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Examination of the NHANES Data Set: Pets, Wheezing, and Allergy Symptoms

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Abstract

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Pender's health Promotion Model provided the framework for examining relationships between pets and asthma-related symptoms, such as itchy eyes, rhinitis, and wheezing using NHANES III data ($n=5408$). Even though cats and dogs are commonly thought to contribute to asthma symptoms, this study found rodents and rabbits to be culpable.

Results indicate that persons reporting having a rodent were four times more likely to have more than four episodes of wheezing within the last year than those reporting no pet. Children having a dog were 1.89 times more likely to report more than four episodes of itchy eyes and rhinitis than those with no pet; those with a cat, 1.74 times more likely to report 1 to 4 episodes and 1.68 times more likely to report more than four episodes.

The facilitation of positive health promotion practices in relation to control of the home environment necessitates healthcare providers be aware that individuals are more inclined to begin or continue health-promoting behaviors if there is perceived value to that behavior. Competing preferences become a critical factor in patient education when the family is faced with the choice between the child wheezing or removing the family pet from the home. Suggestions are discussed regarding indoor environmental control measures when removal of the family pet is not an option.

Key Words: Allergens, Asthma, Child, Home Environment, Pets

Introduction

Health status is influenced by biological, environmental, and sociocultural factors. These multiple influences on health ultimately determine the type and extent of personal health behaviors. Pender asserts that health promotion practices or behaviors are determined by individual perceptions of health, control over health, definition of health, and perceived benefits and barriers to health-promoting behaviors.¹

A healthy lifestyle is easier to maintain when healthful patterns of behavior are learned early in life; family plays a critical role in the development of health beliefs and behaviors.² For children, their parents make most of the decisions related to their health practices or behaviors. Additionally, environmental influences contribute to the person/family's ability to develop their optimum health. Therefore, it is important to understand the effect that pets can have on the indoor environment and its influence on wheezing/asthma and allergy symptoms in children.

Relevant Literature

The incidence of asthma has increased over 50% since 1980, with the most significant increase seen in children ages 5 through 14. An estimated 4.8 million children (7%), under 18 years of age in the United States suffer from asthma, making it the most common chronic illness of childhood.³ Asthma accounts for nearly 500,000 hospitalizations per year.^{4,5} Environmental influences are an important determination in the development and trigger of asthma.⁶ Domestic animals are a dominant trigger.⁷

¹Pender, N. (1987). *Health Promotion in Nursing Practice*, 2nd edition.

Norwalk, CT: Appleton-Lange

²Kravitz, M. & Frey, M. (1989). The Allen nursing model. In J.J. Fitzpatrick & A. L. Whall (Eds.), *Conceptual models of nursing: Analysis and application* (2nd ed.), Norwalk, CT: Appleton-Lange.

³Larkin, M. (1999). Asthma management in schools: Call to action. Asthma Information Center. Retrieved August 11, 2000 from the World Wide Web: <http://www.ama-assn.org/special/asthma/newsline/special/school.htm>

⁴Berge, M., Munir, A., & Dreborg, S. (1998). Concentrations of cat (Fel d 1), dog (Can f and mite (Der f 1 and Der p 1) allergens in the clothing and school environment of Swedish schoolchildren with and without pets at home. *Pediatric Allergy and Immunology*, 9, 25-30.

⁵Yoo, H. & McMullen, A. (1999). Symptom perception and evaluation in childhood asthma. *Nursing Research*, 48(1), 2-7.

⁶Peden, D. (2000). Development of atopy and asthma: Candidate environmental influences and important periods of exposure. *Environmental Health*

Perspectives, 108(3), 475-483.

⁷Crater, S. & Platts-Mills, T. (1998). Searching for the cause of the increase in asthma. *Current Opinion in Pediatrics*, 10, 594-595.

⁸Jones, A. (1998). Asthma and domestic air quality. *Social Science Medicine* 47(6), 755-764.

⁹Mitchell, T. (1998). The great outdoors. *The Journal for Respiratory Care Practitioners*, June/July, 39-43.

