Assessing Work-related Respiratory Problems among Massachusetts Elementary School Staff: Results of a Pilot Survey

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Occupational Health Surveillance Program
Boston, MA

August 2007

Acknowledgements

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This project was conducted with funding for surveillance of work-related asthma from the National Institute for Occupational Safety and Health (NIOSH), cooperative agreement number OH008332-01.

The authors would like to thank Tolle Graham, and the Healthy Schools Network, and the Massachusetts Teachers Association for their work in designing and implementing the project. We appreciate the contributions of the Center for Survey Research and colleagues at NIOSH in the Division of Respiratory Disease Studies, and in the Northeast Occupational Health Surveillance group who reviewed the questionnaire. We also thank the school staff who completed the surveys and the superintendents and principals who participated. We appreciate the contribution of Professor David Kriebel of the University of Massachusetts Lowell, for his supervision of Ms. Baldwin in her Masters studies on this project.

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ABSTRACT

In Massachusetts, sentinel cases of work-related asthma among school personnel have been identified and the presence of respiratory hazards in schools has been documented. However, there has not been a standard survey or reporting tool used to assess the prevalence of work-related asthma among school employees in the Commonwealth. To learn the best way to survey school employees regarding their respiratory health and inform future research, the Massachusetts Department of Public Health, in collaboration with the Massachusetts Teachers Association and the Healthy Schools Network, developed and piloted a short questionnaire to gather information on the prevelance of asthma and respiratory symptoms in school personnel.

This pilot project demonstrated that anonymous, self-reported information on asthma and respiratory symptoms in school staff and observed environmental conditions in schools can be collected using a brief self-administered questionnaire. Self-administered surveys were completed by 359 staff in a convenience sample of 13 public elementary schools (response rate 44%).

Survey findings corroborated the occurrence of respiratory problems among school staff. The design of the pilot project precluded generalizing findings to estimate the prevalence of respiratory problems among all elementary school personnel in Massachusetts.

The proportion of staff reporting current asthma (10%) was no different than the proportion of all adults (9.7%) and somewhat less than the proportion of all females (12.2%) reporting current asthma in the Massachusetts Behavioral Risk Factor Surveillance System (BRFSS). However, the proportion of school staff reporting that their asthma was related to work (25%) was greater than expected from the 2001-2002 Massachusetts BRFSS (8.8% all; 9.0% females). An additional 21% of respondents reported respiratory symptoms associated with work. In response to an open-ended question, staff expressed concern about poor indoor air quality, mold and dust.

The findings of this pilot project, while limited, taken together with sentinel surveillance data on work-related asthma and other published reports, suggest that further research on respiratory health among school personnel and its association with environmental conditions in schools is both feasible and warranted.

EXECUTIVE SUMMARY

Background

Asthma is a critical public health problem nationwide. Seventy percent of those living with asthma are adults, and a significant fraction of asthma in adults is work-related (CDC 2006, American Thoracic Society 2003). Environmental hazards associated with asthma, including water leaks, dampness, mold, pests and poor indoor air quality, have been documented in schools (CDC 2007, Lopes 2006, Park 2006, Fletcher 2006, Cox-Ganser 2005, Cohn 2005, Dangman 2005, Salam 2004, Fryer 2004, IOM 2004, Saarinen 2003). In Massachusetts, sentinel cases of work-related asthma among school personnel have been identified and the presence of respiratory hazards in schools has been documented. However, there has not been a standard survey or reporting tool used to assess the prevalence of work-related asthma among school employees. Further investigation of work-related asthma prevalence and associated hazards in schools is needed and may have implications for both school staff and students.

To learn more about the best way to survey school employees regarding their respiratory health and inform future research, the Occupational Health Surveillance Program (OHSP) of the Massachusetts Department of Public Health developed a short, anonymous, self-administered questionnaire to gather information on the prevalence of asthma and respiratory symptoms in school personnel and piloted delivery of this questionnaire in a convenience sample of Massachusetts elementary schools. The survey instrument included questions about the presence in schools of environmental exposures associated with asthma or respiratory symptoms. Also included was an open-ended question about health concerns related to exposures in schools. These concerns were of key interest to the Massachusetts Teachers Association (MTA), and Healthy Schools Network, partners in planning and conducting the survey.

Methods

With input from researchers, the MTA and the Massachusetts Healthy Schools Network, OHSP developed an anonymous 55-question survey to collect demographic information, health information (diagnosed asthma, respiratory symptoms, and their association with work), observed environmental exposures in schools, and health concerns related to exposures. The asthma and work-related asthma questions were the same as those used by the Massachusetts Behavioral Risk Factor Surveillance System (BRFSS), for comparison purposes. Specific questions were asked about indoor environmental conditions previously associated with asthma or respiratory problems.

A convenience sample of 13 public elementary schools participated (of seventeen invited), with the superintendents' and principals' agreement. Surveys were mailed to an MTA representative in each school, with instructions to deliver and collect the surveys within two weeks. An incentive was offered for the school with the best participation rate. Schools were chosen based on location within 50 miles of Boston and the presence of an MTA representative who could distribute and collect surveys.

