



## Research article

## The influence of facility and home pen design on the welfare of the laboratory-housed dog

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## ABSTRACT

We have an ethical and scientific obligation to Refine all aspects of the life of the laboratory-housed dog. Across industry there are many differences amongst facilities, home pen design and husbandry, as well as differences in features of the dogs such as strain, sex and scientific protocols. Understanding how these influence welfare, and hence scientific output is therefore critical. A significant proportion of dogs' lives are spent in the home pen and as such, the design can have a considerable impact on welfare. Although best practice guidelines exist, there is a paucity of empirical evidence to support the recommended Refinements and uptake varies across industry. In this study, we examine the effect of modern and traditional home pen design, overall facility design, husbandry, history of regulated procedures, strain and sex on welfare-indicating behaviours and mechanical pressure threshold. Six groups of dogs from two facilities (total  $n=46$ ) were observed in the home pen and tested for mechanical pressure threshold. Dogs which were housed in a purpose-built modern facility or in a modern design home pen showed the fewest behavioural indicators of negative welfare (such as alert or pacing behaviours) and more indicators of positive welfare (such as resting) compared to those in a traditional home pen design or traditional facility. Welfare indicating behaviours did not vary consistently with strain, but male dogs showed more negative welfare indicating behaviours and had greater variation in these behaviours than females. Our findings showed more positive welfare indicating behaviours in dogs with higher mechanical pressure thresholds. We conclude that factors relating to the design of home pens and implementation of Refinements at the facility level have a significant positive impact on the welfare of laboratory-housed dogs, with a potential concomitant impact on scientific endpoints.

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## 1. Introduction

There are two crucial reasons to ensure the most humane use of dogs in scientific research: our ethical obligation to prevent suffering, and our scientific need to ensure that they are valid, reliable and predictive models. Legislative (e.g. European Directive 2010/63/EU) and ethical (e.g. Russell & Burch, 1959, the 3Rs) guidelines provide frameworks within which animals can be used in scientific research, however there remains a paucity of quantitative data on which to base best practice in the dog. The Refinement 'R' of the 3Rs (Replacement, Reduction, Refinement) refers to the minimising of harms and promotion of positive states across the lifecycle of the animal (Buchanan-Smith et al., 2005). The positive impact of Refinements to

housing, husbandry practices and regulated procedures on data output has been demonstrated in several laboratory housed species such as rodents (Everds et al., 2013); primates (Tasker, 2012); and dogs (Hall, 2014), however Refinement uptake varies across industry.

Global dog use remains high (~100,000 per year, Hall, 2014), yet the implementation of known Refinements varies considerably across industry and between countries. As the predominant use of dogs is the development of new medicines, it is critical to increase our understanding of effective Refinements.

## 1.1. Home pen design

The design of the home pen and animal room (the area which includes home pens, corridors and any indoor play areas) may be one of the most crucial Refinements for dog welfare, however it has received little scientific attention since the 1990s, since when

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legislative minimum standards have improved. Dogs will spend the majority of the day in the home pen, so its design will have a considerable impact on welfare. EU legislation mandates a minimum pen size of 2.25 m<sup>2</sup> per dog (10–20 kg) when group housed and 4 m<sup>2</sup> when singly-housed, while other legislation (e.g. [National Research Council, 2011](#), in the USA) mandates much smaller minimums, e.g. 0.74 m<sup>2</sup> for dogs of a similar size. Despite industry moving towards modern dog unit and home pen design (see [Fig. 1a](#)) much of the supporting evidence for the benefits of their implementation remains anecdotal. Factors which are considered important for home pen design include visibility for dogs and staff, choice of resting places or platforms, size, ease of entry for staff, ease of partitioning dogs, and use of noise reducing materials ([R. Hubrecht, Serpell, & Poole, 1992](#); [Prescott et al., 2004](#); [Sales, Hubrecht, Peyvandi, Milligan, & Shield, 1997a](#)). Lack of visibility or noise-reducing materials can cause allelomimetic barking which can lead to considerable noise which is detrimental to both dogs and staff ([Prescott et al., 2004](#); [Sales et al., 1997a](#)). Further illustrations of a modern home pen design can be found in [Hall, Buchanan-Smith, Robinson, and Prescott \(2015a\)](#).

