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Hare, E., Joffe, E., Wilson, C., Serpell, J., & Otto, C. M. (2021). Behavior traits associated with career outcome in a prison puppy-raising program. *Applied Animal Behaviour Science*, 236, Article 105218. <https://doi.org/10.1016/j.applanim.2021.105218>

**Published in:**  
Applied Animal Behaviour Science

**Document Version:**  
Peer reviewed version

**Queen's University Belfast - Research Portal:**  
[Link to publication record in Queen's University Belfast Research Portal](#)

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**Behavior Traits Associated with Career Outcome in a Prison Puppy-Raising Program**

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29

30 Abstract

31 The Canine Behavioral Assessment and Research Questionnaire (C-BARQ©) (<http://www.cbarq.org>)

32 has been used to measure behaviors associated with release or graduation from several assistance dog

33 programs, however it has never been evaluated within a prison environment. This study investigated

34 whether a modified version of the C-BARQ© can be utilized in a prison puppy-raising program

35 (Puppies Behind Bars, PBB) to identify behaviors that are associated with dogs' career outcomes.

36 PBB dogs that successfully complete the program are placed as service dogs or explosives detection

37 dogs (EDD). Dogs are released from the program as a result of behavioral or medical problems. The

38 PBB program has more than one career outcome, facilitating an assessment of the C-BARQ© as a

39 tool to identify specific working dog roles based on differences in C-BARQ© subscale scores. We

40 examined the associations between subscale scores and career outcomes by comparing the scores of

41 dogs with successful outcomes (service or EDD) with those released for behavioral reasons. We

42 assessed the questionnaire's application to the PBB setting and its ability to distinguish between

43 outcomes. 314 paper copies of the C-BARQ© were completed by puppy raisers from seven

44 correctional facilities in the New York area when their assigned dog was between 6 and 16 months

45 old. Dogs that had successfully completed the PBB program or had been released due to behavioral

46 issues were included, whereas dogs still in training and those released for medical reasons were

47 excluded. A total of 271 completed C-BARQ© questionnaires were analyzed. Service dogs and EDDs

48 were compared with released dogs to determine whether C-BARQ© subscale scores were associated

49 with outcome. Multinomial log-linear models containing one subscale score and fixed factors (age

50 group, medical category, sex, neuter status within sex, the interaction between age group and medical

51 category) and outcome as the dependent variable, were fitted for each subscale. Service dogs had

52 lower stranger-directed aggression, owner-directed aggression, dog-directed aggression, dog-directed

53 fear, dog rivalry, chasing, stranger-directed fear, and separation-related problems than released dogs.

54 EDDs had lower trainability, dog-directed fear, dog rivalry, and attachment/attention-seeking

55 behavior than released dogs. These findings suggest that some of the C-BARQ© subscales might be

used in the future to predict outcomes for young dogs. Results show that the C-BARQ© can be applied to the PBB program; however, the omission of seven questions is recommended.

Keywords: Canine, Behavior, C-BARQ, Puppy, Dogs, Prison

## **1. Introduction**

Researchers have developed and employed a variety of methods to identify behaviors associated with release or failure in training working dogs. These have included: behavioral and temperament tests, such as placing puppies in novel environments (e.g. Pfaffenberger et al., 1976; Wilsson & Sundgren, 1997; Ruefenacht et al., 2002); questionnaires for trainers or owners (e.g. Diederich & Giffroy, 2006) observations by practiced trainers under semi-naturalistic conditions (e.g. Maejima et al., 2007); measurements of cognitive ability (e.g. MacLean & Hare, 2018) and body posture (De Meester et al., 2008), and evaluations of physiological measures (Tomkins et al., 2011). A shortcoming of these behavioral and physiological assessments is that there is often a lack of standardization between tests, and most have not been validated (Taylor & Mills, 2006). Many also rely on the interpretations of a single trainer or individual and have not been suitably tested for inter-rater reliability (Jones & Gosling, 2005; Taylor & Mills, 2006). The Canine Behavioral Assessment and Research Questionnaire (C-BARQ©) (Hsu & Serpell, 2003; Duffy & Serpell, 2012) is a validated tool developed to assess canine behavioral traits. The current version of the C-BARQ© consists of 100 questions that explore dogs' responses to an extensive number of naturally occurring situations and stimuli. Unlike other testing methods, the C-BARQ© offers a single, standardized method for which both validity and reliability have been established (Hsu & Serpell, 2003). Research into the application of the C-BARQ© as a predictor of success for a specified working role has focused primarily on guide dogs (Duffy & Serpell, 2012) and assistance dogs (Bray et al., 2019). In both cases the C-BARQ© was able to identify behaviors associated with success or release from their respective training programs. Recently, studies have widened the use of the C-BARQ© to assess its ability to distinguish individual characteristics in working dogs. For example, Hare et al. (2018) found that the C-BARQ© could identify behavioral differences between search-and-rescue and pet dogs. The C-