Limitations of the pilot study

The sample of schools that participated in the study was not representative of schools throughout Massachusetts and methods used to distribute and collect surveys were not standardized across

schools. There was also a wide variation in the percentages of school staff who participated in the survey depending on the school. The highly variable response rate among schools raised the possibility that those with health concerns may have been more likely to participate.

Pilot Survey Results

Surveys were received from 359 respondents, representing 44% of the estimated staff in the 13 schools. Participation rates varied greatly among the schools, ranging from 19% to 96% (median 41%). Respondents were primarily white, female teachers, with more than four years of college, never-smokers, with a median age of 43.

The proportion of staff who reported currently having asthma (10%) was no different than the proportion of all adults (9.7%) and somewhat less than the proportion of all females (12.%) reporting currently having asthma in the Massachusetts BRFSS. However, the proportion of school staff who reported that their asthma was related to work (25%) was substantially greater than that reported in the Massachusetts BRFSS (8.8% all; 9.0% females). An additional 21% of the respondents reported experiencing one or more respiratory symptoms associated with asthma, including coughing, wheezing, shortness of breath or chest tightness at a time when they did not have a flu or cold. Of these, 48% thought their condition was related to work. Overall, among the 31% of staff respondents who reported either asthma or respiratory symptoms during the previous year, 41% indicated that their condition was related to work.

In the open-ended questions, fifty-six respondents noted health concerns, over half of which were upper respiratory issues. One hundred and forty-two staff reported concerns about environmental exposures, including poor indoor air quality, mold, and dust.

Conclusions

The survey was designed as a pilot to determine whether data could be adequately collected using a self-administered, anonymous questionnaire. Data presented in this report on asthma, respiratory symptoms and environmental exposures in schools should be considered preliminary. The pilot project demonstrated that self-reported information on asthma and respiratory symptoms in school staff and observed environmental exposures in schools can be collected using a brief self-administered questionnaire.

Survey findings corroborated the occurrence of respiratory problems among school staff. However, the design of the pilot project precluded generalizing findings to estimate the prevalence of respiratory problems among all elementary school personnel in Massachusetts.

The findings of this pilot project, while limited, taken together with sentinel surveillance data on work-related asthma from Massachusetts, California, Michigan and New Jersey, and other published reports, suggest that further research on respiratory health among school personnel and its' association with environmental conditions in schools is both feasible and warranted. Future studies should include mechanisms to improve overall response rates and limit potential response biases. Better understanding of the potential impact of environmental conditions in schools on respiratory health is needed to protect the health of students and school staff alike.

INTRODUCTION

Asthma is a serious chronic disease recognized as a critical public health problem in the United States. Morbidity and mortality associated with asthma has increased markedly during the last several decades (Arif 2002, Asthma Regional Council 2001, Mannino 2002, 1998, Chan-Yeung 1995). Approximately 70% of those living with asthma are adults (CDC 2006). The proportion of adult asthma that is work-related has been estimated between 5% and 29%. The American Thoracic Society reviewed articles published through 2000 and estimated the occupational contribution to the population burden of adult asthma as 15% (American Thoracic Society 2003).

Work-related Asthma

Work-related asthma (WRA) may have serious consequences for those affected. Asthma associated with work appears to result in greater utilization of health care services, more severe symptoms, increased rates of disability, and loss of jobs and earning capacity than asthma unrelated to work (Liss 2000, Lemière 2000, Cannon 1995). In a Massachusetts study, individuals with work-related asthma were more likely to visit emergency departments and more likely to visit physicians for worsening asthma than their counterparts with asthma that was not related to work (Breton 2006).

The Massachusetts Department of Public Health's Occupational Health Surveillance Program (OHSP) conducts surveillance of work-related asthma (WRA) based on physician reports and hospital records, as a part of the Sentinel Event Notification System for Occupational Risks (SENSOR) funded by the National Institute of Occupational Safety and Health (NIOSH). As a sentinel event surveillance system, SENSOR is not intended to identify all cases, or even a large proportion of cases of WRA. Each case of WRA is considered a sentinel health event: an event that may indicate a problem in a particular workplace, or a more widespread problem in an industry or occupation, or associated with a particular process or product. Each sentinel health event serves as a warning signal that preventive intervention is needed (Rutstein 1983). In SENSOR, only individuals that have a doctor's diagnosis of asthma and asthma symptoms associated with work are considered confirmed WRA cases. Confirmed cases are classified as either new onset asthma or pre-existing asthma aggravated by work (Jajosky 1999).

Among sentinel cases of WRA reported during the period 1993 through 2000 in Massachusetts and in three other SENSOR states (Michigan, California and New Jersey), educational services was the third most frequent industry of employment. Confirmed WRA cases in educational services in the four states accounted for 9% of the 2995 cases reported during this period (Mazurek 2005, NIOSH 2002). In Massachusetts, 13% of confirmed WRA cases in the period 1993 to 2004 were employed in educational services, second only to the health care industry (MDPH OHSP 2005). While SENSOR likely captures only a small proportion of the WRA cases that may occur in educational services, the finding of WRA cases in the educational services industry is an indication that further investigation into the causes of these cases is warranted.

