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Survey of 2014 Behavioral Management Programs for Laboratory Primates in the United States

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Abstract

The behavioral management of laboratory nonhuman primates in the United States has not been thoroughly characterized since 2003. This article presents the results of a survey behavioral management programs at 27 facilities and covering a total of 59,636 primates, 27,916 housed in indoor cages and 31,720 in group enclosures. The survey included questions regarding program structure, implementation, and methodology associated with social housing, positive reinforcement training, positive human interaction, exercise enclosures, and several categories of inanimate enrichment. The vast majority of laboratory primates are housed socially (83%). Since 2003, the proportion of indoor-housed primates reported to be housed singly has fallen considerably, from 59% to 35% in the facilities surveyed. The use of social housing remains significantly constrained by: 1) research protocol requirements, highlighting the value of closely involved IACUCs for harmonizing research and behavioral management; and 2) the unavailability of compatible social partners, underscoring the necessity of objective analysis of the methods used to foster and maintain compatibility. Positive reinforcement training appears to have expanded and is now used at all facilities responding to the survey. The use of enrichment devices has also increased in the participating facilities. For most behavioral management techniques, concerns over the possibility of negative consequences to animals are expressed most frequently for social housing and destructible enrichment, while skepticism regarding efficacy is limited almost exclusively to sensory enrichment. Behavioral management program staffing has expanded over time in the facilities surveyed, due not only to increased numbers of dedicated behavioral management technicians but also to greater involvement of animal care technicians, suggesting an increase in the integration of behavioral care into animal husbandry. Broad awareness of common practice may assist facilities with program evaluation and assessment of progress in the field can generate recommendations for continuing the advancement of primate behavioral management programs.

Keywords

psychological well-being; social housing; positive reinforcement training; enrichment

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INTRODUCTION

The United States Department of Agriculture Animal Welfare Regulations require research facilities housing nonhuman primates to “develop, document, and follow an appropriate plan for environmental enhancement adequate to promote the psychological well-being of nonhuman primates” [USDA, 2013]. As stated in section 3.81 of the Animal Welfare Regulations, a facility’s environmental enhancement plan “must be in accordance with the currently accepted professional standards as cited in appropriate professional journals or reference guides, and as directed by the attending veterinarian [USDA, 2013].” Before the 1985 amendment to the Animal Welfare Regulations, which initiated the language requiring programs providing for the psychological well-being of nonhuman primates (hereafter termed “primates”), laboratory institutions did not have formalized plans or dedicated staff [Bloomsmith & Else, 2005]. By 2003, program coordinators and technical positions were commonplace.

Since that time, currently accepted professional standards and practices have been evolving. However, the most recent detailed characterization of enhancement programs described and quantified the state of programs as they existed in 2003 [Baker et al., 2007]. There have been a number of changes since this time. First, regulatory and accreditation expectations have been changing; the National Research Council (NRC) has since published a revised Guide for the Care and Use of Laboratory Animals [NRC, 2011] (hereafter “the Guide”) and the Office of Laboratory Animal Welfare (OLAW) has released FAQs relevant to their Public Health Service Policy, most recently in 2012 [OLAW, 2012]. Another potential influence on changing practices is the increasing wealth of published research (this article does not include a literature review, of which there are many to which one can refer; for a recent example, see the Abee et al. [2012]). The number of professional scientific and veterinary societies endorsing behavioral management and its components has grown (e.g., [American Society of Laboratory Animal Science, 2007; American Society of Primatology, 2014; American Veterinary Medical Association, 2011; Association for the Study of Animal Behavior/Animal Behaviour Society, 2012; Association of Primate Veterinarians, 2012]) suggesting increased recognition that behavioral management is an integral and compulsory component of biomedical research and captive care. Over this period of time and continuing today, there have been claims by the animal rights communities that environmental enhancement programs are stagnant and therefore that existing regulations are ineffective [Balcombe et al., 2011; Chandna et al., 2015; Goodman et al., 2015; New England Antivivisectionist Society, 2014]. Last, the approach to enhancing psychological well-being has broadened from a focus on adding stimuli to captive environments to an integrated approach which also addresses the nature of the human-animal interface (including training and interaction) and environmental design. This holistic approach has been termed “behavioral management” [Whittaker et al., 2001], and will be used herein.

This article presents a current characterization of common practice associated with behavioral management programs for laboratory primates, gleaned from a comprehensive survey of a large number of facilities. In addition to providing for an informed characterization of the state of behavioral management programs in the United States, this article employs survey results to identify areas of comparatively large variability in practices

or relatively little progress over the previous decade. The identification of these aspects of behavioral management programs suggests where varying strategies should be explored and where new research is needed. This article also aims to provide information to guide recommendations for program evaluation, mechanisms for program augmentation, and future priorities for ongoing progress in the care of laboratory primates.

METHODS

This research adhered to the legal requirements of the country in which the research was conducted and adhered to the American Society of Primatologists (ASP) Principles for the Ethical Treatment of Non Human Primates.

A 79-question survey was sent via email to heads of behavioral management programs when known to the author, and otherwise directed to senior management with a request to forward the questionnaire to the appropriate individuals. Other potential participants were identified by other professionals in the primate behavioral management community. Due to the sensitivity of the information sought, emails to individuals not known to the author were copied to the colleague who provided the author with the contact information so that they could confer if necessary. The American Society of Primatology and Association of Primate Veterinarians membership directories, as well as LinkedIn (www.linkedin.com) were used to seek appropriate contacts. Last, a notice was posted to the Laboratory Animal Refinement Forum (awionline.org/content/reflnement-forum-laref). Individuals were assured that their names and institutional affiliations would remain anonymous and the information used only for professional presentation or publication in an academic journal. Several institutions contacted operate more than one separate facility and after confirming that they have independent oversight and staff, and no coordination between behavioral management programs at the different facilities, each facility was counted separately.

After identifying recipients, surveys were sent to 46 facilities, including 28 university-affiliated primate facilities, 14 private laboratory, research, and breeding facilities, and four federal government facilities. Attempts were made to obtain responses from all 21 facilities that participated in the 2003 survey; responses were garnered from 14. The author completed a survey as well.

The survey tool represented an elaboration to the survey distributed in 2003, whose results are reported in Baker et al. [2007]. The document queried 14 elements of behavioral management:

- Behavioral management program oversight and team composition.
- Animal care technician training and participation in behavioral management activities.
- Social housing: the provision of physical contact between individuals of the same species.
- Positive reinforcement training: teaching primates to voluntarily perform desired behaviors by providing rewards immediately following the

performance of the behavior, avoiding the use of coercion (e.g., cage squeeze mechanism or physical restraint).

- Positive human interaction: engaging with primates in activities such as playing, grooming, and handing out feeding enrichment.
- Structural enrichment: housing complexities such as perches, swings, climbing apparatus, and visual barriers.
- Exercise enclosures: caging or pens providing additional space to caged primates, typically to promote additional exercise or activity.
- Enrichment devices: task-oriented items that provide extractive, manipulative or cognitive challenges, such as foraging devices, fleece boards, and puzzle feeders.
- Feeding enrichment: edible items provided to the primates in addition to their standard diet, e.g., fruits, vegetables, nuts, seeds, cereals, and manufactured treats.
- Durable manipulanda: any portable or manipulable objects that are not specifically task oriented, such as balls, mirrors, wood blocks, and dog toys.
- Destructible enrichment: readily mutable material such as paper, cardboard, cloth, browse, straw, and nondurable plastic.
- Sensory enrichment: passive features such as music, video, and aromas.
- Psychological well-being monitoring and intervention for behavioral problems.
- Past programmatic changes and future plans.

