CDC Workplace Safety and Health™

NIOSH HEALTH HAZARD EVALUATION REPORT:

HETA #2000-0168-2871
Nassau Community College
Garden City, New York

March 2002

DEPARTMENT OF HEALTH AND HUMAN SERVICES
Centers for Disease Control and Prevention
National Institute for Occupational Safety and Health

NIOSH

PREFACE

The National Institute for Occupational Safety and Health (NIOSH) conducts investigations and studies of possible health hazards in the workplace. These investigations are conducted under the authority of Section 20(a)(6) of the Occupational Safety and Health Act of 1970 (29 USC 669(a)(6)) which authorizes the Secretary of Health and Human Services, following a written request from any employer or authorized representative of employees, to determine whether any substance normally found in the place of employment has potentially toxic effects in such concentrations as used or found.

NIOSH also provides, upon request, technical and consultative assistance to Federal, State, and local agencies; labor; industry; and other groups or individuals to control occupational health hazards and to prevent related trauma and disease. Mention of company names or products does not constitute endorsement by NIOSH.

ACKNOWLEDGMENTS AND AVAILABILITY OF REPORT

This report was prepared by Patricia L. Schleiff of the Field Studies Branch (FSB), Division of Respiratory Disease Studies (DRDS). Other DRDS staff involved in the field work were Randy Bolystein, Khaled Elsherbini, Amber Harton, Christie Kerrigan, Ju-Hyeong Park, Chris Piacitelli, Jim Taylor, Brian Tift, and Daniel Yereb. The following DRDS staff were involved in the initial site visit: Jean Cox-Ganser and Carol Rao. In addition, the DRDS staff who assisted in data management and processing were Barbara Bonnett, Amber Harton, Christie Kerrigan, and Brian Tift; and Michael Attfield and Kathleen Kreiss assisted in the review process. Medical record review was performed by Eileen Storey. Desktop publishing was performed by Terry Rooney.

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Highlights of the NIOSH Health Hazard Evaluation at Nassau Community College

NIOSH was asked by the Nassau Community College Federation of Teachers and by the President of the college to conduct a health hazard evaluation of respiratory health and indoor air quality at their campus in Garden City, New York. Health concerns included asthma, chronic sinusitis, hypersensitivity pneumonitis, respiratory infections, and dermatitis among occupants of campus buildings.

What NIOSH Did

- Conducted a questionnaire survey of Nassau Community College full-time employees, focusing on respiratory health.
- Reviewed medical records of employees.
- Assessed rooms in campus buildings for water damage and mold.
- Reviewed environmental sampling results and reports from 14 previous indoor air quality investigations.
- Assessed all this evidence to see if campus buildings were contributing to chest problems in employees.

What NIOSH Found

- Cluster building (A through F) and Library employees reported more chest and nasal/sinus symptoms which improved away from the workplace than those employees in other surveyed buildings on campus.
- Asthma and scarring lung disease was reported on some medical records.
- Employees in rooms with water damage or mold had about twice as many chest complaints as employees in undamaged rooms.
- Eighteen percent of employees reported that a physician had diagnosed them with asthma, in comparison to a state population rate of 10%.
- NIOSH found relationships between water damage and mold and reported chest symptoms.
- Based on all the evidence, NIOSH concluded that building-related factors have led to an excess of chest complaints at Nassau Community College in the 1970s buildings.

What Nassau Community College Managers Can Do

- Promptly fix water leaks and replace material that has been wet for a day or longer.
- Promptly remove visible mold. Hire a consulting firm with experience in planning how to remove mold, including hidden mold in walls.
- During construction or renovations, control exposures to dusts and other contaminants.
- Involve a local occupational health clinic to help in the early identification of work-related symptoms and to advise about relocation of affected persons.
- Disseminate the findings of this report to all faculty and staff.

What Nassau Community College Employees Can Do

- Get chest symptoms evaluated.
- Get involved in programs that are established to help improve the conditions at the college.
- Report water leaks, visible mold and odor to management.

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National Institute for Occupational Safety and Health
NIOSH

HETA 2000-0168-2871
Nassau Community College
Garden City, New York

Patricia L. Schleiff, MS
Ju-Hyeong Park, MPH, Sc.D
Daniel J. Yereb, MS

SUMMARY

Nassau Community College (NCC), located in Garden City, New York, is the largest two-year community college in the State of New York, employing over 1,200 full time faculty and staff in 40 different buildings on a 225 acre campus. On February 29, 2000, the National Institute for Occupational Safety and Health (NIOSH) received a formal request to conduct a health hazard evaluation (HHE) at the Nassau Community College. The request, submitted by the Nassau Community College Federation of Teachers (NCCFT), was concerned with indoor air quality-related health effects, including asthma, chronic sinusitis, hypersensitivity pneumonitis, respiratory infections, and dermatitis, within eight specified buildings on campus. On March 16, 2000, a second request was submitted from the President of NCCFT and the President of NCC amending the initial request to include all existing structures on campus. This request followed 20 years of reports and environmental investigations at the college of water incursions, relative humidity problems, mold growth, and ventilation problems, as well as reported respiratory symptoms. Most of these survey reports focused on environmental conditions within the academic buildings built in the late 1970s.

On October 23-27 and December 4-8, 2000, NIOSH conducted an environmental assessment of buildings cited in the request using an 'Environmental Assessment Check Sheet' for visual assessment of water stains, visible mold, mold odor, and standing water or moisture in 724 offices and laboratories in 13 buildings. The 13 buildings included seven buildings, built in 1978, with a history of water damage and six others built either prior to, or after, 1978. On November 20, 2000, NIOSH investigators mailed out health questionnaires on respiratory symptoms, supplemented with questions concerning demographic information, work history information, cigarette/cigar/pipe smoking habits, physician-diagnosed asthma, and use of latex gloves and sensitivity information, to all faculty and staff within 30 departments on campus. This was followed by attempts to increase participation and to assess respondent bias.

The objectives of the investigation were:

- to estimate the prevalence of reported respiratory symptoms, work-related symptoms, and post-hire onset of symptoms and to determine whether building-related excesses exist;
- to assess the indoor environmental factors relating to potential fungal contamination in the campus buildings;
- to examine the possible associations between reported work-related respiratory symptoms and environmental factors; and
- to examine symptom rates among the Nursing Department faculty and staff, especially in relation to their move from Cluster F in February 2000.

Findings from the environmental assessment showed clear differences between groups of buildings across the campus. Rooms within the Cluster buildings and the Library exhibited distinctly more evidence of water stains, visible mold, mold odor, and current moisture than any of the other buildings studied. The one new building examined, built in 1992, had the lowest scores for water-damage associated factors, while the older buildings, built in 1929, had levels which fell between those for the 1970s buildings and the new building.

Of the 393 participants in the questionnaire survey (71% participation), 328 were faculty and 65 were staff. Most were white and never smokers, average age 50 years, with about half being male. Overall, about one third of the participants reported symptoms of wheezing, chest tightness, shortness of breath, or attacks of coughing. About half reported any one of these symptoms. Upper respiratory symptoms, such as nasal and sinus symptoms and throat irritation, and itchy or burning eyes were reported by half to two-thirds of the participants overall. Most of the reported symptoms had onset after starting work at NCC, and about half of those who reported symptoms noted them to be work-related (either less severe or required less medication away from work). Overall, 17% of the participants reported physician-diagnosed asthma, with about half of those noting it to be post-hire onset or exacerbated by work. The prevalence of diagnosed asthma reported by those aged 35-65 years among faculty and staff respondents was 18%, compared to 10% reported overall by New York state residents of that age range.

Symptom prevalences by building group showed marked differences. Employees in the 1970s buildings (those with a history of water damage) reported substantially higher prevalences of both lower and upper respiratory symptoms that were post-hire and work-related. The prevalence of any chest symptoms post-hire was 44% for the 1970s buildings versus 14% for the older buildings (p-value < 0.05) and 21% for the new building (p-value < 0.05). Worked-related prevalences were 34, 3 and 19%, respectively (statistical significance for 1970s compared to older buildings, p-value < 0.05). Post-hire upper respiratory symptoms were not greatly different across buildings, at 72, 69 and 56%, respectively (statistical significance for 1970s compared to newer building, p-value < 0.05). However, the prevalence of work-related upper respiratory symptoms was higher in the 1970s buildings: 56% compared to 31% for the older buildings (p-value < 0.05) and 35% for the newer building (p-value < 0.05).

To explore the relationship between environmental factors in the rooms and reported symptoms and health complaints, we developed an exposure index based on reported time spent in the rooms and the assessments of stains, mold presence and odor, and moisture. Using statistical models that adjusted for employee status (faculty or staff), gender, age, cigarette smoking history, reported allergies, reported use of latex gloves, and the year of hire, we found clear evidence that symptom reporting was related to factors reflecting water damage and its sequelae. Significantly increased odds of having wheeze, chest tightness, shortness of breath, at least one chest symptom, and nasal and sinus symptoms were all related to recorded presence of visible mold (p-values < 0.05). Water stain also was associated with nasal and sinus symptoms and throat irritation (p-value < 0.05). Mold odor was associated with throat irritation and any upper respiratory symptoms or eye irritation (p-value < 0.05). Although elevated odds ratios were frequently found for moisture presence, none were statistically significant.

For participating faculty and staff within the Nursing Department (N=26), 54% reported lower respiratory symptoms and 73% reported upper respiratory symptoms or eye irritation while they were working in Cluster F. After the Nursing Department moved out of Cluster F in the early months of the year 2000, 36% of those who reported having chest symptoms prior to the move reported that their symptoms or breathing problems had either lessened or disappeared after they moved. This improvement, however, was not reflected in the reporting of upper respiratory symptoms.

Overall, the results show high prevalences of lower and upper respiratory symptoms among employees of Nassau Community College, including an excess of asthma compared to state rates. Much of the reported prevalence was likely work-related, either in terms of post-hire onset or exacerbation at work, and was confirmed by evidence from medical records of affected individuals. There were obvious differences in the environmental factors across buildings. Reduction in lower respiratory symptoms was observed among a small subset who moved from the affected buildings. Finally, there was clear evidence of association of health conditions with environmental factors, including higher symptom prevalences in water-damaged buildings and in association with exposure indices based on factors related to water damage and mold growth. Together, these provide convincing evidence that building-related disease has occurred at Nassau Community College.

We recommend the following for this workplace:

1. Promptly fix water leaks and replace material that has been wet for a day or longer. Doing so reduces the potential for microbial growth.

2. Promptly remove visible mold and further evaluate potential hidden mold reservoirs in walls, especially within the classrooms and offices of the 1970s buildings, by obtaining services from a consulting firm with experience in planning how to remove mold, including hidden mold.

3. During construction or renovations, use containment measures to control exposures to dusts and other contaminants.

4. Involve a local occupational health clinic to determine whether persons with work-related symptoms in buildings with previous water damage have building-related conditions that may require relocation. Ongoing medical consultation and surveillance of the faculty and staff can help set priorities for remediation; prevent further illness from developing; and reassure employees when the risk decreases. Medical surveillance activities may involve repeat questionnaire administration, recording of potential cases seeking evaluation, and medical testing.

5. Disseminate the findings of this report to all faculty and staff so that A) they can become more aware of their working environment and promptly report any signs of water leaks, visible mold and odors to the physical plant managers, B) they may seek medical attention if they feel that their symptoms are work-related, and C) they can become involved in programs, such as a medical surveillance program.

NIOSH documented that building-related respiratory problems were occurring among employees of Nassau Community College. Our assessments of environmental contamination showed positive associations with health outcomes. Prognosis for work-related asthma is improved by early recognition and exposure cessation. We recommend that medical surveillance be conducted for the early detection of work-related problems, both for appropriate clinical management and to show whether remediations have been effective in preventing new cases. Prompt remediation of water incursions and replacement of all wetted material that cannot be dried out in 24 hours should be carried out. During renovations, use containment measures that keep exposures to dusts and other contaminants of construction at a minimum.

Keywords: SIC 8222: indoor air quality, work-related asthma, fungal contamination

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INTRODUCTION

On February 29, 2000, the National Institute for Occupational Safety and Health (NIOSH) received a formal request to conduct a health hazard evaluation (HHE) at the Nassau Community College (NCC) in Garden City, New York. The request, submitted by the Nassau Community College Federation of Teachers (NCCFT) was concerned with indoor air quality related health effects, including asthma, chronic sinusitis, hypersensitivity pneumonitis, respiratory infections, and dermatitis within eight specified buildings on campus. On March 16, 2000, a second request was submitted from the President of NCCFT and the President of NCC amending the initial request to include all existing structures on campus. From April 2 through April 5, 2000, NIOSH investigators conducted an initial investigation of the environmental conditions and health concerns. The investigation consisted of a walk-through of certain campus buildings cited in the request, preliminary examination of existing ventilation systems and other building characteristics, and review of maintenance and health complaint records.

NIOSH field investigators conducted an industrial hygiene survey from October 23 through October 27, 2000, to assess qualitatively the indoor environment for dampness and potential biological contamination within all classrooms, laboratories, and offices of Clusters A, B, C, D, E, and F, and the Library. Five hundred and thirty-five rooms were investigated. In addition to conducting this environmental assessment, building materials with suspected fungal growth were collected, photographs were taken of some of the environmental conditions, and in-wall examinations were performed in several rooms using a boroscope and monitor to inspect the inside of the wall cavity.

On November 14, 2000, a NIOSH investigator discussed with NCCFT representatives and NCC Administration the planning stages for a questionnaire survey of employees within twelve selected buildings on campus. This included the eight specified buildings in the initial request, which were all Cluster buildings (A, B, C, D, E, and F), the Library, and Building G, and four additional buildings (Buildings H, V, Z, and Nassau Hall or Building M) that we observed during the initial investigation. A pilot test of the health questionnaire was conducted with members from NCCFT. On November 20, 2000, NIOSH investigators mailed out 1570 health questionnaires to all employees (full-time and part-time) within 30 departments in twelve campus buildings.

On December 4 through December 8, 2000, a second industrial hygiene survey was conducted to finish the qualitative environmental assessment within classrooms, laboratories, and offices of Cluster F, the Library, Buildings G, H, V, Z, and Nassau Hall. Buildings X and Q were also investigated per the request of some employees. One hundred and ninety-eight rooms were investigated during the follow-up, bringing the total number of rooms investigated to 725. Building materials with suspected fungal growth and photographs of some environmental conditions were also collected.

In addition to the environmental assessments from December 4 through December 8, 2000, health questionnaires were collected from participating employees within the twelve selected buildings. On December 13, 2000, a second set of questionnaires was mailed to approximately 300 full-time faculty and staff who did not return their questionnaire in early December. Part-time employees were not included in this mailing because of their low initial participation rate. Around the same time, in the interest of including other interested faculty and staff, the college sent NIOSH questionnaires to all faculty and staff on campus not included in the initial NIOSH mailing. Questionnaires were mailed back to NIOSH, and the collection of questionnaires continued until March 30, 2001.

On April 23 through April 27, 2001, a telephone survey was conducted to collect health information from the non-respondent population of 161 full-time faculty and staff.

On February 7, 2000, an interim letter was sent to the college summarizing some of the environmental information collected during the NIOSH site visits in October and December, 2000. This letter contained information about the distribution of rooms investigated with the 'Environmental Assessment Check Sheet' and an update on the collection of health questionnaires. On March 5, 2000, a second interim letter was sent to the college summarizing the microscopic verification of potential fungal contamination of samples of building material collected during the environmental investigations.

This report presents the results from the health questionnaire and environmental assessment surveys, a summary of the medical records that NIOSH received from faculty and staff at the college, and recommendations for improving

indoor environmental quality and reducing employee symptoms.

BACKGROUND

HISTORY

Nassau is the largest two-year community college in the State of New York. It was created in 1959 as part of the State University of New York (SUNY) system. The first classes at the college began in the early 1960's when it was located in the Old County Courthouse in Mineola, New York. In 1962, classes moved to the former United States air base at Mitchel Field in Garden City, New York, because of the increase in student enrollment. In the Fall semester 2000, over 20,000 students had enrolled in more than 30 academic departments and participated in continuing education and special programs for businesses. Approximately 1231 full-time employees, including 630 full-time faculty, were employed at the college. There was a total of some 3000 employees, including about 400 adjunct faculty and 700 students hired as part-time aides.

CAMPUS BUILDINGS

There are approximately 40 academic and administrative buildings located on the campus, which covers more than 225 acres of land. Some of the buildings (e.g., Buildings H, V, Z, Nassau Hall, North Hall, Bradley Hall) were built in the late 1920s through the early 1940s. Others, such as the Library, Physical Education Complex, Administrative Tower, and two academic wings (Clusters A-D and E-F), were built in the late 1970s. In 1992, the college built the Social Sciences and Visual Arts building (i.e., Building G) and the Student College Center. The buildings on campus are different by structure, purpose, occupant density, and ventilation systems.

The older buildings are refurbished former military buildings (e.g., hospital, barracks, hangars, Continental Air Command headquarters, 1st Bomber Command headquarters, Bachelor Officers quarters) and former military homes. Classrooms, laboratories, faculty offices, and administrative offices are located generally on two floors within these buildings. Originally, some of these buildings were wood structures. Reconstruction of some of the older buildings began in the early 1930s, where wood structures were replaced with brick structures. Most occupied spaces have operable windows. The heating and cooling systems consist of water radiators, heat pumps, and air-conditioning window units. The floors are mostly tiled, but some offices have carpet. All interior walls are sheet-rock material.