Respiratory Hazards in Schools

The presence in schools of environmental hazards related to respiratory health has been documented in a number of reports, prior to this pilot project and since. The US Government Accounting Office (GAO) reported on building conditions in schools throughout the United States, finding that 19.2% of schools in the US and 31% of Massachusetts schools had poor (unsatisfactory or very unsatisfactory) indoor air quality (US GAO 1995, US GAO 1996). A report by the National Center for Education Statistics within the US Department of Education found that 18% of US schools had unsatisfactory indoor air quality (US Dept of Ed 2000). A report on Boston public schools by the Massachusetts Coalition for Occupational Safety and Health (MassCOSH) and the Boston Urban Asthma Coalition (BUAC) (MassCOSH 2006) and investigations of schools statewide conducted by Massachusetts Department of Public Health, Center for Environmental Health (MDPH CEH, CDC 2007) have documented the occurrence of leaks in roof and plumbing, dampness and mold, as well as pests in Massachusetts schools. These and other poor indoor environmental conditions have been associated in numerous studies with respiratory problems or asthma (Lopes 2006, Park 2006, Fletcher 2006, Cox-Ganser 2005, Cohn 2005, Alarcon 2005, Dangman 2005, Salam 2004, Fryer 2004, IOM 2004, Saarinen 2003).

Asthma and Respiratory Symptoms among School Staff

While the occurrence of poor environmental conditions in schools has been well documented and characterized, the occurrence of respiratory symptoms and asthma at elevated rates in school personnel is less well established. Several population-based studies have shown that teachers and school personnel are at increased risk of asthma and related symptoms (Bang 2005, Arif 2003, 2002, Kraut 1997), but other studies have not found elevated rates in school personnel (Arif 2005, Le Moual 2004). Whelan et al (2003) found elevated prevalence of symptoms consistent with asthma (chest wheezing or whistling) among teachers, while physician-diagnosed asthma among teachers was similar to that of all young working women, aged 18-45.

A recent study in Connecticut has shown that teachers presenting to occupational health clinics with asthma frequently reported visible mold and dampness in their schools (Dangman 2005). However, the prevalence of WRA in educational services workers and the specific hazards in the school environment that may be associated with respiratory problems in school staff have not been clearly defined. In Massachusetts, there has not been a standard survey or reporting tool available to determine work-related asthma among school employees, or any other occupational or industry group. Further investigation of the prevalence of work-related asthma and the associated hazards in schools may assist school administrations with prioritizing remediation efforts, focus resources to improve school indoor air quality, and help prevent asthma in school personnel and students.

To learn more about the best way to survey school employees regarding their respiratory health and inform future research, OHSP developed a short, anonymous, self-administered questionnaire to gather information on the prevalence of asthma and respiratory symptoms in school personnel and piloted delivery of this questionnaire to school personnel in a convenience sample of Massachusetts public elementary schools. The survey instrument included questions about the presence in schools of environmental exposures previously associated with asthma or respiratory symptoms. Also included was an open-ended question about health concerns related to exposures in schools. These concerns were of key interest to the Massachusetts Teachers

Association (MTA), and Healthy Schools Network, partners in planning and conducting the survey.

The terms school staff, school personnel and educational services workers are terms used interchangeably in this report to describe individuals employed in the schools, including custodial and cafeteria workers, administrative and guidance staff, school health nurses, as well as classroom teachers, all of whom were the target of our survey efforts.

METHODS

Survey Development

OHSP developed an anonymous, 55 question survey instrument, the School Staff Survey, based on a review of existing instruments, and with input from National Institute for Occupational Safety and Health (NIOSH), the Center for Survey Research at the University of Massachusetts Boston, the Massachusetts Healthy Schools Network, the Massachusetts Teachers Association (MTA), and partners from occupational health programs in other northeastern states. The survey included multiple choice questions related to asthma and respiratory symptoms and environmental exposures in schools that are potential risk factors for occupational asthma. One open-ended question, "*What are your health concerns related to exposures at your school?*" was included to identify key concerns and determine if there were health and environmental issues among school staff that had not been addressed by the multiple choice questions. This information might be used to augment or improve the questionnaire for use in subsequent surveys and was also of key interest to the Massachusetts Teachers Association (MTA) and Healthy School Network, partners in planning and conducting the survey. Demographic information including age, race, height, weight, education level and occupation was also collected, as was smoking status. The survey is attached as Appendix A.

The School Staff Survey was designed to identify asthma (both lifetime and current) and respiratory symptoms consistent with asthma, as well as the temporal relationship between work and these symptoms among respondents. School staff respondents were classified as having asthma or respiratory symptoms based on their responses to the questions listed in Table 1. School staff survey questions used to classify cases of lifetime asthma, current asthma, and work-related asthma were the same as those used by the Behavioral Risk Factor Surveillance System (BRFSS)[1] to allow estimates of asthma prevalence among school staff to be compared with Massachusetts population estimates.