¹⁰CDC (2000). Center for Disease Control. [Strategic Plan 1999-2003](#). Retrieved August 2000 from the World Wide Web

¹¹Dharmage, S., Abramson, M., Raven, J., Thien, F., & Walters, E. (1998). Why do only some of the young adults with bronchial hyperactivity wheeze? *Journal of Asthma*, 35(5), 391-399.

¹²Prince, E., Zacharisen, M., & Krup, V. (1998). Anaphylaxis to rabbit: A case report. *Annals of Allergy, Asthma, & Immunology*, 81, 272-273.

Environmental control plays an important role in asthma management. Decreasing exposure to irritants can minimize bronchospasm and reduce the need of medication.⁸ Even though outdoor irritants have long been a topic of environmental control, indoor irritants are most controllable.⁹ Domestic air quality is seen as a major public health issue. The U. S. Center for Disease Control (CDC) has classified indoor air pollution as a factor of high environmental risk.¹⁰ In their 1999-2003 Strategic Plan, goal number 3 is the identification of indoor environmental hazards related to asthma. The home is of primary concern in indoor environmental control because of the amount of time spent there. Likewise, a number of important environmental agents, such as dust mites, animal by-products, and tobacco smoke, are found there. The environmental factors of interest in this study were pets.

An investigation of risk factors for wheezing among people with nonspecific bronchial hyperactivity found that exposure to household pets must be controlled for those with hyperactive airways.¹¹ Therefore, information related to pets in the home environment can provide insight for the development of interventions. Focusing on manipulation of the indoor environment relative to pets and their role in the management of allergy symptoms such as itchy eyes, rhinitis, and wheezing can facilitate appropriate health promotion behaviors.

Recent literature and research are expanding the parameters of the danger of anaphylaxis to household pets. While pet allergies are common, as is documentation of the dangers, allergic reactions are often associated with direct exposure to cats or dogs. A Wisconsin study reports a case of anaphylaxis following exposure to a pet rabbit.¹² A study assessing the relationship between types of household pets, wheezing and allergy symptoms could benefit the practice of health promotion. This could further assist health professionals in developing national strategies to decrease children's health risk from exposure to pets. Therefore, the purpose of this study was to examine relationships between the type of pet in the respondent's home, allergy symptoms (defined as itchy eyes, and rhinitis), and wheezing, in children.

Methods

¹³CDC (1994). *National Health and Nutrition Examination Survey (NHANES III)*. US Department of Health and Human Services. Atlanta.

¹⁴Burns, N. & Grove, S. (1997). *The practice of Nursing Research: Conduct, Critique & Utilization*, 3rd ed. Saunders: Philadelphia.

This study used secondary analyses of NHANES (National Health and Nutrition Examination Survey) III data¹³ to examine the relationships of allergy symptoms in children and types of pets in the home. Secondary analyses often employ different statistical analysis than in the original analysis. In this case, the secondary analysis also used a new conceptual model to determine risk factors for allergy that could be incorporated into health teaching.¹⁴

Sample

The sample consisted of children ($n=5408$) in families who participated in the NHANES III. For the purpose of this research, children ages 5 to 16 years old were selected. For analysis purposes, children who reported having more than one type of pet in the house were deleted from the sample. When the child was identified as not being able to respond appropriately to a question, the parent present did so. Respondents were asked whether they had a pet in the house.

The children ranged in age from 5 to 16 years with a mean age of 12.4 years (SD 1.42). The majority was European American, but the sample also included African Americans, Hispanics, and others. The sample was almost equally divided on gender with 2669 (51%) males and 2739 (49%) females.

The sample was randomly drawn from the United States but more respondents were from the South than other regions of the country. Furthermore, 49 % ($n=2723$) resided in metropolitan areas and 51% ($n=2685$) in rural areas.

Instrumentation

The NHANES III was designed to obtain nationally representative information on the health and nutritional status of the population of the United States. It is a periodic survey conducted by the National Center of Health Statistics. The NHANES III project was conducted from October 1988 until October 1994. Interviews and physical examinations were used to collect data. The sample design used a stratified, multistage probability sample of counties, blocks, and individuals randomly selected from households. The sample was designed to be self-weighting within a primary sampling unit (PSU) for age, sex, and race-ethnic groups. The targeted population for the NHANES III was the

¹⁵National Center for Health Statistics (1994). *Plan and operation of the Third National Health and Nutrition Examination Survey, 1988-1994*. Hyattsville, MD: Department of Health and Human Services (PHS) 94-1308

United States civilian, non-institutionalized population age 2 months or older.¹⁵ The NHANES III data file used in this study was the Household Youth Questionnaire.