BARQ© has further been applied in veterinary and re-homing settings to establish the characteristics of an individual dog (e.g. Segurson et al., 2005; Duffy et al., 2014). While the C-BARQ© is utilized by numerous organizations internationally, its use as a tool to effectively classify successful and released dogs has only been established for certain populations (e.g. Duffy & Serpell, 2012, Bray et al., 2019). The C-BARQ's validity is likely dependent on the environment that both the raiser and dog are in, and the type of role for which the dog is being trained. For example, in studies by both Duffy & Serpell (2012) and Bray et al. (2019) the dogs were fostered from eight weeks until they entered training and were raised in a home environment. This is the setting that the C-BARQ© was developed for, as it includes questions specific to household environments. The ability of the C-BARQ© to differentiate between dogs in other settings, such as a prison puppy raising program, has not previously been tested.

Puppies Behind Bars (PBB) is an Assistance Dogs International accredited program that places eight-week-old puppies with prison inmates enrolled in a training program. Puppies are raised and trained by their assigned individual for approximately six to 24 months. The variability in duration of training is related to the differences in training procedures between service dogs (assistance dog for a veteran or first responder) or explosives detection dogs (EDD). Puppies are informally evaluated at eight weeks of age based on current behavior and history of behavior with their litters. EDDs and service dogs require different sets of traits. Puppies are trained for service work if they are more confident, easy-going, human-connected, and mild, while EDDs are more vocal, have higher prey drive, or are more timid. Weekly observations are made during classes and monthly reports describe confidence, ease of training, human dependence, energy level, and environmental stability. Each dog's career can be changed based on these observations if the behavioral changes last longer than several weeks to a few months. EDDs usually graduate at about 12 months of age after learning 23 commands, while service dogs usually graduate between 20 and 24 months of age after learning over 80 commands. It is also thought that the difference in training duration is because EDD behaviors, such as sniffing, running, and jumping, are more "natural" for dogs than service dog activities such as turning on light

switches, opening doors, and staying in a tight heel (Carl Rothe, personal communication). Throughout this process, approximately 25% of dogs that begin the program are ‘released’ due to behavioral and/or medical issues and are then offered for adoption to the public. Of those released, approximately 50% are rejected for behavioral reasons (Puppies Behind Bars, 2019). Given the extensive funding and time required to train a puppy, the ability to ascertain behaviors that are non-conducive to success could significantly reduce costs by identifying dogs likely to be released as early as possible. In addition, identifying which behaviors align with certain success outcomes (service or EDD) would add insight into behaviors that should be focused on during training, further ensuring productive placements and possibly reducing the number of dogs transferred between EDD and service training. Prior to implementing the C-BARQ© as a predictive tool, it is necessary to establish whether it can be applied to a prison setting, as it was developed for use in a typical home environment. Further, as the program has more than one success outcome (service or EDD), an assessment of the C-BARQs ability to differentiate between these roles is required. Application of the C-BARQ© to this setting and to these working dog roles have not previously been assessed.

The purpose of this study was therefore to establish the degree to which assessments, based on inmate puppy-raiser responses to the C-BARQ©, can distinguish between prison-raised dogs that proceed to successfully complete training and graduate as service or EDDs, and those that are released for behavioral reasons. Given the unique situation that PBB provides, where more than one graduate outcome is possible, this study can also assess whether specific behaviors are associated with a particular working role. Identifying behaviors that may be associated with particular outcomes (service or EDD) may help to draw focus on specific attributes during training and assist in determining a career outcome for a particular dog.