The School Staff Survey asked specific questions regarding indoor environmental conditions (Table 2) that have been associated with respiratory problems or asthma. These included, among others, mold, leaks, construction activities, pesticides, and cockroaches (Salam 2004, Fryer 2004, IOM 2004, Saarinen 2003). The survey also asked questions about other work area conditions that may contribute to poor indoor air quality, including the absence of sufficient outdoor air ventilation and the presence in the classroom of animals, carpeting, art materials, cleaning products, and gas appliances. The survey focused on exposures occurring in the last 12 months,

[1] BRFSS is a nationwide Center for Disease Control Program, which tracks health risks through random telephone surveys.

and addressed agents present in either the building where the staff member was currently employed, or the work area, defined as the classroom, office or other area where the staff member spent the most time**.**

Table 1. School Staff Survey Questions Related to Asthma, Work-related Asthma, Respiratory Problems and Work-related Respiratory Problems

Survey Questions	**Classification based on a YES response to survey question**
Have you ever been told by a doctor, nurse or other health professional that you have asthma?*	Lifetime Asthma
Do you still have asthma?*	Current Asthma
Have you ever been told by a doctor, nurse or other health professional that your asthma was related to any job you ever had?* AND/OR Have you ever told a doctor, nurse or other health professional that your asthma was related to any job you ever had?*	Work-related Asthma
In the last 12 months, have you coughed, wheezed, had chest tightness, or shortness of breath when you did not have the cold or the flu?	Respiratory Symptoms *If yes response to any one of the four symptoms.*
Are your breathing problems better away from work? Worse after starting work?	Work-related Respiratory Symptoms

Source: OHSP, Mass. Dept of Public Health, School Staff Survey, May 2004

*Questions with the same wording as Behavior Risk Factor Surveillance System Survey, as administered in 2001and 2002 in Massachusetts.

Survey Methods

In consultation with MTA representatives, a convenience sample of 17 elementary schools was selected for inclusion in the study, based on location within 50 miles of Boston and the presence of an MTA representative who could distribute and collect surveys. The schools were not selected based on a history of air quality complaints, recent renovations or age of the schools, and included both urban and suburban schools. School principals and superintendents were contacted to request permission to distribute surveys to staff and collect them within one to two weeks. Thirteen schools agreed to participate. Schools not participating indicated concerns about the amount of time it would take to complete the survey.

In May 2004, MTA representatives distributed the School Staff Survey to about 800 elementary school staff in the 13 participating schools. MTA representatives from these schools reported that they distributed the survey by hand and/or school mail to teachers, administrative staff, guidance counselors as well as housekeeping, food preparation and maintenance staff. Completed surveys were collected and returned to the MTA representative, who returned the surveys to OHSP by mail within two weeks of having received the blank survey forms. An incentive of $300 worth of school supplies was offered to the school with the highest response rate.

Table 2. School Staff Survey Questions Related to Building and Work Area Conditions Experienced in the Last 12 Months

Building
Have you seen any ***cockroaches*** in your school building?
Have ***pesticides*** been applied in your school building?
Has there been any school ***construction*** or renovation in your building?
Have you observed ***mold*** or smelled musty odors in your school building?
Have there been any roof, plumbing or other ***leaks*** in your school?
Work Area
Have you had any ***gas appliances*** in your work area?
Have you had any ***windows that do not open*** in your work area?
Have you had any ***animals*** in your work area?
Have you had any ***air conditioning*** in your work area?
Have you had any ***wall to wall carpeting*** in your work area?
Have you had any ***art materials*** in your work area?
Have you personally used any ***cleaning products*** in your work area?

Source: OHSP, Mass. Dept of Public Health, School Staff Survey, May 2004

Survey Analysis

Completeness and Representativeness

Completeness of the survey is measured as the response rate among the target population. The number of staff members in the target population was determined from staff size numbers provided by MTA representatives, school principals or the school website.

The representativeness of the survey was evaluated against expected demographic characteristics of the target population. Specific gender and racial/ethnic distributions of school staff were not available by school. The demographic distribution of educational services workers in elementary and secondary schools (SIC code 7860) in Massachusetts, determined from the Community Population Survey (CPS) for the academic year in which the survey was distributed, was used as the basis for this comparison.[2]

Prevalence Estimates

The prevalence of respiratory health conditions and school-related exposures were assessed based on school staff responses to specific questions related to respiratory problems and school environmental hazards, respectively. A prevalence estimate was calculated as the proportion of all responding school staff who reported the health condition or school hazard. It should be noted that the survey was distributed to a convenience sample, rather than a random sample of schools, and findings cannot be considered representative of the prevalence of these conditions in other schools in Massachusetts. Also the response rate was approximately 44% and very variable across schools. The findings should be interpreted with caution as there is a possibility of bias in

[2] While this survey was distributed only to elementary school personnel, it is not possible to separate out elementary school from secondary school personnel in the Community Population Survey (CPS).

the results, if those staff with respiratory problems and those observing environmental problems were more likely to participate in the survey.

Health Conditions and Environmental Exposures of Concern

Narrative responses to the open-ended question *"what are your health concerns related to exposures at your school?"* were reviewed and summarized. School staff tended to report concerns related either to their health or to a specific school building exposure. In the analysis, school staff narrative responses were categorized as either health concerns or school exposure concerns, and common responses within these categories were further categorized into groups such as exposure concerns related to indoor air-quality and health concerns related to upper respiratory tract conditions or symptoms.

RESULTS

Survey and delivery methods

Three hundred and fifty-nine surveys were completed by school staff in the 13 participating schools and returned to OHSP. These represented approximately 44% of the total number of surveys distributed. Response rates by school ranged from 18% to 96% (median 41%). Neither the size of the school staff (mean staff size 63, range 23-116), nor the percentage of students eligible for free school lunch (1%-86%) were associated with the staff response rate. The response rate among school staff employed as teachers was slightly higher than for all respondents (57%). The union representatives who volunteered to distribute the survey were instructed to deliver survey packets to staff mailboxes and by hand to staff without mailboxes. At some schools, however, surveys were distributed in person at staff meetings. Information on the method of distribution was not available for four of the thirteen schools.