Questionnaire instructions solicited multiple response choices for many questions. All questions contained a response for “other” accompanied by space for free text, and survey sections pertaining to each program element was concluded with a space for the respondents to offer comments.

Laboratory primates may be housed in a wide variety of enclosure types which vary in size and construction material, as well as whether access to the outdoors is provided. Facilities with outdoor access may or may not have indoor holding areas and access to the outdoors may or may not be continuous. All enclosure types vary in environmental complexity, degree of intrinsic support of psychological well-being, require different strategies for augmenting the captive environment, and are used in accordance with the intended use of the primates housed in them. Behavioral management programs vary according to the needs and restrictions associated with all of these attributes. The majority of facilities contributing to the survey house animals in more than one type of enclosure. The survey tool was designed to address these differences. The survey tool dichotomized enclosure types as follows: 1) small enclosures intended for maintaining individuals housed singly or in small groups (typically in interconnecting individual enclosures or pens), often but not always maintained indoors, and often housing the bulk of a facility’s research subjects; and 2) runs, field cages or other enclosures, with a portion or all of the enclosure allowing access to the outdoors,

often intended for breeding purposes, and rarely housing very small groups. These two categories are herein labelled “cage” and “group” housing.

For questions pertaining to the categories of employees involved in program elements, the following options were provided:

- Animal care technician(s)
- Veterinary technician(s)
- Behavioral management technician(s)
- Behavioral management scientist(s)
- Researcher(s) or research staff
- Veterinarian(s)
- Other

For some program elements, additional employee categories were supplied, namely:

- Dedicated individual, multiple individuals working independently, dedicated committee (regarding behavioral management oversight).
- Dedicated trainer (positive reinforcement training).
- Facility machine shop or physical plant (structural enrichment and enrichment devices).

In order to quantify the degree to which duties are shared versus specialized, results regarding participation are reported here not only as the proportion of facilities engaging different employee categories, but also the proportion of facilities reporting that multiple employee categories participate in a given element of behavioral management.

This survey queried whether certain factors restrict the implementation of behavioral management techniques. For all such questions, the following response options were provided:

- Cost
- Time or staff constraints
- Research protocol exemption
- Concern about potential negative consequences to animals
- Belief that it does not benefit well-being
- Other

For some program elements, additional constraint options were supplied, tailored to issues relevant to that element, namely:

- Housing or space limitations, unavailability of compatible social partners; information from research investigators lacking; single housing required imminently (social housing).

- Current training goals pertinent only to a subset of animals; lack of expertise (positive reinforcement training).
- Available space (exercise enclosures).
- Plumbing or draining concerns; other impacts on sanitation; aesthetic concerns (feeding enrichment and destructible enrichment).

Questions pertaining to implementation levels with respect to the proportion of a facility's population that receives an element of behavioral management included the following six response choices: none, 1–25%, >25–50%, >50–75%, >75–99%, and all. Results were calculated and displayed using four implementation levels (none, 1–50%, >50–99%, all) for comparison to the 2003 results.

Results are reported below as the percentage of facilities that provided each response option for a particular question. Since most questions allowed more than one response choice, many totals sum to more than 100%. Not all returned surveys were complete, so the proportions are reported across all respondents that answered each question. Across all questions and respondents, 1.3% of responses were missing, so that in a very small number of cases, responses sum to less than 100%.

RESULTS

Response and Facility Characteristics

Questionnaires were returned from 39 of the 46 facilities contacted, for a response rate of 85%. In addition, two individuals returned surveys following the query to the online Laboratory Animal Refinement and Enrichment Forum, for a total of 41 questionnaires received. Across all surveys, information was garnered on the behavioral management of 60,141 primates. Data from 14 institutions were excluded from the analysis because they house fewer than 100 primates. These data were omitted in order to facilitate comparison with the published 2003 survey [Baker et al., 2007], which included only one facility with fewer than 100 primates. Excluding results from these small facilities avoided skewing results toward the management of a very small proportion of the United States' laboratory population. The combined population of facilities in the United States that house populations under 100 represents only 3% of the laboratory primates housed in the United States [USDA, 2015].

Results are therefore calculated using data from 27 facilities. Across facilities assessed in this article, 52% were university-affiliated primate facilities, 37% were private laboratory, research or breeding facilities, and 11% were federal facilities. These proportions correspond closely with the distribution of these facility types in the United States (57% University-affiliated primate facilities, 33% private laboratory, research or breeding facilities, and 8% federal facilities [USDA, 2014]). Across facilities analyzed herein, the total population size is 59,636 primates. These figures represent 58% of the population identified in the 2014 USDA Annual Report of Animal Usage and 39% of facilities registered with the USDA as laboratories housing primates [USDA, 2014] and housing over 100 primates. At the time of the survey, 27,916 primates were maintained in "cages" (as

defined above) and 31,720 in groups (as defined above). The majority of facilities housed animals in both settings. Facilities' population sizes ranged from 146 to 9,500, with a mean facility size of 2,209 primates.

Program Administration/Management and Team Composition

With regard to behavioral management program oversight, 41% of programs are overseen by individuals with PhDs, 37% by individuals with Doctorates in Veterinary Medicine, 15% by individuals with a Bachelor's or Associate's degree, and 7% with Master's degrees. One program receives additional oversight by a dedicated group.

Full-time technicians dedicated to behavioral management programs are employed at 78% of facilities. Among facilities employing full-time behavioral management technicians and housing the majority of primates in cages, the average ratio of primates per person ranges from 70 to 911, with a mean of 310 (SD = 257). The remaining 22% of facilities utilize individuals with additional job responsibilities outside of behavioral management. Behavioral management technicians have a variety of educational backgrounds. Across team members, the highest level of educational experience is a Bachelor's or Associate's degree at 40% of facilities, a Master's degree at 24%, a PhD at 15%, a high school diploma at 8%, and a doctorate of veterinary medicine at one facility.

Animal Care Technician Training and Participation in Behavioral Management Programs

Across survey participants, all indicate that animal care technicians receive training regarding behavioral management issues, with 37% stating that more than one employee type contributes to the training of new staff members. This training is conducted by behavioral management technicians at 63% of facilities, veterinarians at 24%, behavioral scientists at 26%, staff supervisors at 22%, and research scientists or staff at 7%, with one facility each utilizing a veterinary technician, a training department or an AALAS training module.

At all facilities, animal care technician job responsibilities involve at least one behavioral management component, and all components of behavioral management are contributed to by animal care technicians at least one facility. In addition, all but 7% of facilities include behavioral management duties in the animal care technician job descriptions. All of the following components of behavioral management are included in job descriptions: feeding enrichment (82% of facilities), manipulable enrichment (56%), human interaction (52%), enrichment devices (48%), sensory enrichment (41%), behavioral assessment (33%), social housing (33%), structural enrichment (33%), destructible enrichment (30%), positive reinforcement training (22%), documentation of behavioral management activities (19%), exercise enclosures (19%), and interventions for abnormal behavior (one job description).