In 1975, construction began on six academic buildings, known as the Cluster buildings A through F. Construction of these buildings halted because of financial reasons, and these buildings remained exposed to the outside environment for about 5 years. By 1978, the Cluster buildings were completed. These buildings are precast concrete structures with flat roofs. They have three floors of classrooms and laboratories, except for Cluster D which has only two floors of laboratories and faculty offices. The offices are located in long corridors that are attached to classroom 'pods'. These buildings have windows that can not be opened. The heating and cooling ventilation systems are unit ventilators located under windows. These units, when operating, bring outside supply air (about 25%) over a hot water pipe during the winter seasons and a chilled water pipe during the summer seasons. Air intake vents are within 6 inches of the ground. Historically, this area was a prime nesting spot for pigeons. A pigeon control program was put into place in the early 1980's, and the number of nesting pigeons has decreased. A central air-handling unit, which is located on the roof of each of these buildings, supplies conditioned air to the interior sections of the building, such as hallways, elevator areas, classrooms, and laboratories, via air diffusers. All laboratories have exhaust hoods. The floors are tiled throughout the classrooms and laboratories, and only the offices are carpeted. Interior walls that touch exterior concrete slabs are metal wallboards. All other interior walls are sheet-rock material.

The library was also built in the late 1970s and has exactly the same interior and exterior structure as the Cluster buildings. There are three floors, all carpeted, and windows that can not be opened. The heating and cooling ventilation system is very similar to that in the Cluster buildings.

The Social Sciences and Visual Arts building is one of the newest buildings on campus. The exterior of the building is brick and the interior surfaces are sheet-rock material. There are three floors of classrooms, laboratories, and faculty offices. All occupied spaces have operable windows. The heating and cooling system consists of heat pumps and air-conditioning window units. The floors are tiled throughout the building, except for the offices, which have carpet.

HISTORICAL ENVIRONMENTAL INFORMATION

Since the early 1980s, there have been reports at the college of water incursions, relative humidity problems, mold growth, and ventilation problems, as well as reported respiratory symptoms. At least fifteen independent environmental consulting groups have evaluated building conditions since 1982. Most of these survey reports focused on environmental conditions within the academic buildings built in the late 1970s, i.e., Cluster buildings (A-F) and the Library. Typical recommendations from these environmental reports were for the proper functioning and maintenance of the ventilation systems; the proper storage of chemicals used in the laboratories; repairing moisture sources, such as roofs and pipes; replacing the water-damaged materials, such as ceiling tiles, carpets, insulation, and walls; removal of contaminated materials; maintaining proper relative humidity in occupied spaces; cleaning and sanitizing occupied spaces; and conducting a medical surveillance study.

In 1983 and 1984, NIOSH received two requests from NCCFT to perform a health hazard evaluation within two of the Cluster buildings (C and D). Faculty members were concerned about the adequacy of ventilation, temperature regulation, pigeon excrement on window ledges, building leaks, mold growth on ceiling tiles and books in offices, and insufficient cleaning and maintenance of the unit ventilators. In the earlier survey, faculty members had reported experiencing episodes of respiratory illness with prolonged absences and disruption of teaching schedules. The recommendations from these evaluations were: (1) adequate supply of outside air through unit ventilators in occupied spaces should be maintained, (2) non-functioning dampers of unit ventilators should be replaced, (3) window ledges and air intake vents should be kept clean of pigeon excrement and other debris, (4) roof and pipe leaks should be controlled, (5) mold-contaminated materials should be replaced, and (6) supply and exhaust measurements should be taken to maintain adequate rates of air so that laboratories remain under negative pressure.

RENOVATIONS AND REPAIRS OF CAMPUS BUILDINGS

Refurbishing or replacement of the flat roof tops, re-caulking (windows and precast sections), re-painting or re-wrapping hot and chilled water pipes, and replacing ceiling tiles were major focuses from 1980 through 2000 for several buildings throughout the campus. Roof repairs and re-caulking for the Cluster buildings (A-F) and the Library were reported to have occurred every six years. From 1995 to 1998, renovations were done in the office wings on the second floor of the Cluster buildings, which included replacement of hot and chilled water pipes running through the return air plenum of the second floor along the exterior perimeter of the buildings, replacement of insulation, the installation of new ceiling tiles, light fixtures, and carpet, and clean-up of the heating and cooling ventilation system.

MEDICAL SURVEY INFORMATION

The Nassau Community College Federation of Teachers Health and Safety Committee conducted two indoor air quality and medical questionnaire surveys in 1990 and 1991. We undertook an analysis of the 1991 survey data of reported respiratory health and environmental conditions within the work spaces of the 233 faculty members participants from 22 buildings on campus. We chose the 1991 survey over the 1990 survey because it had a higher response rate. The most common reported symptoms were headaches (37%), coughing (32%), fatigue (31%), sneezing (20%), and eye & throat irritation (20%). The environmental complaints, such as stuffy air (50%), temperature (48%), soot by air vents (43%), and cleanliness (41%) were commonly reported in the classrooms and offices. Drafts (57%), smokey air (51%), and odors (46%) were commonly reported only in the offices, and noise from the air vents (69%) was the most common complaint within the classrooms.

During the 1999 Fall semester, employees within the Nursing Department (N=41) located in Cluster F reported respiratory and health concerns to their Department Chair. The results of the analysis of those reported concerns are as follows: eye and throat irritation was reported in 46% of the nursing staff, sinus symptoms (e.g., sinusitis and postnasal drip) were reported in 44%, headaches in 32%, nasal symptoms (e.g., stuffy, running, itchy nose, and sneezing) in 27%, allergies in 22%, self-reported asthma in 15%, and frequent respiratory infections was reported in 15% of the nursing staff. One person in the Nursing Department died of adult respiratory distress syndrome [1997]. In early February 2000, the Nursing Department was moved from Cluster F to three other buildings on campus: Building V, Building H, and Nassau Hall.

METHODS

STUDY OBJECTIVES

The first objective of the study was to estimate the prevalence of reported respiratory symptoms, work-related symptoms, and post-hire onset of symptoms in participating current full-time faculty and staff and to compare the prevalence of reported symptoms by groups of studied buildings on campus to determine whether building-related excess existed.

The second objective was to assess the indoor environmental factors related to potential fungal contamination, which include visible signs of mold, water stains, dampness or moisture, and mold odor of studied buildings on campus.

The third objective was to examine the possible associations between reported work-related respiratory symptoms and the parameters related to potential fungal contamination by studied buildings.

The final objective was to determine whether the Nursing Department faculty and staff reported an improvement in their symptoms after they moved out of Cluster F in February 2000, and whether the reported respiratory symptom rates of the Nursing department, while they were located within Cluster F, differed from those of faculty and staff from other departments located currently within Cluster F.

STUDY BUILDINGS AND POPULATION

The campus buildings that were selected for study were all Cluster buildings A through F, Buildings G, H, V, and Z, Nassau Hall, and the Library. Cluster buildings A through F and the Library were grouped together to represent buildings of similar structure built in the late 1970s. Buildings H, V, Z, and Nassau Hall were grouped together to represent buildings built in the late 1920s, and Building G represents a 1990s building structure.

Nassau Community College Administration and the Chairpersons for each of 30 departments provided a roster of all current full-time faculty and staff and a year 2000 Telephone Directory, which were used to estimate how many questionnaires were needed for the survey. Approximately 1570 questionnaires were mailed to all faculty and staff within 30 departments on campus. After three rounds of collection, we received questionnaires from 393 out of approximately 554 full-time faculty and staff in the 12 selected buildings, a 71% response rate. We received 244 questionnaires from other faculty and staff, which includes part-time/adjunct employees, retired employees, and full-time employees who did not work in one of the studied buildings on campus. The responses of these faculty and staff were not considered further in this report, because of their low response rate and the limited amount of time these individuals spent working at the college. See Appendix D for more information.

From April 23-27, 2001, a survey was conducted to compare the non-respondent population to those who did respond, to assess the nature of any selection bias. Approximately 63 (39%) of the remaining 161 full-time faculty and staff non-respondents took part in a phone interview that asked some questions about their current respiratory symptoms, demographic information, office and classroom locations, and information about why they did not respond to the initial survey.

The faculty and staff from the Nursing Department represented a sub-group within the study population, because at the beginning of February 2000 they were relocated out of Cluster building F to three other buildings on campus. No other departments or groups of participants within the study population were relocated during that year. Approximately 74% (26/35) of the faculty and staff from the Nursing Department participated in this survey. Separate analyses were conducted to help answer the last objective of this study.

DATA COLLECTION

Environmental Assessment Check Sheet

On October 23-27 and December 4-8, 2000, NIOSH conducted an environmental assessment of buildings cited in the request using an 'Environmental Assessment Check Sheet' (see Appendix A). Clusters A through E, part of Cluster F, and part of the Library were investigated in October. The remaining work spaces in Cluster F and the Library, Buildings G, H, Q, V, X and Z, and Nassau Hall (Building M) were investigated in December. With the exception of Building G, all classrooms, laboratories, and offices were examined for current signs of moisture, water stains, visible mold growth and odor, other odors, temperature, relative humidity, floor type, heating, ventilation,

and air conditioning (HVAC) type, and square footage of the room. In Building G, about 25% (randomly selected) of all rooms on each floor were included. A total of 724 work spaces within 14 buildings were examined. Among these there were nine rooms where at least two industrial hygiene teams assessed the same room. Eight of the nine were used in the cross-evaluation to assess inter-team agreement, and the remaining one room was evaluated twice by accident. For these nine, assessments were chosen at random from among the teams to avoid duplicate measurements.

An environmental assessment check sheet was designed before the survey, based on information from prior studies of the indoor air environment. Visual and olfactory assessment of a work space involved examination of seven areas within the room. These areas or objects were the ceiling, walls, windows, floor, HVAC, pipes, and furniture. Olfactory assessment of a work space involved overall smell of odors within the room. Visual assessment for water stains involved grading the area/object observed on a 4-point scale (0-3): none, less than 5%, between 5% and 30%, or greater than 30% of the area. An average water stain score for the room was computed over all seven objects, and was used as a continuous variable and as a binary variable (i.e., stain present versus no stain present). Any visible mold in the room on any area/object was used to classify the room as having visible mold (i.e., visible mold present versus no visible mold present). Current moisture was evaluated as "damp" if wet building material existed, and "wet" if standing water existed in the room, and was used as a binary variable (i.e., moisture present versus no moisture present). Odors (mold and other) in the room were assessed by grading the odor on a 3-point scale: none, slight, or strong, and the presence of mold odor was used.

Three teams of industrial hygienists were formed by assigning two industrial hygienists per team. The assignment of two industrial hygienists depended on how well their evaluations of six selected rooms compared, and how well the industrial hygienists could detect mold odors. To assess the possibility of misclassification, eight rooms were selected during the environmental assessment in October 2000 and December 2000 to check the validity of observations of each industrial hygiene team. Cross-evaluation was done in the same room. The inter-team agreement for each measurement ranged from 63% to 100%.

Personal exposure indices were computed for each individual based on each of the four parameters (i.e.,average visible water stains, visible mold, presence of mold odor, and current signs of moisture) related to possible fungal contamination observed in work spaces and the fraction of time spent in any work space within any of the studied buildings for the Fall 2000 semester. Those participants occupying rooms in Building G that were not randomly selected to be evaluated with the environmental assessment check sheet were assigned exposure indices of a zero value.

In addition to conducting visual assessments, samples of building materials with suspected fungal contamination within these buildings, such as drywall pieces, veneer from furniture, HVAC fiberglass insulation, a small cardboard box, and ceiling tile pieces, were collected and sealed in plastic bags for microscopic verification of potential fungal contamination in the NIOSH laboratory. These samples were collected only to confirm fungal growth in these buildings, not to quantify level of fungal contamination. In-wall examinations were performed in several rooms using a 5/8-inch diameter by 8 foot long boroscope. Two-inch holes were drilled in areas where moisture incursion was known to have occurred (e.g., below windows, stains on walls, roof drains, areas of decaying sheet-rock). A monitor was used to examine the inside of the wall cavity.

Questionnaire

On November 20, 2000, NIOSH investigators mailed out health questionnaires on respiratory symptoms, supplemented with questions concerning demographic information, work history information, cigarette/cigar/pipe smoking habits, physician-diagnosed asthma, and use of latex gloves and sensitivity information to all faculty and staff within 30 departments on campus (Appendix B). The modules for respiratory questions were from the European Community Respiratory Health Survey (ECRHS)[1] and American Thoracic Society (ATS)[2] questionnaires. By March 30, 2000, NIOSH had received 393 questionnaires from full-time faculty and staff. Approximately 166 individuals were called to clarify any missing information that was reported on the questionnaire.

The Nursing department received a slightly different questionnaire to what was distributed to employees from other departments because the Nursing department was moved from Cluster F at the beginning of February 2000, and their pre- and post-move health concerns needed to be evaluated. Therefore, detailed respiratory health questions were added to the original questionnaire to

describe their symptoms when they were located within Cluster F and when they were relocated to other buildings on campus.

Symptom questions referred to the 12-month period and the 4-week period prior to the survey. We defined an individual with asthma-like symptoms if there was an affirmative response to wheezing, or if they were awakened by an attack of shortness of breath, or if they had trouble with their breathing that was never quite right, or if they had chest tightness when they were around dusty parts of their house or near animals.[3] We defined individuals with possible hypersensitivity pneumonitis if they had reported at least one of the following: wheezing, chest tightness, shortness of breath with exertion, or usual cough and they reported any systemic symptoms (fevers, chills, night-sweats, or flu-like achiness). We defined shortness of breath as an affirmative response to any one of the shortness of breath questions: attack of shortness of breath while not doing anything strenuous, attack of shortness of breath following strenuous activity, or awakened by an attack of shortness of breath. We defined any chest symptoms (lower respiratory symptoms) as an affirmative response to wheezing, chest tightness, or shortness of breath. We defined throat irritation as hoarseness or burning sensations. We defined any upper respiratory symptoms as an affirmative response to nasal symptoms, sinus symptoms, or throat irritation. Post-hire onset of symptoms was defined as those symptoms that occurred after the reported date of hire. Work-related symptoms were defined as those symptoms that either got better away from Nassau Community College, while on weekends, vacations, or other days off, or the use of more medication on work days than other days.

DATA ANALYSIS

Descriptive statistics, such as averages, standard deviations, and proportions were computed to characterize the demographic information of the study group. Categorical data analysis using chi-square statistics was applied to examine statistical differences between subgroups (faculty and staff, building types, and environmental parameters) and reported respiratory symptoms, work-related symptoms, and post-hire onset of symptoms.

Multivariate logistic regression analysis, adjusting for personal factors, such as employee status (faculty or staff), gender, age, cigarette smoking history, reported allergies, reported use of latex gloves, and the year of hire was performed to 1) assess whether differences in the prevalences of reported upper and lower respiratory symptoms by building age groups exist, and 2) examine the association of personal exposure with upper and lower work-related respiratory symptoms. Odds ratios (OR) and Wald's 95% confidence intervals were computed.

All statistical procedures were accomplished by using program modules provided by the SAS Institute, Inc.[4] Statistical significance was achieved if the p-value, probability of obtaining a more extreme result than what was observed by chance alone given the null hypothesis is true, was less than 0.05.

RESULTS

ENVIRONMENTAL SUMMARY

An environmental assessment of the work spaces within the 12 buildings included 711 offices, classrooms, and laboratories. Two additional buildings were investigated (Building Q and Building X), bringing the total number of rooms to 724 (Table 1). Signs of past water incursions on the ceilings, seams, and concrete support posts were evident by water stains and chalking in most of the classrooms and laboratories, especially in the Cluster buildings and the Library. Several first floor laboratories within the Cluster buildings were observed to have large cracks (2 inches), where the floor met the outside wall. Strong mildew odors were also noticed in several laboratories; this was more evident when drawers of laboratory benches were opened in the Cluster buildings. Most of the furniture in the Cluster laboratories had evidence of being in standing water at some point. The veneer on some of the furniture had separated from the sides of the cabinets within the Cluster buildings and the Library. Heavy stains were also evident in the carpet of the Library. The environmental assessments of rooms within Buildings H, Q, V, X, Z, and Nassau Hall showed some signs of past water incursions which were evident by water stains on the ceilings, walls, and floors. There were very few, if any, visible signs of mold, mold odor, and current moisture within these buildings. Building G had the least number of rooms with visible signs of past water incursion, mold growth, mold odor, and current moisture.

Table 2 shows a summary of the visual and olfactory observations, average percent relative humidity and average temperature (Celsius) measurements collected in the 14 buildings. The highest average percent relative humidity was observed within rooms from the Cluster buildings

and the Library (overall: 41%; standard deviation (std)=9%). The average temperature within the rooms was constant across buildings at about 24 degrees Celsius. The highest average visible water stain score was observed within rooms from the Cluster buildings and the Library (0.8; std=0.5) and the lowest average visible water stain score was observed within rooms from Building G (0.1; std=0.1). More rooms with visible signs of mold, mold odor, and current moisture were observed within the Cluster buildings and the Library than within any other building investigated.

Table 3 shows that for all 724 rooms evaluated, the highest average percent relative humidity, the highest average visible water stain score, the highest proportion of rooms with visible signs of mold, and the highest proportion of rooms with mold odors were all found within classrooms and laboratories, especially on the first and second levels of the buildings. The proportion of rooms with current moisture was equally distributed between offices and classrooms. Offices located on the lower level or basement of a building were found to have an average percent relative humidity of 42% (std=19%), and 33% of these rooms had visible signs of mold.

While conducting the visual assessments within some rooms, samples of building materials with suspected fungal contamination were collected and sealed in plastic bags for microscopic verification of fungal contamination in the NIOSH laboratory. Table 4 shows the results from the microscopic examination of fungal growth on bulk materials collected within the buildings studied. From these tape samples and bulk materials, fungal genera of *Cladosporium*, *Chaetomium*, *Ulocladium*, *Alternaria*, and *Stachybotrys* were observed.

