Characteristics of Latex Glove Usage and Glove-Related Symptoms among Health Care Workers in Each Work Sector of a University Hospital

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Background: *Healthcare workers (HCWs) are one of the high-risk careers for occupational contact dermatitis (OCD).*
Objective: *To compare glove usage characteristics and glove-related symptoms of HCWs in each work sector in a tertiary-care University hospital.*
Material and Method: *Self-administered questionnaires were distributed to 6,880 HCWs working in all departments of a University hospital.*
Results: *The questionnaire response rate was 65.8% and 82.4% of respondents wore gloves at work. HCWs from non-clinical departments used gloves significantly less often than HCWs from clinical departments. The duration of glove usage was significantly longer for HCWs from non-clinical departments. The glove usage per day was notably higher in HCWs from clinical departments. HCWs working in the clinical pathology department had the highest prevalence of glove-related symptoms.*
Conclusion: *The characteristics of work and pattern of glove usage of HCWs in each work sector affect both glove-related cutaneous and non-cutaneous symptoms. The present study of occupational glove-related symptoms among HCWs found a higher incidence in the clinical pathology department that appeared to be related to glove usage patterns.*

Keywords: *latex glove use, glove-related symptoms, health care workers*

J Med Assoc Thai 2017; 100 (5): 558-64
Full text. e-Journal: *http://www.jmatonline.com*

Health care workers (HCWs) or personnel are defined as all persons whose occupational activities involve contact with patients or contaminated material in a healthcare, home healthcare, or clinical laboratory setting. HCWs are engaged in a range of occupations, which included patient contact even though they do not involve direct provision of patient care, such as dietary and housekeeping services. HCWs are one of the high-risk careers for occupational contact dermatitis, especially hand eczema, as they are exposed to multiple allergens/irritants and occupational risk factors including frequent hand washing, exposure to detergents, disinfectants and prolonged glove use[1,2] according to their job descriptions. All of these behaviors can lead to skin irritation. HCWs working in clinical departments are often exposed to a variety of allergens and irritants hence the need to wear gloves for protection more often than those HCWs in non-clinical departments. Occupational contact dermatitis (OCD) is the most common occupational skin disease in developed countries and has a major impact on quality of life[3,4].

Previous publications have reported the prevalence of glove-related symptoms in HCWs varies from 7% to 57% depending on the study method and location[2,5-9]. Each department has different work characteristics and glove usage patterns. We hope the findings in the present study lead to better selection of glove type and further guidance on glove wearing. However, whether the characteristics of specific functions in each work sector affects the pattern of glove usage and glove-related symptoms have not been reported previously. The aim of the present study was to investigate the glove usage characteristics and glove-related symptoms of HCWs in individual departments at a tertiary-care, University hospital.

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Material and Method

The Institutional Review Board approved this questionnaire for a survey study. This was a descriptive study performed at a tertiary-care University hospital from June 2010 to January 2011. The hospital and medical school has 2,200 beds. All 6,880 HCWs using rubber gloves at work from a total of 23 departments were asked to voluntarily answer the questionnaire. All data were recorded anonymously and kept confidential. The populations in the present study were the same group as our previous publication[5]. The self-administered questionnaire was adapted from the American Clinical Association of Allergy, Asthma and Immunology guidelines for latex allergy[10]. The questions were translated into English, and were shown in Appendix. The questionnaire enquired about age, sex, job description, work department, purpose of glove use and current pattern of glove use including frequency, duration and quantity. Additional questions were demonstrated in Appendix. The wording of the questionnaire was "powdered rubber glove, non-powdered rubber glove (which includes synthetic gloves) or both types". In this case, powdered rubber glove represented latex gloves and non-powdered rubber glove represented latex and synthetic compound gloves.

Descriptive statistics, including number, percent, mean, and standard deviation (SD), were used to describe demographic data, glove usage patterns, as well as glove-related cutaneous and non-cutaneous symptoms. Chi-square test or Fisher's exact test was used to compare the glove usage patterns among different groups of HCWs. SPSS software version 17.0 was used for statistical analyses. A p-value of 0.05 was considered statistically significant.

Results

Overall, 4,529 of 6,880 distributed questionnaires were returned with a response rate of 65.8%. However, only the 4,217 cases who answered which department they belonged were analyzed. The response rate from non-clinical departments was 33.2% (128/385 cases) and 63% (4,089/6,495 cases) from clinical departments. Almost all respondents worked in clinical departments (4,089 cases, 97%). Overall, 89.6% were female and 83% were nurses. The demographic data were shown in Table 1.