Social Housing

Implementation status—All facilities participating in this survey house at least some of their population indoors, and 59% also house a portion of their population outside.

For quantification of social housing implementation, each facility provides the number of primates of each species housed in the following configurations: single (alone in an enclosure without physical contact with conspecifics), protected contact (separated from conspecifics by a barred or mesh barrier permitting tactile contact), continuous pair (two individuals sharing an enclosure), intermittent pair (pair routine separated on a daily or weekly basis, but together at other times), indoor group (any type of indoor enclosure or large cage that houses more than two primates), and outdoor group housing.

The report on 2003 environmental enhancement programs [Baker et al., 2007] categorized all housing settings except single housing as social housing. However, the language of the 2011 Guide calls into question the classification of protected contact housing as a form of social housing, as suggested in the following quotation [NRC, 2011, p. 64]: “Single housing of social species should be the exception and justified based on experimental requirements or veterinary-related concerns about primate wellbeing. In these cases, it should be limited to the minimum period necessary, and where possible, visual, auditory, olfactory, and tactile contact with compatible conspecifics should be provided.” (Emphasis mine). In addition, the Association for the Accreditation of Laboratory Animals International (AAALAC) characterizes intermittent full contact housing as a form of “social experience” rather than social housing, stating that “... when full time housing with conspecifics is not possible, whether due to social incompatibility, veterinary concerns or scientific necessity, other social experiences should be considered such as part time access (e.g., overnight, when the animals are between studies, defined periods of time during the day, etc.) ...” [AAALAC, 2011]. Therefore, the current report quantifies housing categories with protected contact housing (reported in 2% of the surveyed population) and intermittent contact (reported in 1% of surveyed population) classified as single housing. Across all facilities, 83% of primates are housed socially.

Many biomedical research protocols require primate subjects to be housed in cages or other indoor enclosures, and a major focus of many behavioral management programs is to increase the proportion of research subjects that are housed socially. Therefore, in order to assess the current status of efforts to reduce the use of single housing in research, the indoor housed population requires separate scrutiny. With group housed primates excluded from the analysis, survey responses pertain to 27,916 individuals, 65% of which are housed socially. Species vary with respect to the proportion housed socially (see Table I).

The survey also queried whether social housing is implemented for primates equipped with experimental devices. Social housing is used for outfitted animals in the following percentages of facilities: collars (88%), telemetry implants or vascular access ports (85%), head caps (60%), eye coils (50%), jackets (39%), and tethers (8%).

Introduction methodology—For caged primates, a step-wise introduction process is utilized at the vast majority of facilities; 85% employ an initial phase of visual access before permitting any level of physical contact, and 96% include a protected contact phase before placing primates in unimpeded contact. Both a visual and a protected contact phase are employed in 85% of programs.

The survey queried five additional aspects of introduction methodology. First, the observation of affiliation is required to deem an introduction successful at 48% of facilities. Introductions are conducted in neutral cages (i.e., the enclosure is novel to all potential partners) in 44% of programs and in enclosures larger than the primary housing at 41%. Medication is used in 22% of facilities with the goal of improving introduction outcomes, and 19% of facilities blunt canines with the aim of reducing the severity of wounding.

Levels and schedules of monitoring vary widely between facilities. The response options included in the survey are shown in Table II. On the first day of introduction in cages, 11% of facilities maintain continuous monitoring, with separation of partners when unsupervised.

At 26% of facilities, the quantity and schedule of monitoring varies. At the remainder, the observation of new pairs follows a consistent schedule. Observations conducted three or more times per day predominate, most commonly in sessions lasting from 15 min to 1 hr. Heightened monitoring continues most commonly for 2–3 days after introduction.

On the first day of the formation of new groups, no facility consistently observes all new groups for the entire day, although this practice is followed for at least some groups in 9% of programs. The majority of facilities (55%) follow a consistent schedule for monitoring. Most frequently, new groups are monitored 2–3 times per day, most often in sessions lasting from 15 min to 1 hr. No session durations or monitoring schedules predominate after the first day.

Employee participation—Employee participation was queried for the following tasks associated with social management: 1) selecting partners; 2) conducting introductions; 3) monitoring newly formed pairs or groups; and 4) monitoring ongoing compatibility. Almost without exception, employees from all categories participate in all four tasks (see Table III). Most facilities report the participation of more than one employee type in most of these four responsibilities. The most widely shared tasks are the selection of prospective cage partners and routine monitoring after the introductory period. Among employee categories, the involvement of behavioral management technicians is most widespread for all but ongoing routine monitoring following the introductory period. The survey queried the use of qualitative and quantitative observations. All programs qualitatively monitor socially housed primates in the course of routine observation; in addition, quantified data are collected at 67% of programs. Quantified data collection is performed most commonly by behavioral management technicians and appears to be the more specialized of tasks associated with social housing.

Constraints—Only one survey participant states that there are no constraints to their implementation of social housing (see Table IV). The percentages of facilities reporting different constraints are shown in Table IV. Of all these limitations, unavailability of compatible social partners is cited most commonly, and research protocol issues are cited by over three-quarters of respondents.

Positive Reinforcement Training

Positive reinforcement training (hereafter abbreviated “PRT”), is a form of operant conditioning that teaches primates to voluntarily perform desired behaviors by providing

positive stimuli immediately following the performance of these behaviors. All facilities include PRT in the behavioral management of caged primates, and 89% provide it to group housed primates, most frequently provided to less than half of the facility's population in both housing categories (see Table V). For both caged and group housed primates, fewer than 20% of programs train all animals.

Most programs utilize PRT toward multiple goals, with an average per facility of five of the seven response choices offered. PRT is applied for the following purposes: cooperation with husbandry procedures (85%), cooperation with research procedures (74% of programs), general enrichment (70%), cooperation with clinical procedures (70%), improved response to people (67%), intervention for abnormal behavior (59%), and enhancement to social housing (41%). The survey queried the use of negative reinforcement, and the majority of participants (74%) report that some negative reinforcement is employed in the course of training. Facility IACUCs may assess the potential use of PRT for research procedures and may require that it be used at 30% of facilities.

Approximately one third of facilities employ a dedicated training coordinator who is involved in PRT across multiple research projects and in the animal care department, and advises other individuals who train primates (see Table VI). Multiple categories of employees conduct PRT at 81% of facilities. The largest proportion of facilities state that behavioral management staff and animal care technicians were the predominant implementors of PRT among staff categories. The survey queried whether physical contact was permissible in the course of training, which was the case in 93% of programs.

Only two survey participants report an absence of constraints to the use of PRT. Time or staff constraints are by far the most commonly expressed limitation, not only within PRT but across all program elements (see Table IV).

Human Interaction

Human interaction is distinct from PRT in that no operant conditioning is applied and the interaction is unstructured; examples include grooming, playing, or treat feeding. All but one respondent state that human interaction is incorporated in their behavioral management programs for caged primates and 83% report implementing human interaction for group housed primates (see Table V). In most cases, facilities provide all caged primates with human interaction, while half provide it to all primates in group enclosures. At all facilities, human interaction is implemented by multiple employee types, most commonly by animal care technicians (see Table VI). Human interaction activity includes physical contact at 80% of facilities. Respondents report no constraints to the implementation of this form of enrichment in 44% of cases. Time or staff constraints are cited most often (see Table IV).