Pilot results

The survey was designed as a pilot, and data collected on asthma, respiratory symptoms and school environmental conditions should be considered preliminary.

The demographic characteristics of the school staff participating in the survey are shown in Table 3. The majority of respondents were female (91%) and had completed more than four years of college (69%). The median age of school staff was 43 years. Ninety-four percent of respondents indicated that they were White; other races reported included Black and Asian. Less than 3% of staff respondents were Hispanic or Latino. While most of the respondents were teachers (72%), health professionals, administrative staff, cafeteria workers, library staff, custodians, and other school staff also participated in the survey. The majority of respondents described themselves as never smokers (74%); one-quarter reported being former smokers (25%). Only 1% reported being current smokers. Compared to the distribution of Massachusetts educational services workers (CPS), responding school staff were more likely to be female, teachers, and have at least a 4-year college degree.

Table 3. Demographic Characteristics of School Staff Respondents (n=359) and Massachusetts Educational Services Workers[a]

	School Staff Survey Respondents	Massachusetts Educational Services workers (2004) [a]
Median Age (years)	43	[b]
White	94 %	91.1 %
Hispanic or Latino	3 %	3.2 %
Female	91 %	72.8 %
Body mass index (median)[c]	24	[b]
Education (highest level attained)		
High school graduate or less	5 %	19.2%
Some college	10 %	13.5%
4-year college graduate	16 %	29.3%
More than college	69 %	38.0%
Occupation		
Teachers	72 %	51.4 %
Health professionals	6 %	9.6 %
Administrative staff	5 %	16.7 %
Library staff	5 %	9.5 %
Cafeteria workers	2 %	3.3 %
Custodians	1 %	5.1 %
Other	9 %	4.4 %
Smoking status		
Current	1 %	[b]
Former	25 %	[b]
Never	74 %	[b]

Source: OHSP, Mass. Dept of Public Health, School Staff Survey, May 2004

[a] Demographic data obtained from the Community Population Survey (CPS), US Census, for academic year September 2004 through June 2005; includes both elementary school and secondary school personnel.
[b] Data not available in CPS.
[c] Body Mass Index is calculated from height and weight. The median reported here is within the "normal" range of 18.5-24.9. See http://www.cdc.gov/nccdphp/dnpa/bmi/calc-bmi.htm

Prevalence of Respiratory Problems

Prevalence estimates of asthma and the proportion of current asthma that is work-related asthma obtained through the School Staff Survey are presented in Table 4, along with population estimates obtained from the Massachusetts BRFSS. As shown, 10% of school staff respondents (n=36) reported currently having asthma, similar to the proportion (9.7%) of all Massachusetts residents and somewhat less than the proportion of Massachusetts females (12.2%) reporting current asthma in the Massachusetts BRFSS for 2004 (MDPH 2006, Breton 2006). Among

respondents with current asthma, 25% reported that their asthma was associated with work (told by and/or told to their health care provider), substantially higher than reported in the 2001-2002 Massachusetts BRFSS for all Massachusetts residents (8.8%), or for Massachusetts females (9.0%), and in a three state BRFSS report (7.4% - 9.7%) based on 2001 data (Flattery 2006).

An additional 21% of the respondents reported experiencing one or more symptoms associated with asthma (wheezing, coughing, chest tightness, or shortness of breath in the last 12 months at times when they did not have a flu or cold). US population prevalence estimates for one or more of these symptoms were not available; however, the reported prevalences of similar symptoms in the European Community Respiratory Health survey were comparable to those found in this pilot Chinn 2004, European Community Respiratory Health Survey 1996). The prevalence of wheeze among respondents in the school staff survey (11.4 %) was slightly less than that estimated from National Health And Nutrition Examination Survey (NHANES) for 2004 (13.1%) (CDC 2004b). Nearly half of the respondents reporting any symptoms (48%) indicated that their symptoms were related to work. Overall, among the 31% of staff respondents who reported either asthma or respiratory symptoms during the previous year, 41% indicated that their condition was related to work. Overall, 13% of all school staff respondents (46/359) indicated that they had a work-related respiratory condition.

Table 4. Estimated Prevalence of Lifetime Asthma, Current Asthma, and Proportion of Asthma that is Work-related in School Staff Respondents and Massachusetts Adults[a]

Respiratory Condition	School Staff Respondents (n = 359)	Massachusetts Adults[a] (95% Confidence Interval)	Massachusetts Adult Females[a] (95% Confidence Interval)
Prevalence of Lifetime Asthma	13%	14.9% (13.9–16.0)	17.8% (16.4-19.3)
Prevalence of Current Asthma	10%	9.7% (8.8– 10.5)	12.2% (10.9-13.4)
Percent of Current Asthma related to work	25%	8.8% [b] (7.0– 10.6)	9.0% [b] (6.8 – 11.3)

Source: OHSP, Mass. Dept of Public Health, School Staff Survey, May 2004

[a] Prevalence estimates for Massachusetts adults are based on findings from Massachusetts Behavioral Risk Factor Surveillance System for 2004, available on line at: http://www.mass.gov/Eeohhs2/docs/dph/behavioral_risk/report_2004.pdf. Questions about work-related asthma were not asked in 2004.

