care facility vitamin A supplementation programme, or what the cost of any such efforts might be. Use of other EPI strategies such as mass immunisation campaigns, need investigation as vehicles for getting vitamin A out to the 'hard-to-reach' population. It is likely, however, that an outreach programme would substantially increase the overall costs of the vitamin A supplementation programme. Whether or not these additional costs would be regarded as worthwhile in terms of the morbidity and mortality they might be expected to avert, is an important albeit independent policy issue.

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LATEX ALLERGY AT GROOTE SCHUUR HOSPITAL — PREVALENCE, CLINICAL FEATURES AND OUTCOME

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Background. The incidence of latex allergy is increasing worldwide but there is very little information available on the clinical outcome for affected individuals.

Objective. To determine the prevalence of latex allergy at Groote Schuur Hospital, a large teaching hospital in Cape Town, and to study the outcome for affected individuals.

Method. Using a questionnaire, we screened 2 316 hospital workers for the presence of work-related symptoms. Workers who were symptomatic had Immunocap RAST (CAP RAST) or skin-prick tests to confirm latex sensitivity. Latex-avoidance measures were implemented in positive subjects. One hundred symptomatic, sensitised individuals were followed up 3 months after intervention to assess their clinical status. A further cohort of 25 individuals with ongoing nasal symptoms were studied in detail.

Results. Latex sensitisation was confirmed in 182 of 717 symptomatic workers (25.3%). Sensitised symptomatic workers were significantly more likely to have had a previous history of urticaria ($P = < 0.001$), oral allergy syndrome ($P = < 0.001$), or allergic conjunctivitis ($P = 0.001$), but not hay fever, perennial rhinitis, eczema or insect allergies. Latex sensitisation occurred among all classes of health care workers. Ocular and cutaneous symptoms were significantly associated with positive latex sensitisation ($P = < 0.001$). After latex intervention, ocular symptoms ($P = < 0.001$), skin rashes ($P = < 0.001$) and wheezing ($P = 0.001$) reduced significantly. Nasal symptoms did not improve. Undiagnosed and untreated underlying allergies to common aero-allergens were present in the majority of latex-sensitised patients with ongoing nasal symptomatology.

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Conclusion. The prevalence of symptomatic sensitisation to latex allergy at Groote Schuur Hospital is between 9.2 and 11.2%. Ocular and cutaneous symptoms are the most prevalent in sensitised workers, and unlike nasal symptoms are significantly reduced when latex-avoidance measures are introduced. Ongoing nasal symptoms after intervention is instituted are probably due to other allergic sensitivities in latex-sensitised health care workers.

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Since the first case of latex allergy was reported in the world literature in 1979[1] there has been a dramatic increase worldwide in the number of hospital employees developing latex allergy. For some workers the symptoms of allergy have been relatively minor, whereas other workers have been incapacitated by the development of severe asthma, rhinoconjunctivitis, generalised urticaria and even anaphylaxis, and have been forced to relinquish their jobs in the medical environment. The first case of latex allergy in South Africa was diagnosed in Cape Town in 1993 in a nursing sister at Groote Schuur Hospital. Identification of the first patient led to a pilot study which identified 23 further cases of latex allergy.[2] This study raised the possibility that the problem of latex allergy may be widespread in South Africa.

There have been several studies reporting the prevalence of latex allergy in hospitals in the USA, Canada, Finland and Hong Kong,[3-6] but as yet no large surveys determining the prevalence of latex allergy in hospitals on the African continent have been published. There are also no published data reporting the outcome for those diagnosed with latex allergy and in whom latex avoidance measures have been instituted.

In this paper we report on the results of a large survey of 2 316 health professionals screened for possible latex allergy at Groote Schuur Hospital.

The first phase of the study determined the prevalence of latex sensitisation in health care workers with allergy symptoms at the hospital and the profile of allergic symptoms in the sensitised employees. The second phase was a follow-up study of the first 100 employees confirmed as having latex allergy and in whom latex-avoidance measures were instituted. In a third phase of the study, 25 of the latex-sensitive employees who had presented with symptoms of nasal allergy in the work environment were studied further to determine to what extent other allergies could be contributing to their work-related symptoms.