Structural Enrichment

All facilities use structural enrichment such as perches, swings, climbing apparatus, and visual barriers for primates housed in cages and group enclosures (see Table V). The vast majority provide it to all primates at the facility, and at no facility is it included in fewer than 50% of cages or group enclosures. Structures can be constructed of a wide variety of materials. Historically, in the author's experience, the use of wood has been controversial

due to concerns that it cannot be sanitized in the same way as metal or plastic. Currently, 62% of facilities use wood as structural enrichment. While many of these facilities house animals both indoors and outdoors, 36% of facilities housing all primates indoors use wood.

All but one facility report that multiple categories of employee participate in the implementation of structural enrichment. All employee categories supplied in the survey are reported to be involved, with the most frequent participants being facilities' machine shop or physical plant (see Table VI). Constraints are reported by only 15% of survey participants, with three respondents reporting research protocols restraints and one reporting cost limitations (see Table IV).

Exercise Enclosures

Additional caging or pen space is provided to caged primates in 50% of programs (see Table V), and among all components of behavioral management is the most rarely used for the entirety of a facility's population. The majority of programs that use exercise enclosures provide access to less than half of their population. The purpose of implementing this form of behavioral management was queried with five response choices. Survey participants using exercise enclosures in their programs most commonly target individuals requiring intervention for abnormal behavior (50% of programs) or singly housed primates (42% of programs). Three other uses are reported at equal levels (17%): prioritized for young animals, used as intervention for obesity, or employed for physical rehabilitation/other clinical needs. One respondent notes that exercise enclosures are a requirement for certain research projects.

Access frequency was queried with four response choices. Among facilities that use exercise enclosures, a particular individual is given access to an exercise enclosure most commonly once weekly to once monthly (50%) followed by less than once per month (33%), several times per week (17%), and daily (8%). Access duration was queried with six response choices. Most frequently, an individual is housed in the enclosure for 1 to 2 weeks (42% of programs) or more than 2 hr but less than 8 hr (42%), followed by more than 24 hr to 1 week (17%), more than 8 hr but less than 24 hr (17%), and longer than 2 week (8%). No respondent indicates that the duration of access is 2 hr or less.

The responsibility for determining the scheduling of the use of exercise enclosures is shared to a greater extent than actual implementation activities such as maintaining the enclosures and moving the primates, which is shared at less than half of facilities (see Table VI). Most commonly, schedules are set by and animals moved by animal care technicians. In all but one case, respondents cite constraints to their use of exercise enclosures with the most common being space restrictions (see Table IV).

Enrichment Devices

All programs provide task-oriented items that provide extractive, manipulative, or cognitive challenges to caged primates, and 94% also provide them to their group housed primates. In the majority of cases, all of a facility's caged primates receive devices. This is also the case for group housed animals at a third of facilities (see Table V). Rotation schedules were queried with six response choices. No rotation schedule strongly predominates for

enrichment devices. Devices are most often rotated every 2 weeks (41%), followed by weekly (33%), on an “other scheduled basis” (19%), randomly (15%), and daily (11%). Devices are not rotated at 19% of facilities. Respondents at 19% of facilities offer the comment that at least one device type is permanently affixed to cages.

Devices are distributed by multiple employee categories at almost three quarters of facilities, primarily by behavioral management technicians (see Table VI). A smaller proportion of facilities report that repair is undertaken by multiple employee types, most commonly including behavioral management technicians. One respondent reports that devices are replaced rather than repaired. Across respondents, 33% report that there are no constraints to the provision of enrichment devices. Time or staff constraints are the most common factor cited (see Table IV).

Feeding Enrichment

All programs provide varied edible items in addition to a nutritionally complete standard diet. The vast majority provide feeding enrichment to all of their primate population (see Table V). No facility provides feeding enrichment to less than 50% of their population. Response choices regarding the frequency of feeding enrichment provisioning included: 1) one or more times per day; 2) two to six times per week; 3) once per week; and 4) less than once per week. With respect to caged primates, two different distribution schedules are reported. In 59% of programs, feeding enrichment is distributed one or more times per day, and two to six times per week in 41% of programs. For group housed primates, the most common distribution schedule is one or more times per day (47% of responses), followed by two to six times per week (42% of responses) and once per week (11%). Feeding enrichment is distributed by multiple employee categories at almost all facilities, most frequently by animal care technicians (see Table VI). Most respondents (85%) report no constraints to the implementation of feeding enrichment. The only cited restriction is protocol issues (see Table IV).

Durable Manipulanda

All programs provide durable manipulable objects to both caged and group housed primates, and a vast majority of respondents report that all of their primate populations receive manipulanda (see Table V). Most programs (81%) rotate durable manipulanda in order to provide novelty. Regarding rotation frequency, six response choices were offered in the survey: 1) not rotated; 2) daily; 3) weekly; 4) every two weeks; 5) other scheduled basis; and 6) randomly. The largest proportion of programs rotate manipulanda every 2 weeks (74%), and 15% rotate them weekly. No facility reports daily rotation or rotation less frequently than every 2 weeks. However, at 22% of facilities, novel manipulanda are rotated for caged primates at random. At over half of facilities surveyed, multiple classes of personnel are involved in the distribution or replacement of manipulanda. Involvement varies between distribution and replacement but animal care technicians are both the principal distributors and replacers (see Table VI). Most survey participants (78%) report no constraints on the implementation of manipulable enrichment. For those that do, time or staff constraints are the most frequently cited limitations (see Table IV).

Destructible Enrichment

Readily mutable materials are provided to caged primates at 85% of facilities and to primates in groups at 76% of facilities (see Table V). Almost half of programs provide it to all of their caged population and approximately a third provide it to all group-housed primates. Across facilities, the majority reports multiple classes of personnel that are involved in the implementation of destructible enrichment, most commonly by behavioral management technicians (see Table VI).

Only 30% of respondents report that there are no constraints on the use of this form of enrichment. Among constraints, the most frequently cited is plumbing, drainage, or sanitization concerns (see Table IV). Aesthetic concerns are rarely reported.

Sensory Enrichment

Programs include some form of passive enrichment (e.g., music, video, or aromas) for caged primates in the vast majority of facilities and for groups at half (see Table V). About half of facilities provide sensory enrichment to all of their caged primates, but less than a quarter provide it to all of their group housed primates. At half of facilities, sensory enrichment is implemented by multiple categories of employee, most commonly by behavioral management technicians (see Table VI). Across respondents, 48% report no constraints to the use of sensory enrichment. Time or staff constraints and the belief that it does not benefit primates are cited most commonly (see Table IV).

Psychological Well-Being Monitoring and Interventions for Behavioral Problems

While it is part of routine animal care to monitor primates on a daily basis, this monitoring may or may not explicitly include scrutiny of variables related to psychological well-being, and may or may not be supplemented by observations conducted specifically for that express purpose. Daily health checks include assessments of behavioral well-being at 78% of facilities. Among these facilities, 94% report that these health checks are implemented by multiple employee categories, most commonly by animal care technicians (see Table VII).

