

Swedish cat shelters: a descriptive survey of husbandry practices, routines and management

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Abstract

Animal shelters rescue and care for society's unwanted companion animals. Nonetheless, several studies have shown that ending up in a shelter can be stressful, and that shelter husbandry can amplify and spread certain diseases. The aim of the present study was to investigate and describe husbandry policy, practices and routines as well as occurrence and prevention of diseases in Swedish cat shelters. A survey was sent to 64 potential shelters of which 39 (61%) responded. Thirty-two shelters (82%) housed cats (*Felis silvestris catus*) in groups; one shelter provided only solitary housing. Thirty-one shelters provided single, pair and group housing. The most common group size was 3–5 cats (59%). Ninety-two percent of responding shelters had routines and/or protocol(s) for the management of the cats, 35 had healthcare routines and 30 shelters had routines for the admission of cats. All shelters with the exception of one had quarantine, and 22 shelters (58%) vaccinated cats prior to admittance. There was a significant positive correlation between shelter size and number of reported diseases. The most common reported disease was cat 'flu/cold, although altogether, shelters reported a low occurrence of disease. Practices differ between shelters relating to management, eg use of quarantine and vaccination routines. In Sweden, group housing is common and shelters provide cats with plenty of resources, eg hides and climbing structures, often providing outdoor access and a more 'home-like' environment. The possibility that providing a more 'enriched home-like' environment can help cats cope with the shelter environment is discussed, thereby decreasing the occurrence and transmission of infectious diseases.

Keywords: animal welfare, disease, domestic cat, husbandry, routines, shelter

Introduction

In the most recent survey of Swedish pet ownership (SCB 2012) the domestic cat (*Felis silvestris catus*) population showed a slight decrease from 1.3 to 1.2 million between 2006 and 2012 (SCB 2006, 2012). In contrast, elsewhere, the cat is gaining in popularity as a pet in many parts of the world (Lyons & Kurushima 2012). Unfortunately, in conjunction with this rise, increasing numbers of cats (Scarlett *et al* 2002; Dantas-Divers *et al* 2011) end up euthanised, abandoned on the streets or given up to shelters. There are indications that the number of cats ending up in shelters is on the increase (Patronek *et al* 1996; Eriksson *et al* 2009). Of those cats ending up in shelters, euthanasia rate is approximated to be 10% in Sweden (Eriksson *et al* 2009), 47% in Australia (RSPCA) and 40–50% in the US and Canada (Turner *et al* 2012). One hypothesis to explain this difference could be that shelters in Australia, US and Canada have the expectation of a greater turnover of cats (eg adoption rate) since they are often part of larger animal welfare organisations or funded by the government. In Sweden, cat shelters are privately run, often do not belong to any organisation and receive no funding from the government, ie other than Swedish legislation no external regulation of shelter practices exists. Kass

(2007) estimated that 3.3 million cats are euthanised yearly in US shelters. However, initiatives are in place, eg collaborations between animal welfare groups and animal shelters and the provision of better tools for co-operation within communities, to try to increase the 'live rate release' from shelters (Weiss *et al* 2013).

The aim of an animal shelter is to rescue and care for companion animals no longer wanted by society. Despite these aims, previous research has shown that ending up in a shelter can be stressful for a cat (eg Kessler & Turner 1997; Ottway & Hawkins 2003; Pedersen *et al* 2004; Dinnage *et al* 2009; Tanaka *et al* 2012; Möstl *et al* 2013) as cats are sensitive to novel environments (Griffin & Hume 2006; Stella *et al* 2013) and many unfamiliar situations can induce a stress response (Griffin & Hume 2006). Potential stressors in connection with relinquishment start with being surrendered by the owner (Dybdall *et al* 2007), entering a new environment (Dybdall *et al* 2007; Gooding *et al* 2012), living under crowded conditions (Möstl *et al* 2013) and/or in groups with unknown individuals (Ottway & Hawkins 2003) with a high turnover of cats (Tanaka *et al* 2012), and inconsistent handling and routines (Carlstead *et al* 1993).

Stress is known to affect the behaviour (eg paralysis or increase in locomotion [Morgan & Tromborg 2007]), physiology (eg glucocorticoid levels) and animals' immune response (Griffin 1989; Toats 1995). According to Gooding *et al* (2012) inhibition of normal behaviours is an indicator of stress in cats, and Iki *et al* (2011) found a positive correlation between vocalisation and plasma cortisol levels in cats exposed to a mild stressor. Other behavioural signs of stress in cats can be auto-grooming, ie self-grooming, which in anxious cats can result in over-grooming to the point of physical injury (Seksell 2012), and urine marking and elimination problems, mostly spraying (Jongman 2007; Levine 2008; Herron 2010; Rodan 2012). Stress can have a detrimental effect on immune function (Griffin 1989), which can result in an increased risk of developing diseases (Moberg 2000), the animal becoming more susceptible to secondary infections (Sykes 2010) and recrudescence of latent viruses (eg Day *et al* 2010). Fear and anxiety can also be a component underlying behavioural problems, such as aggression (Levine 2008). When entering a new environment cats can display fear-related aggression (Slater *et al* 2010) however, a previous study by Barry and Crowell-Davis (1999) showed that bouts of aggression seem to decrease with time cats spend together.