METHODS

In phase 1 of the study a standard questionnaire was administered by a trained nursing sister to 2 316 employees at Groote Schuur Hospital working in areas of the hospital where latex gloves or products were used. The questionnaire sought information specifically relating to the working location of the employee, pre-existing allergic conditions, the relationship between the working environment and allergic symptoms, specific details regarding the type of symptoms experienced in the work environment and the type of exposure to latex (rubber) products in both the work and home environments.

Health workers who reported any allergic symptoms in the work environment were interviewed and reassessed at a special latex allergy clinic established for the purposes of the study.

Individuals who gave a history of clinical symptoms suggestive of possible latex allergy had a blood sample taken to determine latex-specific immunoglobulin E (IgE) using the Immunocap (CAP RAST) test (Pharmacia, Uppsala). Symptomatic health workers who tested positive (> 0.35 kU/l) on CAP RAST were regarded as being sensitised to latex. Symptomatic health workers who tested negative using CAP RAST were brought back to the clinic for careful titrated skin-prick testing using the Stallergenes (France) or the Alk-Abello (Denmark) latex skin-prick testing reagents. A wheal of 3 mm or greater than the saline-negative control was regarded as positive, and 2 mm was regarded as borderline. Histamine-positive controls were also conducted on all patients tested.

Patients who tested positive using either skin-prick tests or CAP RAST were carefully instructed about appropriate latex-avoidance measures. They were advised to wear only non-latex gloves (e.g. neoprene, vinyl or nitrile) and to avoid entering or working in any environment where powdered gloves were being used. They were also informed about other possible modes of exposure to latex, and were provided with an information brochure and a booklet listing non-latex alternatives in the hospital and home environments. They were advised to wear a medic-alert bracelet or chain and instructed as to how and where to treat themselves with antihistamines and/or self-injectable adrenaline should they develop mild or severe symptoms from inadvertent exposure to latex.

The hospital management was educated regarding the risks of latex allergy to the employee, their legal responsibilities to the employee in relation to the South African Occupational Health and Safety Act (1993), the need to convert the hospital to a glove powder-free environment, and of their obligation to provide non-latex gloves to affected employees. The names of all affected employees were notified to the Commissioner for Occupational Diseases in Pretoria.

In phase 2 of the study a follow-up questionnaire was administered 3 - 6 months after the institution of latex-avoidance measures, in the first 100 employees in whom latex allergy was confirmed by skin test or RAST.

In this questionnaire information regarding the type of gloves used after intervention, the presence of ongoing

symptoms at work and the effect of the diagnosis of latex allergy on the employee's ability to continue his or her work and on future career options was obtained.

Because some individuals identified in phase 2 of the study continued to have work-related symptoms after latex-avoidance intervention measures were instituted, a phase 3 study was conducted. This assessed in some detail the allergic status of these employees in order to determine whether other as yet undiagnosed allergies could be accounting for their ongoing symptoms. Twenty-five latex-sensitive subjects who had ongoing nasal allergy in the work environment were recruited and re-interviewed using a standardised questionnaire to obtain clinical details of the duration of the symptoms, seasonality, medication, known allergies and known triggers of symptoms. Further skin-prick tests to a panel of eight inhalant allergens were conducted using the Bayer skin-prick test extracts for housedust mite, cockroach, dog, cat, five-grass mix, *Alternaria alternata*, *Cladosporium herbarum* and a tree mix, with histamine-positive and saline-negative controls.

Statistical analysis

The significance of the differences in the frequency of parameters measured in the study groups was determined by the chi-square test using the Boni Ferri correction. A corrected *P*-value of < 0.05 was considered significant.

Ethical consent

Approval for the study was obtained from the Ethics and Research Committee of the University of Cape Town.