Most facilities (89%) employ individuals whose job duties include regularly scheduled behavioral observations beyond daily health checks, to monitor for the presence of behavioral problems. This duty is shared at only a third of facilities. Most often, behavioral management technicians perform these checks, with the frequency ranging from daily to annually (see Table VIII). For caged primates, the schedule for behavioral checks involves monthly observations in the highest proportion of cases. However, for group housed primates, at almost a third of facilities these observations are not scheduled but rather are conducted upon referral.

Qualitative observations are performed at 78% of facilities. In the survey, the duration of qualitative observations was dichotomized as either less than 3 min versus 3 or more minutes of sustained monitoring per individual. Among facilities that perform qualitative observations, the longer duration is employed in 54% of programs and the shorter duration in 46%. With respect to quantitative observations, 52% of respondents employ observations

such as focal or scan sampling data collection. Two survey participants offer the comment that video monitoring is employed.

All programs address behavioral pathologies. Interventions are most commonly designed by behavioral management technicians (see Table VII), but multiple employee types contribute to this task at 63% of facilities. Implementation of therapeutic interventions for individuals with behavioral problems is reported to be shared among several employee categories at the majority of facilities, with the most frequent participant being behavioral management technicians. All programs track individual responses to intervention for abnormal behavior, most commonly on a weekly basis (see Table VIII).

Programmatic Changes

Respondents state in 93% of cases that they have modified their programs over the previous four years (This interval of time was chosen based upon the publication of the new edition of the Guide [NRC, 2011]). Table IX shows the proportion of survey participants reporting changes for 17 aspects of behavioral management programs. Each behavioral management components addressed in this survey was altered in at least one facility. Social housing and employee training stand out in terms of the proportion of programs that have modified this aspect of their behavioral management.

As far as the mechanisms prompting changes to programs, of the nine response choices offered, the most commonly cited are changes in regulatory standards or policies (59% of programs), followed by conferring with colleagues (48%), conferences or workshops (48%), publications (37%), USDA or AAALAC review (37%), interested individual (15%), IACUC review (11%), and consultants (7% of facilities). Only one respondent reports that internal assessments other than IACUC review have driven modifications to their programs. Three mechanisms are reported by single respondents, including client requests or audits, changes in staff, and “general evolving expectations.”

All respondents report plans to modify to their behavioral management programs in the future (see Table IX), with a mean of four changes planned per facility. The most frequently cited change pertains to employee training.

DISCUSSION

This survey has three main aims. The first is to characterize current practices in behavioral management programs in the United States. The second aim is to evaluate changes in behavioral management practices over time. The manner in which programs have changed can be most thoroughly addressed via comparison to the results of a similar survey conducted in 2003 [Baker et al., 2007], although neither survey sampled all United States facilities or included a randomized sample of facilities. For many comparisons, survey questions were identical in both surveys, permitting precise comparisons. However, other comparisons between the 2003 and 2014 surveys are somewhat limited, because, unlike the 2014 survey, the 2003 survey was not designed to distinguish between the management of caged and group housed primates. In addition, some program components included in the

present survey (exercise enclosures, destructible enrichment, and sensory enrichment) were not addressed in the 2003 survey.

Several additional caveats must be noted. The degree to which results of this survey and comparison to past practices has translated into increased psychological well-being among the United States' population of laboratory primates cannot be concluded here. A change in this respect might only be inferred to whatever degree certain program components have been shown to be of benefit by the scientific literature. It must also be noted the management of very small colonies (under 100 primates) was not assessed and is very likely to differ dramatically from the programs characterized here. In addition, results of this survey reflect only 39% of USDA-registered facilities, and a majority rather than all of the laboratory primates housed in the United States. The third aim of this article is to generate recommendations regarding topics in need of assessment or research, which are discussed in the relevant sections below.

Program Structure and IACUC Interface

Per regulations, environmental enhancement plans must be directed by a facility's attending veterinarian. Nonetheless, from a functional standpoint, programs may be overseen by individuals with alternative background and degrees, and this was more common in the past. A larger proportion of respondents (37%) report oversight by veterinarians as compared to 2003 (27%). Veterinarians with primary oversight should therefore have an advanced level of behavioral expertise, or work in close collaboration with behavioral scientists, to identify the requirements of their population, make sciencedriven decisions, ensure that resources are optimally allocated, and guide evolving practices. As in the past, oversight by individuals without terminal degrees or by a committee is relatively rare.

With respect to behavioral management staff, the two surveys suggest that educational background and staffing levels have changed over the past 11 years. Among facilities surveyed, the proportion of facilities employing technicians without college degrees has fallen from 25% to 8%. Currently, 40% of facilities employ technicians with degrees beyond a bachelor's degree. Facilities also appear to be increasing the staffing of behavioral management employees. Among facilities employing full-time technicians and housing most primates indoors, the mean ratio of animals per person averages 310. In 2003, the mean was 643 animals per person.

IACUCs play a pivotal role in behavioral management programs, and it is encouraging that some IACUCs address the use of positive reinforcement training as a part of protocol review. This activity may in fact be underestimated as not all heads of behavioral management may be privy to IACUC matters. However, only 11% of survey participants currently report that modifications to their programs have been driven in part by the activities of their IACUC, whereas in 2003, 20% of program changes had been driven by internal review. This difference could be explained by the 2014 respondents being less aware of the influence of their facility's IACUC rather than IACUCs being less active in fomenting change. However, neither explanation is desirable. Given IACUCs' empowerment and the challenges in harmonizing biomedical research with behavioral management, their involvement is critical for advancing programs and increasing the use of social housing in biomedical research. The

frequency with which survey participants report that research protocol issues constrain the implementation of social housing has not changed over the previous 11 years, and there is no other component of behavioral management impacted so severely by research protocols. While there are numerous reasons why social housing may be incompatible with research, the results of this survey may guide IACUCs in detecting additional opportunities for social housing, for instance by challenging assumptions regarding the social housing for study subjects outfitted with experimental appliances.

The Animal Care Technician

In addition to the increase in staffing level of behavioral management technicians among survey participants, manpower associated with behavioral management programs also includes increased involvement of animal care technicians, while retaining oversight by behavioral scientists and veterinarians. All respondents state that animal care job responsibilities involve at least one of the behavioral management categories queried in this survey. In comparison to 2003 results, participation has increased almost three-fold for human interaction, more than doubled for both PRT and the implementation of interventions for individuals displaying abnormal behavior. In addition, there have been gains of 50% or more in the frequency of contribution toward the monitoring social introductions, installation of enrichment devices, and monitoring well-being in the course of daily health checks. As a whole, these results suggest an increase in the integration of behavioral care into animal husbandry.

These gains may exert positive effects beyond increasing available manpower. Since animal care technicians work in every animal holding areas every day, potential benefit of their involvement include abundant opportunities for observation, greater implementation efficiency, and increased promptness with which certain issues can be addressed. In addition, these technicians may broadly address animal stress in a manner in which behavioral management technicians would be unable to. For a caged primate, animal care technicians make up the bulk of its proximity to and encounters with humans. In addition, these technicians conduct potentially stressful events associated with sanitation, transfer between cages, and capture. Adding additional positive events associated with the people most often in close proximity to the animals may alter the degree of anxiety experienced by caged primates, although this is currently only a speculative idea. It is interesting to note that animal care technician job descriptions routinely include behavioral management duties, a step that formalizes their contributions and brings these duties under the umbrella of job performance assessments. This may be advisable for facilities aiming to increase the participation of animal care departments.