The shelter environment can also increase the risk of disease (Pedersen *et al* 2004), by accumulation and spread of infectious agents, through, eg inadequate hygiene and crowding (Möstl *et al* 2013). Infectious pathogens known to be especially problematic for cat shelters are: feline herpesvirus (FHV) as cats often become lifelong carriers and can shed virus without displaying clinical signs (Thiry *et al* 2009); feline calicivirus (FCV), a highly contagious virus that can persist in the environment (Radford *et al* 2009); feline panleukopaemia virus (FPV), a highly contagious virus, which is resilient in the environment (Truyen *et al* 2009); and feline coronavirus (FCoV), which is transmitted via the faecal-oral pathway (ie litter-boxes) and can develop into feline infectious peritonitis (FIP) (Addie *et al* 2009). Clinical diseases, especially problematic in multi-cat households, are different types of upper respiratory tract diseases (URTD) (Scarlett *et al* 2002), eg upper respiratory infection (URI) (Spindel *et al* 2013), caused mostly by FHV and FCV. In a previous study of shelter cats in the US, Tanaka *et al* (2012) found that 58% develop URI within 21 days of admission to the shelter, and Pedersen *et al* (2004) showed that after one week, 52% of cats shed FHV and 15% shed FCV, compared to 4 and 11%, respectively, at admission. Many of these problems can be alleviated by careful adherence to specific routines, eg correct usage of quarantine and vaccination programmes, minimising time cats spent in the shelter (Dinnage *et al* 2009), good hygiene and prevention of overcrowding (Möstl *et al* 2013). No definition of crowding was provided in Möstl *et al* (2013), however, previous research has found that stress levels, measured through a behavioural stress score, increase when cat density was 0.6 cats per m² (Kessler & Turner 1999) and cats were more inactive when densities reached 0.5 cats per m² (Gouveia *et al* 2011).

There has been one previous study of Swedish cat shelters (Eriksson *et al* 2009) but little information exists on specific routines, husbandry practices and the occurrence of detectable diseases, ie general management of cats in Swedish shelters. It is clear that routines and practices vary since no regulation or unifying organisation for shelters are in place, and there is a lack of financial support from the Swedish government. Shelters in Sweden are run by small organisations or private owners, mostly on a voluntary basis (Eriksson *et al* 2009). However, registered shelters are subjected to inspections by Animal Welfare Inspectors from the County Administrative Boards.

The aim of the present study was to build on the survey of Eriksson *et al* (2009) and, based on previous knowledge of potential problems in shelters, investigate and describe policy, husbandry practices and routines, as well as occurrence and prevention of diseases in Swedish cat shelters, as reported by shelter staff.

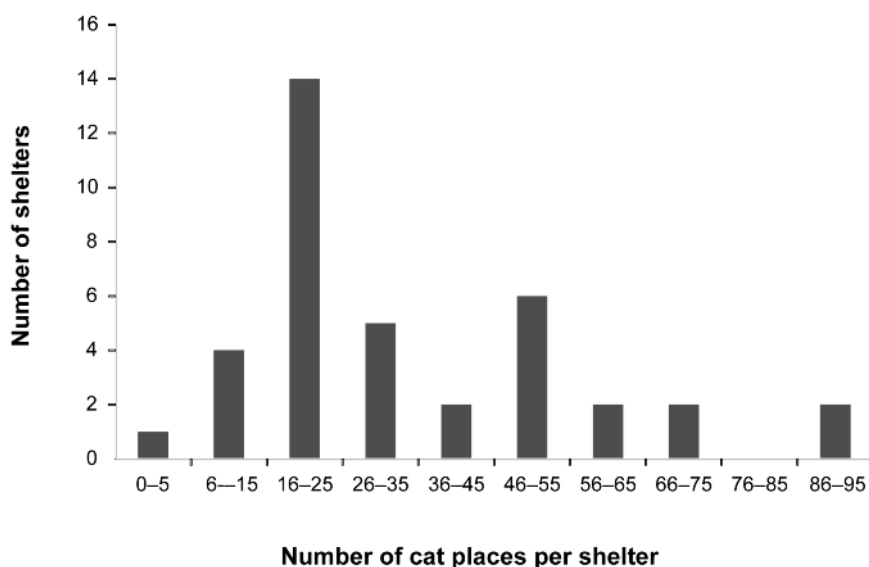
Materials and methods

Cat shelters were found at the following websites; www.google.se, www.djurhem.ifokus.se and www.katter.nu/sv/katthem.htm, and supplemented with the list of shelters from 2006 used in the previous survey of Swedish cat shelters (Eriksson *et al* 2009). In this study, organisations and members of the general public receiving, holding, caring and providing a transfer/relocation service for cats are all included, under the term 'shelters'. In cases where shelters recommended other unknown organisations, these were also contacted (two cases). In total, 96 potential shelters keeping cats were found. For shelters where the postal address could not be found, contact was made via e-mail or telephone call, explaining the purpose of the study and requesting that they participate. Information provided during these interactions was identical to that of the cover letter accompanying the survey, so that all shelters participated under the same presumption. A reminder to provide an address was sent to those shelters that did not respond to the first e-mail. A pilot of the survey was performed and one shelter manager provided feedback, after which point the survey was revised slightly for clarity (this shelter was not included in the results).