During previous environmental investigations by independent firms, 2-inch diameter holes were drilled in most of the rooms in the Cluster buildings and the Library to evaluate biological contamination within the wall cavities. During the NIOSH investigation, some of these holes were used, as well as some newly-drilled holes, to make in-wall examinations for potential fungal contamination with a boroscope within 11 rooms of three studied buildings. The results of these examinations are shown in Table 5. While there was no current evidence of visible moisture, there was evidence of previous water incursion due to stains on the inside of the wall panels and on the metal studs. Damage to the sheet-rock by water incursion was observed in most of the in-wall examinations, the most severe being along the bottom of the wall where the sheet-rock abutted the concrete floor. In-wall examinations produced no evidence of current mold growth, except for one room in Cluster A.

QUESTIONNAIRE SUMMARY

Demographic Information

The study group of 393 current full-time workers consisted of faculty (83%) and staff (17%). They were primarily Caucasians (87%) and females (54%). The average age was approximately 51 years-old (± 10 years). The majority of participating workers were non-smokers (67%). Ex-smokers and current cigarette smokers made up 29% and 4% of the study group, respectively. The average age they began smoking was 18 years-old (± 5 years), and they smoked an average of three-quarters of a pack of cigarettes per day. Table 6 shows the reported characteristics of the study group for all 393 participants.

Employment Characteristics

The majority (84%) of the study group began working at Nassau Community College after 1970 (Figure 1). Less than one percent began work prior to 1963 when the college was not located at Mitchel Field. During the time when the new academic wings (Cluster A-F and the Library) were completed and open for classes, which was around 1978, approximately 32% of the study group was working at the college. Sixty five percent of the participants had been working at the college since 1980s. Only 5% of the study group had been hired in 2000. The average tenure for the population was 17 years, ranging from 3 months to 40 years. The typical number of hours a participant worked at the college was approximately 30 hours, and they worked these hours on average four days of the week. Staff reported working more hours at the college than faculty: 35 hours versus 30 hours respectively.

The questionnaire survey focused on the following 12 buildings: Clusters A, B, C, D, E, and F, Buildings G, H, V, Z, Nassau Hall (Building M), and the Library. All participants except for six individuals provided information on their office location or job title for the full year of 2000. Sixty-eight percent (262/387) of the participants worked within the Clusters and the Library, 21% (82/387) worked within the refurbished military buildings (H, V, Z, and Nassau Hall), and 11% (43/387) worked within Building G. Professors constituted 31% of the participants, associate and assistant professors constituted 19%, and instructors constituted 15% of the study group.

Reported Respiratory Symptoms

The prevalence of the reported symptoms for all participating faculty and staff are graphically displayed in Figures 2 and 3. There were no statistical distinctions between what was reported by the faculty and what was reported by the staff based on chi-square statistics (p-values > 0.05). Forty-six percent of all participants reported they had experienced at least one chest symptom (wheezing, chest tightness, or shortness of breath) within the past 12 months of the survey, and 31% reported at least two of these symptoms. Attacks of shortness of breath were reported by 35% of the participants, 33% reported wheezing, and 27% reported they had chest tightness. Forty-three percent of the participants reported they had asthma-like symptoms (wheeze, shortness of breath, chest tightness around animals or dust, or breathing troubles) within 12 months prior to the survey, and 17% reported physician-diagnosed asthma. For reported upper respiratory symptoms or eye irritation within the past 12 months of the survey, Figure 3 shows that nasal and sinus symptoms were reported the most by faculty and staff (61% and 60%, respectively). Itchy and burning eyes were reported by 46% of all participants and 41% reported throat irritation, which includes hoarseness or burning sensations. Seventy-eight percent reported at least one upper respiratory symptom (nasal symptoms, sinus symptoms, or throat irritations) or eye irritation within the past 12 months of the survey, and 63% reported at least two of these symptoms. Eighteen percent of the study group reported symptoms consistent with possible hypersensitivity pneumonitis within the past 12 months of the survey. For other reported symptoms (data not shown), 37% reported headaches, 27% reported skin irritations, 25% reported sinus infections, 22% reported having difficulty in remembering things, 16% reported nose bleeds, 20% reported one or more systemic symptoms (chills, fevers, night sweats, or flu-like achiness), and 4% reported nausea within the past 12 months of the survey.

Thirty-six percent of all participants with any one of the chest symptoms reported occurrence after they had started their job at the college (Table 7). Sixty-nine percent of all participants with any upper respiratory symptoms or eye irritation reported inception after they started their job. Wheezing (22%) was the highest prevalence work-related chest symptom, and nasal symptoms (32%) were the highest prevalence work-related upper respiratory symptom for the study group. Eight percent of all participants reported physician-diagnosed asthma that occurred after they began working at the college, and 9% reported physician-diagnosed asthma with symptoms that either got better away from the college, or for which they were currently taking more medicine on workdays than on other days. The distribution of reported chest symptoms for the 17% who reported physician-diagnosed asthma was as follows: 76% reported they had wheezed in the past 12 months, 71% had shortness of breath, and 62% had chest tightness in the past 12 months (data not shown). For those who had physician diagnosis of asthma in the years prior to working at the college (21/393), 29% reported that their asthma got worse after they began working at the college.

For reported symptoms within 4 weeks of the survey, similar patterns were observed to the 12 month patterns. For example, 32% of the participants reported at least one chest symptom and 68% reported at least one upper respiratory symptom or eye irritation. Nasal and sinus symptoms were the most common reported upper respiratory symptoms within 4 weeks of the survey. (Data not provided).

Associations Between Reported Office and Classroom Locations and Respiratory Symptoms

All participants, except for faculty and staff within the Nursing Department (N=26), were placed into one of three building groups based on their reported percentage of time spent in any particular building over all three semesters within the year 2000. Nursing faculty and staff were not considered for this analysis, because they were relocated in the early part of the year, making it difficult to assign a primary building for that year. Buildings H, V, Z, and Nassau Hall were grouped together because they represented similar buildings built in the late 1920s; Clusters A, B, C, D, E, and F and the Library were grouped together because they represented similar buildings built in the late 1970s; and Building G was grouped alone because it was the only building of the twelve that represented a newer building. Seventy-two percent (255/356) of the participants reported that they had spent most of their working day within the Clusters and the Library. Sixteen (58/356) and twelve (43/356) percent reported working within the older buildings and newer building, respectively. Four individuals reported spending equal amounts of time working in more than one building, one individual reported working primarily in an older building not selected for study, and six individuals reported no information

on their location; these were excluded from this analysis.

The distributions of reported symptoms for non-nursing faculty and staff participants by building age group are presented in Figures 4 and 5. Logistic regression analysis showed significant differences (p-values < 0.05) in the prevalence of any chest symptoms and any one of the four upper respiratory or eye irritation symptoms by building age group, after personal factors, such as employee status (faculty or staff), gender, age, cigarette smoking history, reported allergies, reported use of latex gloves, and the year of hire were considered in the analysis. Significant differences were also observed for reported wheezing, shortness of breath, and nasal symptoms by building age group. The highest prevalence estimates were found for those non-nursing participants who spent the majority of their working day in buildings built in the late 1970s compared to those working in other studied buildings. This was particularly true for those who had their office and classrooms located in Cluster A. Figures 6 and 7 show the distribution of reported work-related upper and lower respiratory symptoms by the Cluster buildings and the Library and other studied buildings. For any one of the chest symptoms, those in Cluster A reported the highest prevalence of work-related symptoms than those in all other studied buildings (58% compared to 25%). For any one of the upper respiratory symptoms or eye irritation, those in Cluster E reported the highest prevalence of work-related symptoms compared to those in all other studied buildings (76% compared to 48%).

Physician-diagnosed asthma was reported equally across building groups. However, those who worked primarily in Cluster C reported the highest prevalence of physician-diagnosed asthma compared to those working in all other studied buildings (38% compared to 16%) (Figure 6). For possible hypersensitivity pneumonitis, the reporting rates were not statistically different among building groups (Figure 4). However, those working within buildings built during the 1970s, especially those in Cluster E (41%), reported more symptoms of possible hypersensitivity pneumonitis than those participants working in all other studied buildings (18%) (data not shown).

Table 8 shows statistically significant differences (p-values < 0.05), after adjusting for personal factors, between occupants of buildings for reported post-hire onset of any one of the chest symptoms, especially wheeze and shortness of breath. Significant differences were also found for post-hire onset of any upper respiratory symptoms or eye irritation. For work-related symptoms, statistically significant differences were observed for all reported upper and lower respiratory symptoms, except for shortness of breath, physician-diagnosed asthma, and eye irritation. Again, the highest prevalence estimates were found for those who primarily worked in the 1970s buildings.

Associations Between Environmental Assessment and Reported Work-related Respiratory Symptoms

The current environmental assessment check sheets and the reported work-related respiratory symptoms within the past 12 months were evaluated for all non-nursing faculty and staff who reported information about where they worked during the Fall semester of 2000 (N=323). Nursing faculty and staff were not considered for this analysis because of a conflict with the time period of the health questions and the relocation of the nurses. Personal exposure indices were computed for each individual based on each of four parameters (i.e., average visible water stains, visible mold, presence of mold odor, and current signs of moisture).

Table 9 shows the adjusted odds ratio of reported work-related respiratory symptoms within 12 months of the survey and work-related physician-diagnosed asthma for individual exposure indices. When an individual exposure index was based on the average visible water stain score in a room as a continuous index, significant exposure-response relationships were found for wheeze, throat irritation, and any upper respiratory symptoms or eye irritation. Adjusted odds ratios (95% confidence interval) were 2.3 (1.1-4.5) for wheeze, 2.4 (1.3-4.4) for throat irritation, and 1.9 (1.1-3.3) for any upper respiratory symptoms, implying that the risk of those respiratory symptoms increases by about 2-fold as the average water stain exposure index increases by one unit. Although there were no significant exposure-response relationships of the exposure index based on the average water stain score as a continuous variable for work-related nasal symptoms and work-related sinus symptoms, there was significantly increased risk associated with observations of any water stain for these upper respiratory symptoms. The adjusted odds ratios were 4.4 (1.2-15.3) and 3.8 (1.1-13.4), respectively.

When the exposure index was based on the presence of visible mold, significantly increased

risks were found for all work-related lower respiratory symptoms, except for work-related attack of cough. The risk of these lower respiratory symptoms were more than 2-fold, and the highest risk (OR=2.6) was found for work-related chest tightness and work-related shortness of breath. About a two-fold odds was found for work-related nasal symptoms, work-related sinus symptoms, and work-related eye irritation.

When the exposure index was based on the presence of mold odor, significantly increased risks were found for work-related throat irritation (OR=2.3; CI=(1.2-4.3) and any work-related upper respiratory symptom (OR=2.3; CI=1.2-4.3).

For symptoms reported to be work-related within 4 weeks of the survey, similar adjusted odds ratios were found for most symptoms based on exposure indices. There were a few exceptions. When the exposure index was based on the average water stains observed as a continuous variable, the adjusted odds ratio for work-related wheeze was 1.4 (CI=0.6-3.2). When the exposure index was based on the presence of mold odor, the adjusted odds ratio for any work-related upper respiratory symptom was 1.7 (CI=0.9-3.2).

Reported Symptoms for Participating Nursing Faculty and Staff

For participating faculty and staff within the Nursing Department (N=26), 54% reported chest symptoms (wheezing, chest tightness, or shortness of breath) within the past 12 months of the survey and had these symptoms while they were working in Cluster F. Seventy-three percent reported upper respiratory symptoms (nasal symptoms, sinus symptoms, or throat irritation) or eye irritation within the 12 months prior to the survey, and they reported having these symptoms while working in Cluster F. After the Nursing Department moved out of Cluster F in the early months of the year 2000, 36% of those who reported having chest symptoms prior to the move reported that their symptoms or breathing problems had either lessened or disappeared after they moved. However, none of the nurses who reported having nasal, sinus, throat, or eye symptoms prior to the move reported improvement of their symptoms after they were relocated.

Pre-move symptom prevalences for those participants in the Nursing Department who had been located in Cluster F (N=22), based on onset dates of prevalent symptoms, were compared to symptom prevalences of participating employees from other departments in Cluster F (N=45). There were four nurses who never worked in Cluster F; these were excluded from this comparison. Similar demographic characteristics, except for age and gender, were observed between the nurses and other employees within Cluster F. The participating nurses reported a higher average age of 51 years compared to the other employees, whose average age was 46 years (p-value = 0.04). The nurses were primarily females (21/22) compared to the individuals within the other departments (29/45). Figures 8 and 9 show no significant differences (p-values > 0.05) in the prevalence of reported work-related symptoms. There were no significant differences in the reported post-hire onset of symptoms among the two groups (p-values > 0.05).

MEDICAL RECORD REVIEW SUMMARY FOR FACULTY AND STAFF

NIOSH obtained permission to review medical records from twelve individuals who worked at the college, of whom most are from the Department of Nursing. Nine had diagnoses of lower respiratory disease, five of which were well documented in the records. Seven carried a diagnosis of asthma, and the medical records suggest the presence of interstitial lung disease in six of these during at least some part of their illness. One individual died of interstitial pneumonitis in 1997. Five individuals developed their disease before 1994, and eight had evidence of new onset or marked exacerbation of their lung disease between 1995 and 2000.

The medical records did not provide detailed occupational or environmental histories, and no specific evaluation of the relationship of symptoms or clinical findings to an individual's time spent in a particular building could be made. One individual who left a building showed improvement in symptoms over subsequent months.

COMPARISON OF REPORTED SYMPTOMS BETWEEN RESPONDENT POPULATION AND NON-RESPONDENT POPULATION

A survey of non-respondents to the main questionnaire survey was undertaken to assess whether the participants were representative of the college population as a whole. The response rate for the non-respondent survey was low, at 39%

(63/161). The overall characteristics of the non-respondents were similar to those in the main study population (N=393). The only difference was the gender distribution, where the non-respondent population was 56% males compared to 44%. Similar distributions of primary building location for offices and classrooms for the Fall 2000 semester were observed between the non-respondent and respondent population, where the primary buildings were the Clusters and the Library. Reports of wheeze for non-respondent occupants of the 1970s (N=40) and 1920s (N=10) buildings were similar to those of the respondents (35% and 20% compared to 37% and 19%). Non-respondents and respondents by building age group were also similar for any chest symptoms (40% and 20% compared to 52% and 24%). However, reports of shortness of breath and chest tightness were generally lower for the non-respondents (20% and 0% compared to 39% and 12% for shortness of breath; 18% and 10% compared to 31% and 14% for chest tightness). Comparisons of reported symptoms between non-respondent and respondent occupants of the 1990s building (N=13) also were generally lower. Although the non-respondents reported fewer symptoms, the patterns across the three building age groups were similar to those for the participants of the main study. Similar prevalence was observed for physician-diagnosed asthma across all building age groups (16% for non-respondents compared to 17% for respondents). See Appendix C for more information.

DISCUSSION

This NIOSH investigation documents that building-related respiratory problems are occurring among staff and faculty on the campus. The evidence supporting this conclusion is four-fold. First, the prevalence rate of reported physician-diagnosed asthma is elevated compared to state and county statistics, which were obtained with similar questions on interview questionnaires. Reported diagnosed asthma prevalence for those aged 35-65 years among faculty and staff respondents was 18% compared to 10% reported overall by New York state residents of that age range.[5] The comparison to Nassau county rates, available only for all ages, also showed an excess among faculty and staff – 17% versus 3% at the county level.[6]

The second line of evidence for building-related chest problems concerns the distribution of chest symptoms across the campus building populations. The proportion of persons with chest complaints was considerably and statistically higher in buildings built in the late 1970s (Cluster buildings and the Library) than in either older or newer buildings. It is unlikely that there are health, employment, smoking, or other personal factors that explain why persons with symptoms would be housed in one part of the campus (apart from the nursing faculty). Rather, the building environment is the most logical causal factor for the unequal risk of respiratory disease across the campus. The interpretation that there are environmental explanations for the increase in respiratory symptoms in the Cluster buildings and the Library is strengthened by the statistically different prevalences of symptoms that arose after study respondents occupied these buildings. Building-related exposures preceded the development of symptoms, rather than reflect assignment of symptomatic persons to specific building environments. Similarly, work-relatedness of symptoms is suggested by higher proportions of persons in buildings built in the late 1970s reporting that their symptoms improved away from work or required more medication at work than employees working elsewhere on the campus. This constellation of epidemiologic findings is strong evidence that there are exposures causing chest symptoms in a portion of the faculty and staff in the Cluster buildings and the Library.

The third line of evidence for building-related chest illness comes from medical records of affected employees who released their records for our review. Physicians seeing these patients documented both asthma and interstitial lung disease that they attributed in some instances to the building environment in which they worked. Asthma is a common disease in the U.S. population and has increased markedly in prevalence and severity since the 1970s.[7] Not all asthma occurring among faculty and staff is likely building-related, and many asthmatics are likely to have suffered from asthma in childhood, long before employment at Nassau Community College. There is substantial epidemiologic evidence that home dampness and indices of mold exposure increase the risk of asthma and respiratory symptoms.[8, 9] The evidence that office buildings with moisture incursion can contribute to asthma is less developed. However, several studies exist describing this phenomenon.[10-12] When adults develop asthma for the first time, a search for environmental determinants is always wise. In the setting of symptoms arising or exacerbated while at work, a cause at the workplace must be considered. At Nassau Community College, many who reported a physician diagnosis of asthma after they started at

the college were occupants of the Cluster buildings and the Library. There were many persons with symptoms compatible with asthma that did not report a physician diagnosis of asthma. This is consistent with studies, which have shown that those with symptoms and evidence of airways hyperreactivity, the hallmark of asthma, do not report a diagnosis.[13]

Several of the medical records received for our review documented findings consistent with interstitial lung disease. Hypersensitivity pneumonitis is an example of interstitial building-related disease in which persons exposed to airborne fungi or bacteria develop an immune response to the inhaled microorganisms which causes symptoms of cough, shortness of breath with exertion, and sometimes fevers, severe fatigue, and weight loss. The medical literature has scores of reports on building-related hypersensitivity pneumonitis outbreaks and case reports, usually in the setting of exposures associated with water damage, contaminated ventilation systems, or aerosols.[12, 14] Attack rates can be high and subclinical illness often goes undiagnosed or unsuspected.[14] Buildings with cases of hypersensitivity pneumonitis often have building-related asthma cases as well.[10, 12] The symptom information available for Nassau Community College participants is consistent with the occurrence of building-related hypersensitivity pneumonitis even though statistically significant differences were not observed between building age groups.

