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BRIEF PRACTICE

Increasing the Post-Use Cleaning of Gym Equipment Using Prompts and Increased Access to Cleaning Materials

Ilexis Elba[1] · Jonathan W. Ivy[1]

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Abstract

A multiple treatment reversal design was used to evaluate the effects of three different antecedent-based interventions on the post-use cleaning of gym equipment. Unidentified students, faculty, staff, and community members participated in this study. An announcement, signs, and signs together with increased accessibility to cleaning materials were evaluated. The highest level of post-use cleaning was observed under the signs plus accessibility condition. These results indicate that the use of antecedent-based interventions may be a viable option for increasing cleaning behavior.

Keywords Antecedent-based interventions · Cleaning behavior · Prompts · Gym

Although regular exercise is associated with numerous health benefits (Centers of Disease Control and Prevention, 2015a; CDC), individuals who exercise at public gyms can be exposed to dangerous bacteria (Markley, Edmond, Major, Bearman, & Stevens, 2012). For example, the CDC (2015b) estimates that up to 30% of the general population are carriers of potentially harmful bacteria that can cause skin infections, such as *Staphylococcus aureus*. Skin infections can be transferred to unaffected individuals through contact with shared surfaces. This is especially true for members of sports teams who share close quarters (Zinder, Foley, Scarlata, & Vasily, 2010). Between 10 and 30% of tested gym surfaces were found to contain bacteria that can lead to skin infection or illness (Oller, Province, & Curless, 2010; Markley et al., 2012).

Bullet points
- Although there are benefits to exercise, individuals who utilize public gyms or exercise facilities can be exposed to dangerous bacteria.
- One of the ways to eliminate the bacteria that may be present on the surface of gym equipment is through post-use cleaning with a disinfectant.
- Interventions were chosen to minimally interfere with the environment and be of low effort for implementation.
- Decreasing response effort and providing prompts within the environment evoked the highest level of post-use cleaning.

✉ Jonathan W. Ivy
jwi106@psu.edu

[1] Behavioral Sciences and Education, The Pennsylvania State University—Harrisburg, Middletown, PA 17057, USA

One of the ways to eliminate the bacteria that may be present on the surface of gym equipment is through post-use cleaning with a disinfectant (CDC, 2016). Oller et al. (2010), for example, found that cleaning with a disinfectant eliminated antibiotic-resistant *Staphylococcus aureus* (or MRSA) on gym and locker room surfaces. Given the high rate of gym use and membership across the country (International Health, Racquet, & Sportsclub Association, 2016), cleaning gym equipment post-use can create a safer exercise environment.

Behavior analysts have long been interested in improving behavior of social significance (Baer, Wolf, & Risley, 1968), including behaviors related to public health and safety. Although responses that produce a cleaner and safer environment are an uncommon focus in behavioral research, there is an opportunity and need to extend behavior analysis beyond conventional practice (Normand & Kohn, 2013). At the time of this writing, we have found no behavior analytic research that attempted to increase post-use cleaning of gym equipment. However, the behavior of cleaning may be influenced by variables similar to those that have been effective in promoting other public health and safety-related behaviors.

Fournier and Berry (2013), for example, evaluated the effects of two interventions on hand-washing of university students. The first intervention included a sign prompt, increased access to hand-sanitizer, and a "change agent" who "encouraged and educated students about hand-sanitizer gels" (p. 158). The second intervention condition was similar to the first, except the change agent component was omitted.

The authors found that the combination of a change agent, sign-prompt, and increased access to cleaning supplies produced the highest rate of hand-washing. However, including a change agent may not always be feasible. The cost associated with hiring a person to "encourage" the occurrence of target public health behaviors would be prohibitive in many settings. Although less effective, the authors found that increased access to cleaning supplies and sign prompts increased the level of hand-washing above baseline.