RESULTS

A total of 2 316 health care workers employed at Groote Schuur Hospital were screened. Questionnaires were returned by 1 968 recipients (85%). Seven hundred and seventeen of the respondents reported work-related symptomatology. Sensitisation was confirmed in 182/717 subjects with symptoms suggesting allergy to latex (25.3%). Sensitisation was confirmed by CAP RAST in 39.6%, and in the remaining 60.4% by skin-prick tests. In 32 subjects a 'borderline' wheal, 2 mm greater than the negative control, was observed in the latex skin-prick test. These patients also had a negative CAP RAST.

Distribution of concurrent or previous allergic diseases in the health workers who were symptomatic at work according to the questionnaire and who tested latex-positive are compared with those who tested latex-negative (Fig. 1). There were no significant differences in the frequency of hay-fever, perennial rhinitis, eczema or insect allergies in the two groups. In contrast, urticaria, previous anaphylaxis, oral allergy syndrome, allergic conjunctivitis and other occupational allergies were significantly more frequent in the latex-positive

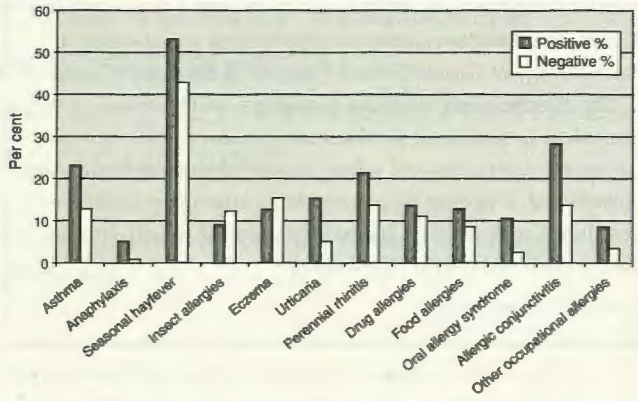

Fig. 1. Distribution of pre-existing allergic diseases in latex-positive (N = 182) and latex-negative (N = 535) subjects with work-related symptoms. Significant differences in the frequency of pre-existing allergic disease were present for asthma (P = 0.022), anaphylaxis (P = 0.007), urticaria (P = < 0.001), oral allergy syndrome (P = < 0.001), allergic conjunctivitis (P = < 0.001) and other occupational allergies (P = < 0.001).

group. Sensitivity to banana and avocado was significantly associated with positive latex sensitivity (*P* = < 0.001).

Latex allergy was confirmed in individuals working in all areas of the hospital where powdered gloves were used. Nursing staff working in theatres or labour wards had the highest prevalence of latex allergy, followed by doctors and laboratory staff. Latex-sensitive individuals were also identified among kitchen staff, radiographers, physiotherapists and cleaning staff.

A comparison of the symptoms experienced in the work environment in the latex-sensitive and latex-negative groups is presented in Table I. Ocular, chest, and cutaneous symptoms were significantly more common in latex-affected individuals (*P* = < 0.001). Twelve of the sensitised patients (6.6%) reported development of allergic symptoms when handling equipment other than latex gloves (e.g. rubber tubing, anaesthetic apparatus, catheters and endoscopes). A further 10 of the sensitised patients (5.5%) reported symptoms of allergy when using sporting equipment or rubber equipment in the home environment. A few patients volunteered that they developed allergic reactions to condoms.

Table I. Percentage of symptoms in the work environment

	Latex-positive group (*N* = 182)	Latex-negative group (*N* = 535)	*P*-value
Itchy eyes	66.5	43.2	< 0.001
Runny or blocked nose	59.3	49.7	NS
Coughing	28.6	19.1	NS
Wheezing	29.1	12.3	< 0.001
Itchy skin	61.0	48.2	0.018
Skin rashes	57.7	38.5	< 0.001
Dizziness	12.6	9.5	NS

NS = not significant.