The Household Youth Questionnaire (HYQ) data file contains all the data collected during the survey from household interviews for children (2 months to 16 years old). The questionnaire covered several topics such as birth experience, motor and social development, household conditions, health service usage, dental care, tobacco use, and medication usage. The HYQ was administered to 13,944 children during the survey period. The field staff that conducted these interviews received intensive initial training and continued retraining to ensure that high levels of skill were maintained. The interviews were conducted in both English and Spanish. Excluding any identifiable information on subjects from the data file ensured subject confidentiality.

The NHANES III addressed the health events of interest to this research by asking the following questions in the HYQ interview:

1. How many episodes of wheezing or whistling has (the child) had in the past 12 months?
2. How many episodes of itchy eyes and rhinitis has (the child) experienced in the last 12 months?
3. What type of pet was in the household in the last 12 months?

The dependent variables for this study were the incidence of wheezing, itchy eyes, and rhinitis experienced by the sample in the last 12 months.

Analysis of Data

Descriptive techniques were used to assess the demographic characteristics of the sample (gender, ethnic background, region of the country, rural vs. metro, family income level). Sample totals, means, proportions, percentages, and medians were presented.

Logit analysis was used to determine the relationships between the prevalence of allergic events in children and the type of pets in the house. A generalized logit model was employed with multiple independent variables and nominal level data.¹⁶ The Multilog procedure of the SUDAAN Statistical package was used to provide logit analysis of the sample data. The Genlogit option was used in the analysis. In this option, a linear model is fit to the generalized logit transform log, which tests each dependent variable cell against the last cell.¹⁷ Because the NHANES III sample design used a stratified, multistage probability sample, the SUDAAN statistical computer software package was used for the analysis

¹⁶Stevens, J. (1992). *Applied multivariate statistics for the social sciences*. Hilldale, NJ: Lawrence Erlbaum Associates.

¹⁷Research Triangle Institute (1996). *SUDAAN basics*. Research Triangle Park, NC: Research Triangle Institute.

procedure.

Results

Forty percent (n=1457) of those surveyed reported having a pet in the house while 60% (n=3951) reported no pets in the house. Reported pets included dogs, cats, birds, rodents, rabbits, reptiles, and other. The “other” category was dropped from the analyses because of the diversity of responses and small number of responses to that category. (See [Table 1](#) for the distribution of pets reported.) The most commonly reported pet was a dog, followed by a cat.

In examining the relationship between the type of pet in the home and the number of wheezing episodes, a significant relationship was found for rodents and rabbits (See [Table 2](#)). Those reporting having a rodent (e.g. ferret, mouse, gerbil or hamster) as a pet were about four times more likely to have more than four episodes of wheezing in the last year than those with no pet. Those who reported having a rabbit were nine times more likely to have had between 1 and 4 episodes of wheezing in the last year than those with no pet. Having rodents as pets was more likely to be associated with recurring episodes of wheezing (>4 episodes per year). It is interesting to note that no significant relationship was found between wheezing and having a dog or cat. This was not consistent with frequent references in the literature linking wheezing and asthma in children to contact with cats or dogs. ([Table 2](#))

When the data were examined to determine whether there was a relationship between reported episodes of itchy eyes and rhinitis in the last year and the type of pet, two pets were linked with allergy symptoms. Those children who had a dog were about twice as likely to have reported four or more episodes of itchy eyes and rhinitis than those with no pet. Those with a cat were close to two times more likely to report 1 to 4 episodes and one and a half times more likely to report more than four episodes in the last year. ([Table 3](#))

In this national sample of children, there was a significant relationship between having a furry pet in the home and episodes of wheezing, itchy eyes, and rhinitis. It is important to note the highly significant relationship between rodents and wheezing.