Interventions that include the components of prompts and increased access to materials, in isolation or combined have been effective at promoting recycling behavior (Austin, Hatfield, Grindle, & Bailey, 1993; O'Connor, Lerman, Fritz, & Hodde, 2010) and may produce similar effects on other socially important behavior, such as cleaning gym equipment. Thus, the purpose of this pilot study was to evaluate the effects of prompts and increased access to cleaning materials on the post-use cleaning of gym equipment.

Method

Participants and Institutional Review

A group of unidentified students, faculty, staff, and community members participated in this study. All students, staff, and faculty were registered at a public Pennsylvania state university campus offering bachelor, graduate, and certificate degrees. Individual participants were not identified. As of fall semester 2015, 3866 (61% male, 39% female) undergraduate and 812 (39% male, 61% female) graduate students were enrolled. An institutional review board approved all procedures prior to participant enrollment.

Setting and Materials

The study was conducted in a university fitness room. The fitness room had an open floor plan, approximately 5000 square feet. Workout equipment included, but was not limited to benches, weight resistance machines and cardio equipment. A walkway split the room in half with cardio machines on one side and free weights and weight machines on the other.

The fitness room had four cleaning stations each provided with a paper towel dispenser and spray bottles containing disinfectant that hung or sat beside the dispenser. A station was located on each of the four walls. Two bathrooms were located inside the fitness room, which also contained paper towels.

Signs were randomly located around the room promoting cleaning of the equipment and other messages such as to place weights back in the proper location. Three signs each read, "Always wipe down equipment after each use" and "wipe down (w/ disinfectant spray) & return mats." On the wall opposite of the entrance was a large university-sponsored sanitation display sign that listed the rules and guidelines of the gym. One of the rules listed on this sign included a statement reading, "Anti-bacterial spray and paper towels are available in the fitness center. Each equipment user is responsible for cleaning the equipment immediately after use. Areas to be cleaned include handles, seating areas, control panels, and anywhere else where perspiration might accumulate." Other statements not pertaining to cleaning, such as handling equipment and dress code, were also included on the displayed policies.

Preliminary Observations

Observations were conducted to formulate an operational definition and observe current patterns of post-use cleaning. Observations ranged in length from about 30 min to 1 h, over the period of about 4 weeks. To remain inconspicuous, the first author wore gym attire and was positioned at various natural points throughout the gym (e.g., sitting on gym equipment). These preliminary observations revealed that the benches were the most frequently used piece of gym equipment, and like other pieces of gym equipment, were often not cleaned after use. Based on these observations, the benches were the focus of this pilot project.

Target Behavior and Measurement

Cleaning was measured using event recording with mutually exclusive definitions for full, partial, or no clean. A *full clean* was defined as wiping the total surface of the bench area with an unused paper towel and disinfectant, either sprayed on the machine or paper towel, following machine use. A *partial clean* was defined as wiping any part of the total surface, but not all areas with an unused paper towel and disinfectant. *No clean* was defined as the absence of any cleaning behavior, not using a paper towel with disinfectant, or wiping the surface with a used paper towel. Additionally, groups of two or more individuals using a machine together were scored as one opportunity. Termination of a workout opportunity was defined as the individual leaving the gym, engaging with a new machine, or a new individual or group of individuals using the bench. Additionally, sitting on a bench without engaging in an exercise, such as to rest or talk with a peer, was not counted as a cleaning opportunity. Surface area did not include the metal legs of the bench.

Data were collected three to four times per week, Monday through Thursday. Each session started at approximately 5:00 pm and lasted 30 min. This time was selected based on the high volume of occupants. Following each session, event recording data were converted to a percentage by dividing the total number of each clean type by the total number of

opportunities. A percentage was calculated because the number of machine uses per session was unequal.

Interobserver Agreement

Interobserver agreement (IOA) was measured during 30% of the sessions by having a second observer independently collect data. Total count IOA was calculated for each dependent variable by dividing the smaller count by the larger number count, then multiplying by 100. Mean IOA was 89.5% for full clean, 81.8% for partial clean, and 86.6% for no clean.

Procedures

Baseline Gym users were free to work out on any machine. All cleaning stations were stocked with cleaning spray and paper towels. There was no programmed consequence or performance feedback during this or any subsequent phase of the study.