The fourth line of evidence supporting the existence of building-related respiratory problems is the association between work-related lower and upper respiratory symptoms and the exposure indices of possible microbial exposure. Our surrogate measures of the potential for microbial contamination were signs of water stains, visible mold, presence of mold odor, and visible signs of dampness (water incursion). These exposure indices, whether they were based on the average water stains observed or the presence of visible mold, were not only positively associated with work-related lower and upper respiratory symptoms but showed evidence of an exposure-response trend after adjusting for personal factors. Dales and colleagues demonstrated that self-reported moldy odor in residential environments was significantly associated with total culturable fungi in dust samples, and that homes with reported visible mold growth also showed higher level of *Aspergillus* spp. and *Penicillium* spp. than those without visible mold.[15] Finnish research on the development of classification systems of moisture-damaged dwellings in relation to health effects has found similar positive associations with upper and lower respiratory symptoms.[16]

The field of indoor air quality has little scientific evidence that measurements of microbial agents can be linked to health outcomes. Where hazard of specific microbial agents cannot be objectively measured, standards or guidelines do not exist for safe levels. Decisions about need for remediation to protect building occupants have to be made in the absence of quantitative guidelines. Although specific microbial cause(s) remains unknown, a robust body of knowledge exists to support the association of moisture incursion or presence with respiratory disease. Much of this is from epidemiologic studies of residential characteristics and risk of asthma and respiratory symptoms.[17, 18] The same risks occur in office settings which have been water-damaged, as has occurred in the 1970s buildings. Examples of investigations showing this phenomenon exist in individual building investigations,[10-12] as well as epidemiologic studies of building risk factors for work-related respiratory symptoms.[19] Thus, the findings of work-related respiratory disease in this investigation are not unusual or surprising.

In this investigation, we did not take any air samples for measuring airborne fungal propagules in rooms of the buildings on campus. Instead we developed and used an environmental assessment checksheet to evaluate signs of water incursion, visible mold, and presence of mold odor. Although past remediations of the cluster offices were done, which may have removed visual evidence of prior water incursion, the Cluster buildings, with a history of water damage, still showed higher indices of potential microbial contamination than those with no history of water damage. Classrooms and laboratories showed the highest indices of signs of water incursion, visible mold, and presence of mold odor compared to the offices. The indices of exposure employed in this analysis are surrogate indications of potential bioaerosol exposure and not quantitative levels of airborne contaminants. Nevertheless, they have been shown here to be associated with reported health outcomes related to lung disease, especially asthma. Similar findings have been reported in another water-damaged building in which a similar environmental check sheet was employed. Moreover, in that building, correlations between measured levels of airborne fungal contaminants and respiratory symptoms were also detected.[20] The latter finding provides support that data from the environmental check sheet provide some information on potential bioaerosol exposures.

Some degree of disagreement among classifying industrial hygienists might have limited the repeatability and reliability of the exposure indices. These limitations of the visual and olfactory approach result in possible misclassification of a room occupant's exposure level. However, any misclassification is likely equivalent in both directions because the trained industrial hygienists who evaluated the room environments did not know the health status of the room occupants. This random misclassification of exposure would tend to bias the measure of association with health outcomes toward the null. In the absence of misclassification, we might have obtained stronger associations between indices of moisture problems and presence of mold odor and respiratory health outcomes. Another limitation of any epidemiologic study is bias. Bias in surveys such as ours might be suspected from several sources. In buildings with indoor air quality complaints, overreporting of symptoms is expected.[21] In addition, respondents may reply differently than non-respondents. However, the results from the non-respondents were generally similar to those of the respondents. In particular, reports of physician-diagnosed asthma showed almost identical prevalences among the respondents and non-respondents. In addition, the limited results from the non-respondent survey support the main findings of this report since the pattern of symptom prevalences across the building age groups echo, or are even more pronounced than that seen for the respondents. We also know from the non-respondent questionnaire responses that the reasons for non-response were not reported to be health-related. Overall, we feel that selection bias was not an issue in this survey.

The surrogate measures of potential microbial contamination, such as the exposure indices defined in this study, can be useful in documenting areas for environmental remediation, but cannot be used as an assurance that health effects are unlikely. Remediation may result in complete removal of evidence of previous moisture problems without necessarily removing reservoirs of bioaerosol exposure. In this investigation, high rates of respiratory symptoms are evident in buildings which have been renovated, such as the Cluster buildings. When renovation does not result in intended effects on work-related symptoms, at least three possible interpretations arise. One possibility is that the cause is unrelated to the building environment and its associated exposures. The epidemiologic evidence reported here makes this unlikely. Another possibility is that persons with building-related lung disease are so sensitive to minute exposures (through immune system sensitization) that they react to much lower bioaerosol exposures than may have existed to sensitize them. For hypersensitivity pneumonitis cases, there is substantial published medical evidence that this is often the case and that affected persons cannot reoccupy the implicated environment after remediation without becoming objectively ill again.[21] The third possible explanation is perhaps most likely. Cosmetic renovation by painting, removing ceiling tiles and water-damaged carpeting, etc., may not solve the root problem of moisture incursion through an inadequate building shell or remove long-standing reservoirs of mold in previously wet walls. Pressure relations within the building may result in hidden sites of bioaerosol amplification, disseminating spores, toxins, allergens, and microbial volatiles within the occupied space. Available sampling methods for bioaerosols do not accurately reflect exposures because of their problems in repeatability and short sampling times.

This current study of health concerns and environmental conditions on this campus followed nearly twenty years of the college seeking consultation in response to indoor air quality concerns by faculty and staff. The fourteen reports preceding this one, some from leading indoor air quality consultants, reflect the evolving conceptual approaches to building-related complaints which began to be common across the nation in the late 1970s. The reports included recommendations for increased outdoor air ventilation, attention to control of pollutants generated by occupants in their personal and professional activities, ventilation balancing, and eliminating conditions supporting microbial growth. (Mold growth was apparent by at least the 1983 NIOSH health hazard evaluation of some of the Cluster buildings.) Although medical surveys and absenteeism or medical record reviews were recommended as early as 1982, no systematic effort appears to have been made to establish whether a relationship existed between health concerns and environmental conditions in the college buildings. This lack of information may have contributed to the failure to resolve the ongoing concerns of faculty and their union representatives.

Health effects are the most important indication of whether a problem exists; environmental sampling may not necessarily reveal or identify problems. An example of the discrepancy between the health effects and the historical environmental measurements conducted at the college exists in the 1970s buildings, especially in Cluster F. The Nursing Department had many employees with

building-related respiratory complaints in the Fall 1999 semester, many substantiated by physicians. The Nursing staff moved out in the early months of the year 2000, with some resolution of symptoms. However, consultant evaluation in 1999 documented no elevation in airborne mold samples in the Nursing Department and low levels of bacteria, fungi, and actinomycetes colonies (< 500 colony forming units per square inch of surface area, CFU/in^2) in swab samples. Here, environmental sampling may have been falsely reassuring. The high rate of systemic symptoms suggesting hypersensitivity pneumonitis in the 1970s buildings, especially in Cluster E, raises consideration of relocation of employees shown by medical evaluation to be affected. With continued exposure, building-related asthma can become permanent and hypersensitivity pneumonitis can result in permanent scarring interstitial disease and even death. The death of a Nursing Department employee from interstitial disease is worrisome.

Appropriate remediation for building-related respiratory problems can be costly and disruptive. Many of the consultant reports have recommendations pertinent to assessing the degree of water damage to the building shell, fixing roof leaks, and medical surveillance. We emphasize that the health data suggest that preventable disease is occurring among faculty and staff at Nassau Community College and call for further remediation including consultation from environmental firms with expertise in remediating water-damaged buildings. This likely will involve further characterization of building envelope and moisture barrier deficiencies, detailed remedial plans and cost estimates of appropriate remediation, referral of employees with symptoms to medical consultants knowledgeable about building-related respiratory disease, and relocation of affected persons to buildings free of chronic moisture incursion.

RECOMMENDATIONS

We recommend the following for this workplace:

1. Promptly fix water leaks and replace material that has been wet for a day or longer. Doing so reduces the potential for microbial growth.

2. Promptly remove visible mold and further evaluate potential hidden mold reservoirs in walls, especially within the classrooms and offices of the 1970s buildings, by obtaining services from a consulting firm with experience in planning how to remove mold, including hidden mold.

3. During construction or renovations, use containment measures to control exposures to dusts and other contaminants.

4. Involve a local occupational health clinic to determine whether persons with work-related symptoms in buildings with previous water damage have building-related conditions that may require relocation. Ongoing medical consultation and surveillance of the faculty and staff can help set priorities for remediation; prevent further illness from developing; and reassure employees when the risk decreases. Medical surveillance activities may involve repeat questionnaire administration, recording of potential cases seeking evaluation, and medical testing.

5. Disseminate the findings of this report to all faculty and staff so that A) they can become more aware of their working environment and promptly report any signs of water leaks, visible mold and odors to the physical plant managers, B) they may seek medical attention if they feel that their symptoms are work-related, and C) they can become involved in programs, such as a medical surveillance program.

REFERENCES

1. The European Community Respiratory Health Survey. "Medicine and Health". EC Directorate General XIII, Office for Official Publications, L-2920 Luxembourg, 1994.

2. Ferris BG. Epidemiology standardization project. American Review of Respiratory Disease 1978;118:1-53.

3. Burney PGJ, Chinn S, Britton JR et al. What symptoms predict the bronchial response to histamine - evaluation in a community survey of the bronchial symptoms questionnaire (1984) of the International Union Against Tuberculosis and Lung Disease. International Journal of Epidemiology 1989; 18(1):165-173.

4. SAS/STAT Users' Guide, Version 8. Cary, NC: SAS Institute Inc., 1999.

5. Behavioral Risk Factor Surveillance System Prevalence Data for NY - year 2000. Web site page: http://apps.nccd.cdc.gov/brfss/page.asp?cat=AS&yr=2000&state=NY.

6. Estimated Prevalence of Lung Disease by Lung Association Report, April 2001 for Nassau Country, NY - year 1998 data. Web site page: http://www.lungusa.org/data/lae_01/lae.html.

7. Burney PGJ, Luczynska C, Chinn S, Jarvis D. The European Community respiratory health survey. European Respiratory Journal 1994; 7:954-960.

8. Dales RD, Burnett R, Zwanenburg H. Adverse health effects among adults exposed to home dampness and molds. American Review of Respiratory Disease 1991; 143:505-509.

9. Bornehag Cg, Blomquist G, Gyntelberg F, et al. Dampness in buildings and health - Nordic interdisciplinary review of the scientific evidence on associations between exposure to "dampness" in buildings and health effects (NORDDAMP). Indoor Air 2001; 11(2):72-86.

10. Jarvis JQ, Morey PR. Allergic respiratory disease and fungal remediation in a building in a subtropical climate. Applied Occupational and Environmental Hygiene 2001; 16 (3):380-388.

11. Seuri M, Husman K, Kinnunen H, Reiman M, et al. An Outbreak of respiratory diseases among workers at a water-damaged building - A case report. Indoor Air 2000; 10:138-145.

12. Hoffman RE, Wood RC, Kreiss K. Building-related asthma in Denver office workers. American Journal of Public Health 1993; 83(1): 89-93.

13. Milton DK, Solomon GM, Rosiello RA, Herrick, RF. Risk and incidence of asthma attributable to occupational exposure among HMO members. American Journal of Industrial Medicine 1998; 33:1-10.

14. Rose CS, Martyny JW, Newman LS, Milton DK, King TE Jr, Beebe JL, McCammom JB, Hoffman RE, Kreiss K. "Lifeguard lung": Endemic granulomatous pneumonitis in an indoor swimming pool. American Journal Public Health 1998; 88:1795-1800.

15. Dales RE, Miller D, McMullen ED. Indoor air quality and health: Validity and determinants of reported home dampness and moulds. International Journal of Epidemiology 1997; 26(1): 120-125.

16. Haverinen U, Husman T, Vahteristo M, et al. Comparison of two-level and three-level classifications of moisture-damaged dwellings in relation to health effects. Indoor Air 2001; 11: 192-199.

17. Dales RE, Zwanenburg H, Burnett R, Franklin C. Respiratory health effects of home dampness and molds among canadian children. American Journal Epidemiology 1991; 134:196-203.

18. Spengler JD, Burge H, Su HJ. Biological agents and the home environment. Presented at Bugs, Mold & Rot: A Workshop on Residential Moisture Problems, Health Effects, Building Damage, and Moisture Control, May 20-21, 1991. Washington, DC: National Institute of Building Sciences, 1991.

19. Sieber WK, Stayner LT, Malkin R, Petersen MR, Mendell MJ, Wallingford KM, Crandall MS, Wilcox TG, Reed L. The National Institute for Occupational Safety and Health indoor environment evaluation experience. Part Three: Associations between environmental factors and self-reported health conditions. Applied Occupational and Environmental Hygiene 1996; 11:1387-1392.

20. Cox-Ganser J, Rao C. Hazard evaluation and technical assistance report: Benefis Healthcare, Great Falls, Montana. Morgantown, WV: U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, NIOSH Report No. HETA 2000-0255-2868, 2001.

21. Kreiss K, Hodgson MJ. Building-associated epidemics. In: Walsh PJ, Dudney CS, Copenhaver ED, editors. Indoor Air Quality. Florida: CRC Press, 1984; 6:87-106.

TABLE 1
Distribution of offices, classrooms, and laboratories investigated during the environmental assessment surveys, Nassau Community College, 2000

Building	Number of rooms	Room type	
		Office/Other	Classroom/Laboratory
Cluster A	69	41	28
Cluster B	74	41	33
Cluster C	84	56	28
Cluster D	71	55	16
Cluster E	75	53	22
Cluster F	121	75	46
Library (L)	64	64	0
Building G	52	33	19
Building H	25	24	1
Nassau Hall (Building M)	47	31	16
Building Q	10	8	2
Building V	24	15	9
Building X	3	3	0
Building Z	5	4	1
All	724	503	221

TABLE 2
Environmental assessment summary by building, Nassau Community College, 2000

Buildings	Number of rooms	Average percent relative humidity (Std)	Average temperature in Celsius (Std)	Average water stain score (Std)	Visible mold present N (%)	Mold odor present N (%)	Current moisture present N (%)
Cluster A	69	41.5 (7.6)	24.1 (1.5)	0.9 (0.4)	19 (28)	2 (3)	1 (1)
Cluster B	74	42.1 (8.6)	24.1 (1.3)	1.0 (0.5)	22 (30)	7 (9)	0
Cluster C	84	38.0 (6.2)	24.6 (2.0)	0.6 (0.4)	3 (4)	3 (4)	0
Cluster D	71	40.2 (7.0)	23.8 (1.1)	0.8 (0.3)	15 (21)	8 (11)	0
Cluster E	75	47.1 (7.0)	23.4 (1.4)	1.2 (0.5)	16 (21)	7 (9)	2 (2)
Cluster F	121	41.3 (6.2)	23.8 (1.9)	0.5 (0.4)	13 (11)	2 (2)	2 (2)
Library (L)	64	37.1 (13.8)	23.8 (1.9)	0.8 (0.6)	21 (33)	1 (2)	3 (5)
Building G	52	21.3 (0.5)	22.9 (0.7)	0.1 (0.1)	1 (2)	0	0
Building H	25	22.8 (3.9)	23.4 (4.1)	0.5 (0.3)	0	0	0
Nassau Hall (Building M)	47	23.6 (1.2)	24.0 (2.0)	0.6 (0.4)	2 (4)	0	0
Building Q	10	22.7 (0.5)	21.2 (1.3)	0.3 (0.3)	1 (10)	0	0
Building V	24	24.0 (1.5)	23.4 (0.8)	0.3 (0.2)	0	2 (8)	0
Building X	3	35.3 (2.1)	20.9 (0.3)	1.2 (0.4)	0	0	0
Building Z	5	20.0 (0)	20.9 (1.9)	0.9 (0.3)	0	0	0
All	724	36.9 (10.8)	23.8 (1.8)	0.7 (0.5)	113 (16)	32 (4)	8 (1)

Std = standard deviation
N = number of rooms
% = percent of rooms

TABLE 3
Environmental assessment summary by room type and floor, Nassau Community College, 2000

Room type	Number of rooms	Average percent relative humidity (Std)	Average temperature in Celsius (Std)	Average water stain score (Std)	Visible mold present N (%)	Mold odor present N (%)	Current moisture present N (%)
Classroom/Lab	221	40.0 (11.5)	23.6 (1.6)	0.8 (0.5)	78 (35)	16 (7)	3 (1)
Lower Level	5	21.4 (0.5)	22.7 (1.4)	0.2 (0.2)	--	--	--
First Level	81	42.7 (10.1)	23.4 (1.4)	0.7 (0.4)	39 (48)	8 (10)	1 (1)
Second Level	94	37.7 (12.2)	23.7 (1.7)	0.9 (0.6)	29 (31)	6 (6)	2 (2)
Third Level	41	42.1 (10.1)	24.0 (1.9)	0.8 (0.7)	10 (24)	2 (5)	--
Office/Other	503	35.6 (10.2)	23.8 (1.9)	0.7 (0.4)	35 (7)	16 (3)	5 (1)
Lower Level	21	42.1 (18.9)	23.5 (4.2)	0.6 (0.5)	7 (33)	--	1 (5)
First Level	90	32.4 (11.9)	23.8 (1.8)	0.6 (0.4)	14 (16)	3 (3)	1 (1)
Second Level	179	36.4 (9.7)	23.9 (1.7)	0.9 (0.5)	13 (7)	5 (3)	2 (1)
Third Level	213	35.6 (8.1)	23.8 (1.8)	0.5 (0.3)	1 (0.5)	8 (4)	1 (0.5)