The literature is replete with issues of environmental triggers of asthma and allergy symptoms.¹⁸⁻²³ Authors agree on some intervention strategies and disagree on others. Consensus reached

¹⁸Luskin, A. (1995).
Environmental control: *Key to asthma management*,
16(3), 253-266.

¹⁹Crater & Platts -Mills, op. cit.

²⁰Frankel, K. & Wamboldt, M. (1998). Chronic childhood illness and maternal mental health- why should we care? *The Journal of Asthma*, 35(8), 621-630.

²¹Grant, J. (1998). Bronchial asthma. *Allergy and Immunology*, 25(4), 849-867.

²²Hanson, J. (1998). Parental self-efficacy and asthma self-management skills. *Journal of the Society of Pediatric Nurses*, 3(4), 146-154.

²³Horner, S. (1998). Catching the asthma: Family care for school-aged children with asthma. *Journal of Pediatric Nursing*, 13(6), 356-366.

among all researchers is the importance of identifying asthma triggers and eliminating them from the environment as much as possible.

Cats and dogs are the usual allergen source, but rabbits, birds, guinea pigs, and hamsters can also be culprits. Selection of a warm-blooded breed of pet with low intrinsic allergenicity is unlikely, thus making the home as allergy-free as possible is the best option. Limiting exposure to the animal is usually practical and may reduce allergic signs and symptoms. Keeping the pet outdoors is preferable. However, since animal hair and saliva are harbingers of allergens, even if the allergic person avoids the pet, when people other than the allergy sufferer handle the pet, the allergens can be carried indoors.

Discussion and Conclusions

Pender's Health Promotion Model (HPM) addresses making choices about one's own health. The HPM stresses the importance of focusing on the incorporation of promotive strategies in nursing practice.²⁴ The incorporation of teaching health promotion activities to children and their families is without question a priority in nursing interventions for children with asthma. These activities include control of the indoor environment and accurate assessment of triggers.

²⁴Pender, op. cit.

²⁵Bardana, E. (1994). Air pollution in the home: What to advise your patients. *The Journal of Respiratory Diseases*, 15(7), 612-618.

²⁶Murphy, A. & Platts-Mills, T. (1996). Asthma: Realistic ways to help your patient control indoor allergens. *Consultant*, May, 1022-1028.

²⁷Priestly, L. (1998). Allergen avoidance. *Nursing Times*, 94(25), 77-78.

²⁸Bush, R., Fadal, R., & Van Metre, T. (1995). Taming your patient's animal allergies. *Patient Care*, April 15, 71-83.

There are ways to decrease the impact for the person with allergies living with a pet. These include: 1) removing carpet, 2) eliminating upholstered furniture,²⁵⁻²⁷ 3) restricting the animal to infrequently used rooms (patients can retreat to "safe" rooms if allergic responses begin to develop), 4) keeping the animal from the allergic person's bedroom, 5) having separate venting for the room the animal is confined to (animal allergens can travel through air ducts), 6) closing the main vent, and 7) investing in an independent heat and air source for the room where the animal is confined.²⁸

There are numerous anecdotal reports suggesting that bathing cats and dogs, even with plain water, over time, appears to make them less of an allergic source. Regular bathing of the pet will not adversely affect an animal's coat or general health. Shampoos, soaps, and plain water are options for bathing the pet, as are emollient solutions made to wipe on the animal and formulated to cleanse the fur and skin. Washing achieves a large and immediate reduction in aeroallergen shedding, but the duration of this effect appears to be limited to less than a week.²⁹⁻³³ Pet bedding and towels should be laundered separately from those of the allergic person. No information on using this strategy with rodents and rabbits were found in the literature. This is a topic for further research.

²⁹ibid.

³⁰Luskin, op. cit.

³¹Mudd, K. (1995). Indoor environmental allergy: A guide to environmental controls. *Pediatric Nursing*, 21(6), 534-574.

³²Priestly, op. cit.

³³Jones, op. cit.

