

# ANALYSIS OF FERRET BITE INCIDENTS AT CDC

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## ABSTRACT

**Background:** Ferrets are commonly used as an animal model in biomedical studies, including research on several infectious agents. However, their unpredictable behavior and occasional aggressiveness can lead to bites and scratches incurred by animal care/veterinary personnel.

**Methods:** Laboratory incidents involving ferrets occurring at CDC during the past 5 years (2013-2017) were reviewed and analyzed. This included evaluation of incident risks, sustained injuries, potential for exposure to infectious agents, root-cause, and findings with corrective actions.

**Results:** Between Jan. 1, 2013, and Dec. 31, 2017, 3780 ferrets were housed and used for research at CDC vivaria. During the same period, 11 ferret-related incidents were reported. Most injuries (hand/finger bites) occurred during routine ferret handling/treatment and involved naïve animals, thus presented no or very low risk of infection. Institutional SOPs were followed and the appropriate PPE was used. Root cause analysis revealed that the incidents were primarily caused by animal aggression.

**Conclusions:** Given the anatomic features of ferrets (making mechanical restraining difficult), the understanding of ferret behavior is the key to the application of safe manual restraint performed on this species. Considering the challenges posed by the large numbers of ferrets housed and handled at CDC and their unpredictable nature, the low frequency of incidents involving these animals indicates the quality and safety of the CDC animal program.

The investigation results obtained for each incident included: (i) analysis of sustained injuries, (ii) evaluation of incident risks including potential for exposure to infectious agents; (iii) root-cause analysis identifying possible causal factors; and (iv) final findings and possible corrective actions.

## RESULTS

From the period of 1 January 2013 to 31 December 2017 the CDC has maintained an average daily census of 263 ferrets (Fig. 1). The total census after entries and departures from the numerous approved studies was 3780 ferrets. This population of ferrets was often accessed daily for routine husbandry, study procedures and health monitoring. Approximately 67 animals were handled on a regular work day, resulting in 335 weekly individual possible exposures to ferret bites or scratches. Annually this represents approximately 16,420 separate events where ferrets were manipulated.

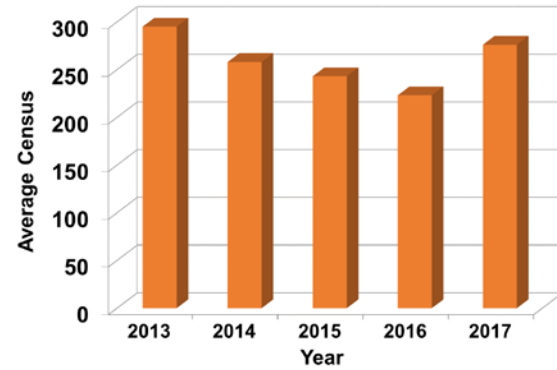


Figure 1. Average daily census of ferrets at CDC from January 1, 2013, to 31 December, 2017.

Date	Injury	Involved Activity	Animal Infectious Status	Hand Protection Used
Jan. 2013	left hand 5 <sup>th</sup> finger	study procedure	naïve, uninfected	nitrile and latex gloves
Sept. 2013	left hand index finger	Husbandry	naïve, uninfected	nitrile and latex gloves
Sept. 2013	right hand index finger	physical examination	naïve, uninfected	nitrile and latex gloves
Jan. 2014	right hand index finger	physical examination	naïve, uninfected	nitrile and latex gloves
April 2015	left hand index finger	Husbandry	naïve, uninfected	nitrile and latex gloves
May 2015	right hand index finger	study procedure	low-pathogenic seasonal influenza virus	double nitrile gloves and bite resistant leather gloves
Feb. 2016	right hand index finger	physical examination	naïve, uninfected	double nitrile gloves
Nov. 2016	left hand thumb	physical examination	naïve, uninfected	double nitrile gloves
Aug. 2017	right hand 4 <sup>th</sup> finger	physical examination	naïve, uninfected	double nitrile gloves
Oct. 2017	left hand thumb	Husbandry	naïve, uninfected	double latex gloves and bite resistant leather gloves
Dec. 2017	right hand thumb	physical examination	naïve, uninfected	nitrile and latex gloves

Table 1. Reported incidents involving ferrets at CDC from January 1, 2013, to 31 December, 2017.