The survey was posted out and included pre-stamped self-addressed envelopes. The decision was taken to use regular mail and not go with a web-based survey as a result of the previously high response rate in the same population (76% in Eriksson *et al* 2009). Information provided in the accompanying cover letter stated the purpose of the study, enquiring as to whether they ran a cat shelter in accordance with our set definition (ie permission to keep more than nine [adult] cats in one location with transfer/relocation of cats), and if they wanted to participate. In the end, the survey was sent out to 82 potential shelters in October 2012. A reminder was sent out to those shelters that had not answered by the 1st of November (49 shelters), and a second reminder was sent out to the non-responders on the 6th of December (26 shelters). In the end, the final reply came in on the 13th of December. Up to this date, the postal service had returned

Table 1 Specification on how categorisation of open-ended questions from the survey was performed.

Question	Category	Included answers
4(d) Enrichment Toys	Toys	Shelters specifying specific toys, eg balls, as well as stating toys
	Activation feeders	Different types of food dispensers; activation dispenser, activation table and feeding balls
4(e) Quarantine	Separate room/house	Quarantine is mentioned to be 'separated' or 'closed' from other cats, through: room, garden shed, house or cottage
	Separate room with box/cage	Quarantine is mentioned to be (i) 'separated' or 'closed' from other cats, through: room, garden shed, house or cottage, (ii) containing 'box' or 'cage'
	Box/cage	No mention of separation from the rest of the shelter, only that cats are kept in 'box' or 'cage'

Figure 1

The number of cats each shelter has room to accommodate at any given time-point (median = 28; min = 4; max = 90).

eight letters (unknown forwarding address), three shelters stated that they had received double surveys, and seven replied to say they no longer were active, only providing a transfer/relocation service. This left 64 potential shelters to be included in our study.

The survey consisted of nine major questions, with sub-questions concerning: received animals, euthanasia, husbandry practices, routines, the cats' health and occurrence of diseases (a copy of which is available [in Swedish] from the first author). The questionnaire was composed of a combination of closed and open-ended questions; with space for additional comments, as we were unsure on what types of responses to expect. The closed questions were transferred directly onto an Excel® file, while open-ended questions were classified into comprehensive categories (Table 1) for analysis. Data were prepared and analysed using Microsoft® Excel® 2010 and Figure 1 was created in Excel®. The results are presented as percentages and/or counts of the total number of responses to a certain question. A Pearson correlation was made between the number of reported diseases during the month preceding the survey, shelter size and maximum group size within shelters (Minitab® Statistical software version 16.1.0© 2010 Minitab Inc).

Results

The questionnaire was sent to 64 potential cat shelters of which 39 (61%) responded. Not all shelters that responded provided answers to all the questions. The mean number of cats housed per shelter were 35 (min = 4, max = 90) (Figure 1). On average, during one month, a shelter; received eight cats (min = 0, max = 30), adopted or transferred nine cats (min = 0, max = 35) and euthanised one cat (min = 0, max = 12).

Housing and management

Of the 39 respondents, 32 shelters (82%) housed cats in groups (> 3 cats), 31 shelters kept cats in pairs and 34 shelters kept cats solitary. This adds up to more than 39 shelters, because most shelters had some combination of solitary, pair and group housing. One shelter provided only solitary housing, two had solitary and group housing, and five had only group housing. The remaining 31 shelters (79%) had the option of providing all three housing types. Of the 32 shelters stating that they practiced group housing, 27 (84%) provided specification for group size in the survey, of which most stated more than one group size (Table 2). Of the five shelters keeping cats in groups but not providing information about size, one stated that they only

Table 2 Number of shelters keeping cats in each group size for the 27 shelters that provided specification for size. The proportion adds up to more than 100% as shelters were asked to state all group sizes kept.

Group size	Number of shelters	Proportion (%)
3–5	16	59
6–9	14	52
10–15	11	41
> 15	2	7

Table 3 The different enrichments provided by cat shelters according to category and sub-category.

Category	Subcategories	Enrichment	Shelters (n)	
Animate	Human contact	Play	7	
		Cuddling/petting	2	
		Socialisation	1	
Inanimate	Feeding	Activation feeder	3	
		Olfactory	(Cat) grass	3
			Catnip	2
			Cat sweets	2
			'Home-made' forest	1
	Physical	Toys	38	
		Climbing structures	26	
		Shelves	15	
		Scratching poles	11	
		Hides	6	
		Tunnels	4	
		Resting places	3	
		Mimic home environment	2	
		(Climbing) trees	2	
		Shrubs	2	
		Stairs	1	
		Furniture	1	
		Small houses	1	
		Bunks	1	
Sensory	Window	5		
	Outdoor access	3		
	Radio/TV	3		

In total, 145 answers were provided by the 38 shelters specifying their enrichment, one shelter did not specify. Each shelter specified between 1 and 7 different enrichments. Categories are based on Ellis (2009).

group-housed litter siblings and one only females with kittens. Two shelters stated that it was dependent upon the cats and one shelter stated groups of two, ie pairs. The most common group size was 3–5 cats (59%) followed by 6–9 cats (52%). However, two shelters kept large groups of 17 and 25 cats, respectively. Of the 38 shelters that practiced pair and/or group housing, 22 stated that they had routines for regrouping of cats, of which 16 used trial-and-error to see whether cats would function in a group. Five shelters did not regroup cats at the shelter, four based groups on prior knowledge of the cats or a 'feeling' based on the cats' personality, and three observed the cats in the new groups to see whether the group dynamic worked.