Tannic acid sprays for carpet and furniture may inactivate cat allergens and reduce airborne allergens. Vacuuming should be done at least weekly (daily in bedrooms) with high efficiency filters to trap allergens. Electrostatic filtration and room air cleaners with very high rates of air exchange may reduce allergens as well.^{34,35} Further research is needed to focus on the impact of rodents and rabbits on persons with asthma. Additionally, research should focus on how families living with these pets can best adapt their environment to decrease airborne allergens. An examination of the "homes" of the pets could reveal clues to what is precipitating the allergic response. Examples of questions to be considered include:

³⁴Tovey, E. & Marks, G. (1998). Methods and effectiveness of Environmental control. *The Journal of Allergy and Clinical Immunology*, 103(2), 179-191.

³⁵Mudd, op. cit.

- 1) What sort of bedding (cedar shavings, straw, etc.) is involved?
- 2) Do these animal "homes" require frequent cleaning?
- 3) What sort of cleaning agents are used?
- 4) Are smaller pets, like rodents and rabbits, more likely to be held closer to the face?
- 5) Are they less likely to be washed?
- 6) Are they more likely to live in the child's room?

Pender asserts that nurses in practice should focus on understanding and addressing variables that are most predictive of given health behaviors in order to encourage adaptation of healthy lifestyles.³⁶ The HPM identifies the targeting of immediate and competing demands (low control) and preferences (high control). The accurate identification of allergy triggers dictates the activity-related affect. The HPM asserts that health promotion practices are partially determined by individual perceptions of control over health and perceived benefits and barriers to health promoting behavior. The Model places emphasis on activities that improve client awareness related to wellness behaviors. Families facing asthma and allergies as a factor of their lives need education about their ability to control

³⁶Pender, op. cit.

their environment and, thus eliminate barriers to health.

Cats and dogs have previously been identified culprits in asthma. Iguanas and bats have even been identified as producing asthma triggers.^{37,38} Based on the findings of this study, however, rodents and rabbits may be even more culpable. Patient education on home environmental control is essential. If the pets cannot be removed from the home environment, use of the control methods discussed earlier in this paper should be instituted. Families should be made aware of the perceived benefits of controlling the home environment.

It is only through the combined efforts of health care provider and patient-family partnership that optimum wellness can be achieved. Because asthma triggers and symptoms vary from patient to patient, goals of the partnership should be focused on identification and elimination or control of these triggers. These factors should be the focus of healthcare interventions and research.³⁹

³⁷Senti, G., Lundberg, M. & Wuthrich, B. (2000). Asthma caused by a pet bat. *Allergy*, 55(4), 406-407.

³⁸Kelso, J., Fox, R., Jones, R. & Yunginger, J. (2000). Allergy to iguana. *Journal of Allergy Clinical Immunology*, 106(2), 369-372.

³⁹Meininger, J., Hayman, L., Coates, P. & Gallagher, P. (1998). Genetic and environmental influences on cardiovascular disease risk factors in adolescents. *Nursing Research*, 47(1), 11-18.

Table 1**Types of Pets**

Type of Pet	Number of Households with Pet	Weighted Percent
Dogs	775	48.4
Cats	444	36.2
Birds	161	7.9
Rodents	47	4.3
Rabbits	16	.8
Reptiles	14	2.4
Total	1457	100.0

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Table 2**Number Of Episodes Of Wheezing By The Type Of Pet**

Type of Pet	1-4 Episodes		>4 Episodes	
	Beta	Odds Ratio	Beta	Odds Ratio
Dog	0.14	1.15	0.48	1.61
Cat	0.28	1.32	-0.10	0.90
Bird	0.41	1.51	0.13	1.14
Rodent	0.13	1.14	1.45**	4.28
Rabbit	2.23**	9.34	1.28	3.61

** $p < 0.01$

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Table 3**Episodes Of Itchy Eyes And Rhinitis By Type Of Pet**

Type of Pet	1-4 Episodes		>4 Episodes	
	Beta	Odds Ratio	Beta	Odds Ratio
Dog	0.23	1.26	0.64**	1.89
Cat	0.55**	1.74	0.52*	1.68
Bird	0.12	1.13	0.29	1.34
Rodent	0.51	1.66	-0.11	0.90
Rabbit	2.47*	11.87	1.31	3.70

* $p < 0.05$ ** $p < 0.01$

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