## 2. Materials and Methods

### 2.1 Participants

The current study resulted from an on-going collaboration between Puppies Behind Bars (PBB) and The University of Pennsylvania School of Veterinary Medicine (Philadelphia, PA). Surveys were collected from seven prison locations in New York State. Dogs were provided to the PBB program by independent breeders. Dogs enter the program at eight weeks of age and graduate between 12 and 24 months. All puppy raisers were asked by the PBB organization to complete a paper copy questionnaire (C-BARQ©) every six months, starting when the dogs were six months of age through to graduation or release. Five hundred C-BARQs from a total of 314 dogs were collected between 2012 and 2017. If a puppy raiser filled out multiple C-BARQs for the same dog, the most recent questionnaire (taken at the oldest recorded age for that dog) was used for analysis because most dogs only had one complete C-BARQ© at the time of data collection. There were not enough dogs with multiple C-BARQs at different time points to use a repeated measures model. Dogs still in training and dogs released for medical reasons were excluded (Category 3 health condition). All dogs released for medical reasons were in the same medical category, so including them would not allow the assessment of the impact of medical records category on the outcomes. To assess whether certain behavioral traits could be associated with underlying health issues, medical conditions 0 – 2 were included in the model. In total, 271 dogs were included in the analysis: 147 males (54%) and 124 (46%) females. The majority of dogs were Labrador Retrievers (256, 94%) with small numbers of Golden Retrievers (8, 3%) and crosses of Golden and Labrador Retrievers (7, 3%). The dogs were a mix of sexually intact and neutered (96, 65% of males) or spayed (86, 70% of females) at the time that the survey was taken, and thus neuter status nested within sex was included as a possible predictor in statistical models.

### 2.2 Outcomes

Dogs included in the analysis were either considered ‘successful’ (graduated from the program) or ‘released’ (due to medical or behavioral problems). Outcome information was determined based on

medical records provided by the PBB program and information from the PBB website, and confirmed through personal communication with the Senior Instructor of PBB. Graduates were further classified based on their ultimate career placements (service or EDD) and released dogs were classified based on their reason for leaving the program (medical or behavioral). Decisions made by the PBB program to release dogs from training were made independently of C-BARQ© results. There were 150 successful detection dogs (55%), 79 successful service dogs (29%) and 42 dogs released for behavior reasons (15%).

### *2.3 C-BARQ© administration and delivery*

Puppy raisers completed the C-BARQ© based on the protocol defined in Duffy & Serpell (2012) which generated quantitative scores (0-4) for 14 behavioral subscales (see Table 1). Questionnaires were mailed to the University of Pennsylvania School of Veterinary Medicine to be logged.

### *2.4 Database*

Upon receipt of a C-BARQ© or medical record for each dog, an ID number was assigned. The following information from each C-BARQ©, if provided, was entered into a master spreadsheet: dog information (ID number, microchip/registration number, dog name, date of birth, sex, breed, spay/neuter status, weight, time spent training in months, number of dogs previously trained by the inmate raiser, and current health issues), numerical responses to each of the 100 questions, and any additional details given by the raisers in the spaces provided. It was not possible to include information about raisers or their levels of experience in further analysis because of frequent missing data and incomplete data when dogs were transferred between puppy raisers and prison facilities.

Any subscale calculated that included a value of “NA” (i.e. a contributing question had been left unanswered by the respondent) was given a value of “NA.” Calculations were modified when items



were dropped by dividing subscale scores by the number of items used in each subscale. Subscale scores for each dog were considered missing if < 75% of the items were answered.

## *2.5 Age Categories*

Early versions of the C-BARQ® questionnaire (2012- 2013) did not specify the date on which the survey was completed. Later versions of the C-BARQ® were updated to include this information, however for 146 surveys received, dogs' ages and order of sequence of C-BARQs had to be estimated based on a variety of factors (weight, time spent with specific raiser, receipt date of the survey). Ultimately, dogs were separated into three age groups using certain criteria for those for which the exact age was not known. Age Group 0 (n = 71, 26%) was assigned to dogs known to be less than six months of age, or to dogs that were not yet spayed or neutered whose age was missing (as dogs in the program are spayed or neutered at approximately six months of age). Age group 1 (n = 143, 53%) was assigned to dogs known to be between six and fifteen months of age, or to dogs that had been spayed or neutered and whose age was missing. Age Group 2 (n = 57, 21%) was used for those known or suspected to be older than 16 months based on his or her reported age, time spent training, and/or age of exit from the program.