Std = standard deviation
N = number of rooms
% = percent of rooms

TABLE 4
Microscopic identification of bulk samples of building materials collected during the environmental assessment, Nassau Community College, 2000

Building	Room number	Sample type	Fungal genera
A	303	sheetrock material	*Stachybotrys*
A	313	tape from top of HVAC coil	*Cladosporium*
A	315	piece of drywall	*Chaetomium*
D	108	veneer from furniture	*Chaetomium*, *Ulocladium*
D	3124	glue from wall	none
E	109	veneer from baseboard	suspected spore
E	315	HVAC fiberglass insulation	none
E	315	tape sample from HVAC	*Cladosporium*
F	107	small cardboard box	*Stachybotrys*
L	303	tape sample from drain pan	*Cladosporium*
L	327	paper material behind file cabinet	*Stachybotrys*, *Alternaria*
L	LL02 H	piece of ceiling tile	*Stachybotrys*
M	217G	wall paint chips from behind cabinet	unknown spores, *Stachybotrys*
Z	restroom	bathroom drywall	*Chaetomium*

TABLE 5
In-wall examination by room number, Nassau Community College, 2000

Room number	In-wall observations
A 303	mold growth
A 316	water stains
C 109	water stains
C 111	water stains
F 231	water stains
F 226	water stains
F 307	water stains
F 309	water stains
F 312 left corner	water stains
F 314 right corner	water stains
F 317	water stains

TABLE 6
Demographic characteristics of all study participants (N=393), Nassau Community College, 2000

Characteristics	Employee status		Total
	Faculty	Staff	
Total participants N (%)	328 (83)	65 (17)	393
Average age in yrs Mean (Std)	50 (10)	52 (10)	51 (10)*
Gender N (%)			
Female	160 (49)	54 (83)	214 (54)
Male	164 (50)	9 (14)	173 (44)
Not responded	4 (1)	2 (3)	6 (2)
Ethnicity N (%)			
White	289 (88)	55 (85)	344 (87)
African-American	17 (5)	5 (8)	22 (6)
Other	12 (4)	2 (3)	14 (4)
Not responded	10 (3)	3 (4)	13 (3)
Smoking status N(%)			
Non-smokers	219 (67)	43 (66)	262 (67)
Ex-smokers	98 (30)	15 (23)	113 (29)
Current	11 (3)	5 (8)	16 (4)
Not responded	—	2 (3)	2 (<1)

* There were 20 individuals that did not provide information on their age.
N = number of participants
% = percent of participants
Std = standard deviation

TABLE 7
Reported post-hire onset, work-related symptoms, and total prevalence within the past 12 months for all participating full-time faculty and staff (N=393), Nassau Community College, 2000

Symptoms in the last 12 months N (%)	Post-hire onset	Work-related	Total prevalence
Wheezing	104 (26)	85 (22)	129 (33)
Chest tightness	83 (21)	68 (17)	105 (27)
Shortness of breath	105 (27)	74 (19)	136 (35)
Any chest symptoms	143 (36)	108 (27)	180 (46)
Attack of coughing	89 (23)	64 (16)	113 (29)
Nasal symptoms	190 (48)	126 (32)	238 (61)
Sinus symptoms	193 (49)	113 (29)	234 (60)
Throat irritation	126 (32)	112 (28)	163 (41)
Itchy and burning eyes	151 (38)	103 (26)	182 (46)
Any upper respiratory symptoms or eye irritation	272 (69)	195 (50)	306 (78)
Physician-diagnosed asthma †	32 (8)	34 (9)	66 (17)
Less than 16 years of tenure (N=192)††	12 (6)	16 (8)	35 (18)
At least 16 years of tenure (N=200)	20 (10)	18 (9)	31 (16)

† Physician-diagnosed asthma was defined as ever having asthma diagnosed by a doctor.
†† Tenure of 16 years represents the median value.
N = number of participants
% = percent of participants

TABLE 8
Reported post-hire onset of symptoms and reported work-related symptoms by building group for all participants (N=356), except those in the Nursing department, Nassau Community College, 2000

Symptoms in the last 12 months N (%)	Building group					
	1970s (N=255)		1920s (N=58)		1990s (N=43)	
	Post-hire onset	Work-related	Post-hire onset	Work-related	Post-hire onset	Work-related
Wheezing	82 (32)[a]	68 (27)[a]	5 (9)[a]	1 (2)[a]	7 (16)	6 (14)
Chest tightness	65 (25)	58 (23)[a]	6 (10)	1 (2)[a]	5 (12)	4 (9)
Shortness of breath	81 (32)[a]	61 (24)[b]	4 (7)[a]	--	6 (14)	3 (7)[b]
Any chest symptoms	112 (44)[a b]	86 (34)[a]	8 (14)[a]	2 (3)[a]	9 (21)[b]	8 (19)
Attack of coughing	65 (25)	51 (20)[b]	8 (14)	4 (7)	9 (21)	3 (7)[b]
Usual cough[†]	32 (12)	--	1 (2)	--	5 (12)	--
Usual phlegm[†]	44 (17)	--	3 (5)	--	5 (12)	--
Physician-diagnosed asthma[††]	24 (10)	25 (10)	2 (3)	2 (3)	2 (5)	3 (7)
Nasal symptoms	135 (53)[b]	95 (37)[b]	23 (40)	13 (22)	14 (32)[b]	4 (9)[b]
Sinus symptoms	134 (52)[b]	87 (34)[b]	29 (50)	10 (17)	13 (30)[b]	3 (7)[b]
Throat irritation	94 (37)[a]	86 (34)[a]	9 (16)[a]	7 (12)[a]	10 (23)	8 (19)
Itchy and burning eyes	106 (42)[b]	76 (30)	22 (38)	9 (16)	10 (23)[b]	7 (16)
Any upper respiratory symptoms or eye irritation	183 (72)[b]	143 (56)[a b]	40 (69)	18 (31)[a]	24 (56)[b]	15 (35)[b]

[†] For both usual cough and usual phlegm, work-related patterns could not be assessed.
[††] Physician-diagnosed asthma was defined as ever having asthma diagnosed by a doctor.
[a] Significant difference at p-value < 0.05 between 1970s buildings and 1920s buildings.
[b] Significant difference at p-value < 0.05 between 1970s buildings and 1990 building.
N = number of participants
% = percent of participants

TABLE 9
Adjusted [*] odds ratios (95% confidence interval) of work-related respiratory symptoms for each exposure index[†] of environmental factors, Nassau Community College, 2000

Work-related symptoms	Average water stain score		Visible mold present	Mold odor present	Current moisture present
	Continuous variable	Any stain present			
Wheeze	2.3 (1.1-4.5)	2.6 (0.7-9.2)	2.0 (1.1-3.7)	1.1 (0.5-2.3)	1.2 (0.3-4.5)
Chest tightness	1.9 (0.9-3.8)	1.9 (0.5-6.9)	2.6 (1.3-4.9)	1.0 (0.5-2.2)	1.0 (0.2-4.2)
Shortness of breath	1.7 (0.8-3.6)	6.3 (0.8-51.1)	2.6 (1.3-5.1)	1.4 (0.7-3.2)	3.3 (0.9-11.9)
Any chest symptoms	1.8 (0.9-3.3)	2.4 (0.8-7.5)	2.3 (1.3-4.0)	1.0 (0.5-2.1)	2.1 (0.6-7.1)
Attack of cough	1.3 (0.6-2.6)	3.2 (0.7-14.4)	1.5 (0.8-2.8)	1.7 (0.8-3.6)	1.0 (0.2-4.5)
Physician-diagnosed asthma	0.5 (0.2-1.5)	1.7 (0.2-13.7)	0.8 (0.3-2.1)	0.5 (0.1-1.8)	1.6 (0.3-7.6)
Nasal symptoms	1.5 (0.8-2.8)	4.4 (1.2-15.3)	1.7 (1.0-3.0)	1.1 (0.6-2.1)	1.7 (0.5-6.0)
Sinus symptoms	1.6 (0.9-2.9)	3.8 (1.1-13.4)	2.0 (1.2-3.4)	1.3 (0.7-2.5)	0.8 (0.2-2.9)
Throat irritation	2.4 (1.3-4.4)	2.0 (0.7-5.6)	1.3 (0.7-2.1)	2.3 (1.2-4.3)	1.5 (0.4-5.1)
Eye irritation	1.3 (0.7-2.4)	1.9 (0.6-5.9)	1.8 (1.0-3.2)	0.7 (0.4-1.6)	0.9 (0.3-3.3)
Any upper respiratory symptoms or eye irritation	1.9 (1.1-3.3)	2.2 (0.9-5.2)	1.6 (0.9-2.6)	2.3 (1.2-4.3)	1.5 (0.4-5.6)

[*] Adjusted for age, gender, status (faculty or staff), cigarette smoker, allergies, use of latex gloves, and year of hire.

[†] Exposure index for individual $j = \sum_{i=1}^{k} E_i \times TF_{ij}$, $TF_{1j}+TF_{2j}+ \ldots +TF_{kj} = 1.0$

Where, i = room k where individual j spent their time.
E_i = individual component of environmental factors for room i
TF_{ij} = time fraction an individual j spent in room i during the Fall 2000 semester.

FIGURE 1
Distribution of date of hire for all participants (N=393), Nassau Community College, 2000

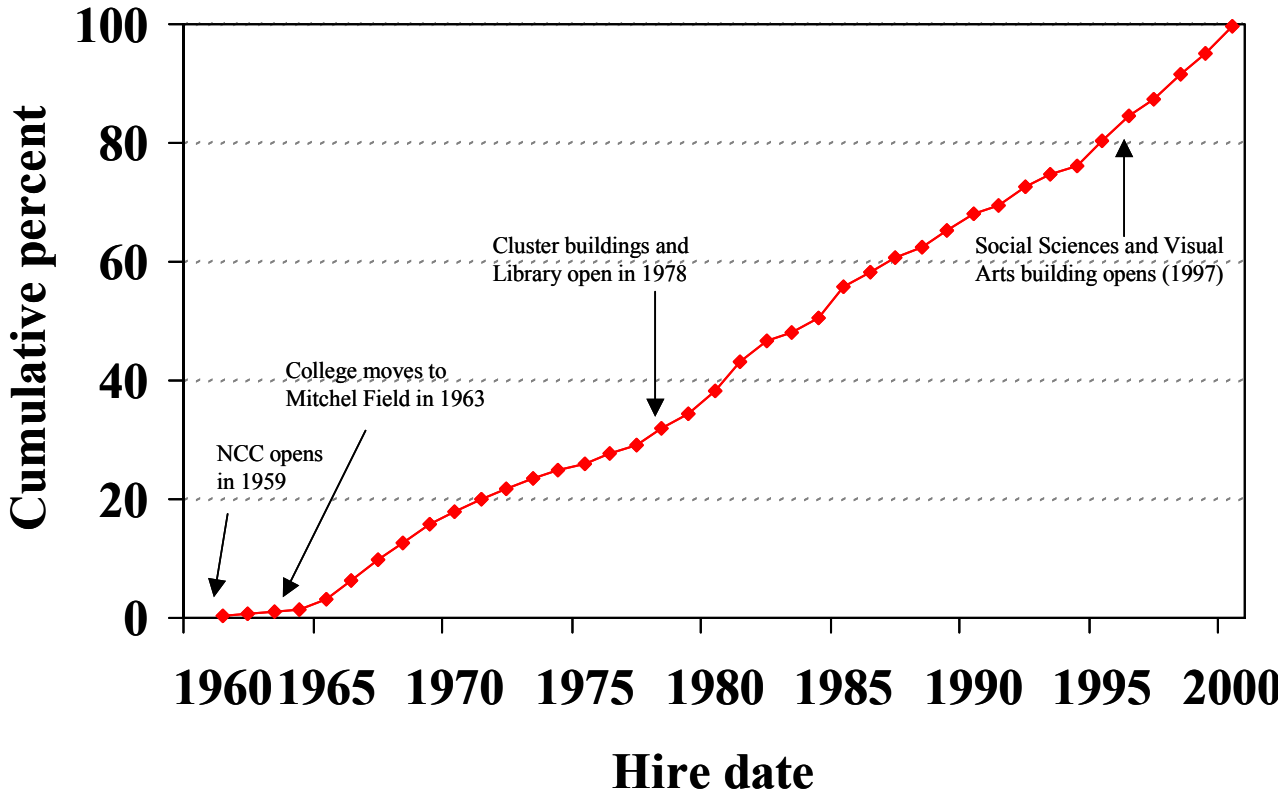
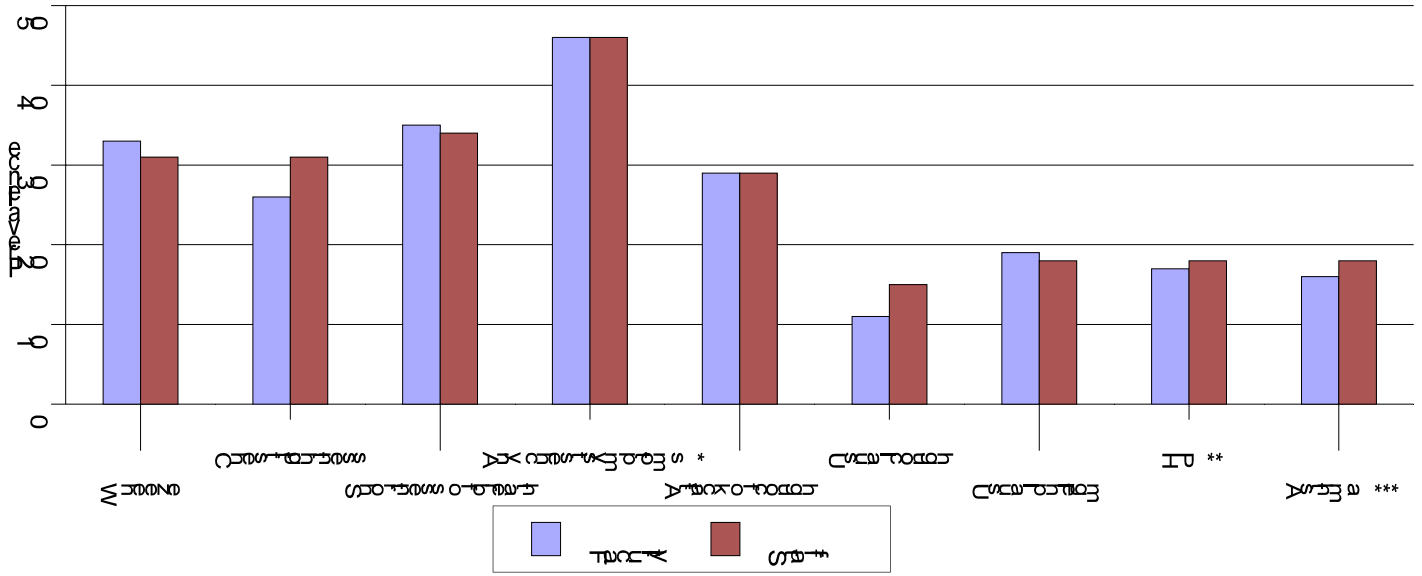
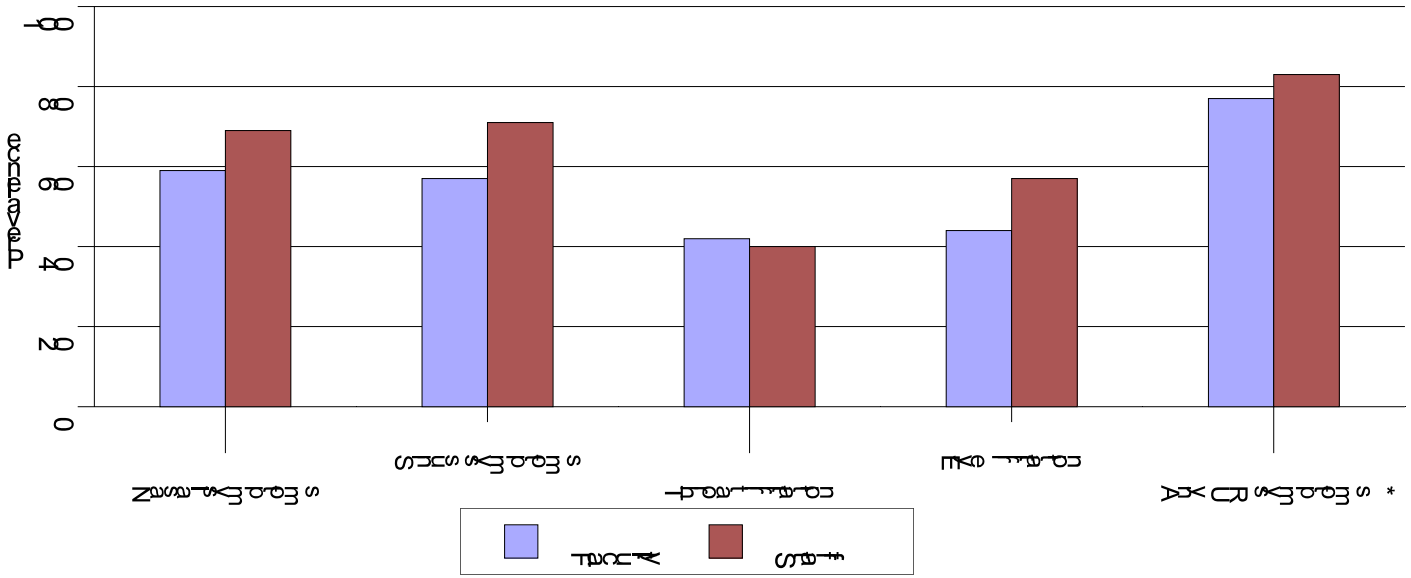