[b] Questions about work-related asthma were included in the Massachusetts BRFSS in 2001 and 2002. See analysis by Breton 2006.

School Environmental Exposures

Seventy-four percent of respondents (267) reported at least one school building exposure. The presence of leaks in the roof or plumbing, reported by 61% (219) of respondents, was the

building condition most frequently observed by school staff. The presence of mold or musty odors was also common; 47% (169) of responding school staff reported this exposure. Fifteen percent of staff reported school construction or renovation in their schools, and 5% of staff had seen cockroaches in the school buildings.

In response to the question about their specific work area, 83% of respondents (298) reported that they had used cleaning products in the last 12 months. School staff also frequently reported having art materials (70%) and wall-to-wall carpeting (51%) in their work area. Twenty eight percent had air-conditioning and 12% of staff had windows that did not open. Fewer than 3% of staff had gas appliances in the work area.

Health Conditions of Concern

In response to the question "*do you have any health concerns related to exposures at your school*," 26% of' staff responded "yes." In response to the follow-up open-ended question "*what are your health concerns related to exposures are your school*," 56 staff indicated specific health concerns, which are summarized below in Table 5. Health concerns noted were separated into the following categories: upper respiratory tract, defined as any condition relating to the nasopharynx, oral cavity, or throat; lower respiratory tract, defined as any condition relating to the bronchial tract or the lungs; and other health concerns. Of note, 14 school staff reported concerns about allergies, which were the most frequently reported single health concern.

Table 5. Distribution of Health Conditions of Concern among Staff Who Reported Health Concerns (n = 56)

Self-Reported Health Concerns	Percent
Upper Respiratory Tract[1]	52%
Lower Respiratory Tract[2]	25%
Other[3]	23%
All reported health concerns	100%

Source: OHSP, Mass. Dept of Public Health, School Staff Survey, May 2004
[1]URT category includes allergies, sneezing, sinus infection, stuffy, nose, sinusitis, bloody nose, sore throat, dry throat and red itchy eyes.
[2]LRT includes asthma, coughing, shortness of breath, chest tightness, bronchial irritation.
[3]Other includes headaches, cancer, comfort, high blood pressure, skin irritation and chemical sensitivity.

School Exposures of Concern

In response to the question "*what are your health concerns related to exposures at your school*?" 142 staff indicated specific exposures of concern. These are summarized below in Table 6. The majority of concerns were related to indoor air-quality, mold, or dust.

Table 6. Distribution of School Exposures of Concern among Staff Who Reported Exposure Concerns (n = 142)

Self-Reported School Exposures	Percent %
Indoor Air Quality[1]	28%
Mold	25%
Dust	17%
Chemical Hazards[2]	11%
Dirty carpet	5%
Leaks	5%
Pests[3]	3%
Other[4]	6%
Total reported exposures	100%

Source: OHSP, Mass. Dept of Public Health, School Staff Survey, May 2004

[1] IAQ includes concerns related to ventilation, humidity, temperature, and air conditioning.
[2] Chemical hazards category includes concerns related to chipping paint, natural gas, asbestos, pesticides, bus exhaust, pollen and chalk.
[3] Pests category includes concerns related to ants, wasps, mouse droppings and lice.
[4] Other category includes concerns related to stress, cutting grass, electromagnetic fields, and construction.

DISCUSSION

Findings

The findings of this pilot project indicate that self-reported information on respiratory symptoms in school staff and environmental conditions in schools can be effectively collected using a brief, anonymous, written questionnaire distributed by school personnel. The information collected, albeit limited, can be compared to the sentinel surveillance information that is collected by OHSP and corroborates the occurrence of work-related respiratory problems among educational services workers and the presence in schools of adverse environmental conditions that have been associated with asthma.

The proportion of respondents reporting asthma in this survey was similar to the proportion of all adults and somewhat lower than the proportion of all females reporting current asthma in the Massachusetts BRFSS. The proportion of respondents reporting respiratory symptoms was similar to that found in national and international population studies. However, the proportion of respondents who attributed their current asthma or respiratory problems to the school environment (25% and 48%, respectively) was much higher than estimates from the 2002 BRFSS in Massachusetts and the 2001 BRFSS in California, Massachusetts and Michigan. While this excess of reported work-related respiratory conditions suggests an association between school environmental conditions and asthma and respiratory symptoms, this result

should be interpreted cautiously given the pilot nature of this project and the limitations discussed below.

Limitations

The survey was distributed to a convenience sample – a set of schools with MTA representatives identified by the MTA as likely to participate – rather than a random sample of schools. While this provides a valid sample for testing the questionnaire and the procedures for its administration, the findings regarding the occurrence of respiratory problems and environmental conditions from these schools cannot be considered representative of other schools in Massachusetts because the participating schools were not selected to be representative of the range of schools in Massachusetts. Further, the decision of the schools to participate in the survey may have been influenced, either positively or negatively, by the presence or absence of environmental problems at the school.