Social Housing

The use of social housing in the laboratory environment has become more widespread in facilities participating in the surveys, rising from 71% of primates in 2003 to 83% in 2014 (2003 values reported here are slightly lower than those reported in Baker et al. [2007], which quantified protected and intermittent contact as social housing). As pointed out in Baker et al. [2007], a major focus of many behavioral management programs is to increase

the proportion of indoor-housed primates housed socially. By 2014, the figure had risen from 41% to 65%.

Social housing is in a unique position in behavioral management programs as it is widely considered to be the most effective technique for supporting well-being, yet it poses unique challenges as well. Compared to other techniques, it holds greater risk to the animals, since introduction attempts and later social incompatibilities can result in injury or distress. Almost 90% of respondents state that the implementation of social housing is constrained by social incompatibility, a level that has increased since 2003. In addition, 15% of individuals report concerns over negative consequences. This places a premium on identifying best practices for introducing primates and maintaining social groups. However, an individual facility may have adopted practices that may lack prior objective evaluation but become fixed in the facility's management culture. Increased awareness of alternative techniques may prompt internal assessment of current practices. With few exceptions, the methodologies queried in the survey show little consistency across facilities, not only suggesting topics requiring further study but providing opportunities for cross-facility assessments. The requirement to observe affiliation during introduction should be tested as predictive of introduction outcome. For future research, it will be important to employ consistent definitions of a successful introduction, which is currently not the case, and can interfere with cross-facility collaboration.

Positive Reinforcement Training

The use of PRT has expanded considerably over the last 11 years by two survey metrics. First, in the 2003 survey, only slightly over half of facilities conducted PRT, and by 2014, all facilities did so. Second, the proportion of facilities that employ dedicated PRT coordinators rose from 9% to 31%. Nonetheless, training of 50% or more of a facility's caged population occurs at only 26% of facilities; the corresponding value for primates in groups is 21%. Widening the scope of PRT at a facility is likely to be one manner in which behavioral management programs can expand, and employing dedicated trainers may be one means for accomplishing this. Another promising impetus for continued progress may be the IACUC, which currently addresses the use of PRT at almost a third of facilities.

Notably, concerns over personnel injuries are currently mentioned as a constraint among only 8% of respondents. Still, some facilities conducted PRT without any contact with primates. It is possible that this restriction impairs the ability to achieve some training goals, although this speculation has not been evaluated. While hazard vary by species and research, it might be useful for Occupational Health and Safety departments to be aware that prohibition of all contact is rare and that contact can be successfully incorporated into PRT programs. In addition to comparing the safety of coercive and cooperative methods for accomplishing a specific goal, a broader examination of trends in workplace safety may illuminate whether there are effects of maintaining more cooperative animals.

As the name indicates, positive reinforcement training programs employ the technique of using a positive stimulus after the performance of a behavior in order to increase the likelihood of the behavior occurring again. However, 74% of participants in the current survey report also employing negative reinforcement training (NRT) techniques (the

withdrawal of a negative stimulus after the performance of a behavior in order to increase the likelihood of the behavior occurring again). A 2007 survey of facilities in the United Kingdom found that 60% of facilities with PRT programs employ NRT as well [Prescott & Buchanan-Smith, 2007]. In a 2009 survey, NRT was applied to half of the training goals queried in the survey [Perlman et al., 2012]. NR may be an underreported element of training programs that by name imply that only positive reinforcement is utilized. While there have been recent explorations of the utility of this techniques, it considered to be less supportive of primate welfare, and sufficient evidence is lacking to fully compare PRT's versus NRT's potential costs to well-being.

Human Interaction

The vast majority of caged colonies currently receive human interaction, as they did in 2003. Almost all of the employee categories queried contribute to human interaction at high levels: behavioral management and veterinary technicians, veterinarians, researchers, and possibly most importantly, animal care technicians (at 96% of facilities). This may be of special significance as suggested above.

Contact is prohibited during human interaction in a larger proportion of facilities than it is during PRT, and concerns for personnel safety are much more widespread. This may be associated with human interaction's implementation by a wider variety of employee types as well as the varied contexts in which people and primates interact. As with PRT, Occupational Health and Safety departments may value the information that the prohibition of all contact is relatively rare.

Inanimate Enrichment

Exercise enclosures—Half of programs use exercise enclosures and they do so for a wide variety of purposes. Implementation levels within a facility, however, are reported to be relatively low. Most facilities provide access to any particular individual very infrequently, with a third provides access less than once per month. The efficacy in accomplishing the varied goals, particularly at relatively low implementation levels has received little testing. Especially because full-colony implementation levels are extremely low, it may be important to focus their use by identifying the class of animals most likely to benefit from access to exercise enclosures.

It may be daunting to identify feasible means for boosting implementation. By far the most prevalent limitation on the use of exercise enclosures is the unavailability of space for enclosures. In some cases, space is limited because dedicated space for an exercise enclosure is unavailable or animal rooms are fully occupied and/or too narrow to accommodate additional enclosures. In these circumstances, facilities might be able to accommodate this technique if they made use of flexible primary caging rather than utilizing an additional enclosure. While potentially impacting carrying capacity, design features such as tunnels or removable flooring or side walls could be used to expand the space of primary caging. Using flexible caging would also reduce the need for transporting animals between enclosures, reducing associated workload. In addition to space limitations, cost and staff constraints are cited by approximately half of individuals surveyed. It may be important to compare the cost

of purchasing stand-alone enclosures and the financial impacts (including impacts on maximum population size) of modifying existing caging versus purchasing new caging with the features permitting them to function as exercise enclosures. Individuals may want to pursue the inclusion of features that permit flexible use as part of long-term planning for future caging purchases.

Other forms of inanimate enrichment—As in 2003, structural, feeding and manipulable enrichment are almost universally provided, both in the proportion of programs implementing such measures and in the proportion of primates within a facility that receives them. Relatively few constraints are reported. Implementation of enrichment devices has increased. In 2003, only 58% of facilities provided them to half or more of their population, and by 2014, 82% of facilities did so. The permanent installation of devices on caging is likely to be one mechanism for furthering the use of enrichment devices in light of the significant restrictions imposed by staffing. Forms of enrichment not queried in 2003 (destructible and sensory enrichment) are implemented on a less widespread basis and face unique challenges, such as concern regarding impact on plumbing and sanitation, level of perceived risks to animals, and/or skepticism regarding benefits. These two components of behavioral management may particularly benefit from simple exchange of practical information across facilities.

Program Augmentation

Most respondents report alterations to aspects of their behavioral management programs in the previous 4 years. Facilities have modified an average of three to four program elements over this period. By far, the most commonly reported change pertains to social housing, which is not surprising given its increased emphasis by AAALAC, OLAW, and the AWA [NRC, 2011; OLAW, 2012; USDA, 2013]. Employee training, enhancement plans, PRT programs, documentation of implementation, and sensory enrichment have each been augmented in more than 25% of the facilities surveyed.