Announcement A prerecorded announcement was played once at the beginning of the session and then again 15 min into the session. To increase the saliency of the announcement, any overhead music was turned off, followed by a 3–5 s pause and then the announcement was played at maximum volume. The announcement consisted of a female voice saying, "Hey! Hey, you! Someone wants to use that machine after you. Wipe down all equipment after use." After the announcement, 3–5 s of silence occurred and then the overhead music was turned back on.

Signs Six informational signs were posted by staff before the start of a session. All signs were contained within the section of the gym that contained the benches, approximately 3–6 ft. from the benches. The signs were orange with a large white X across the center and contained two graphic pictures of skin diseases. The message on the sign read, "Where do you want yours? Wipe down benches after use!"

Signs and Accessibility This condition was identical to the previous sign condition with the addition of increased availability of cleaning materials. A paper towel roll and spray bottle were placed next to all of the benches by gym staff. The spray bottle was filled at least a quarter way full with sanitation solution.

Design

A multiple treatment reversal design was used to evaluate the effects of the interventions on cleaning gym equipment.

Results and Discussion

Figure 1 depicts the percent of full and partial cleans for each phase of the study. During baseline, levels of full ($M = 8\%$, range = 0–14%) and partial ($M = 3\%$, range = 0–15%) clean were low. The introduction of the announcement condition had no discernable effect on cleaning (full clean $M = 8.8\%$, range = 0–22%; partial clean $M = 1.8\%$, range = 0–9%).

Elimination of the announcement showed similar results to the previous two conditions. Levels of full ($M = 12\%$, range = 7–21%) and partial clean ($M = 1.7\%$, range = 0–6.67%) remained low and stable.

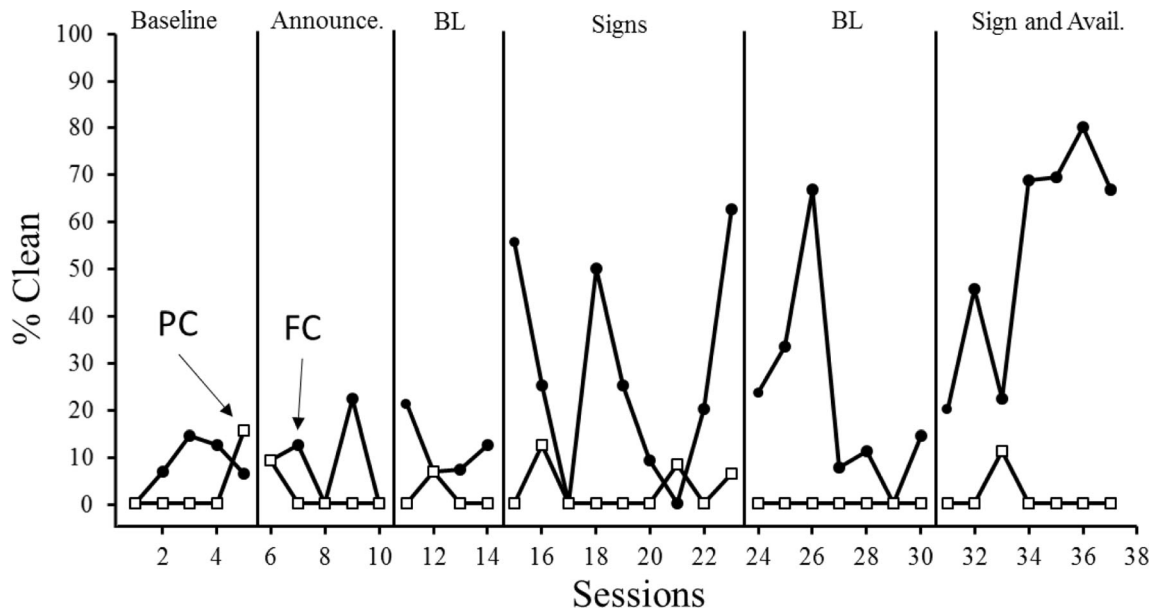

Fig. 1 Percent of full (FC) and partial (PC) post-use cleaning of gym equipment across baseline (BL), announcements (Announce.), signs, and signs plus increased availability of cleaning materials (Sign and Avail)