Detailed variables between non-clinical and clinical departments were shown in Table 2. Personal history of atopy and allergy to fruit cross-reacting with latex were comparable between the non-clinical and clinical department groups. However, the job types in each group were significantly different. There were a higher percentage of doctors, housekeepers, and especially technicians/scientists working in non-clinical departments. Among the participants, most used gloves for occupational purposes (3,474 cases, 82.4%), while the others used gloves for both occupational and household purposes (740 cases, 17.6%). Powdered and powder-free latex gloves were used in 3,637 and 1,858 participants (66.2% and 33.8%) respectively. The most common types of glove supplied annually by the Procurement Division of the Hospital were powdered latex gloves (95.6%). Nitrile glove, powder-free latex glove, and neoprene glove were provided in the proportion of 2.55%, 1.85%, and 0.01%, respectively.

Regarding the frequency of glove usage, 59.3% of HCWs from clinical departments and 50.8% from non-clinical departments used latex gloves in

Table 1. Demographic data of questionnaire respondents by department group

Data	Number (%)
Non-clinical department	128 (3)
Gender; male:female ratio	1:1.8
Mean age±SD (years)	36.8±11.5
Pathology	39 (30.5)
Biochemistry	28 (21.9)
Microbiology	23 (18)
Physiology	17 (13.3)
Clinical pathology	16 (12.5)
Gross anatomy	5 (3.9)
Clinical department	4,089 (97)
Gender; male:female ratio	1:9.5
Age; mean±SD (years)	34.3±10.4
Surgery	1,129 (27.6)
Medicine	897 (21.9)
Pediatrics	543 (13.3)
Obstetrics and Gynecology	536 (13.1)
Ophthalmology	236 (5.8)
Radiology	205 (5)
Orthopedics	173 (4.2)
Transfusion medicine	72 (1.8)
Rehabilitation medicine	56 (1.4)
Dermatology	52 (1.3)
Psychiatry	47 (1.1)
Otolaryngology	36 (0.9)
Traditional Thai medicine	34 (0.8)
Anesthesiology	27 (0.7)
Forensic medicine	21 (0.5)
Dentistry	15 (0.4)
Preventive medicine	10 (0.2)

Table 2. Variables by department group

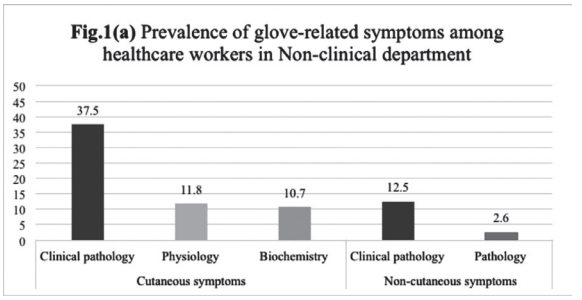
Variables	Non-clinical departments n = 128 (%)	Clinical departments n = 4,089 (%)	*p*-value
History			
Personal history of atopy	36 (28.1)	1,077 (26.4)	0.360
History of allergy to fruit cross-reacting with latex	8 (6.3)	302 (7.4)	0.394
Job types			<0.001
Doctor/Dentist	20 (15.6)	202 (5.0)	
Registered nurse/Practical nurse	0 (0.0)	3,434 (84.7)	
Technician/Scientist	99 (77.3)	211 (5.2)	
Physiotherapist	0 (0.0)	65 (1.6)	
Hospital housekeepers	9 (7.0)	141 (3.5)	
Purpose of glove usage			0.291
Occupation use	110 (85.9)	3,364 (82.3)	
Both occupation and household use	18 (14.1)	722 (17.7)	
Characteristics of glove usage			0.482
Powdered latex gloves	70 (54.7)	2,285 (55.9)	
Powder-free latex gloves	22 (17.2)	554 (13.6)	
Both types	36 (28.1)	1,246 (30.5)	
Frequency of glove usage			<0.001
1-2 days/week	35 (27.3)	545 (13.3)	
3-4 days/week	28 (21.9)	1,119 (27.4)	
5-7 days/week	65 (50.8)	2,421 (59.3)	
Duration of glove usage			<0.001
<2 hrs/day	39 (30.5)	1,947 (47.7)	
2-6 hrs/day	64 (50.0)	1,734 (42.4)	
>6 hrs/day	25 (19.5)	404 (9.9)	
Quantity of glove usage			<0.001
<1 pair/day	35 (27.3)	330 (8.1)	
1-5 pairs/day	76 (59.4)	2,379 (58.2)	
>5 pairs/day	17 (13.3)	1,376 (33.7)	
Glove-related symptoms			
Cutaneous symptoms	17 (13.3)	413 (10.1)	0.242
Non-cutaneous symptoms	3 (2.3)	191 (4.7)	0.214
Both cutaneous and non-cutaneous symptoms	1 (0.8)	53 (1.3)	1.000

Hrs, hours

their work very often (5-7 days/week). Non-clinical HCWs used gloves significantly less often than the clinical HCWs ($p<0.001$). The duration of latex glove use per day (working hours are approximately 6–8 hours/day), was significantly longer for non-clinical HCWs compared to clinical HCWs ($p<0.001$). However, the quantity of glove usage per day was notably higher for clinical HCWs compared to non-clinical HCWs ($p<0.001$).