FIGURE 2
Prevalence of reported respiratory symptoms and physician-diagnosed asthma by faculty and staff for all participants (N=393), Nassau Community College, 2000



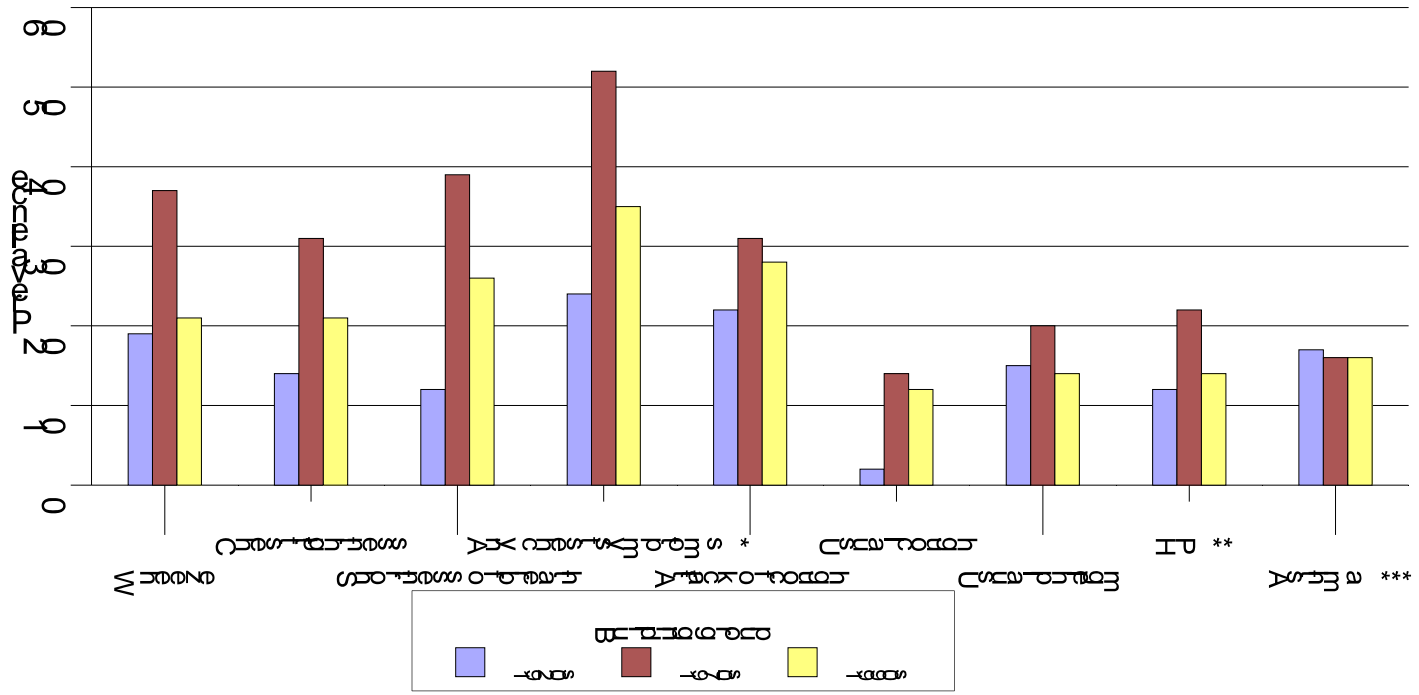
* Refers to any one of the following: wheeze, chest tightness, or shortness of breath.
** HP refers to possible Hypersensitivity Pneumonitis. (See page 7)
*** Asthma refers here to physician-diagnosed asthma.

FIGURE 3
Prevalence of reported upper respiratory symptoms or eye irritation by faculty and staff for all participants (N=393), Nassau Community College, 2000



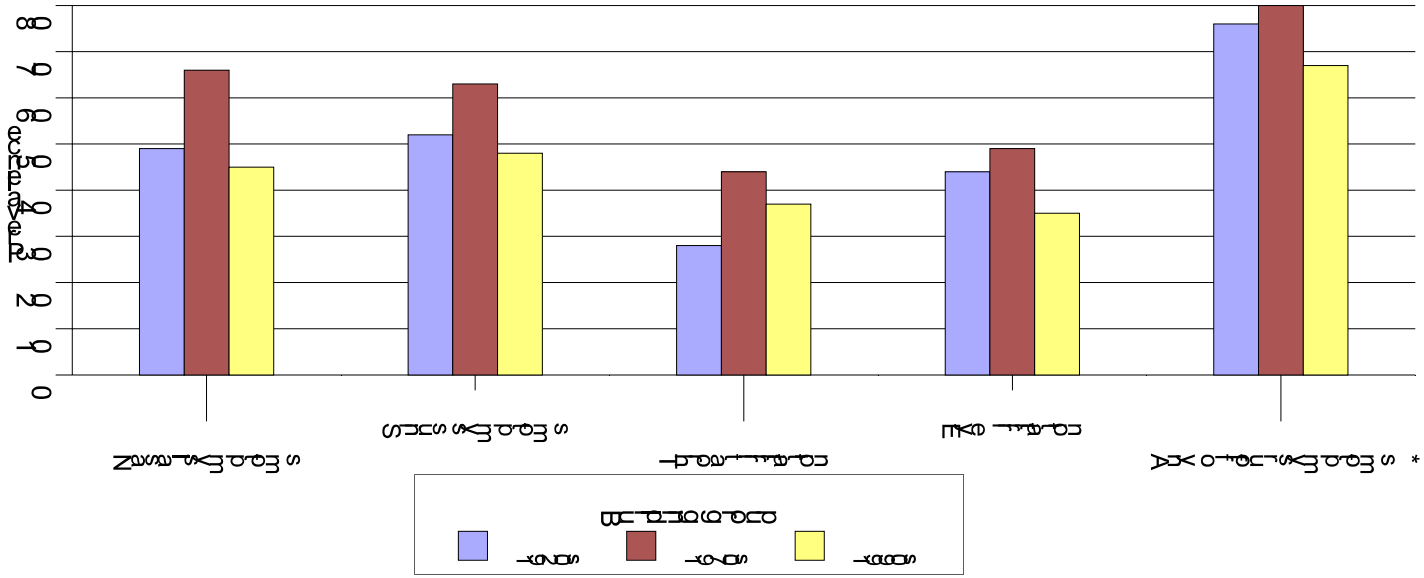
* Refers to any one of the following upper respiratory symptoms: nasal symptoms, sinus symptoms, throat irritation, or eye irritation.

FIGURE 4
Prevalence of reported respiratory symptoms and physician-diagnosed asthma by building group for all participants (N=356), except those in the Nursing department, Nassau Community College, 2000.



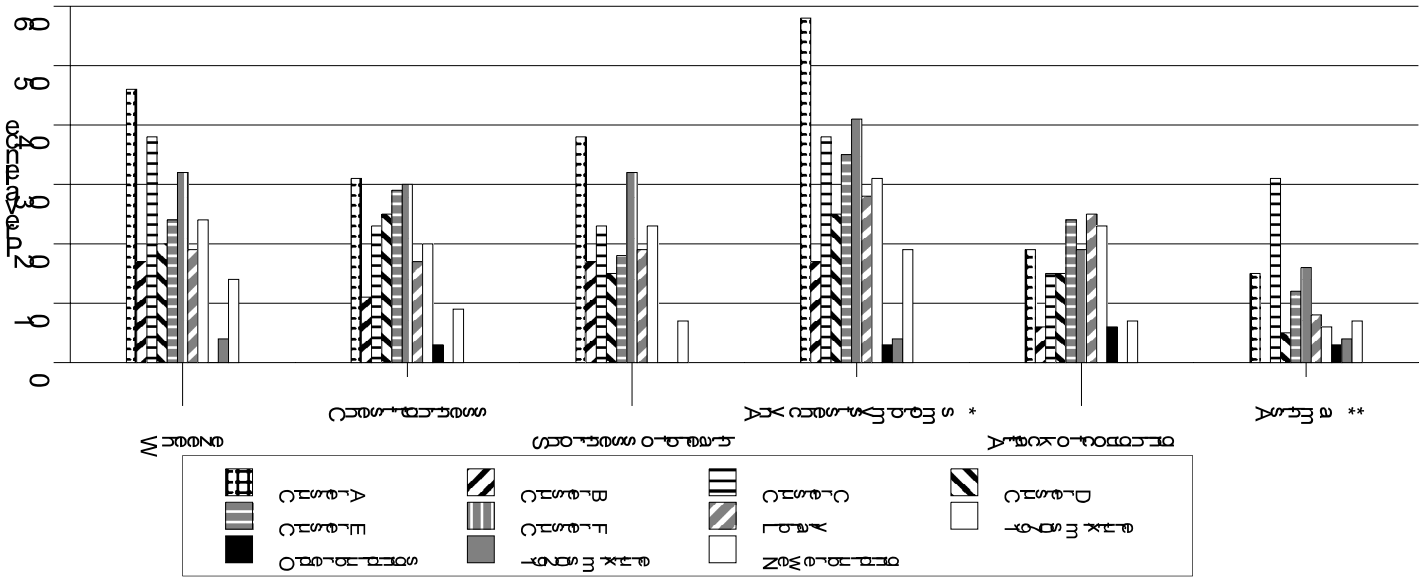
* Refers to any one of the following: wheeze, chest tightness, or shortness of breath.
** HP refers to possible Hypersensitivity Pneumonitis. (See page 7)
*** Asthma refers to physician-diagnosed asthma.

FIGURE 5
Prevalence of reported upper respiratory symptoms or eye irritation by building group for all participants (N=356), except those in the Nursing department, Nassau Community College, 2000



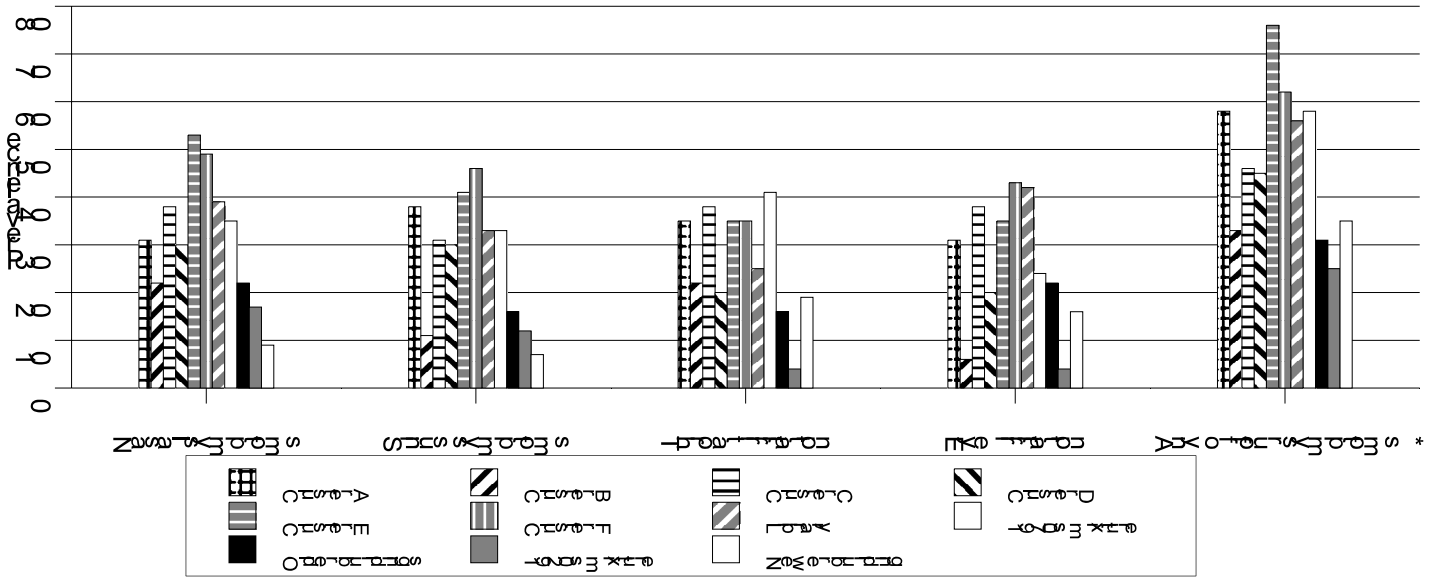
* Refers to any one of the following: nasal symptoms, sinus symptoms, throat irritation, or eye irritation.

FIGURE 6
Prevalence of reported work-related respiratory symptoms and work-related physician-diagnosed asthma by 1970s buildings and other buildings for all participants, except those in the Nursing department, Nassau Community College, 2000



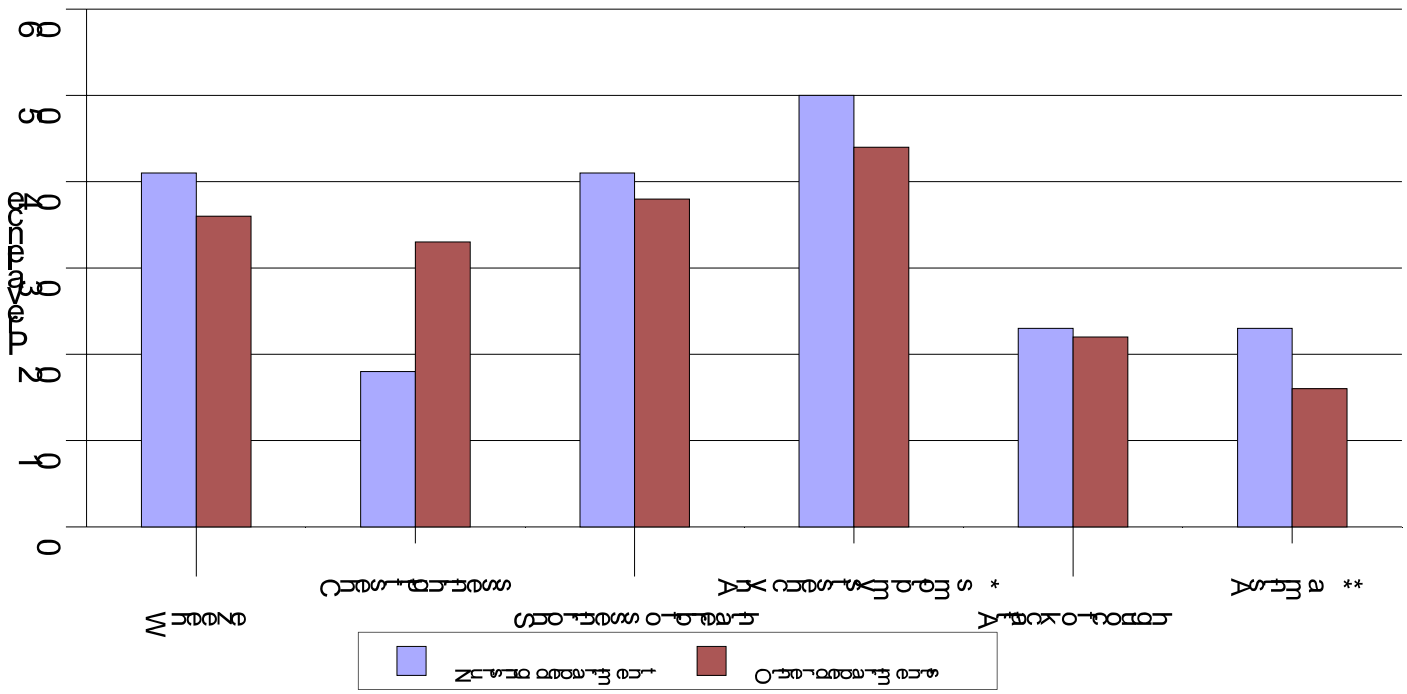
* Refers to any one of the following: wheeze, chest tightness, or shortness of breath.
** Asthma refers to physician-diagnosed asthma.

FIGURE 7
Prevalence of reported work-related upper respiratory symptoms or eye irritation by 1970s buildings and other buildings for all participants, except those in the Nursing department, Nassau Community College, 2000



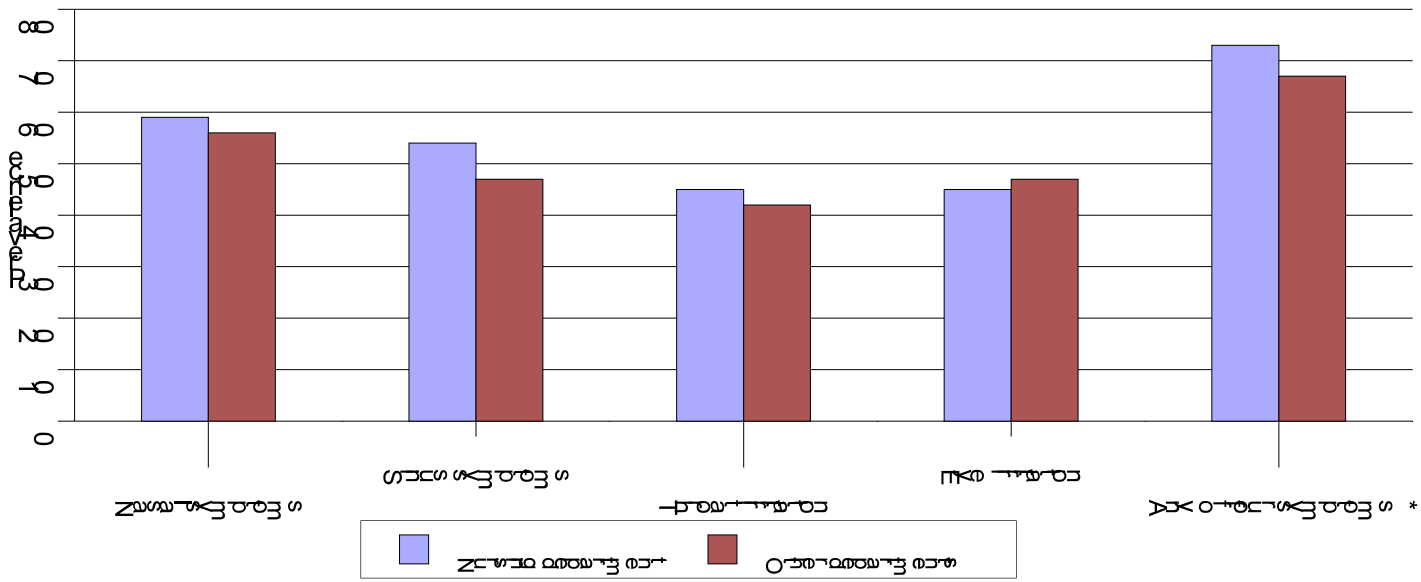
* Refers to any one of the following: nasal symptoms, sinus symptoms, throat irritation, or eye irritation.