## *2.6 Medical Categories*

Official medical records provided by the PBB program were used to classify dogs into one of four health categories (Table 2). Category 0 (n = 186, 68%) was used to describe dogs with no significant medical issues. Category 1 (n = 66, 24%) described dogs with minor medical conditions that could be treated successfully. Category 2 (n = 19, 7%) described dogs with moderate medical conditions that could be treated but which might affect the dog's performance in later life. Dogs in Category 3 were released from the program due to untreatable conditions and were excluded from the study. These categories were intended to help account for moderate or recurring health conditions as a contributing factor to behavioral release.

## 2.7 Analysis

Analysis focused on the data from each dog's most recently completed C-BARQ© and training outcome. Data from 273 dogs were included after individuals with missing data were removed. An additional two dogs in the database were omitted from the analysis due to the inability to determine which C-BARQ© was most recent, leaving 271 dogs.

Fourteen C-BARQ© subscales were computed according to the protocol outlined in Duffy and Serpell (2012); however, seven questions were omitted (Table 3). These were items that could not be evaluated by puppy raisers in the prison system as they were irrelevant to the training style employed (such as the question about corrections, which are not used by PBB trainers) or could not be observed (such as aggressive reactions to strangers when in the car or in public) (Table 3). Trainability is the only subscale where a high value is more desirable, for all other scales a low value is more favorable.

## 2.8 Statistical Analysis

Descriptive statistics for the C-BARQ© scores were calculated using the open-source R statistical software (R Core Team, 2017; available at <http://www.r-project.org>). Cronbach's alpha was calculated using the 'cronbach' function in the 'psy' R package (Falissard, 2012) as a measure of the agreement between the individual items in each subscale.

To determine whether C-BARQ© subscale scores were associated with each of the three possible outcomes, multinomial log-linear models containing one subscale score and fixed factors age group, medical category, sex, neuter status within sex and the interaction of age group and medical category as explanatory factors and dependent variable outcome were fitted for each subscale. Breed was not used as a fixed factor because of the small number of dogs that were not Labrador Retrievers. The reference categories for sex and neuter status were "male" and "neutered" respectively. Models were fitted using the 'multinom' function in the 'nnet' R package (Venables & Ripley, 2002), which uses neural networks to fit nonlinear models to categorical outcomes. Z-scores and Chi-square p-values

were calculated for the significant explanatory factors. Odds ratios and their p-values were calculated using the ‘questionr’ package (Barnier et al., 2017).

### 3. Results

Descriptive statistics including means, standard deviations, and Cronbach’s Alpha for C-BARQ© subscales are presented in Table 4. Figure 1 shows mean subscale scores by outcome (service dog, EDD or released for behavioral reasons). Table 5 includes means and standard deviations by outcome. Dogs that graduated as service dogs had lower reported owner-directed aggression (OR 1.7E-26, 95% CI 1.7E-26, 1.7E-26), stranger-directed aggression (OR 0.02, 95% CI 0.01, 0.33), dog-directed aggression (OR 0.13, 95% CI 0.04, 0.46), dog-directed fear (OR 0.22, 95% CI 0.08, 0.63), stranger-directed fear (OR 0.11, 95% CI 0.03, 0.43), chasing (OR 0.47, 95% CI 0.24, 0.92), dog rivalry (OR 0.30, 95% CI 0.11, 0.82) and separation related behaviors (OR 0.11, 95% CI 0.01, 0.75) than dogs that had been released from the program for behavioral reasons (all significant at  $p < 0.05$ ; Table 6). Dogs that graduated as EDDs had lower trainability (OR 0.27, 95% CI 0.10, 0.71), dog-directed fear (OR 0.43, 95% CI 0.20, 0.93), dog rivalry (OR 0.43, 95% CI 0.19, 0.98), and attachment/attention-seeking (OR 0.41, 95% CI 0.23, 0.73) than dogs released for behavioral reasons (all significant at  $p < 0.05$ ; Table 6). Subscales that did not differ significantly between each outcome group and dogs released for behavior reasons were touch sensitivity, excitability, and energy.