Further caution in interpreting these results is warranted by the somewhat low and variable survey response rate among the participating schools. The response rate over all participating schools was about 44%. Response rates of 44% are not optimal, but are increasingly common in surveys, and the findings should not be disregarded. However, the fact that the response rate was very variable across the participating schools (18-96%, median 41%) raises a strong possibility that the results are biased. It is possible that response rates were higher in schools with prominent environmental problems or in schools having many staff with respiratory problems. Even in schools with less prominent problems, those staff with respiratory problems and those observing environmental problems (or both) could have been more likely to participate in the survey. A bias in reporting does not suggest a coordinated or conscious effort to skew the survey results. It merely arises because people are more likely to take the time to complete a survey on issues that concern them and the presence of adverse conditions is more likely to be noticed and be a matter of concern than is the absence of adverse conditions.

The variable response rate among schools may be in part a result of the failure to institute clear, consistent methods for distribution and collection of surveys across schools, rather than any bias. However, given the potential for response bias, the overall findings regarding the occurrence of respiratory symptoms and environmental conditions from these schools cannot be considered representative of actual conditions across the participating schools because we cannot rule out the possibility that respiratory conditions and environmental problems were over-reported.

Implications

The findings of the pilot project, while limited given the cautions above, taken together with SENSOR and other published reports, suggest that further research of respiratory health among school personnel and its association with environmental conditions in schools is feasible and warranted.

This pilot provided valuable lessons to be taken into account in future studies. The survey instrument was effective in collecting self-reported information on respiratory health and

environmental conditions among school staff that could be compared to sentinel findings and population-based estimates. The input of the Massachusetts Teachers Association was instrumental in developing and implementing the survey. However, failure to institute clear, consistent methods for distribution and collection of surveys across schools introduced widely disparate participation rates. Should the School Staff Survey be repeated, a number of methodological changes are needed:

- Maintain better control of survey distribution; at a minimum, establish a standard method or range of methods for distributing the survey, train union representatives distributing the surveys, and track the method of distribution in each school. Ideally, the survey study should be designed to include mechanisms and resources to allow for follow-up of non-respondents to improve overall response and limit potential biases. Consider sending surveys by mail to the residences of the school staff. While mailing of surveys increases costs, it provides a mechanism for tracking non-respondents. Anonymity can be maintained by using numbered surveys and maintaining survey data separate from mailing databases.
- Use a random or stratified random selection of schools and survey all staff in these schools. If participation is again low, a less biased analysis may be possible by conducting a nested case-control analysis.

Optimally, future studies on respiratory disease among school staff would also be able to examine health outcomes in relation to standardized objective assessments of school environmental conditions. The Environmental Health Tracking program at MDPH has recently reported higher rates of asthma in children attending schools with documented moisture or mold problems (Suzanne Condon, personal communication, June, 2007, CDC 2007). The capacity to link findings regarding health outcomes among staff and students' health with each other and with school environmental conditions, will provide further information and incentive to abate hazards in the school environment. Current research regarding many of the school hazards, such as dampness, mold, pests and pesticides, is sufficient to trigger prevention steps now. Continuing research will help build a better understanding of the associations between school conditions and respiratory health and will provide more specific data that can be used to protect the health of students and staff alike.

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ABOUT YOUR HEALTH

1. In the last 12 months, have you had any of the following breathing problems at times when you did not have a flu or cold?

	YES	NO	DON'T KNOW
a. Wheezing	☐	☐	☐
b. Coughing	☐	☐	☐
c. Chest tightness	☐	☐	☐
d. Shortness of breath	☐	☐	☐

- **If you answered "YES" to any of the items in Question 1, proceed to Question 2**
- **If you answered "NO" to all the items in Question 1, go to Question 18 on page 2**

2. In the last 12 months, about how many days have you had any of the breathing problems you indicated in Question 1?

☐ 1 - 5 days
☐ 6 - 10 days
☐ More than 10 days

3. In what month and year did your breathing problems begin?

_____/_____ Write in month and year

4. Do you currently have breathing problems?

☐ Yes
☐ No

5. In the last 12 months, have your breathing problems been different when you were away from work (for example, on weekends or when you were on vacation)?

☐ Yes
☐ No → **If No, go to Question 7**

6. How were they different?

☐ My breathing problems were worse when I was away from work
☐ My breathing problems were better when I was away from work

7. In the last 12 months, have your breathing problems changed soon after starting your work day?

☐ Yes
☐ No → **If No, go to Question 9**

8. How did they change?

☐ My breathing problems were worse after starting work

☐ My breathing problems were better after starting work

9. Did your breathing problems first start after you breathed something irritating?

☐ Yes
☐ No → **If No, go to Question 11**

9a. What did you breathe?

_____

10. Where were you when you breathed something irritating?

☐ At home
☐ At work
☐ Somewhere else → Please specify:

_____

11. Do you try to avoid certain activities or places because they make your breathing problems worse?

☐ Yes
☐ No → **If No, go to Question 13**

12. What activities or places do you try to avoid?

_____

_____

13. In the last 12 months, have you used any prescription medication for your breathing problems? This includes using an inhaler.

☐ Yes
☐ No → **If No, go to Question 25**

14. What prescription medication for your breathing problems have you used?

_____

_____

15. Compared to the work week, how often do you use your prescription medication for your breathing problems on the weekends?