One hundred employees in whom latex allergy was confirmed and who continued to work at the hospital, participated in the 3-month follow-up study to assess the effectiveness of the latex-avoidance intervention strategy. This group included 64 nurses, 10 doctors, 8 technologists, 7 paramedics, 2 administrative assistants, 6 cleaners and 3 other staff members. In this cohort 91 subjects no longer wore latex gloves, and 49 of the 100 employees experienced a clear reduction of symptoms once latex intervention was instituted. In 34, symptoms had subsided completely. In 7 individuals there had been no improvement of their work-related symptoms. A comparison of the presence of symptoms before and after latex intervention is given in Fig. 2. There was a significant reduction in both cutaneous ($P = < 0.001$) and ocular symptoms ($P = < 0.001$). Although nasal and respiratory symptoms reduced after intervention, the reduction was not statistically significant. Thirty employees considered that the diagnosis of latex allergy had adversely affected their ability to continue working in their chosen career at Groote Schuur Hospital and 40 employees felt that the diagnosis of latex allergy would limit their career options in the future. Thirty-two employees were considering applying to the Commissioner of Occupational Diseases for workers' compensation. Overall, 85% were satisfied that their work-related symptoms had been adequately addressed in the work environment. An unexpected finding of this study was that nasal and respiratory symptoms were not improved significantly by latex-avoidance strategies (Fig. 2).

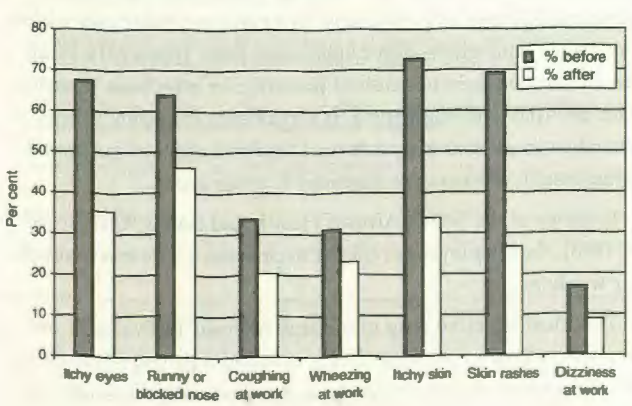

Fig. 2. Presence of symptoms before and after latex avoidance measures were instituted in 100 workers with confirmed latex sensitisation. A significant reduction in itchy eyes ($P = < 0.001$), itchy skin ($P = < 0.001$) and skin rashes ($P = < 0.001$) was observed. No significant reduction was found in incidence of runny or blocked nose, coughing, or dizziness at work.

In the phase 3 further evaluation of 25 latex-sensitised employees with rhinoconjunctivitis, 7/25 reported having had nasal allergies before commencing work in the hospital. Fifteen of 25 had developed symptoms during the past 10 years, 12/25 had perennial allergic disease, 13/25 reported seasonal exacerbations in the spring or summer, and 22/25 experienced nasal or ocular symptoms when wearing latex gloves or handling other latex products.

In this cohort only 10/25 subjects had significant or complete resolution of their symptoms since latex intervention was instituted. In 11/25 improvement was noted as being slight and in 4/25 there had been no improvement in nasal symptoms. Only 7/25 had previously had allergy tests. There were 13 reports of oral allergy to fruits which cross-react with latex: 4 to banana, 3 to avocado, 3 to tomato and 1 each to kiwi fruit and apricot. Fifteen of 25 subjects believed they had pollen allergies, 9/25 pet allergies and 11/25 housedust mite allergies. The majority of the subjects reported that their symptoms were aggravated by factors such is air conditioning (20/25), perfumes (17/25) and sprays and paints (17/25). The results of the skin-prick tests on these 25 subjects are shown in Table II.

Table II. Profile of positive specific aero-allergen sensitivity in 25 latex-sensitive individuals with rhinoconjunctivitis

	Subjects ($N = 25$)
House dust mite	17
Cockroach	9
Dog	11
Cat	11
Five-grass mix	16
Alternaria alternata	9
Cladosporium herbarum	8
Tree mix	9

DISCUSSION

In this large survey of the prevalence of latex allergy at Groote Schuur Hospital, 182 (25.3%) of the staff who reported work-related allergy symptoms suggestive of possible latex allergy had a diagnosis of latex allergy confirmed by specific testing. This represents a 9.2% prevalence of confirmed latex allergy. If one also includes the 38 staff members who had strong clinical histories, but with borderline test results, the prevalence of latex allergy among health care workers at Groote Schuur Hospital is closer to 11.2%.