Of the 38 responding shelters, 22 (58%) responded that they offered outdoor access, in the form of: 'exercise yard' (19 shelters); enclosed yard (1 shelter); free outdoor access with cat flap (1 shelter); or walks with shelter staff (3 shelters). This adds up to 24 shelters, and only 22 stated that they provided outdoor access. The reason for this is that two of the shelters that stated they took cats for walks only did so sporadically (ie this was not offered to all cats). Three shelters specified that quarantined cats did not have outdoor access, although this was not requested. Outside enclosures were either shared between all cats at the shelter, between some indoor groups of cats or were separate for each indoor enclosure.

All responding shelters (n = 39) responded that cats were provided with some form of enrichment. The question was open, and respondents were asked to define in what way cats were enriched. Thirty-eight of the 39 shelters specified the provision of at least one type of enrichment. The different types consisted both of animate (human interaction, eg play) and inanimate (toys, food dispensers etc) enrichments (Table 3). The most common enrichments were 'toys' provided by 97%, followed by 'climbing structures' provided by 67% of the shelters. Three shelters stated that they enriched in order to provide a 'home-like' environment.

The majority of shelters, 29 of 37 respondents, stated that other species besides cats were not accepted. Of the shelters (n = 8) that did provide sanctuary for other species, three kept them in the same location as the cats. Additional species cared for by the shelters were, eg rabbits (*Oryctolagus cuniculus*) (n = 7), dogs (*Canis lupus familiaris*) (n = 4), Guinea pigs (*Cavia porcellus*) (n = 2), birds (*Aves*) (n = 2) and rats (*Rattus norvegicus forma domestica*) (n = 2).

Ninety-two percent of responding shelters (n = 37) had routines and/or protocol(s) for the management of the cats, 35 (92%) out of 38 respondents had healthcare routines and 30 shelters (77% of 39) had written routines for the admission of new cats.

Twenty-two (69%) of the 32 group-housing shelters as well as three pair-housing shelters responded that they had routines for re-grouping of cats. One group-housing shelter stated that they only group-housed litter siblings. A few shelters provided additional comments that they housed cats according to 'temperament' (ie personality) and several stated that the manager could see which permutations of cats worked and which did not.

Prevention of disease

All shelters with the exception of one ($n = 38$) had some form of quarantine. The one shelter that did not, stated that the whole shelter was considered a quarantine. Respondents were also asked to specify what type of quarantine they implemented. The responses were divided into seven categories: 'separate room/house' ($n = 17$); 'separate room with box/cage' ($n = 7$); 'box/cage' ($n = 7$); 'in accordance with the County Administrative Board' ($n = 3$); 'room' ($n = 2$); 'guest house/foster home' ($n = 2$); or the 'whole shelter' is a quarantine ($n = 1$). Additional comments from the shelters included that: the quarantine had separate entrance ($n = 3$) or had (air) lock ($n = 2$); separate ventilation ($n = 1$) or air purifier ($n = 1$); required exchange of clothes ($n = 1$) or use of hand disinfectant ($n = 1$); included quarantine kitchen ($n = 1$) or was built to be easy to clean ($n = 1$). These comments were mainly provided by three shelters. The quarantine was used routinely by 36 (95%) of the shelters while two shelters did not put new cats in quarantine on a regular basis. Those two shelters specified that the quarantine was only used: for sick cats, if the cat did not thrive or when there was need of extra attention, eg with feeding or medication; always used when the cat entered from 'outside', and that fully vaccinated cats, when 'transfer cases', eg relinquished by an owner, did not need quarantine. Additional comments concerning use of quarantine were that it was not used when the cat had a valid vaccination card, but was utilised for the isolation of cats, sick cats and housing of pregnant queens. Ten shelters reported variable minimum stays in quarantine: ten days ($n = 1$), 14 days ($n = 7$) or 21 days ($n = 2$).

Thirty-eight shelters responded to the question of whether the cats were vaccinated prior to entering the shelter, 22 (58%) vaccinated all cats before they entered the shelter itself. However, four additional shelters specified that the cats were vaccinated before leaving the quarantine area. Twenty-four (63%) shelters specified what they inoculated against. The most common combination of vaccines given were against cat plague (FPV) and cat 'flu' ($n = 22$), one shelter stated full vaccination and one answered vaccine against FPV, FHV, FCV (which are included in the vaccines against cat 'flu and cat plague) and chlamydia. One shelter replied only that they used inactivated vaccine for kittens and (attenuated) modified live-vaccine for adults.