With regard to the impetus for program augmentation, large proportions of facilities cite exchanges with colleagues, attendance at conferences and workshops, and publications, rather than solely in response to regulatory or accreditation activity. In fact, exchanges with colleagues and conference attendance were cited by a larger proportion of facilities than changes in regulatory or accreditation activity. This result suggests that the behavioral management community is not merely reactionary but self-propelling to a considerable degree. Opportunities for collegial exchange include: 1) online forums (e.g., the Laboratory Animal Refinement and Enrichment Forum (http://www.awionline.org/lab_animals/LAREF.htm#forum); 2) participation in workshops (e.g., the Primate Training and Enrichment Workshop [University of Texas M.D. Anderson Cancer Center and Yerkes National Primate Research Center, Primadaption Workshop [Animal Care Training Services]]; and 3) conferences (e.g., the American Society of Primatology and American Association for Laboratory Animal Science). The science of behavioral management for laboratory primates can be explored in a variety of journals such as American Journal of Primatology, Journal of Applied Animal Behaviour Welfare, Journal of Applied Animal Welfare Science, and the Journal of the American Association of Laboratory Animal

Science. Other publications focus on the sharing of practical information and ideas (e.g., The Shape of Enrichment, The Enrichment Record, and Laboratory Animal Science Professional). Annotated bibliographies such as the Environmental Enrichment and Refinement of Husbandry for Nonhuman Primates [<https://awionline.org/content/primatteenrichment-database>] are practical means for conducting an overview of both the scientific and practical literature on primate behavioral management.

As far as future plans, all participants in this survey report that they are planning further changes to their programs. Unlike past progress, no elements strongly predominate. The most frequent planned alterations involve employee training, social housing PRT, and assessment of behavior, as emphasized in the Guide [2011]. Almost one quarter of facilities are planning changes to their use of exercise enclosures. As noted above, this technique poses fairly daunting challenges with respect to costs and space for enclosures.

Consensus Regarding Benefits and Risks

Attitudes toward behavioral management techniques can hold great sway over their implementation, because behavioral management experts are unlikely to have independent financial and decisionmaking power. There is remarkable consensus regarding the perception of the benefit of various elements of behavioral management, at least as reflected in the reported impact of skepticism. Sensory enrichment is by far the most frequently reported component of behavioral management to be considered of no benefit, and there is sparse literature to test this view. Perception of risk is most frequently expressed for destructible enrichment, followed by social housing and sensory enrichment. With regard to risks to research aims, social housing is by far the most commonly cited technique. Given the mission of biomedical laboratories, the sweeping benefits of social housing and the potential for social housing to confound research projects, constant vigilance must be applied, and the IACUC is pivotal in providing this attention.

CONCLUDING THOUGHTS—STAKEHOLDERS

As measured in the 2003 and 2014 surveys, behavioral management programs have made great strides in terms of investment in manpower and increased implementation of several programmatic components, and they have done so in line with the philosophy of shifting from a concentration on stimuli (i.e., environmental enrichment) to a more holistic approach to primate care. These results stand in contrast to recent claims that programs have stagnated (e.g., New England Antivivisectionist Society [2014]), a claim that relies in part on the 2003 survey of common practice [Baker et al., 2007].

The need for broad awareness of common practice is critical to ensuring regulatory compliance, and can also be a springboard for facilities to evaluate and augment their programs. The information in this article may assist with problem-solving. Facilities are unlikely to be static with respect the research projects undertaken and in many aspects of operation. The ability to tailor behavioral management programs to changes in operation and to retain a complementary status in the face of new research projects can be facilitated through increased awareness of variations in practices and techniques. This article can also enable managers to gain an estimate of the prevalence of the strategies they have adopted at

their facilities, and detect whether they are using techniques that are not widespread. Should relatively rare practices be supported by insufficient research, they may be appropriate targets for new objective evaluation and collaboration. This article may also assist managers in exploring and promoting changes that could be perceived by other stakeholders to be “outside the box” and therefore suspect.

This article suggests avenues for continuing this progress, including practical steps and research topics as discussed above (e.g., formal integration of animals care technicians into program duties and exploring strategies for gaining the ability to utilize exercise caging and studies of social housing methodologies, and efficacy of exercise caging toward addressing multiple aims). However, it must be recognized that that formulaic recommendations are impractical. Programs must be customized to facility size and the species that the facility houses, as well as research aims and available resources; cost/benefit analyses, currently rare in the literature, are needed. It is in recognition of the need for this flexibility that the AWA and the Guide [2011] employ performance standards rather than evaluating behavioral management programs on the basis of engineering standards. In addition to the recommendations herein, the information provided in this article may spark ideas and stimulate new research, data sharing, and collaborative projects in the future.

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TABLE I

Species, Number of Individuals, and Use of Social Housing

Species	Number of primates	Number of facilities	Percent socially housed (all enclosure types)	Number of primates housed indoors	Percent socially housed indoors
Marmoset (<i>Callithrix</i> spp.)	792	5	87	792	87
Tamarin (<i>Saguinus</i> spp.)	751	3	99	751	99
Owl monkey (<i>Aotus</i> spp.)	525	3	91	525	91
Squirrel monkey (<i>Saimiri</i> spp.)	131	5	83	131	83
Titi monkey (<i>Callicebus</i> spp.)	89	1	99	89	99
Capuchin (<i>Cebus</i> spp.)	53	3	100	42	100
Rhesus macaque (<i>Macaca mulatta</i>)	36,149	23	83	12,337	50
Cynomolgus macaque (<i>M. fascicularis</i>)	16,117	23	83	11,789	77
Pigtailed macaque (<i>M. nemestrina</i>)	1,474	8	72	713	42
Japanese macaque (<i>M. fuscata</i>)	239	1	90	44	48
Stumptailed macaque (<i>M. arctoides</i>)	1	1	100	1	100
African green monkey (<i>Chlorocebus aethiops</i>)	797	2	86	277	59
Mangabey (<i>Cercocebus</i> spp.)	332	3	52	198	19
Patas monkey (<i>Erythrocebus patas</i>)	36	2	81	36	81
Baboon (<i>Papio</i> spp.)	1,561	5	93	137	21
Chimpanzee (<i>Pan</i> spp.)	589	4	99.7	54	96

TABLE II

Social Housing Monitoring Schedules: Percent of Facilities Reporting (More Than One Scheduling Plan May Be Employed Within a Facility)

	<u>First day monitoring schedule</u>			<u>Observation session duration</u>			<u>Monitoring duration beyond first day</u>	
	Cage	Group		Cage	Group		Cage	Group
Once per day	15	11	Less than 5 min	11	5	None	4	11
Twice per day	26	32	5–15 min	44	37	2–3 days	59	42
Three or more times per day	78	79	>15–60 min	52	47	4–7 days	26	32
			>1–3 h	19	37	More than 1 week	19	21
			>3 h	0	14			

TABLE III

Participants in Social Housing: Percent of Facilities in Which Activity Is Shared Across Employee Category, and the Percent of Facilities Reporting Participation of Each Employee Type

	<u>Selecting partners</u>		<u>Conducting introductions</u>		<u>Monitoring new partners</u>		<u>Ongoing monitoring (cage or group)</u>	
	Cage	Group	Cage	Group	Cage	Group	Routine	Quantified data collection
Activity shared by multiple participants	89	71	52	71	59	58	85	33
Participants								
Animal care techs	23	12	30	47	56	42	78	17
Veterinary techs	15	0	26	6	26	16	41	17
Beh mgmt techs	77	71	81	71	74	74	78	89
Beh mgmt scientists	31	35	19	18	22	21	15	22
Researchers	31	18	11	12	15	11	33	22
Veterinarians	31	41	4	6	11	5	33	11
Other employees ^a	9	35	0	18	0	6	7	6

Beh mgmt, behavioral management.