Latex allergy has been reported to be increasing worldwide, with the highest prevalence being reported from hospitals in highly developed countries such as Finland where the prevalence of latex sensitisation among operating room staff was found to be 7%,[3] and in France[4] and Canada[5] where the prevalence of latex sensitisation among operating room nurses, surgeons, anaesthesiologists and radiologists was between 9% and 10%. The present survey of 2 316 workers at Groote Schuur Hospital is one of the largest published in the literature to date. The second largest survey, a recently published cross-sectional survey of 1 351 hospital workers from Hamilton Hospital,

Ontario, Canada, reported a 12.1% prevalence of latex sensitisation (9.5% of all those eligible).[6]

In South Africa two smaller studies of the prevalence of latex allergy have been conducted among health care workers working in high latex exposure areas. In a study done at Red Cross War Memorial Children's Hospital in Cape Town,[7] 7.0% of symptomatic workers were sensitised, and at Tygerberg Hospital, also in the Cape,[8] 16.8% of a high-risk group were found to be sensitised to latex. A small study of latex allergy among 146 laboratory workers at the South African Institute for Medical Research (SAIMR) in Johannesburg by Stewart *et al.*[9] using the CAP RAST test found an overall prevalence of 2.7%. In the latter study skin-prick tests were not conducted. The prevalence of latex allergy in the general population is thought to be less than 1%.[3]

Our study at Groote Schuur Hospital only evaluated latex sensitisation in health care workers who were symptomatic at work. The rate of asymptomatic sensitisation to latex in the hospital is probably much higher. In the study by Liss *et al.*,[6] 40% of the participants with positive prick tests were asymptomatic. In their study the rate of sensitisation increased with increasing glove usage.

Confirmation of latex allergy sensitisation can be done using *in vitro* tests, e.g. the CAP RAST or by skin-prick test. We have previously shown that the CAP RAST has an overall sensitivity of about 60% but that this is much higher for non-cutaneous latex allergy.[2] The most sensitive test for sensitisation is the skin-prick test.

We have found that for individuals who give only a history of cutaneous symptoms, e.g. urticaria, following latex exposure, the skin-prick test can be safely performed as an initial screening test. In these patients it is much more sensitive than the CAP RAST.[2] In patients who give a clinical history of systemic reactions to latex (e.g. asthma or anaphylaxis) it is safer to do a blood test.

More than 70% of the employees who were sensitised to latex reported other pre-existing atopic diseases (Fig. 1). Although the nursing staff comprised the largest group, other health care workers were at risk throughout the hospital, particularly among laboratory workers and doctors, but also among radiographers, cleaners, kitchen staff and even administrative staff working in areas where powdered glove usage was high. There was no difference in the prevalence of hay fever or allergic rhinitis in the latex-negative and latex-positive groups. Ocular symptoms ($P = < 0.001$), wheezing ($P = < 0.001$) and cutaneous symptoms ($P = < 0.001$) were more common work-related symptoms in the latex-sensitised group (Table I), but nasal symptoms were not different in the two groups. Concurrent and cross-reacting allergies to fruits were also encountered, as has been reported by others.[10]

Latex allergens are airborne allergens in work environments where powdered gloves are regularly used, and as such represent a particular health hazard to health care workers who are inadvertently exposed to them on an almost continuous basis. Health care workers with an atopic diathesis have a high risk of eventually becoming sensitised with time, if exposed. Once sensitised, further exposure leads to the development of worsening symptoms which may be incapacitating, even life-threatening.

Intervention caused an overall reduction in symptoms (either complete or partial) in 83 of the workers. Symptoms that improved significantly included itchy eyes, skin rashes, and skin itchiness ($P = < 0.001$). Reasons for persistence of symptoms included incomplete avoidance of latex glove powder exposure and the presence of other underlying allergies which were also contributing to symptoms during working hours. There was no significant reduction in the presence of nasal symptoms overall.