### 1.2. Environmental enrichment

Environmental enrichment (EE, the provision of items or opportunities which enhance the well-being of captive animals and promote desirable behaviours ([Buchanan-Smith, 2010](#))) is commonly provisioned as a Refinement to laboratory-housed dogs, and is recommended in both legislation and good practice guidelines. However, in order to act as Refinements, the enrichment items must improve the welfare of the dogs. Appropriate enrichment provides opportunities for animals to make choices, increasing their ability to maintain homeostasis or to control social interactions ([R. C. Hubrecht, 2014](#)). Given the time spent in the home pen, providing suitable EE should be considered a critical Refinement for the laboratory-housed dog.

Novel toys, particularly those which can be chewed, are of interest to dogs ([R. Hubrecht, 1993, 1995](#)) and can result in positive changes in behaviour ([Hall, 2014](#)). Separate indoor and outdoor play areas are also recommended (see [Fig. 1c](#)). The facilities studied in this paper differed in terms of the EE available to dogs (see [Table 1](#)).

### 1.3. Training for dogs and positive staff contact

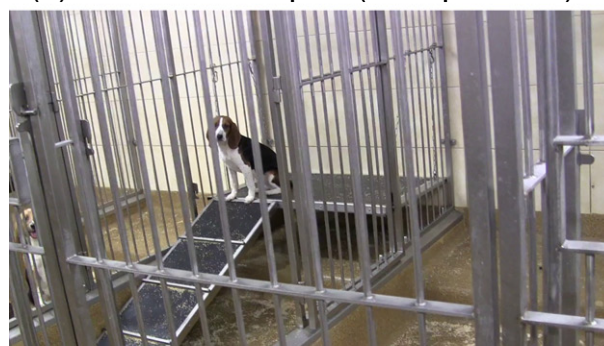
Training dogs with positive reinforcement is a necessary component of smoothly-run animal units. Contact with staff is an unavoidable aspect of the environment, with staff responsible for pleasant events such as access to play areas, toys and feeding and also for carrying out regulated procedures or other unpleasant events ([Balcombe, Barnard, & Sandusky, 2004](#)). As a result, encouraging positive staff contact can discourage negative associations with staff members ([Laule, 2010](#); [Prescott et al., 2004](#)). The facilities studied in this paper differed in terms of the provision of training and staff contact provided to dogs, see [Table 1](#) for details.

### 1.4. Measuring welfare in the dog

'Welfare' has many uses in common language, but must have an objective definition in scientific use not influenced by moral or ethical considerations ([Broom & Kirkden, 2004](#)), and which concentrates on empirical evidence. Welfare can be understood in terms of physical health, and in terms of subjective experience. [Broom \(1986\)](#) describes welfare as a term which describes an individual's state in relation to its attempts to cope with a situation; therefore welfare does not reflect external circumstances but rather how effectively an individual is coping with them and the resulting impact on (evolutionary) fitness. It is well accepted that 'welfare' is a continuum from negative to positive, rather than a desirable condition.



(a) Modern homepen (Groups 1-3,6)



(b) Traditional home pens (Groups 4-5)



(c) Indoor play area

**Fig. 1.** The design of dog (a) modern home pens (Groups 1–3 and 6), (b) traditional home pens and (c) indoor play areas. Aspects of good practice in the modern home pens can be seen, such as increased visibility for dogs and staff, horizontal bars to prevent "paddling", a choice of locations, exit points and ledges within the pen, and the provision of climbing frames and toys in the play areas.

Behaviour can be thought as the 'gold standard' of welfare assessment, as it can be measured instantly, non-invasively, without the need for specialist equipment. However, in isolation, behaviour provides little information about the internal state of animals. The behavioural measures employed in this study are derived from a welfare assessment framework created for the laboratory-housed dogs ([Hall, 2014](#); [Hall, Robinson, & Buchanan-Smith, 2015b](#)) and which includes behaviour, affective state, cardiovascular output and mechanical pressure threshold.

Age, sex, strain and exposure to licensed procedures vary between the dogs studied in this paper. Although there is no consistent

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