Other variables included in the models were age group, neuter status nested within sex, medical category, and the interaction between age group and medical category. Age group was not significantly associated with any outcome. Neutered females were more likely to be both service dogs and EDDs in many of the models fitted. The relationship between being a neutered female and a service dog was significant at the  $p = 0.05$  level for models including trainability, owner-directed aggression, dog-directed aggression, and rivalry with odds ratios between 7.44 and 9.03. The relationship between being a neutered female and an EDD was significant for models including trainability, stranger-directed aggression, owner-directed aggression, dog-directed aggression, and touch sensitivity with odds ratios from 6.43 to 11.97. No relationship was found between medical

category 1 or 2 compared to category 0 with outcome. Interactions between age category and medical category were also not significant.

#### **4. Discussion**

This study provides evidence that the C-BARQ© can be successfully applied to an inmate puppy raising setting, and, further, that it can distinguish career outcomes in a prison program (PBB). We identified seven individual questions (from six subscale categories) that were not applicable, and were therefore omitted. While the extensive coverage of naturalistic scenarios is a strength of the survey, in that it allows for a breadth of assessment across various situations, it cannot be directly applied to a prison setting. The questions omitted had a high percentage of missing values and were confirmed by the director of the program to be difficult or impossible to evaluate by inmate puppy-raisers. For example, the question referring to the dog's reaction to the doorbell ringing could not be applied to the PBB program, where these dogs were never exposed to such events. Other studies implementing the C-BARQ© have been criticized for amending the questionnaire to such an extent that it can no longer be considered valid (Batt et al., 2009 c.f. Duffy & Serpell, 2012). Here, we assessed the meaningfulness of the subscale scores with Cronbach's alpha, a measure of the reliability or internal consistency of a set of items (Cortina, 1993) such as a C-BARQ© subscale. Alpha varies between 0 and 1, with values between 0.8 and 0.9 indicating good agreement, while lower alphas indicate poorer agreement and alphas above 0.90 may reflect scale redundancy (Mair, 2018). In this study, subscales with alpha higher than 0.80 included stranger-directed aggression, dog-directed aggression, chasing, stranger-directed fear, and excitability. Many subscales had moderate values from 0.70 to 0.80 (trainability, dog-directed fear, rivalry, non-social fear, attention-seeking and energy, while separation issues and touch sensitivity had alphas below 0.70). Further validation of this modified version to a prison setting would be recommended to establish this preliminary finding. In future, this modified version of the C-BARQ© may help to inform studies applying the questionnaire to a prison environment as a potential predictive screening tool.

Results show distinct patterns of behavioral subscales that were significant for either service dogs or EDDs, indicating that the C-BARQ© can differentiate between behaviors associated with specific working dog roles. We found that successful service dogs had lower owner directed aggression, stranger-directed aggression, dog-directed aggression, dog-directed fear, stranger-directed fear, rivalry, chasing and separation-related problems than dogs released because of behavioral reasons. It should be considered that the majority of the behaviors with a significant association were fear or aggression based. This is consistent with the PBB evaluation process in which desired traits for service dogs include “confident” and “easy going.” EDDs showed lower dog-directed fear, rivalry, trainability and attention-seeking than dogs released from the program. The lower attention-seeking in EDDs may be related to the fact that dogs that are “human-connected” tend to be selected for service dog training. Overall, more subscale scores are associated with service dogs’ success than with EDDs’ success. There may be more behavioral requirements for service dogs because of the larger number of commands they learn or the high level of environmental stability, obedience, and impulse control necessary for service dogs that accompany their handlers in public facilities and transportation. The type of behavior required for service dogs to accompany their handlers in public may be a reason why various types of fear (of strangers, dogs, and separation anxiety) and aggression (stranger-, owner-, and dog-directed) are associated with failure to complete training. Dogs experiencing stress associated with fear may be inhibited in learning service dog tasks. In dogs admitted to a shelter, high speed of learning two operant tasks was associated with low levels of fearful behavior (Blackwell et al., 2010) and associations of fear with impaired learning has been found in numerous species (Rooney et al., 2016).