☐ I use more medication on the weekends
☐ I use less medication on the weekends
☐ I use the same amount of medication on the weekends

16. Do you use more prescription medication for your breathing problems during allergy season?

☐ Yes
☐ No → **If No, go to Question 18**

17. In which months do you use more prescription medication?

_____

_____

18. Have you ever been told by a doctor, nurse or other health professional that you have asthma?

☐ Yes
☐ No → **If No, go to Question 29**

19. In what month and year did your asthma symptoms begin?

_____/_____ Write in month and year

20. Have you ever been told by a doctor, nurse or other health professional that your asthma was related to any job you ever had?

☐ Yes
☐ No → **If No, go to Question 22**

21. Have you ever been told by a doctor, nurse or other health professional that your asthma was related to your current job?

☐ Yes
☐ No

22. Have you ever told a doctor, nurse or other health professional that you thought your asthma was related to any job you ever had?

☐ Yes
☐ No → **If No, go to Question 24**

23. Have you ever told a doctor, nurse or other health professional that you thought your asthma was related to your current job?

☐ Yes
☐ No

24. Do you still have asthma?

☐ Yes
☐ No → **If No, go to Question 29**

25. Are there things at work that make your asthma worse?

☐ Yes
☐ No → **If No, go to Question 27**

26. What things at work make your asthma worse?

_____

_____

27. Think about the building at work where you spend the most time. Overall, since you started working in that building, how has your asthma been?

☐ It has gotten better
☐ It has gotten worse
☐ It has stayed the same

28. In the last 12 months, how much time have you missed from work because of your asthma?

☐ No days
☐ 1 - 5 days
☐ 6 - 10 days
☐ More than 10 days

29. Have you ever been told by a doctor, nurse or other health professional that you have any lung disease other than asthma?

☐ Yes
☐ No → **If No, go to Question 31**

30. What were you told that you had?

_____

_____

ABOUT YOUR WORK

31. What is your current occupation?

☐ Classroom teacher
☐ Other teacher → Please specify:

_____

☐ Cafeteria worker
☐ Custodian
☐ Administrative Staff
☐ Other → Please specify:

_____

32. In what year did you start working in this occupation?

_____ Write in year

33. Do you work in more than one building at this school?

☐ Yes → If you work in more than one building, please answer the next questions about the building at this school where you spend **most of your time**.

☐ No
☐ There is only one building at this school

34. In what month and year did you start working in your school building?

_____/_____ Write in month and year

35. In the last 12 months, have there been any roof, plumbing or other leaks in your school building?

☐ Yes
☐ No → **If No, go to Question 37**
☐ Don't know → **If Don't Know, go to Question 37**

36. Where were the leaks?

_____

_____

37. In the last 12 months, have pesticides been applied <u>in</u> your school building?

☐ Yes
☐ No
☐ Don't Know

38. In the last 12 months, have you observed mold or smelled musty odors in your school building?

☐ Yes
☐ No

39. In the last 12 months, have you seen any cockroaches in your school building?

☐ Yes
☐ No

40. In the last 12 months, has there been any school construction or renovation in your building?

☐ Yes
☐ No
☐ Don't Know

41 Your "work area" is the classroom, office, temporary building, or other area where you spend most of your time.

How many hours <u>each week</u> are you in your work area?

_____ Write in hours per week

42. In the last 12 months, have you had any of the following items <u>in your work area</u>?

	YES	NO
a. Animals	☐	☐
b. Wall to wall carpeting	☐	☐
c. Art materials	☐	☐
d. Air conditioning	☐	☐
e. Windows that open	☐	☐
f. Gas appliances	☐	☐

Please continue with Question 43 on the back

43. In the last 12 months, have you personally used any cleaning products <u>in your work area</u>?

☐ Yes
☐ No → **If No, go to Question 46**

44. In the last 30 days, on how many days did you personally use any cleaning products <u>in your work area</u>?

_____ Write in number of day (0-31)

45. Please list the names of the cleaning products you have used in your work area in the last 30 days.

_____

_____

ABOUT YOU

46. Are you?

☐ Male
☐ Female

47. In what month and year were you born?

_____/_____ Write in month and year

48. How tall are you?

_____feet _____inches

49. How much do you weigh?

_____ pounds

50. Which of the following best describes you?

☐ Current smoker
☐ Former smoker
☐ Never smoked

51. What is the highest grade or level of school that you have completed?

☐ 8th grade or less
☐ Some high school, but did not graduate
☐ High school graduate or GED
☐ Some college or 2 year degree
☐ 4-year college graduate
☐ More than 4-year college degree

52. Are you of Hispanic or Latino origin or descent?

☐ Yes, Hispanic or Latino origin
☐ No, not Hispanic or Latino origin

53. What is your race? Please check all that apply.

☐ White
☐ Black or African-American
☐ Asian
☐ Native Hawaiian or other Pacific Islander
☐ American Indian or Alaska Native
☐ Other (Please specify: _____)

54. Do you have any health concerns related to exposures at your school?

☐ Yes
☐ No → **If No, go to Question 56**

55. What are your health concerns related to exposures at your school?

_____

_____

_____

_____

_____

_____

56. Thank you for your participation in this study!

Please return this survey to the designated envelope in the main office.