FIGURE 8
Prevalence of reported work-related respiratory symptoms and work-related physician-diagnosed asthma for Nursing department, when it was located in Cluster F, and other departments currently in Cluster F, Nassau Community College, 2000



* Refers to any of the following: wheeze, chest tightness, or shortness of breath.
** Asthma refers to physician-diagnosed asthma.

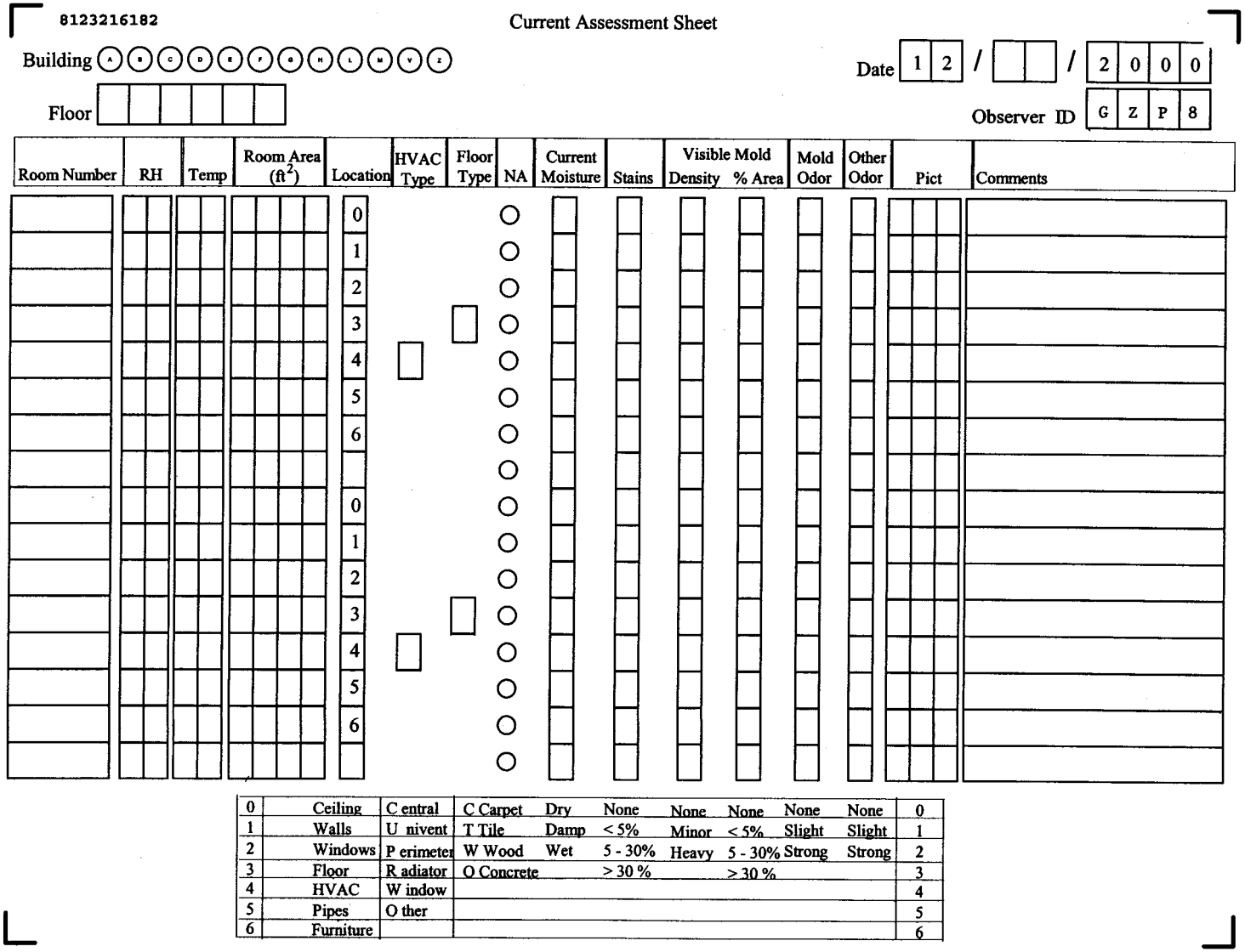
FIGURE 9
Prevalence of reported work-related upper respiratory symptoms or eye irritation for Nursing department, when it was located in Cluster F, and other departments currently in Cluster F, Nassau Community College, 2000



* Refers to any of the following: nasal symptoms, sinus symptoms, throat irritation, or eye irritation.

APPENDIX A

EXAMPLE OF THE 'CURRENT ASSESSMENT SHEET' USED IN EXAMINING THE WORK SPACES DURING THE DECEMBER 2000 SITE VISIT, NASSAU COMMUNITY COLLEGE, 2000



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Current Assessment Sheet

Building (A) (B) (C) (D) (E) (F) (G) (H) (L) (M) (V) (Z)

Date 1 2 / / 2 0 0 0

Floor

Observer ID G Z P 8

Room Number	RH	Temp	Room Area (ft^2)	Location	HVAC Type	Floor Type	NA	Current Moisture	Stains	Visible Mold Density	Visible Mold % Area	Mold Odor	Other Odor	Pict	Comments
				0			○								
				1			○								
				2			○								
				3		☐	○								
				4	☐		○								
				5			○								
				6			○								
							○								
				0			○								
				1			○								
				2			○								
				3		☐	○								
				4	☐		○								
				5			○								
				6			○								
							○								

0	Ceiling	C entral	C Carpet	Dry	None	None	None	None	None	0
1	Walls	U nivent	T Tile	Damp	< 5%	Minor	< 5%	Slight	Slight	1
2	Windows	P erimeter	W Wood	Wet	5 - 30%	Heavy	5 - 30%	Strong	Strong	2
3	Floor	R adiator	O Concrete		> 30 %		> 30 %			3
4	HVAC	W indow								4
5	Pipes	O ther								5
6	Furniture									6

APPENDIX B

EXAMPLE OF QUESTIONNAIRE USED IN THE HEALTH SURVEY, NASSAU COMMUNITY COLLEGE, 2000

Section I: Identification and Demographic Information

Please print your answers.

Name:_____ _____ ____
(Optional) (Last Name) (First Name) (MI)

Home Address:_____
(Optional) (Number, Street, and/or Rural Route)

_____ _____ _____
(City) (State) (Zip Code)

Home Telephone Number: (__ __ __) __ __ __ - __ __ __ __
(Optional)

Business (Work) Telephone Number: (__ __ __) __ __ __ - __ __ __ __
(Optional)

---

1. Date of Birth: ___ ___ / ___ ___ / ___ ___ ___ ___
(Month) (Day) (Year)

2. Gender: 1. _____ Male 2. _____ Female

3. Race/Ethnicity:
1. _____ White
2. _____ African-American or Black
3. _____ Asian
4. _____ American Indian or Alaska Native
5. _____ Native Hawaiian or Other Pacific Islander
6. _____ Other (*Please specify:*_____)

Section II: Health and Well-Being Information

INSTRUCTIONS: ***Most questions can be answered by a simple 'Yes' or 'No'. If you are not sure about the answer, please answer 'No'. Please mark with an 'X' the response that best describes the way you feel.***

The following questions concern chest symptoms and breathing problems.

Wheeze and tightness in the chest

Please answer both questions A and B.

4. Have you had wheezing or whistling in your chest at any time
   - A. in the last ***12 months***? 1. Yes _____ 2. No _____
   - B. in the last ***4 weeks***? 1. Yes _____ 2. No _____

5. Have you woken up with a feeling of tightness in your chest at any time
   - A. in the last ***12 months***? 1. Yes _____ 2. No _____
   - B. in the last ***4 weeks***? 1. Yes _____ 2. No _____

IF 'Yes' TO ANY OF QUESTION 4 or 5:

i) In what *month* and *year*, during your lifetime, did this wheezing and/or chest tightness *first* start? ___ ___ / ___ ___ ___ ___ (Month) (Year)

ii) When you are away from Nassau Community College on weekends, vacations or other days off, is this wheezing or chest tightness

(*Please select one statement only.*)
1. _____ Worse
2. _____ Same
3. _____ Better

Shortness of breath

Please answer both questions A and B.

6. Have you had an attack of shortness of breath that came on during the day when you were *not* doing anything strenuous at any time
   - A. in the last ***12 months***? 1. Yes _____ 2. No _____
   - B. in the last ***4 weeks***? 1. Yes _____ 2. No _____

7. Have you had an attack of shortness of breath that came on *following* strenuous activity at any time
   - A. in the last ***12 months***? 1. Yes _____ 2. No _____
   - B. in the last ***4 weeks***? 1. Yes _____ 2. No _____

8. Have you been woken by an attack of shortness of breath at any time

A. in the last ***12 months***? 1. Yes _____ 2. No _____

B. in the last ***4 weeks***? 1. Yes _____ 2. No _____

IF 'Yes' TO <u>ANY</u> OF QUESTIONS 6, 7, or 8:

i) In what *<u>month</u>* and *<u>year</u>*, during your lifetime, did this shortness of breath *<u>first</u>* start? ___ ___ / ___ ___ ___ ___
(Month) (Year)

ii) When you are away from Nassau Community College on weekends, vacations or other days off, is this shortness of breath

(*Please select <u>one</u> statement only.*)

1. _____ Worse
2. _____ Same
3. _____ Better

<u>Cough and phlegm from the chest</u>

Please answer <u>both</u> questions A and B.

9. Have you been woken by an attack of coughing at any time

A. in the last ***12 months***? 1. Yes _____ 2. No _____

B. in the last ***4 weeks***? 1. Yes _____ 2. No _____

IF 'Yes' to QUESTION 9:

i) In what *<u>month</u>* and *<u>year</u>*, during your lifetime, were you *<u>first</u>* woken up at night by coughing? ___ ___ / ___ ___ ___ ___
(Month) (Year)

ii) When you are away from Nassau Community College on weekends, vacations or other days off, is this coughing

(*Please select <u>one</u> statement only.*)

1. _____ Worse
2. _____ Same
3. _____ Better

10. Do you usually have a cough?
(*Count a cough with first smoke or on first going out-of-doors. Exclude clearing of throat.*) 1. Yes _____ 2. No _____

IF 'Yes' to QUESTION 10:

A. Do you usually cough like this on most days for 3 consecutive months or more during the year? 1. Yes _____ 2. No _____

B. In what *month* and *year* did you *first* have this cough? ___ ___ / ___ ___ ___ ___ (Month) (Year)

11. Do you usually bring up phlegm from your chest?
(*Count phlegm with the first smoke or on first going out-of-doors. Exclude phlegm from the nose. Count swallowed phlegm.*) 1. Yes _____ 2. No _____

IF 'Yes' to QUESTION 11:

A. Do you bring up phlegm like this on most days for 3 consecutive months or more during the year? 1. Yes _____ 2. No _____

B. In what *month* and *year* did you *first* have trouble with phlegm? ___ ___ / ___ ___ ___ ___ (Month) (Year)

Breathing

12. Do you *ever* have trouble with your breathing? 1. Yes _____ 2. No _____

IF 'Yes' to QUESTION 12:

A. Do you have this trouble (*Choose only one of the following.*)

1. _____ continuously so that your breathing is never quite right?
2. _____ repeatedly, but it always gets completely better?
3. _____ only rarely?

13. When you are near animals, such as cats, dogs or horses, near feathers, including pillows, quilts, or down or feather comforters, or in a dusty part of your house, do you *ever*

A. Get a feeling of tightness in your chest? 1. Yes _____ 2. No _____

B. Start to feel short of breath? 1. Yes _____ 2. No _____

14. Are you troubled by shortness of breath when hurrying on the level or walking up a slight hill? 1. Yes _____ 2. No _____

IF 'Yes' to QUESTION 14:

A. In what *month* and *year*, during your lifetime, did this breathlessness *first* start? ___ ___ / ___ ___ ___ ___ (Month) (Year)

B. Do you have to walk slower than people of your age on the level because of breathlessness? 1. Yes _____ 2. No _____

C. Do you ever have to stop for breath when walking at your own pace on the level? 1. Yes _____ 2. No _____

D. Do you ever have to stop for breath after walking about 100 yards (or after a few minutes) on the level? 1. Yes _____ 2. No _____

Asthma

15. Have you *ever* had asthma? 1. Yes _____ 2. No _____

IF 'Yes' TO QUESTION 15:

A. About what age did your asthma *start*? _____ Years old

B. Have you had an attack of asthma at *any* time
1. in the last ***12 months***? 1. Yes _____ 2. No _____
2. in the last ***4 weeks***? 1. Yes _____ 2. No _____

C. Did you have asthma *in the year before* you started working at Nassau Community College? 1. Yes _____ 2. No _____

IF 'Yes':

1. Overall, since you *started working* at Nassau Community College, has your asthma:

(*Please select one statement only.*)
1. _____Gotten Worse
2. _____ Stayed the Same
3. _____ Gotten Better

Continue with asthma questions on next page.

CONTINUATION OF ASTHMA QUESTION 15:

D. Was your asthma *diagnosed by a doctor*? 1. Yes _____ 2. No _____

IF 'Yes':

1. When were you *first* diagnosed with asthma?

___ ___ / ___ ___ ___ ___
(Month) (Year)

E. Are you *currently* taking any inhaled or oral medications for your asthma? 1. Yes _____ 2. No _____

IF 'Yes':

1. When do you use your inhaler or nebulizer?
(*Please check only one.*)
1. _____ More on workdays than other days
2. _____ Less on workdays than other days
3. _____ Same on workdays as other days
4. _____ Only take oral medications
5. _____ Don't know

F. When you are *away* from Nassau Community College on weekends, vacations or other days off, are your asthma symptoms
(*Please select one statement only.*)
1. _____ Worse
2. _____ Same
3. _____ Better

16. If you answer **'Yes'** to *any* of the questions on chest symptoms and breathing problems - Questions 4 through 15, what kinds of exposures/triggers do you think tend to set off these symptoms? (*Please list the exposures/triggers and mark the places where this is most likely to occur.*)

List below the exposures/triggers that set off your symptoms. (*Please PRINT.*)	Where is this most likely to occur? (*Check all that apply*)				
		At work			
	A. At home	B. Office	C. Classroom	D. Laboratory	E. Elsewhere (*Please specify.*)
1.					
2.					
3.					
4.					
5.					

Nasal symptoms

Please answer both questions A and B.

17. Apart from a cold, have you had nasal symptoms, such as a stuffy or blocked nose, itchy nose, runny nose or episodes of sneezing, at any time
    A. in the last ***12 months***? 1. Yes _____ 2. No _____
    B. in the last ***4 weeks***? 1. Yes _____ 2. No _____

IF 'Yes' TO QUESTION 17:

i) In what *month* and *year*, during your lifetime, did you *first* notice these nasal (nose) symptoms? ___ ___ / ___ ___ ___ ___
(Month) (Year)

ii) When you are away from Nassau Community College on weekends, vacations or other days off, are these nasal symptoms
(*Please select one statement only.*)
1. _____ Worse
2. _____ Same
3. _____ Better

18. Have you *ever* had nose bleeds at any time
    A. in the last ***12 months***? 1. Yes _____ 2. No _____
    B. in the last ***4 weeks***? 1. Yes _____ 2. No _____

IF 'Yes' TO QUESTION 18:

i) In what *month* and *year*, during your lifetime, did you *first* notice these nose bleeds? ___ ___ / ___ ___ ___ ___
(Month) (Year)

ii) When you are away from Nassau Community College on weekends, vacations or other days off, are these nose bleeds
(*Please select one statement only.*)
1. _____ Worse
2. _____ Same
3. _____ Better

Sinus symptoms

Please answer <u>both</u> questions A and B.

19. Apart from a cold, have you had sinus symptoms, such as a sinus headache or facial pain and/or pressure, postnasal drip or drainage in the back of your throat, thick mucus from your nose, at any time

A. in the last ***12 months***? 1. Yes _____ 2. No _____
B. in the last ***4 weeks***? 1. Yes _____ 2. No _____

IF 'Yes' TO QUESTION 19:

i) In what *<u>month</u>* and *<u>year</u>*, during your lifetime, did you *<u>first</u>* notice these sinus symptoms? ___ ___ / ___ ___ ___ ___
(Month) (Year)

ii) When you are away from Nassau Community College on weekends, vacations or other days off, are these sinus symptoms
(*Please select <u>one</u> statement only.*)
1. _____ Worse
2. _____ Same
3. _____ Better

Throat and eye symptoms

Please answer <u>both</u> questions A and B.