We were particularly interested to follow up our observation that rhinitis symptoms tended to persist even after instituting latex avoidance. All the workers who had ongoing symptoms had underlying allergies to indoor and outdoor allergens and in 12 subjects symptoms were perennial. It is therefore extremely important to investigate these patients for additional allergies in order to institute appropriate environmental control in the home, allergen avoidance and possibly allergen immunotherapy for a long enough period, before attributing all work-related symptoms to latex.

The sudden emergence of latex allergy during the past 5 years could be due to the fact that in state hospitals cheaper powdered gloves with high levels of proteins have been widely purchased, and gloves have been used more frequently by all health care workers because of the surge in infectious diseases such as AIDS and hepatitis B. It is probable that latex allergy is prevalent in all our hospitals and that this will be confirmed when health workers are screened in other areas.

In terms of the South African Health and Safety Act (No. 85 of 1993), the employer is obliged to provide a safe environment for workers.

The most effective way to manage affected individuals and to prevent further sensitisation is to adopt a powder-free policy for all hospitals in South Africa, as has been recommended in the UK, Canada and Scandinavia. The Food and Drug Administration (FDA) in the USA has ruled that all medical devices containing latex must now be labelled 'Caution: This product contains natural rubber latex which may cause allergic reactions'. The American Academy of Allergy, Asthma and Clinical Immunology has also recommended that only powder-free latex gloves with low allergen content should be purchased and used and that the routine use of latex gloves by food handlers, housekeeping, transport and medical personnel in low-risk situations (food handling, bed transport, physical examination) should be discouraged.

The FDA has also banned the use of the term 'hypo-

allergenic glove', since such gloves still contain latex and may not be used by latex-sensitised individuals, and will not prevent the development of latex allergies in those as yet unaffected workers.

It is essential that the problem of latex allergy in hospitals should be addressed as a matter of urgency by the authorities and hospital administration in order to contain the problem. Although the provision of a completely powder-free environment may be initially more expensive, the long-term savings in terms of loss of staff, morbidity, loss of productivity, and litigation far outweigh the short-term gains of purchasing cheap quality powdered gloves.

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Dr M Isaacs of the Groote Schuur Hospital Biostatistics Department performed the statistical analysis of the data.

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HIGH-DOSE IMMUNOSUPPRESSIVE THERAPY IN GENERALISED MYASTHENIA GRAVIS — A 2-YEAR FOLLOW-UP STUDY

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Background. Immunosuppressive (IS) therapy is increasingly advocated in the treatment of myasthenia gravis (MG). This study assessed whether early 'high-dose' IS therapy in new patients with generalised MG (GMG) altered the outcome and reduced the morbidity of GMG.

Methods. Patients with GMG were treated with 'high-dose' IS therapy (prednisone ≤ 1 mg/kg, azathioprine 2 - 3 mg/kg) and followed up for 2 years. Prednisone and azathioprine were initiated on diagnosis. Outcome measures were compared with those of controls previously treated at our clinic with 'low-dose' IS therapy. The primary outcome measure was the number of patients in remission at 1 and 2 years. Secondary outcomes included the MG scores (MGS) after 1 and 2 years, as well as the number of plasma exchanges (P/E), hospital and intensive care unit (ICU) admissions required for decompensated MG.

Findings. At 1 and 2 years there were significant improvements in the MGS of patients treated with 'high-dose' IS therapy compared with those of controls; 50% of these patients were in remission after 2 years compared with less than 16% of controls. The number of hospital and ICU admissions had also dropped significantly in the first year of patients receiving 'high-dose' IS treatment.

Conclusion. Early 'high-dose' IS therapy using azathioprine and prednisone in GMG resulted in a significant increase in the number of patients in remission and reduced morbidity at 1 and 2 years.

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Myasthenia gravis (MG) is an autoimmune disorder mediated by immunoglobulin G (IgG) antibodies to the muscle acetylcholine receptor (AChR).[1] This results in a reduction in the number of effective AChRs, impaired neuromuscular transmission, and therefore clinically in fatiguable muscle weakness.[1] Autoantibodies against the AChR can be detected in

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