The findings presented here differ somewhat from those from studies of other working dog populations. These variations could be related to differences between prison and home raising environments or other differences between samples of dogs, raisers, or training methods. In a study of guide and service dog puppies from five programs raised in homes, favorable scores on all subscales measured at six and twelve months of age, except for dog-directed fear measured at six months of age, were associated with successful training (Duffy & Serpell, 2012). The lack of association of some subscales with training success in the present study may be due to different raising and training

practices or the wider range of breeds and the presence of guide dogs in the other study sample. For Swedish military working dogs, higher trainability scores were associated with successful training and higher stranger-directed fear, non-social fear, and dog-directed fear were associated with unsuccessful training (Foyer et al., 2014). Although military working dogs are trained on some different tasks than EDDs, both types of work appear to require dogs that score low on various types of fear. Among service dog puppies in the Canine Companions for Independence (CCI) program, significant predictors of training success included trainability, stranger-directed fear, and dog-directed aggression (Bray et al., 2019), showing a narrower range of significant fear-related behaviors predicting success. This could be due to different sample composition of Labrador Retrievers, Golden Retrievers, and crosses of these breeds in the CCI population, different levels of fear in the dogs from the CCI and PBB programs, or differences in the dogs' environment between prison and home or difference in training methods between programs. Overall, trainability and fearlessness appear to be important traits for a wide variety of working dog disciplines and raising situations.

Odds ratios represent the impact of a one-unit change in predictor variables (e.g. C-BARQ© subscale scores) on the outcome. The odds ratio for owner-directed aggression for service dogs was close to zero, suggesting a large difference between service dogs and dogs released for behavioral reasons. In fact, service dogs had a mean of zero for the owner-directed aggression subscale score compared with 0.04 for dogs released for behavior reasons. Although owner-directed aggression is rare in this population, it appears to be incompatible with success as a service dog. In contrast, the largest statistically significant odds ratio was 0.47 for chasing in service dogs. The odds of service dog success are 53% greater for each unit decrease in chasing. These percentages are greater for the other significant C-BARQ© subscales. For this population, information on the C-BARQ© scores for these significant traits could help with decisions about whether to retain dogs in training, and whether they should be used in a breeding program.

Although all PBB groups scored high on trainability (Table 5) compared to search and rescue dogs (mean 3.16), a group of non-search dogs (mean 2.64) (Hare 2018) and dogs in the Swedish military (Foyer 2014); successful EDDs showed lower trainability than those PBB dogs that were released from the program. This finding may suggest that trainability (the willingness to attend to the owner, obey simple commands, learn quickly, fetch objects, and ignore distracting stimuli) is a less critical discriminating trait for EDDs. Alternatively, it is possible that dogs have other, unaccounted for, behavioral traits that impact trainability in varying situations. As released dogs show higher dog-directed aggression, dog-directed fear and dog rivalry than both outcome groups, it suggests that these behaviors are of primary importance to a dog's release from the program. C-BARQ© subscales that were not associated with either outcome group were touch sensitivity, excitability, and energy. This suggests that, for this population, these behaviors were not predictors of release from the PBB program, however future assessments could confirm this finding.

We did not find any relationship between medical record category 1 or 2 compared to category 0 with outcome, suggesting that the medical conditions in these categories did not contribute to dogs' success or release for behavior reasons.

This study analyzed a single C-BARQ© per dog to assess the population, whereas previous studies, such as Duffy and Serpell (2012), utilized multiple tests over time. Implementing serial C-BARQs© in a prison setting could be beneficial in assessing the earliest age that behavioral differences can be identified that will predict outcome. In future, it would be valuable to understand whether these traits are present from the dog's arrival to the prison setting, or develop over time. A limitation is that the earliest version of the C-BARQ© did not ask for the specific age of the dog. Therefore, we used categories based on variables such as neuter status. The ages included were not consistent, as C-BARQs© were submitted by puppy raisers between six and 16 months of age. Given that some ages had to be estimated using the information provided, there would be benefit in future in obtaining specific time-point data to ensure that potential effects of age were controlled for. Fitting exact age as a covariate in our models would have resulted in more statistical power to detect age effects. Furthermore, it should

be considered that the older the dogs get the more likely they are to develop medical conditions that may impact their career outcome.