During the sign prompt, an increase in full cleans was observed but were highly variable ($M = 27.5\%$, range = 0–63%); partial cleans remained low ($M = 3\%$, range = 0–12%). A return to baseline showed an initial period of high responding for full cleans but percentages decreased to previous baseline levels ($M = 22.4\%$, range = 0–67%). Partial cleans were at zero levels.

When sign prompts and increased access to cleaning materials were implemented, the level of full cleans increased and stabilized for the remaining four sessions of study ($M = 53\%$, range = 20–80%) while partial cleans remained low ($M = 1.6\%$, range = 0–11%).

The purpose of this research was to increase post-use cleaning of gym equipment, namely the benches. Informal observations conducted by the authors, during standard use of the gym, revealed that very few of the gym-goers cleaned equipment after use. This project was developed to identify possible antecedent changes to promote cleaning. Based on the data, the findings of this study support outcomes suggested by previous research relating to cleaning behavior with the use of antecedent interventions (Fournier & Berry, 1986). Furthermore, we attempted to select and evaluate antecedent interventions that were natural to the gym environment.

The announcement phase was selected first for its relatively low intrusiveness and minimum response effort on the part of the gym staff. Additionally, the maintenance duties for the announcement would be negligible with the use of a prerecorded message played on a preset, timed schedule. Although an announcement is frequently used as a behavior change practice in cafeterias, hotels, hospitals, and similar public spaces, the results of the current study demonstrated that the announcement had little effect on the patrons' cleaning behavior. This type of prompt may be rendered largely ineffective by competing stimuli (e.g., music playing through headphones). Further, an announcement delivered at a fixed time may not function as an effective antecedent for a temporally delayed behavior. The preliminary results of this study suggest announcements may be ineffective at promoting some public health and safety behaviors.

Cleaning the benches increased while the signs were posted. Relative to the announcement, the sign prompts created permanent and likely more salient antecedent conditions. However, responding was highly variable. Anecdotally, it appeared that the sign prompts were effective at increasing post-use cleaning for some individuals, but not others.

The final intervention sought to decrease the relative response effort for cleaning by increasing access to cleaning materials, coupled with the sign-prompt. Although this condition appeared to be the most effective, it represents the most intrusive of the three conditions evaluated and required the greatest amount of staff resources to implement (e.g., replenishing cleaning supplies at each station). These findings replicate Fournier and Berry (2013) by demonstrating that a combination of sign prompts and increased access to cleaning materials can improve public health-related cleaning behavior. Further, these findings extend Fournier and Berry in two ways. First, we evaluated different types of prompts (i.e., an announcement and signs). Second, the level of cleaning in the final condition was increased, relative to the other conditions, without the use of a behavior change agent (e.g., someone verbally prompting the cleaning of equipment), which would be very resource intensive.

In evaluating the results of this study, there are a number of limitations that need to be taken into account. First, due to time constraints of the academic calendar, it was not possible to return to baseline and replicate the sign plus accessibility condition. Additional sessions would provide opportunity to demonstrate a more rigorous functional relation and maintenance of responding. The present study and related findings are best viewed as preliminary.

Second, the focus of the current study was to increase post-use cleaning of only the benches. The benches were selected because they were the most frequently used gym equipment and were rarely cleaned post-use. Future research should seek to extend implementation and data collection across not just a subset of equipment, but other gym equipment.

Third, as sign prompts and increased access to cleaning materials were combined, we do not know if one component was more effective than the other or if the combination of the two was necessary. Therefore, the increased accessibility component should be evaluated independently in future research.

