 3). Although the intervention did not significantly change steps from baseline, after the intervention was removed, steps decreased by almost 700. A significant main effect—but no interaction effect—by gender was observed. At baseline, males increased steps by more than 1000 compared with females, and this gap widened by an additional 500 steps during the intervention. No main or interaction effects were detected for BMI. For grade level, an interaction—but no main effect—was observed. In other words, on no-PE days steps were not significantly different between grades over time but were significantly different within grades. Specifically, 1) 8th graders took more steps at baseline than at post intervention, which were in turn more than during the intervention; 2) 7th graders took more steps during the intervention than at baseline, which in turn were more than at post intervention; and 3) 6th graders took more steps during the intervention and at baseline than at post intervention.
Figure 3 — Steps by grade (PE days).
### Table 2  Overview of PE Day Findings

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<th>P</th>
<th>Partial η²</th>
<th>Power_{observed}</th>
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Abbreviations: B, baseline; I, intervention; P, postintervention; M, male; F, female.

*a Huynh-Feldt corrected degrees of freedom.

* P < .05; ** P < .01; *** P < .001.

### Table 3  Overview of No-PE Day Findings

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Abbreviations: B, baseline; I, intervention; P, postintervention; M, male; F, female.

* P < .05; ** P < .01; *** P < .001.
Discussion

One aim of the current study was to quantify pedometer-determined physical activity of Muslim American youth attending a parochial middle school. Children’s average steps during any phase and on either type of day were below reported at-school values.\(^2\) Specifically, peak values for males and females occurred on PE days during intervention and baseline, respectively, and were approximately 100 and 1300 steps below previously reported lowest range values by respective gender.\(^1\) Step differential between PE and no-PE days was consistently between 2000 to 2400 steps across phases. Discounting the ~500 steps necessary to transport to/from the park where PE was held, the average PE lesson generated between 1500 to 1900 steps in 50 min, which is significantly below the 82 to 88 steps/min guideline associated with 50% MVPA.

A second aim of the current study was to determine the impact of a faith-based pedometer intervention on steps by assessing time-, gender-, BMI classification-, and grade-moderated effects. Initial step increases during baseline—particularly associated with PE days—may have been associated with the novelty of wearing a pedometer. Overall, the intervention further increased steps for males only and only on PE days. The effect appeared to decay over the latter half of the intervention and into post intervention. Pedometer interventions that are less than 8 weeks in length have been associated with the novelty of wearing a pedometer. Overall, the intervention further increased steps by assessing time-, gender-, BMI classification-,

steps necessary to transport to/from the park where PE was held, the average PE lesson generated between 1500 to 1900 steps in 50 min, which is significantly below the 82 to 88 steps/min guideline associated with 50% MVPA in middle school PE.\(^2\)

There were no differences in steps based on BMI classification and between grades. Researchers have not been able to classify children by weight according to international BMI-referenced steps/d cut points.\(^5\) Median steps/d during the middle school years (ie, 11- to 13-y) appear stable in girls and decreasing in boys.\(^11\) Results reported here may be artifacts of a cohort effect. As a whole, students were exposed to the same school policies, environmental conditions, and PE classes, thus their steps should have been similar. It is encouraging that students responded similarly regardless of BMI classification or age.

Our study found that VU had a modest effect on steps for males on PE days that decayed over time but remained significantly higher than when baseline conditions were reinstated. An interesting question then is, how much more effective would the VU intervention be if it were faithfully administered endogenously? While this cannot be answered immediately, in the interim, because VU effects were limited to PE days, the frequency of PE in conjunction with the intervention should be increased as they appear to operate synergistically. (Currently, children accumulate only half the state-mandated number of minutes of PE every 2 weeks.) In addition, the walkability of the school grounds is limited and the intervention may have even greater impact in contexts that afford students ample outdoor space and sufficient time to be active. Insufficient space and inability to engage in mixed-gender play may have contributed to females choosing sedentary activities at recess and lunch. At PE, some curricular offerings and instructional/managerial practices curtailed step accumulation opportunities. Martin, McCaughtry, and Shen\(^3\) found that Arab American middle school females scored higher than males on subjective norm toward their