Occurrence of disease

The survey concluded with questions regarding the incidence of illness and disease in their shelter, and was answered by 34 respondents. During the month preceding the survey (September 2012), 17 shelters stated that they had no occurrence of disease. The remaining 17 shelters mentioned between 1–7 diseases. There was a significant positive correlation between number of reported diseases and number of cats at a shelter ($P < 0.01$; $r_p = 0.47$). However, no significant correlation was observed between number of reported diseases and maximum group size (ns; $r_p = 0.15$). The most common diseases were; cat 'flu/cold' ($n = 7$) and eye infection/inflammation ($n = 7$) followed by

feline ear scabies ($n = 5$). Additional, less prevalent diseases (< 2 shelters) were feline odontoclastic resorption lesions (FORL) and tartar, cat plague, urinary problems and allergies. For the previous year there were 13 shelters that had no disease occurrence, and 12 that had none going back three years. During September 2012, one shelter showed incidences of cat plague. For the previous year one shelter had cases of FIP and going back three years saw two additional shelters with cases of cat plague and a further three with cases of FIP. In total, for the last three years, three shelters had cat plague and four had FIP.

The respondents were asked to estimate which disease was most common at their cat shelter. Four shelters did not provide an answer, six answered that the shelter did not have a commonly occurring disease. Eleven, out of 35 responding shelters, answered cat 'flu/cold, which made up 31% of the respondents answers. Six shelters stated that feline ear scabies was the most common disease. Other diseases mentioned by < 3 shelters were lower gastrointestinal problems, tartar and infections. All but six shelters responded to the question of which feline disease they personally thought was most severe. One shelter stated 'don't know', which leads to 32 responses. FIP was considered the most severe disease by eleven shelters, cat plague by six shelters and cat 'flu/cold by five. The remaining respondents considered diseases (< 3 shelters) such as lower gastrointestinal problems, eye infections, diabetes and kidney problems the most severe. A matrix of shelter routines and occurrence of disease can be found in Appendix 1 (see the supplementary material to papers published in *Animal Welfare* section at the UFAW website, www.ufaw.org.uk).

Discussion

The aim of this study was, through use of a survey, provide information on husbandry practices, management routines and occurrence of infectious diseases in Swedish cat shelters, from the point of view of shelter staff. As this study was retrospective, based on self-reported data by shelter staff, there was no opportunity to check answers, which may influence the accuracy of the data. The response frequency for the survey was 61%, providing us with an insight into husbandry practices and routines as well as occurrence of detected diseases, enabling us to compare Swedish shelter practices and disease management with previous studies of cat shelters.

Sixty-four potential shelters were located and contacted, and it is impossible to say whether the 25 non-respondents were shelters or not, therefore this might have introduced a response bias. Perhaps it was only the 'good' well-managed shelters, without problems, that had sufficient time, interest or opportunity to reply? Despite contacting all shelters identified and ending up with a total similar to that of Eriksson *et al* (2009), a number may have been missed out and not receive the survey. By sending the survey to all shelters found, using regular mail and providing a prepaid self-addressed envelope, we aimed to avoid a selection bias in this study. Not all shelter managers responded to every question. It is difficult to find a reason to explain this as no

more than four shelters neglected to reply to any single question. However, this leads to different response rates to some questions, and therefore the number of respondents is given in connection to each question.

Housing and management

The majority of shelters practiced group housing. Swedish legislation limits the maximum number of adult cats per group to 15 (SJVFS 2008:5, chapter 3 4§), however, two shelters stated that they kept groups with more than 15 cats, for example, one respondent specified that they kept 25 cats in one group. The effect of this on, for example, occurrence of disease is difficult to discern as these two shelters kept smaller groups of cats in addition to the large group, and all questions were asked at the shelter level. However, no significant correlation was found between maximum group size at a shelter and reported number of detected diseases for the month preceding the survey. Several studies have shown that group housing can be problematic (Ottway & Hawkins 2003) and negatively affect some cats (Kessler & Turner 1997). Using a behavioural measurement of stress, the Cat-Stress-Score, Kessler and Turner (1999), showed that the number of cats in a group is correlated with the individual cat's behavioural stress level. Recommendations are to keep cat groups small, between four to eight individuals, as groups this size can be easily monitored, and there is less risk of introducing and spreading infectious agents (Griffin & Hume 2006). In the present study, no correlation was found between group size and reported disease. However, the questions in the survey were at shelter level rather than by housing type and, since most shelters provided more than one type of housing, firm conclusions cannot be drawn. Looking at the effect of housing and handling, Gourkow and Fraser (2006) showed that adoption rate was higher in cats housed communally and those provided with an enriched environment. Both communal housing and enrichment reduced behavioural stress levels, as measured by the Cat-Stress-Score, which were lower compared to the standard single-cage housing. This effect was seen despite the fact that the cats in the communal housing were subjected to more disturbances, eg dog barking, a previously known stressor (McCobb *et al* 2005).