Prison puppy raising programs are popular and diverse. Over 330 programs throughout the United States. England, Canada, Australia, New Zealand, South Africa, Austria, Italy, Poland, Spain, and Scotland also have programs. Practices vary between programs according to characteristics of the prisons (e.g. high or low security), the population of puppy raisers, and the goals of training. In some programs, dogs from shelters are trained to be adoptable family companions or service dogs. In other programs such as PBB, dogs are trained for specific working roles. Programs vary in formality; some, including PBB, have training manuals that are used at multiple prison locations (e.g. within US states). Another aspect of these programs that varies is the amount of time the puppies spend outside of the prison, living with trainers (PBB) or visiting volunteers for weekends so they can be exposed to different environments and develop skills and environmental stability they will need as service dogs. (Cooke, 2019). The PBB program requires an eight-month training program for the raisers before they receive puppies and provides extensive, weekly oversight during puppies' development (Carl Rothe, personal communication). PBB is a program specific to the New York State area. Providing a representative sample for the PBB program was considered by including multiple prison locations that are part of PBB, however other prison-based programs, both domestic and internationally, may have different career outcomes and training methods than the current sample. Programs that do not share characteristics that are likely to affect dogs' behavior and success should conduct research on their specific populations to determine whether C-BARQ© scores are predictive of successful completion.

#### *4.1 Conclusion*

The present study finds that the C-BARQ© can differentiate between working dog roles in a prison environment, however minor adaptations are required for its success. We provide primary findings as to how systematic data collection could be applied in subsequent investigations as a prognostic tool to improve the process of selecting and releasing dogs from a PBB program. We further identified



certain behavioral traits that are associated with graduating as either a service dog or EDD. This is of interest given that the C-BARQ© has previously not been studied in prison puppy programs to our knowledge, and it may add insight into specific behaviors that should be assessed when making decisions on what outcome a dog is suited for. This study does not employ the C-BARQ© as a predictive tool, however the results suggest that there may be scope for its development as such a screening tool in the future. Application of this method on a wider scale could help to reduce costs and ensure optimal placement partnerships, ultimately providing more successful assignments of service and EDDs through the PBB program.

#### **Declaration of interest**

Declarations of interest: EH is the sole proprietor of Dog Genetics LLC, which provides statistical and genetic analysis for working dog organizations.

#### **Role of the funding source**

CW's work was funded by Boehringer Ingelheim; however, this sponsor had no involvement in the publication.

#### **Acknowledgements**

Our thanks go to PBB for their willingness to collect and share the responses, and the puppy raisers who raised the dogs.

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## Tables

Table 1. Fourteen behaviors measured by subscales of the C-BARQ© and analyzed in this study.

Table 2. Criteria used to classify the health of dogs in the Puppies Behind Bars puppy raising program.

553  
554 Table 3. Items removed from analysis of C-BARQ© questionnaires, their question numbers, and  
555 associated subscales. These questions could not be answered by puppy raisers in the prison  
556 environment.  
557

558 Table 4. Descriptive statistics for C-BARQ© subscales on 271 PBB program puppies, including  
559 number of items per subscale, number of missing observations, mean, standard deviation, skewness,  
560 kurtosis, and Cronbach's Alpha for each subscale. Subscale scores range between 0 and 4.  
561  
562

563 Table 5. Means and standard deviations of C-BARQ© subscale scores for 271 Puppies Behind Bars  
564 program dogs by training outcome (released for behavior reasons, successful service dog, and  
565 successful explosives detector dog (EDD)). Subscale scores range between 0 and 4.  
566

567 Table 6. Odds ratios (OR) and 95% confidence levels (CI) for C-BARQ© subscales with significance  
568 levels. Outcomes are "released for behavior reasons" (reference level), "service dog," or "explosives  
569 detection dog" (EDD).  
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572 Figures

573

574 Figure 1. Mean subscale values for 14 behavioral traits measured with the C-BARQ© among 271  
575 Puppies Behind Bars dogs by outcome (released for behavioral reasons, successful service dog, and  
576 successful explosives detection dog (EDD)). Standard deviations and further descriptive statistics are  
577 in Table 4.