^aCages: colony managers, animal care supervisors, all stakeholders; Groups: animal care supervisors breeding colony and husbandry managers, colony managers, geneticists.

TABLE IV

Percent of Facilities Reporting Constraints to Implementation

a) Social housing, positive reinforcement training, human interaction, structural enrichment, and exercise enclosures					
	Social housing	Positive reinforcement training	Human interaction	Structural enrichment	Exercise enclosures
Cost	4	39	22	4	58
Time or staff	44	92	52	0	62
Protocol issues	78	0	4	11	12
Concerns about negative consequences	15	0	0	0	8
Belief no benefit to animals	0	0	4	0	8
Unavailability of compatible partners	89	NA	NA	NA	NA
Clinical exemptions	67	NA	NA	NA	NA
Behavioral exemption	52	NA	NA	NA	NA
Housing or space	41	NA	NA	NA	NA
Timing (e.g., imminent euthanasia)	11	NA	NA	NA	NA
Information needed from researcher	11	NA	NA	NA	NA
Personnel safety concerns	NA	8	30	NA	NA
Goals pertinent to subset of animals	NA	31	NA	NA	NA
Lack of expertise	NA	15	NA	NA	NA
Belief not effective (goals)	NA	0	NA	NA	NA
Space for enclosure	NA	NA	NA	NA	81
b) Enrichment devices, feeding enrichment, durable manipulable enrichment, destructible enrichment, and sensory enrichment					
	Enrichment devices	Feeding enrichment	Durable manipulable enrichment	Destructible enrichment	Sensory enrichment
Cost	41	0	7	22	15
Time or staff	52	0	15	46	22
Protocol issues	7	11	4	5	15
Concerns about negative consequences	4	0	4	19	11
Belief no benefit	0	0	4	0	19
Drainage/plumbing	NA	0	NA	63	NA
Other impacts on sanitation	NA	0	NA	41	NA
Aesthetic concerns	NA	NA	NA	7	NA
Other	4 ^a	0	0	4 ^b	7 ^c

NA, not applicable.

^aStructural limitations.^bClient request.^cFacility logistics.

TABLE V

Implementation Levels: Percent of Facilities

a) Positive reinforcement training, human interaction, structural enrichment, and exercise enclosures									
	Positive reinforcement training		Human interaction		Structural enrichment		Exercise enclosures		
	Cage	Group	Cage	Group	Cage	Group	Cage	Group	
None	0	11	4	17	0	0		50	
1–50% of animals	74	68	18	28	0	0		39	
>50–99% of animals	11	5	4	5	15	5		4	
All animals	15	16	74	50	85	95		8	

b) Enrichment devices, feeding enrichment, durable manipulable enrichment, destructible enrichment, and sensory enrichment										
	Enrichment devices		Feeding enrichment		Durable manipulable enrichment		Destructible enrichment		Sensory enrichment	
	Cage	Group	Cage	Group	Cage	Group	Cage	Group	Cage	Group
None	0	6	0	0	0	0	15	24	7	53
1–50% of animals	18	61	0	0	0	0	26	41	26	26
>50–99% of animals	30	0	11	5	11	11	11	0	15	0
All animals	52	33	89	95	89	89	48	35	52	21

TABLE VI

Implementing and Distributing Behavioral Management Components: Percent of Facilities Reporting Staff Participation

a)	Positive reinforcement training	Human interaction	Structural enrichment	Exercise enclosures	
				Scheduling	Moving animals
Activity shared by multiple participants	81	100	100	69	44
Animal care techs	65	96	65	46	69
Veterinary techs	50	81	31	8	0
Beh mgmt techs	77	81	69	31	6
Beh mgmt scientists	23	35	46	0	0
Researchers	46	65	31	31	19
Veterinarians	12	50	46	31	0
Dedicated trainers	31	NA	NA	NA	NA
Machine shop	NA	NA	81	NA	NA
Other employees	3 ^a	58 ^b	12 ^c	31 ^d	0

b)	Enrichment devices		Feeding enrichment	Durable manipulable enrichment		Destructible enrichment	Sensory enrichment
	Distribute	Repair/replace		Distribute	Replace		
Activity shared by multiple participants	70	62	89	56	67	63	50
Animal care techs	67	39	96	93	70	54	58
Veterinary techs	19	15	33	7	11	21	13
Beh mgmt techs	78	69	67	56	67	71	63
Beh mgmt scientists	7	4	11	7	15	13	8
Researchers	22	0	56	7	2	13	13
Veterinarians	0	0	19	0	0	4	0
Machine shop	NA	50	NA	NA	NA	NA	NA
Other	4 ^b	12 ^c	4 ^b	4 ^b	0 ^c	4 ^a	0

Beh mgmt, behavioral management; NA, not applicable.

^aVolunteer.

^bStudent.

^cFacility managers.

^dStaff setting the sanitation or cleaning schedule.

TABLE VII

Monitoring Behavior and Implementing Interventions: Percent of Facilities Reporting Staff Participation

	Daily health/ wellbeing checks	Regular behavioral observations	Decisions regarding implementation	Intervention implementation
Activity shared by multiple participants	94	33	63	67
Participants				
Animal care techs	51	4	0	44
Veterinary techs	44	21	15	22
Beh mgmt techs	11	79	67	78
Beh mgmt scientists	4	21	41	7
Researchers	19	8	7	11
Veterinarians	7	4	44	22
Other (student volunteers)	4	4	0	0

Beh mgmt, behavioral management.

TABLE VIII

Observing NHPs: Percent of Facilities Reporting Each Schedule

	<u>Scheduled observations</u>		<u>Follow-up assessment: enrichment intervention</u>
	<u>Cage</u>	<u>Group</u>	
Daily	4	5	7
Weekly	13	9	44
Monthly	29	23	41
Quarterly	13	14	7
Semi-annually	25	14	4
Annually	8	9	NA
By referral	8	32	NA
Verbal report only	NA	NA	37

Note: some facilities employ more than one schedule. NA, not applicable.

TABLE IX

Changes to Behavioral Management Programs: Percent of Facilities Reporting

	Programmatic elements reported to have changed 2011–2014	Programmatic elements planning to change
Enhancement plan	37	15
Staffing levels and/or funding	19	11
IACUC-related matters	11	7
Employee training	52	37
Social housing	67	30
Positive reinforcement training	33	30
Human interaction	15	7
Structural enrichment	11	11
Exercise enclosures	7	22
Enrichment devices	4	22
Feeding enrichment	4	26
Durable manipulable enrichment	4	19
Destructible enrichment	7	19
Sensory enrichment	26	11
Assessment of behavior	11	30
Intervention for abnormal behavior	15	15
Documentation	30	22