The most common type of housing provided was a combination of single, pair and group housing (79%). Keeping a combination of housing types is in accordance with literature recommendations, as this creates the opportunity to meet the needs of most categories of cats (Griffin & Hume 2006), eg socialised or non-socialised towards conspecifics. Several shelters responded that they had routines for regrouping of cats. Routines can help avoid haphazard (re)groupings which is important, as changes in groups can result in agonistic interactions (Overall *et al* 2005). Introduction of a new member should always occur gradually (Overall *et al* 2005). Regrouping of cats can be disruptive to the whole group, and induce stress, not only for the introduced individual, but also for the original members (Griffin & Hume 2006) and should be kept to a minimum once a social group has become established.

Therefore, all shelters practicing group housing should consider measures to reduce stress.

Thirty shelters (77%) had established protocols for new intakes, and almost all respondents stated that they had routines for healthcare (92%) as well as for the care and management (92%) of the cats. This proportion is large when compared with a non-representative survey of North American shelters where about half (56%) of the shelters stated that they had routines for management of URI (Spindel *et al* 2013). However, the fact that the question was framed more specifically in the survey by Spindel *et al* might go some way towards explaining the difference. Management and caretaking routines are important, especially if there is a high turnover of staff and/or a large variety of different staff/volunteers caring for the cats. Management and routines should be kept consistent, as previous studies have shown that unpredictable environments and husbandry can induce a stress response in cats (Carlstead *et al* 1993; Gourkow & Fraser 2006). Consistency also permits review of shelter management to identify problems and improvements (Weiss *et al* 2013).

Out of 38 responding shelters, approximately half of the respondents answered that they could provide the cats with outdoor access. Outdoor access is a good way to activate and stimulate cats, and is often recommended as a way of reducing behavioural problems, which may be caused by boredom or stress from an indoor environment (Rochlitz 2005). The outdoor enclosures were arranged in different ways, but at some shelters, the outside enclosures were shared by several separated indoor groups. Outdoor areas, for example, grass or gravel, are impossible to disinfect but should be kept as clean as possible to prevent disease transmission, eg daily removal of faeces (Newbury *et al* 2010). Shared outdoor access and providing cats with access to communal areas, eg corridors or staff areas, during certain parts of the day can provide an opportunity for certain diseases, transmitted via fomites (eg FPV [Möstl *et al* 2013]) to spread within the shelter population. One concern then would be that different indoor groups were sharing the same outdoor enclosures, with an increase of pathogen transmission between indoor separated cat groups. Excluding cats in quarantine from outdoor access, as three shelters stated, is good as this should help reduce the risk of spreading certain infectious diseases. However, our questionnaire did not allow us to establish whether the majority of shelters kept quarantine cats indoors only.

All shelters stated that they provided enrichment. However, no definition of enrichment was included, so the concept may have been interpreted in various ways. Since cats may spend long periods of time in the shelters it is important for them to be provided with a suitable environment. In addition to the direct welfare benefit, enrichment can also positively influence viewings of animals by potential adopters and adoption rates (Gourkow & Fraser 2006; Fantuzzi *et al* 2010). However, simply adding a toy cannot be assumed to be enrichment. According to Newberry (1995), the aim with environmental enrichment should be to

make an improvement to the biological functioning of an animal through changes in its environment. For example, in conservation programmes for wild animals, the aim of the zoo environment is to provide similar resources to that of the wild where the animals are destined to be released (Newberry 1995). Provision of an environment more similar to the public's housing of cats (ie more 'home-like environment') has previously been suggested as a way of ameliorating stress associated with unsatisfactory husbandry (Loveridge *et al* 1995), and the environments provided in Swedish shelters seemed designed with the home in mind. Comments in the survey from a few shelters were that they try to provide a 'home environment'. Shelters in Sweden rarely kept cats in cages, compared to US shelters where single-cage housing seems to be more prevalent (Tanaka *et al* 2012; Spindel *et al* 2013).

Reviewed papers concerning US shelters, that specified cage size, all provided stainless steel cages, including laminate surfaces less than 1 m², approximately 70 × 70 with depth of 60 cm (Gourkow & Fraser 2006; Fantuzzi *et al* 2010; Tanaka *et al* 2012). In contrast, for cats housed permanently, Swedish animal legislation provides a minimum space allowance of 6 m² (ceiling height: 1.9 m), with a minimum of 2 m² per individual, (SJVFS 2008:5, chapter 3, section 11). Three cats can be kept in 6 m² and an additional 2 m² is required for every additional cat. In the current survey, one Swedish shelter only provided single housing, whereas Spindel *et al*'s (2013) study of North American shelters revealed that 59% provide single-cage housing and only 13% provide group rooms. The low frequency of single housing in the present study is in accordance with observations during visits to eleven Swedish shelters, where none provided single-cage housing except for recovering or injured cats.

US shelters commonly provide an environment comprised of small cages without hiding places, scratching surfaces or environmental enrichment (Tanaka *et al* 2012). Duplex housing systems, which consist of rows of cages stacked on top of each other, are in use (eg Gourkow & Fraser 2006; Fantuzzi *et al* 2010) but can cause stress as cats seek elevated spots for hiding (Overall & Dyer 2005). Previous work found hiding to be an important behaviour for cats to regulate stress (Kry & Casey 2010; Moore & Bain 2013), and has been suggested as a method of coping in cats (Carlstead *et al* 1993), as hiding increases in response to stress (Overall & Dyer 2005). Therefore, providing the opportunity to hide may be a simple way of reducing stress levels in shelters, as opportunity for active behavioural responses can help a cat cope, and behavioural control of a situation can limit the potential impact of a stressor (Griffin & Hume 2006). Not providing hides may also result in disruption of the cage furniture in a cat's attempt to create hides (Gourkow & Fraser 2006).