For glove usage characteristics in each work sector, participants working in the clinical pathology department had a higher frequency, duration and quantity of glove usage than those from other departments ($p<0.05$). HCWs in the clinical pathology department also had a greater usage of powder-free latex gloves compared with all other groups (43.8% vs. 13.54%, $p = 0.012$) and the highest prevalence of both cutaneous (37.5%) and non-cutaneous (12.5%) symptoms compared with other groups (Fig 1). The ranking of prevalence of glove-related symptoms of individual work sectors was shown in Fig 1.

Rubber glove-related symptoms among HCWs were categorized as cutaneous symptoms (itching, redness, hives, swelling, dryness, cracking, blisters, weeping), and non-cutaneous symptoms (red eyes, eye irritation, itching of eyes or nose, runny nose, stuffy nose, sneezing, wheezing, shortness of breath, chest tightness). HCWs from both non-clinical and clinical sectors had glove-related cutaneous symptoms more often than non-cutaneous symptoms but this was not significantly different.



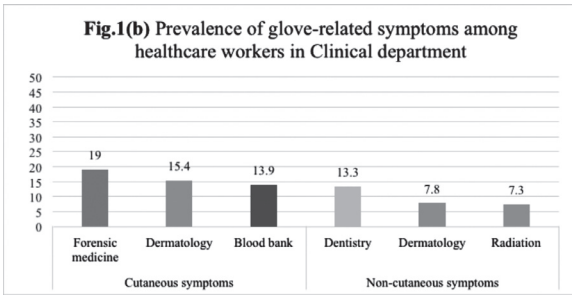


Fig. 1 Ranking of prevalence of glove-related symptoms.

Discussion

HCWs face an increased risk of developing abnormal glove-related symptoms when using gloves according to universal precautions. Previous reports showed the prevalence of glove-related symptoms among HCWs was 12.4-13.3%[5,9]. Risk factors identified in those two studies included age greater than 35 years, personal history of atopy, more than 10 years of working in a hospital, and frequency, duration and quantity of glove usage[5,9]. History of atopy and allergy to fruit cross-reacting with latex, previously reported as risk factors of glove-related symptoms[5], was similar between non-clinical and clinical departments.

The characteristics of HCW jobs in non-clinical and clinical departments were different; therefore, their pattern of glove usage was also different. HCWs from non-clinical departments had a longer duration but lower frequency and quantity of glove usage when compared to the other HCW groups. The pattern of glove usage corresponded to their work characteristics as clinicians must change their gloves for individual patients. However, the results presented here represent the mean results from all clinical departments, including radiology, psychiatry, traditional medicine and preventive medicine, which might not use many gloves. The present study was performed in an academic hospital setting; therefore, individual personnel might undertake different tasks each day such as teaching, lecturing, surgery, or out-patient services. HCWs from non-clinical departments had a higher prevalence of glove-related cutaneous symptoms but a lower incidence of non-cutaneous symptoms than those from the clinical department. HCWs from the clinical department had higher non-cutaneous symptoms and a greater quantity of glove usage confirming a previous report[11]. The higher frequency and longer duration of wearing gloves were associated with the development of glove-related cutaneous symptoms, whereas the quantity of glove usage was related to non-cutaneous symptoms[7,11]. The prevalence of glove-related symptoms in the present study was not significantly distinct between HCWs from clinical and non-clinical departments, which might be explained by much lower numbers of respondents from non-clinical departments compared to clinical departments. The HCWs in clinical department may be aware about their glove-related symptoms more than HCWs in non-clinical department, which lead to more questionnaire response.

Considering among non-clinical departments, HCWs from the clinical pathology department had the highest prevalence of both cutaneous and non-cutaneous symptoms. The majority of HCWs (87.5%) used gloves very often and a moderate number of pairs of gloves. Moreover, approximately two-thirds of them wore gloves for a longer duration compared with other groups. We further explored their work characteristics and found that the clinical pathology department is composed of different units dealing with patients and patient specimens including the blood collection unit, central laboratory, clinical laboratory and special laboratory. These units operate twenty-four hours a day, seven days a week. HCWs working in the laboratory frequently handle patient specimens so they must wear gloves for self-protection almost all their working hours, although they occasionally change gloves.