Fourth, treatment integrity of gym staff implementing each intervention was not formally assessed. Although the experimenters guided staff in the implementation of each intervention prior to the start of a condition (e.g., placing signs and cleaning materials by specific pieces of exercise equipment), a direct measure of treatment integrity would allow for monitoring of each step of an intervention across time and staff. Such a measure is particularly important for interventions implemented by non-behavior analyst, community members.

Conclusion

The current study demonstrates promising results for increasing cleaning using antecedent-based interventions. For some individuals, the stimulus of a used bench may evoke a cleaning response. However, for others—based on learning history—additional prompts may be necessary to promote cleaning. Although cleaning is not a common target of behavioral intervention and research, the absence of cleaning can produce harmful or dangerous environmental outcomes (e.g., infected surfaces). Antecedent-based interventions are particularly well suited to improving behaviors related to public health and safety (e.g., cleaning), as most antecedent-based interventions represent static or fixed changes to the

environment (e.g., posting of a sign or making materials more accessible). The science of behavior analysis has significant potential to impact public health and safety practice at both an individual and group level; however, further research is needed.

Compliance with Ethical Standards

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed Consent The requirement for informed consent was waived by the institutional review board. The participants were unidentified members of the public in a public setting. No identifying information was collected.

Conflict of Interest The authors declare that they have no conflict of interests.

References

Austin, J., Hatfield, D. B., Grindle, A. C., & Bailey, J. S. (1993). Increasing recycling in office environments: the effects of specific, informative cues. *Journal of Applied Behavior Analysis, 26*(2), 247–253. https://doi.org/10.1901/jaba.1993.26-247.

Baer, D. M., Wolf, M. M., & Risley, T. R. (1968). Some current dimensions of applied behavior analysis. *Journal of Applied Behavior Analysis, 1*(1), 91–97. https://doi.org/10.1901/jaba.1968.1-91.

Centers for Disease Control and Prevention. (2015a). *Physical activity and health*. Retrieved from https://www.cdc.gov/physicalactivity/basics/pa-health/

Centers for Disease Control and Prevention. (2015b). *General information about MRSA in healthcare settings*. Retrieved from https://www.cdc.gov/mrsa/healthcare/index.html

Centers for Disease Control and Prevention. (2016). *Cleaning & disinfecting athletic facilities for MRSA*. Retrieved from https://www.cdc.gov/mrsa/community/enviroment/athletic-facilities.html

Fournier, A., & Berry, T. (2013). Interventions to increase hand hygiene behavior among university students: implications for response cost and socially–assisted interventions. *Behavior and Social Issues, 21*, 152–164 https://doi.org/10.5210/bsi.v21i0.3979.

International Health, Racquet, & Sportsclub Association. (2016). *About the industry.* Retrieved from http://www.ihrsa.org/about-the-industry/

Markley, J. D., Edmond, M. B., Major, Y., Bearman, G., & Stevens, M. P. (2012). Are gym surfaces reservoirs for Staphylococcus aureus? A point prevalence survey. *American Journal of Infection Control, 40*, 1008–1009 https://doi.org/10.1016/j.ajic.2012.01.015.

Normand, M. P., & Kohn, C. S. (2013). Don't wag the dog: extending the reach of applied behavior analysis. *The Behavior Analyst, 36*(1), 109–122.

O'Connor, R. T., Lerman, D. C., Fritz, J. N., & Hodde, H. B. (2010). Effects of number and location of bins on plastic recycling at a university. *Journal of Applied Behavior Analysis, 43*(4), 711–715. https://doi.org/10.1901/jaba.2010.43–711.

Oller, A., Province, L., & Curless, B. (2010). Staphylococcus aureus recovery from environmental and human locations in 2 collegiate athletic teams. *Journal of Athletic Training, 45*(3), 222–229. https://doi.org/10.4085/1062-6050-45.3.222.

Zinder, S. M., Basler, R. S. W., Foley, J., Scarlata, C., & Vasily, D. B. (2010). National Athletic Trainer's Association position statement: skin diseases. *Journal of Athletic Training, 45*(4), 411–428. https://doi.org/10.4085/1062-6050-45.4.411.