During this period, 11 ferret related incidents were reported (Table 1). Most injuries (hand/finger bites) occurred during routine handling, treatment or study related procedures with mostly naïve animals. The non-infected status of this particular subset of the colony represented a very low risk for transmission of experimental or zoonotic diseases. The incidence rate of receiving a ferret related injury falls within the range of 1 in 1600 manipulations (.000625%). The acceptable safety level for this incident rate has yet to be determined since current scientific literature contains no comparable reports.

## DISCUSSION

Root cause analysis indicates that the incidents involved injuries associated primarily with the non-restraining hand. The random and unpredictable, either playful or aggressive, behavioral patterns commonly exhibited by ferrets may contribute to these injuries occurring during the handling and manipulation of ferrets. The need to maintain adequate flexibility to perform treatment or inoculation procedures also contributes to the risk of an inadequately protected hand being bitten or scratched. Based on the time of the incident reports, there is no predilection for the time of day that these incidents occurred (data not shown). Also of note is the fact that these 11 incidents involved 10 individuals which would indicate that no single individual experienced a particular lack of attentiveness while performing procedures.

Institutional SOPs have been established and are in use for the appropriate application of protective measures including Personal Protective Equipment (PPE). Proper use of PPE and restraint techniques is commonly employed in risk avoidance strategies to mitigate ferret bites and scratches at the CDC. Wearing bite resistant gloves composed of leather or Kevlar has been suggested as a method to properly restrain ferrets during experimental manipulations. Unfortunately bite resistant restraint gloves often prove too inflexible for use in experimental procedures, which often requires a vinyl or latex glove for increased dexterity. Contributing to this potentially critical biosafety issue in manipulating any animal model used in research, the anatomic features of the ferret (makes physical restraint difficult) and the inherent behavior of the ferret requires increased safety precautions. The paradox presented in ferret handling lies in the temperament of the ferrets. Ferrets from different vendors may vary in temperament which could make some better adapted to research and possibly present less risk to handlers.



Figure 2. Procedure restraint with leather gloves (A) and Kevlar gloves (B).

Ferret handling and training techniques are provided as a mechanism to minimize possible bite/scratch incidents. Individuals handling and manipulating ferrets are taught methods to avoid placing a non-restraint glove protected hand near the head and mouth of a ferret. CDC is currently working with suppliers to develop a prototype bite resistant glove that would preserve adequate human dexterity to maintain proper restraint of ferrets during procedures as shown in Figures 2-3. Temperament testing and behavioral training in ferrets have not been shown to reduce risk of injury (data not shown). Assessment of vendor facilities and careful consideration of breeding lines may lead to a more tractable animal model that is less prone to aggressive behaviors.



Figure 3. Restraint for oral dosing with leather gloves (A) and Kevlar gloves (B) demonstrates the difficulty with decreased dexterity.

## CONCLUSIONS

Mitigation efforts employed at the CDC for handling frequently unpredictable ferrets has revolved around the use of bite resistant gloves, vendor selection assessments, and a pronounced effort to train individuals in the safe manipulation of ferrets. Efforts to require two individuals to perform ferret techniques have been implemented and may further reduce the incidence rate. The incident rate of bite/scratch incidents presented here seems relatively low; however acceptable risks are hard to determine with the apparent paucity of citations in the literature to actually benchmark comparable institutions. Further reductions in incidents may be possible with better designed, bite-resistant procedural gloves or development of a temperament assessment protocol applicable to ferrets.

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