All enrichment strategies (and protocols) need to be adapted to the animal rather than developed from an anthropomorphic perspective (Shyan-Norwalt 2005) and need to be evaluated for success (Newberry 1995; Ellis 2009). In

shelters where resources, ie space, are often limited, care should be taken to ensure that enrichment truly is effective and that it does not impact adversely on space availability. For example, Gourkow and Fraser (2006) found more negative encounters in cats housed in enriched communal housing systems (aimed to promote contact between cats) compared to basic communal (aimed to minimise contact), and concluded that it was likely a result of less space being available for cats to claim as personal space, and less opportunity to avoid each other to access essential resources.

Eight shelters (22%) stated that they accepted additional species besides cats: a lower proportion compared to the findings of Eriksson *et al* (2009) where one-third of participating Swedish shelters accepted other species. Mixing species in shelters can be problematic, especially when mixing prey and predators, which can be stressful especially for the prey species (Newbury *et al* 2010). The most common additional species housed in Swedish shelters were rabbits (a prey species for cats), followed by dogs (predator species for cats). As dogs were the second most common species accepted, it is important to keep them separate from the cats as proximity to dogs (Rees & Lubinski 2008; Javinsky 2012) and their barking (Tanaka *et al* 2012) are major stressors for shelter cats (McCobb *et al* 2005).

Prevention of disease

All but one of the shelters kept a quarantine area, which is comparable to Spindel *et al*'s (2013) finding that 91% of North American shelters provide a quarantine area. However, two shelters only used the quarantine area as a hospitalisation area for sick cats and cats in need of additional attention or care rather than for general quarantine. Dinnage *et al* (2009) suggest that a quarantine period of 7–10 days, should help reduce FHV and FCV (the most common cause of UR TD). Of the ten shelters that specified time spent in quarantine, all kept the cats for a minimum of ten days. For the quarantine to be effective, vaccination against FHV and FCV needs to be provided during the quarantine, as well as treatments for any signs of illness (Dinnage *et al* 2009). Vaccination for cat 'flu and cat plague (FHV, FCV and FPV) was provided by 22 out of 24 responding shelters. Vaccination before entering the shelter was provided by 22 shelters. However, when going through the answers to this question it was clear that the question was ambiguous regarding whether the cats were vaccinated before coming in contact with resident cats (ie not quarantine), or before entering quarantine. Of the 16 shelters stating that they did not vaccinate prior to entering the shelter, a few stated that the cats were vaccinated before leaving quarantine. Therefore, 58% of shelters inoculating cats before coming into contact with resident cats is likely an underestimation.

In Sweden, vaccines against FHV, FCV and FPV are seen as basic vaccines (Windahl & Ingman 2003). These are recommended as core vaccines by the European Advisory Board on Cat Diseases (ABCD), and should be provided to all cats (Hosie *et al* 2013). Vaccination rate against FHV, FCV and FPV in Swedish shelters (92%) is similar to North

American shelters where 98% stated that they inoculated against these three viruses (Spindel *et al* 2013). In the present study, one shelter specified what type of vaccines was used, attenuated for adults and inactivated for kittens. In a study of UR TD in multi-cat housings, Helps *et al* (2005) found no difference between inactivated or attenuated FHV and FCV vaccine in their efficiency in preventing development of UR TD. Both reduced the prevalence.

One concern is that pregnant females are kept isolated in the quarantine area at some shelters. This can be problematic as kittens are especially sensitive to UR TD with high mortality (Dinnage *et al* 2009), and FCV can last up to one month in the environment (Möstl *et al* 2013). Kittens are also sensitive to FPV, with mortality up to 90% (Truyen *et al* 2009), a virus known to be resilient in the environment (Möstl *et al* 2013). During the first weeks, kittens are protected from FPV by maternally derived antibodies, however, there is a gap between 8 and 12 weeks when the maternally derived immunity does not protect from infection, but may still interfere with vaccination (Truyen *et al* 2009). ABCD recommends keeping a separate area for queens with kittens, or even better, to not place kittens in the shelter at all, but instead keep them in foster care, to minimise exposure to infectious agents (Möstl *et al* 2013).

Occurrence of detected diseases

All responses were reported by unidentified shelter staff who may or may not have been medical professionals, which might affect the accuracy of disease reports. Cat 'flu, the common name for UR TD (Helps *et al* 2005), was the most common disease in Swedish shelters according to the survey. Clinical signs commonly include sneezing, nasal and ocular discharge, and coughing (Helps *et al* 2005; Dinnage *et al* 2009). It could be that the rate of cat 'flu is underestimated by shelter staff and more common than the survey indicates, as references to eye infection and coughing in the survey could be signs of cat 'flu.