20. Apart from a cold, have you had hoarseness or loss of voice at any time

A. in the last ***12 months***? 1. Yes _____ 2. No _____
B. in the last ***4 weeks***? 1. Yes _____ 2. No _____

21. Have you *<u>ever</u>* had burning sensations of the throat at any time

A. in the last ***12 months***? 1. Yes _____ 2. No _____
B. in the last ***4 weeks***? 1. Yes _____ 2. No _____

IF 'Yes' TO <u>ANY</u> OF QUESTIONS 20 or 21:

i) In what *<u>month</u>* and *<u>year</u>*, during your lifetime, did you *<u>first</u>* notice these throat symptoms? ___ ___ / ___ ___ ___ ___
(Month) (Year)

ii) When you are away from Nassau Community College on weekends, vacations or other days off, are these throat symptoms
(*Please select <u>one</u> statement only.*)
1. _____ Worse
2. _____ Same
3. _____ Better

22. Have you *ever* had itchy, burning eyes at any time
   A. in the last ***12 months***? 1. Yes _____ 2. No _____
   B. in the last ***4 weeks***? 1. Yes _____ 2. No _____

IF 'Yes' TO QUESTION 22:

i) In what *month* and *year*, during your lifetime, did you *first* notice these eye symptoms? ___ ___ / ___ ___ ___ ___
(Month) (Year)

ii) When you are away from Nassau Community College on weekends, vacations or other days off, are these eye symptoms
(*Please select one statement only.*)
1. _____ Worse
2. _____ Same
3. _____ Better

Allergies

23. Do you have any nasal allergies, including hayfever? 1. Yes _____ 2. No _____

IF 'Yes' TO QUESTION 23:

i) Have you had these allergies at *any* time
   A. in the last ***12 months***? 1. Yes _____ 2. No _____
   B. in the last ***4 weeks***? 1. Yes _____ 2. No _____

ii) What are the exposures/triggers that set off your allergies? (*Please PRINT.*)
_____
_____
_____

General symptoms and conditions

24.

In the last ***12 months***, how often have you had (*Please answer all Questions A-K.*)	(*Please CHECK only one box for each item A-K.*) No	Yes			***IF 'YES'*** 1. What happened to this symptom or condition at times when you were away from work? (eg, weekends, vacations)			2. How many years have you had this symptom or condition?
	1. Never	2. Rarely	3. Monthly	4. Weekly	1. Got Worse	2. Stayed Same	3. Got Better	
A. Fever?								
B. Chills?								
C. Night-sweats?								
D. Flu-like achiness?								
E. Unusual tiredness or fatigue?								
F. Sinusitis or sinus infection?								
G. Skin rash, dryness, itchy, irritation of the skin?								
H. Joint pains?								
I. Headaches?								
J. Difficulty remembering things or concentrating?								
K. Nausea?								

Latex gloves and sensitivity

25. Do you wear gloves when working? 1. Yes _____ 2. No _____

IF 'Yes' TO QUESTION 25:

A. What types of gloves do you wear *most* often?
1. _____ Powdered latex
2. _____ Non-powdered latex
3. _____ Non-latex (i.e, vinyl, nitrile, etc.)
4. _____ Other (*Please specify:*_____)

B. Where do you wear these gloves?
(*Check all that apply.*)
1. _____ Laboratory
2. _____ Clinic
3. _____ Hospital
4. _____ Other
(*Please specify:*_____)

26. When you wear or are around others wearing latex gloves, have you experienced *any* of the following symptoms?

A. Rash, itching, cracking, chapping, scaling of the skin? 1. Yes _____ 2. No _____ 3. NA _____

B. Hives (red, itchy, swollen welts within 30 minutes or "water blisters" on your hands within a day)? 1. Yes _____ 2. No _____ 3. NA _____

C. Itchy, red eyes; fits of sneezing; runny or stuffed nose? 1. Yes _____ 2. No _____ 3. NA _____

D. Shortness of breath, wheezing, chest tightness, or difficulty breathing? 1. Yes _____ 2. No _____ 3. NA _____

E. Other acute reactions, including generalized or severe swelling or shock? 1. Yes _____ 2. No _____ 3. NA _____

IF 'Yes' TO ANY OF QUESTION 26:

i) Do these symptoms persist when you stop wearing or are no longer around latex gloves? 1. Yes _____ 2. No _____

Section III: Smoking Information

27. Have you *ever* smoked cigarettes? 1. Yes _____ 2. No _____
(*Answer 'No' if less than 20 packs of cigarettes in a lifetime or less than 1 cigarette a day for 1 year*.)

IF 'Yes' TO QUESTION 27:

A. How old were you when you *first* started smoking regularly? _____ Years old

B. Over the entire time that you have smoked, what is the average number of cigarettes that you smoked per day? _____ Cigarettes/day

C. Do you still smoke cigarettes? 1. Yes _____ 2. No _____

IF 'No' to C:

1. How old were you when you stopped smoking regularly? _____ Years old

28. Have you *ever* smoked cigars regularly? 1. Yes _____ 2. No _____
(*Answer 'Yes' if more than 1 cigar a week for a year.*)

29. Have you *ever* smoked a pipe regularly? 1. Yes _____ 2. No _____
(*Answer 'Yes' if more than 12 oz. of tobacco in a lifetime.*)

Section IV: Work History Information

30. When did you *first* begin working at Nassau Community College? ___ ___ / ___ ___ ___ ___
(Month) (Year)

31. What is your *current* job title at this college? _____
(Job Title)

32. What academic department do you *currently* work in? _____
(Department)

33. Are you a full-time or an adjunct faculty, or a full-time or part-time civil servant employee at this college?
1. _____ Full-time faculty
2. _____ Adjunct faculty
3. _____ Full-time civil servant
4. _____ Part-time civil servant

34. How many hours per week do you *typically* work at this college? _____ Hours/week

35. How many days of the week do you work at this college? _____ Days/week

The following questions are about your office, classroom, and/or laboratory assignments for the YEAR 2000. This includes all three semesters (Spring, Summer, and Fall).

Please answer ALL three questions (Questions 37, 38, and 39).

To help you remember your assignments, please check with your department to obtain your Faculty Program Schedule - Form #DI-6 for the Year 2000.

36. During the Year 2000, have you taught in the (*Check all that apply.*)
1. _____ Spring Semester
2. _____ Summer Sessions
3. _____ Fall Semester

37. ***Please list <u>all</u> offices, classrooms and laboratories you have occupied or taught in during the <u>Spring Semester 2000</u> (January 18th through May 11th) as best as you can. The first few rows of each section are examples.***

	Spring Semester: 1/18 - 5/11 A. Please list <u>all</u> **offices**	1. Building Name	2. What % of time per week did you spend in this room? Note: each semester should total 100%.	During the semester, did you notice <u>*any*</u> of the following in the room? (*Please circle 'Y' for YES, 'N' for NO, and 'DR' for DON'T REMEMBER..*)			
				3. Visible mold/mildew	4. Mold odor	5. Persistent presence of unintended water or water damage	6. Bird/animal droppings
Example	**4000**	**W**	**20**	Y N DR	Y N DR	Y N DR	Y N DR
				Y N DR	Y N DR	Y N DR	Y N DR
				Y N DR	Y N DR	Y N DR	Y N DR
				Y N DR	Y N DR	Y N DR	Y N DR
				Y N DR	Y N DR	Y N DR	Y N DR
	B. Please list <u>all</u> **classrooms (C) and laboratories (L)**						
Example	**400 - C**	**W**	**40**	Y N DR	Y N DR	Y N DR	Y N DR
Example	**400 - L**	**Q**	**40**	Y N DR	Y N DR	Y N DR	Y N DR
				Y N DR	Y N DR	Y N DR	Y N DR
				Y N DR	Y N DR	Y N DR	Y N DR
				Y N DR	Y N DR	Y N DR	Y N DR
				Y N DR	Y N DR	Y N DR	Y N DR
				Y N DR	Y N DR	Y N DR	Y N DR
				Y N DR	Y N DR	Y N DR	Y N DR
				Y N DR	Y N DR	Y N DR	Y N DR
				Y N DR	Y N DR	Y N DR	Y N DR
				Y N DR	Y N DR	Y N DR	Y N DR
				Y N DR	Y N DR	Y N DR	Y N DR
				Y N DR	Y N DR	Y N DR	Y N DR

38. ***Please list all offices, classrooms and laboratories you have occupied or taught in during the Summer Semester 2000 (May 22nd through August 18th) as best as you can. The first few rows of each section are examples.***

	Summer Semester: 5/22 - 8/18 A. Please list all **offices**	1. Building Name	2. What % of time per week did you spend in this room? Note: each semester should total 100%.	During the semester, did you notice any of the following in the room? (*Please circle 'Y' for YES, 'N' for NO, and 'DR' for DON'T REMEMBER..*) 3. Visible mold/mildew	4. Mold odor	5. Persistent presence of unintended water or water damage	6. Bird/animal droppings
Example	**5000**	**AA**	**10**	Y N DR	Y N DR	Y N DR	Y N DR
				Y N DR	Y N DR	Y N DR	Y N DR
				Y N DR	Y N DR	Y N DR	Y N DR
				Y N DR	Y N DR	Y N DR	Y N DR
				Y N DR	Y N DR	Y N DR	Y N DR
	B. Please list all **classrooms (C) and laboratories (L)**						
Example	**200 - C**	**R**	**40**	Y N DR	Y N DR	Y N DR	Y N DR
Example	**100 - L**	**R**	**50**	Y N DR	Y N DR	Y N DR	Y N DR
				Y N DR	Y N DR	Y N DR	Y N DR
				Y N DR	Y N DR	Y N DR	Y N DR
				Y N DR	Y N DR	Y N DR	Y N DR
				Y N DR	Y N DR	Y N DR	Y N DR
				Y N DR	Y N DR	Y N DR	Y N DR
				Y N DR	Y N DR	Y N DR	Y N DR
				Y N DR	Y N DR	Y N DR	Y N DR
				Y N DR	Y N DR	Y N DR	Y N DR
				Y N DR	Y N DR	Y N DR	Y N DR
				Y N DR	Y N DR	Y N DR	Y N DR
				Y N DR	Y N DR	Y N DR	Y N DR

39. ***Please list all offices, classrooms and laboratories you have occupied or taught in during the Fall Semester 2000 (September 6th through December 23rd) as best as you can. The first few rows of each section are examples.***

	Fall Semester: 9/6 - 12/23 A. Please list all **offices**	1. Building Name	2. What % of time per week did you spend in this room? Note: each semester should total 100%.	During the semester, did you notice *any* of the following in the room? (*Please circle 'Y' for YES, 'N' for NO, and 'DR' for DON'T REMEMBER..*) 3. Visible mold/mildew	4. Mold odor	5. Persistent presence of unintended water or water damage	6. Bird/animal droppings
Example	**1010**	**P**	**20**	Y N DR	Y N DR	Y N DR	Y N DR
				Y N DR	Y N DR	Y N DR	Y N DR
				Y N DR	Y N DR	Y N DR	Y N DR
				Y N DR	Y N DR	Y N DR	Y N DR
				Y N DR	Y N DR	Y N DR	Y N DR
	B. Please list all **classrooms (C) and laboratories (L)**						
Example	**100 - C**	**EE**	**40**	Y N DR	Y N DR	Y N DR	Y N DR
Example	**201 - L**	**J**	**40**	Y N DR	Y N DR	Y N DR	Y N DR
				Y N DR	Y N DR	Y N DR	Y N DR
				Y N DR	Y N DR	Y N DR	Y N DR
				Y N DR	Y N DR	Y N DR	Y N DR
				Y N DR	Y N DR	Y N DR	Y N DR
				Y N DR	Y N DR	Y N DR	Y N DR
				Y N DR	Y N DR	Y N DR	Y N DR
				Y N DR	Y N DR	Y N DR	Y N DR
				Y N DR	Y N DR	Y N DR	Y N DR
				Y N DR	Y N DR	Y N DR	Y N DR
				Y N DR	Y N DR	Y N DR	Y N DR
				Y N DR	Y N DR	Y N DR	Y N DR

APPENDIX C

A SUMMARY OF DEMOGRAPHIC CHARACTERISTICS AND REPORTED RESPIRATORY SYMPTOMS FOR THOSE WHO PARTICIPATED IN THE NON-RESPONDENT SURVEY IN APRIL 2000, NASSAU COMMUNITY COLLEGE, 2000

A survey of non-respondents to the main questionnaire survey was undertaken from April 23-27, 2001, to assess whether the participants were representative of the college population as a whole. The response rate for the non-respondent survey was low, at 39% (63/161). Table C1 shows the demographic characteristics of those 63 individuals who responded to this survey. Table C2 shows the reported respiratory symptoms that had occurred within 12-months of the survey.

TABLE C1
Demographic characteristics of non-respondent population, Nassau Community College, 2000

Characteristics	Employee status		Total
	Faculty	Staff	
Total participants N (%)	54 (86)	9 (14)	63
Gender N (%)			
Female	20 (37)	8 (89)	28 (44)
Male	34 (63)	1 (11)	35 (56)
Smoking status N(%)			
Never smokers	34 (63)	5 (56)	39 (62)
Ever smokers	20 (37)	4 (44)	24 (38)
Building age groups* N (%)			
1920s or 1940s	10 (19)	--	10 (16)
1970s	33 (61)	7 (78)	40 (63)
1990s	11 (20)	2 (22)	13 (21)
Average age, yrs Mean (Std)	50 (9)	47 (13)	49 (10)**
Average tenure, yrs Mean (Std)	17 (11)	8 (5)	16 (11)†

* Reported primary building for Fall 2000 semester.
** Two individuals did not provide their age.
† One individual did not provide a hire date.
N = number of participants
% = percent of participants
Std - standard deviation

TABLE C2
Reported respiratory and other symptoms within the past 12 months of the survey for non-respondents, Nassau Community College, 2000

Reported symptoms N(%)	Employee status		Total (N=63)
	Faculty (N=54)	Staff (N=9)	
Wheezing	13 (24)	3 (33)	16 (25)
Chest tightness	5 (9)	3 (33)	8 (13)
Shortness of breath*	6 (11)	3 (33)	9 (14)
Any chest symptoms	16 (30)	3 (33)	19 (30)
Attack of coughing	9 (17)	2 (22)	11 (17)
Nasal symptoms (e.g., stuffy or blocked nose, itchy nose, runny nose or episodes of sneezing)	27 (50)	4 (44)	31 (49)
Systemic symptoms (e.g., fever, chills, night-sweats, flu-like achiness)	24 (44)	3 (33)	27 (43)
Unusual tiredness or fatigue	20 (37)	4 (44)	24 (38)
Physician-diagnosed asthma	5 (9)	5 (56)	10 (16)

* Shortness of breath is defined as an attack of shortness of breath at any time.
N = number of participants
% = percent of participants

In order to improve our future Health Hazard Evaluation surveys, participants of the non-respondent survey were asked why they did not respond to the initial health questionnaire survey. Twenty-nine percent of the participants stated that the initial questionnaire was too long. Five percent had a concern with confidentiality. Another five percent said that they did not receive a questionnaire. Two percent were not interested with the survey. The remaining 59% of the non-respondent population reported other reasons why they did not respond to the initial questionnaire. Participants reported being too busy as the most common other reason.

APPENDIX D

A SUMMARY OF DEMOGRAPHIC CHARACTERISTICS AND REPORTED RESPIRATORY SYMPTOMS FOR THOSE PARTICIPANTS NOT SELECTED FOR THE MAIN STUDY, NASSAU COMMUNITY COLLEGE, 2000

An additional 244 employees who participated in the health survey were not considered for the main study, because of their low response rate and the limited amount of time these individuals spent working at the college. These individuals were retired employees, or employees on extended leave (i.e., sabbatical/maternity), or employees teaching full time off campus or in any building not selected for study, or part-time staff and adjunct faculty. Table D1 shows the demographic characteristics of these individuals. There were 65 full-time and 179 part-time employees who participated. Over half of these individuals worked in Towers, the Administrative office building which was built in the 1970's.

TABLE D1
Demographic characteristics of participants not selected for the main study (N=244), Nassau Community College, 2000

Characteristics	Full-time (N=65)	Part-time (N=179)
Employee status N (%)		
Faculty	12 (18)	149 (83)
Staff	53 (82)	30 (17)
Gender N (%)		
Female	40 (62)	86 (48)
Male	19 (29)	91 (51)
Not responded	6 (9)	2 (1)
Ethnicity N (%)		
White	50 (77)	158 (88)
African-American	5 (8)	6 (3)
Other	2 (3)	8 (4)
Not responded	8 (12)	7 (4)
Smoking status N (%)		
Non-smokers	29 (45)	109 (61)
Ex-smokers	20 (31)	56 (31)
Current	15 (23)	13 (7)
Not responded	1 (2)	1 (<1)
Building group* N (%)		
1920's - 1940's	5 (8)	32 (18)
1970's	42 (65)	98 (55)
1990's	1 (2)	45 (25)
Unknown	17 (26)	4 (2)
Average age, yrs Mean (Std)	48 (10)†	52 (14)†
Average tenure, yrs Mean (Std)	11 (9)	12 (11)

* Reported building for Fall 2000 semester.
† There were 12 full-time individuals and 13 part-time individuals who did not provide information on their age.
N = number of participants
% = percent of participants
Std = standard deviation

Table D2 shows the reported respiratory and other symptoms within 12 months of the survey and physician-diagnosed asthma for those participants that were not included in the main study.

TABLE D2
Reported respiratory and other symptoms within the past 12 months of the survey and physician-diagnosed asthma for participants not part of the main study, Nassau Community College, 2000

Reported symptoms N (%)	Full-time (N=65)	Part-time (N=179)
Wheezing	21 (33)	51 (28)
Chest tightness	21 (33)	37 (21)
Shortness of breath Not doing anything strenuous Following strenuous activity Awoken by an attack of shortness of breath	28 (44) 14 (22) 24 (38) 13 (20)	42 (23) 22 (12) 37 (21) 17 (10)
Attack of coughing	20 (31)	46 (26)
Usual cough	9 (14)	16 (9)
Usual phlegm	17 (27)	32 (18)
Nasal symptoms	44 (70)	92 (51)
Sinus symptoms	46 (72)	85 (47)
Throat irritation	22 (34)	52 (29)
Itchy and burning eyes	29 (45)	76 (42)
Physician-diagnosed asthma	12 (18)	32 (18)

N = number of participants
% = percent of participants