social norms for physical activity engagement may also curtail its engagement among Muslim females.\(^27\) This may be particularly true within Islamic day schools in the U.S., which are tacitly charged with constructing and reinforcing Islamic morality in their female students, which may inadvertently suppress expressions of physical activity.\(^28\) Indeed, Muslim-American female adolescents scored significantly higher than males on measures of religiosity, including elements related to appearance, creed, and jurisprudence that (in)directly relate to physical activity.\(^29\) Results also suggest that sex-segregated PE at CSSC offered males more step opportunities than females. Informal observations of PE revealed that males tended to more frequently play continuous-play invasion games (eg, basketball) while females played more discontinuous-play invasion (eg, football) and field (eg, softball) games. At school, we observed males using their recess and lunch times in high-intensity soccer and tag games in the limited playground space while females typically sat, stood, occasionally walked, or stayed indoors. This differentiated use of discretionary time, which would widen step gaps on PE days as well as create a gap on no-PE days, has been previously reported among western European Muslim adolescents.\(^30\) Underlying this difference is the belief in some cultural communities that physical activity and exercise are not consonant with Muslim girls’ expected roles and behaviors.\(^31\)
PE teacher’s attitudes and beliefs about MVPA. As the entire teaching staff is female, adult modeling of desirable physical activity behavior during the school day is paramount, especially for the teachers who deliver PE and are in position to convey its importance to their female students. These strategies take on even greater importance on no-PE days when physical activity levels for females were particularly low. Considering these points in sum, the CSSC should consider modification and adoption of policies that effectively remove constraints on students’ ability to participate in physical activity and purposefully build physical activity into the school day and curriculum to shift the school culture around physical activity. In addition to recommendations offered above, a retractable partition exists in the multipurpose room where morning assembly is held, and could be used to separate boys and girls so morning calisthenics could be conducted before first period. Recess and lunch breaks could be staggered so females can engage in physical activity without the presence of males. As mothers are more likely to drop off/pick up their daughters and linger at the CSSC, inviting them to coparticipate in physical activity programming can provide needed social support of their daughters.

The study’s methodological strengths include securing an 85% retention rate across 3 grades, delaying the intervention across grades in the absence of a control school, measuring steps on 2 types of days over an extended period in a naturalistic setting, and employing a mixed analytic approach. While it can be argued that VU is narrow in scope, it is patterned after the Map Challenges found in SPARK, which is research-tested and widely disseminated. Moreover, the idea of virtual travel as a basis for step intervention is applicable in most settings while embedding interdisciplinary concepts could readily be translated to other religions and ethnic groups. CSSC is the only Islamic day school in San Diego County, thus results may be limited in generalizability. Other schools may offer larger grounds, greater time allocations for unstructured physical activity during the school day, PE specialists, or some combination. We welcome replications in Islamic schools and translations of VU materials to non-Islamic schools, toward further understanding how tailored, interdisciplinary pedometer interventions can be used to maximize steps taken at school.

References


Appendix

Journey of Umra - Leg 14

From
Abu Dhabi, United Arab Emirates

Journey length: 577 miles
Steps necessary: 13,738

To
Riyadh, Saudi Arabia

UAE Facts
Area: slightly smaller than Maine
Population: ~4.6 million
Capital: Abu Dhabi
Currency: Emirati dinar
Average annual income per person: $37,000
Life expectancy: males (73), females (78.5)
Literacy rate (%): males (76), females (82)
Agriculture: dates, vegetables, watermelons

Saudi Arabia Facts
Area: ~5x size of USA
Population: ~28 million
Capital: Riyadh
Currency: Saudi riyal
Average annual income per person: $19,800
Life expectancy: males (74), females (78)
Literacy rate (%): males (85), females (81)
Agriculture: wheat, barley, tomatoes, melon, dates, citrus

To FIND OUT along the way:
1. How many times per day do trains run on the country’s only railway (between Riyadh and Dammam)?
2. Steering wheels are located on what side of cars in Saudi Arabia?
3. What is the name of the hotel being built in Mecca across the street from the Masjid al-Haram that when finished will be the tallest and largest hotel in the world?
4. What tourist attraction is located in Mada’in Saleh and is sometimes compared to Jordan’s Petra?
5. In what decade were boundaries with Jordan, Iraq, and Kuwait established through a series of treaties?
6. What city is considered the commercial and banking center of the kingdom?
7. Taif, considered the summer capital of the kingdom, is known for what flower, which is also a popular girl’s name in Arabic – Zahirah?
8. Approximately how high does the King’s Fountain in Jeddah spray?
9. Name the Saudi princess who stated that there was a need to “seriously and realistically look into the issue of introducing sports in girls’ schools because of the rise in diseases linked to obesity and lack of movement.”
10. Pictured above, Hadi Souan Somalyi won Saudi Arabia’s first ever Olympic medal in the 400 meter hurdles at which Olympics?