Larger shelters reported more occurrences of disease. This can be a result of more infectious agents being introduced into the shelter, as well as the larger turnaround of animals, but other factors may also be important as the two shelters with most cats had low occurrence of reported disease. Also, there was no effect of group size on reported occurrence of disease. Regarding occurrence of diseases amongst the shelter cats, none were detected in the last three years in 12 shelters, none in the last year in 13 shelters and none in 17 shelters in the month preceding the survey. Keeping in mind that shelters take in stray cats and relinquished animals with unknown medical and vaccination histories this seems unusually high. It is not possible to say if these shelters actually are free of disease or not, it could be that small clinical signs have not been interpreted as illness. Previous studies of shelter cat populations have found that 20 (Belgium: Zicola *et al* 2009) to 52% of cats (USA: Pedersen *et al* 2004) are carriers of FHV, which in most cats result in lifelong latent infection, and between 15 (Pedersen *et al* 2004) and 33% (Zicola *et al* 2009) are infected with

FCV. As these are the two leading viruses behind UR TD, ie cat 'flu (Dinnage *et al* 2009), every shelter is very likely to have come across and taken in individuals carrying and shedding these viruses. Because these viruses are recrudescence in stressful environments, some cats will almost certainly have developed or displayed clinical signs, or shed virus asymptomatic (FHV). It is therefore unclear whether the rate found in the survey represents the true occurrence of disease or whether a number of shelters have incorrectly interpreted slight signs of UR TD. It is also worth noting that we cannot be sure that all shelters keep and save their logbooks, so the occurrence of disease going back through the last three years could be inaccurate. Underestimation of FIP (mentioned by four shelters) is also possible, since ante mortem there is no easy or conclusive detection method (Addie *et al* 2009).

The incidence of certain diseases may vary throughout the year. For instance, Zicola *et al* (2009) found evidence of differences in frequency of infection to FHV and FCV over the different quarters of the year. This suggests that the month of September surveyed in the current study might not be representative for the whole year. Detection rate (ease of detection) differs between viruses, which can confound results of the actual number of carriers. For instance, FHV is shed only intermittently during activation, while FCV is shed almost continuously (Helps *et al* 2005).

Since the incubation period of infectious agents differs, the length of stay can affect the diseases that individuals acquire in shelters and their rate of occurrence. In the previous survey of Swedish shelters (Eriksson *et al* 2009), the mean length of stay was estimated to be (at least) three months, compared to the median of 22 days (5–120) in North American shelters (Spindel *et al* 2013). It is important to inform adopters of potential health and behavioural problems that can occur after adoption. Lord *et al* (2008) studied behaviour- and health-related problems in adopted animals one week and one month after adoption and found that over 70% of adopted cats displayed signs of UR TD one week following adoption.

There were a few references to elimination problems, or problems related to the urinary tract or bladder. Moreover, during the last three years only six shelters showed problems related to the urinary tract, eg urinary infection and calculi (stones). This is surprisingly low, as elimination problems are one of the most common reasons for relinquishment and euthanasia (Patronek *et al* 1996; Salman *et al* 2000). One explanation might be that most cats entering Swedish shelters are strays (Eriksson *et al* 2009). Another reason might be that elimination problems are considered a behavioural problem rather than a disease, despite often being connected to feline idiopathic cystitis (FIC) which is known to be intensified by stress (Westropp *et al* 2006). In a study of cats at four different shelters, McCobb *et al* (2005) found traces of haematuria in over 25% of urine samples which might have been signs of chronic stress in the cats.

There seem to be two different 'paths' or 'ideologies' that shelters follow, one with an emphasis on hygiene and prevention of disease transmission, and one where the focus rests on providing a more enriched environment. While a combination of these approaches may be important for shelter cat welfare, it would be beneficial to know whether a more 'enriched environment' outweighs the need to keep an environment sterile and free of infectious agents and we plan to focus on this in future research.

Animal welfare implications

Entering and living in a shelter can be stressful for cats depending upon the cat's life-history and previous experiences (Kessler & Turner 1997; Crowell-Davies *et al* 2004; Overall *et al* 2005). Several husbandry practices at Swedish shelters may have negative implications for the animals' well-being. Several specified that they did not accept feral (unsocialised) cats. However, it is not clear how they differentiate between unsocialised and frightened cats, nor whether these cats might end up adding to the feral population. Keeping cats in large groups can be problematic, and regroupings of cats at the shelters using 'trial-and-error' may reduce the cats' welfare during the process. However, there are also practices at Swedish shelters that may promote the welfare of the cats, eg provision of enrichment, especially hides, and supplying cats with outdoor access.

Conclusion

We found that a majority of shelters surveyed practiced some degree of group housing, often in combination with single and pair housing. We also found that the majority of shelters had routines for management, healthcare, as well as regrouping of cats. Several shelters did not accept feral (unsocialised) cats. Shelter cats were provided with different types of enrichment, such as toys and climbing structures and many cats had outdoor access. A majority of the shelters had some sort of quarantine in place for cats entering the shelter and most cats were vaccinated prior to coming into contact with the other cats. There was a low incidence of diseases reported by the shelters, despite the fact that many cats lived in groups and had contact with other cats that could be potential carriers of different infectious agents. There was a correlation between shelter size and prevalence of disease, but no correlation with group size.

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