Data from the Procurement Division of our hospital showed that powdered latex gloves accounted for 95.6% of all kinds of gloves used at the hospital in one year. The use of powdered latex gloves can produce airborne latex allergens and cause respiratory symptoms[12]. The US Food and Drug Administration highlighted the adverse reactions from glove usage, and the use of powdered latex gloves at US hospitals declined to 34% in 2008[13,14]. The use of powder-free latex gloves should be encouraged among HCWs at our hospital, and may help to minimize non-cutaneous symptoms. There was an apparent discrepancy between

the HCWs reporting of the type of gloves used and the procurement of gloves in the hospital, suggesting the Procurement Division lacks awareness regarding the type of gloves required by HCWs.

A limitation of the present study was the small sample size from some departments, which might have hindered our analyses. The severity of symptom cannot be addressed in our study because our questionnaire was not included severity assessment part. Furthermore, the questionnaire did not specify allergy types, type I or IV, or separate allergy from irritation. In addition, the presence of the glove-related symptoms could have affected the current pattern of gloves usage among participants. Therefore, as the Clinical Pathology Department has a high prevalence of symptoms, further study is required to determine the cause of this finding. Another limitation was that detailed medical information required to assess additional contributing factors was not collected during the study.

Conclusion

The present study assessed occupational glove-related symptoms among HCWs and their specific work sectors and found a higher incidence of symptoms in HCWs of the Clinical Pathology Department that appeared to be related to glove usage patterns. The majority of HCWs at our Hospital are still using powdered latex gloves although HCWs in developed countries have reduced the usage of this type of glove,[13,14]. Powder-free latex gloves or synthetic gloves should be recommended for all HCWs, if possible, especially for HCWs in the Clinical Pathology Department. The duration and frequency of glove usage should be shortened as necessary. Additional measures such as work adjustment, type of glove use and hand care programs should be implemented to improve working conditions and create a safe work environment in hospitals.

What is already known on this topic?

Health care workers (HCWs) are one of the high-risk careers for occupational contact dermatitis due to the exposure to multiple allergens and irritants. The prevalence of glove-related symptoms among the HCWs is 13.3%. Glove-related cutaneous and noncutaneous symptoms were found in 11.3% and 5.9%, respectively. Factors associated with glove-related cutaneous symptoms are frequency and duration of glove use, history of allergy to fruit cross-reacting with latex, and atopy history. The quantity of glove use, history of atopy, and allergy to fruits cross-reacting with latex are risk factors for the occurrence of glove related noncutaneous symptoms.

What this study adds?

Incidence of glove-related symptoms among HCWs is higher in the clinical pathology department, which appeared to be related to glove usage patterns. HCWs from non-clinical departments had longer duration of glove usage, whereas the glove usage per day was notably higher in HCWs from clinical departments. The duration and frequency of glove usage should be shortened as necessary. Powder-free latex gloves or synthetic gloves should be recommended for all HCWs, if possible.

Acknowledgement

We would like to thank Ms. Pacharee Iamtharachai and Ms. Monthathip Bunyavaree for technical assistance in the contact dermatitis clinic. We are indebted to the Procurement Division who provided data regarding the number and type of gloves used at Siriraj Hospital. The present study was funded by the Faculty of Medicine Siriraj Hospital, Mahidol University.

Potential conflict of interest

None.

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การแพ้ถุงมือและลักษณะการใช้ถุงมือยางในบุคลากรทางการแพทย์ในโรงพยาบาลระดับมหาวิทยาลัยแยกตามหน่วยงาน

วรัญญา บุญชัย, วรารัตน์ สิริกุตตา, ปราณี เกษมศานติ์

ภูมิหลัง: *บุคลากรทางการแพทย์เป็นหนึ่งในกลุ่มอาชีพที่มีความเสี่ยงสูงต่อการเกิดโรคผื่นสัมผัสที่เกิดจากการทำงาน*
วัตถุประสงค์: *เพื่อเปรียบเทียบลักษณะการใช้ถุงมือยางและอาการจากการแพ้ถุงมือยาง ในบุคลากรทางการแพทย์ที่ปฏิบัติงานในโรงพยาบาลมหาวิทยาลัยระดับตติยภูมิโดยแยกตามหน่วยงาน*
วัสดุและวิธีการ: *ผู้วิจัยได้ส่งแบบสอบถามไปยังบุคลากรทางการแพทย์ 6,880 คน ที่ปฏิบัติงานในทุกแผนกของโรงพยาบาลระดับมหาวิทยาลัย 1 โรงพยาบาล*
ผลการศึกษา: *อัตราการตอบแบบสอบถามเท่ากับ 65.8% โดย 82.4% ของผู้ตอบแบบสอบถามใช้ถุงมือในขณะปฏิบัติงาน บุคลากรทางการแพทย์ในภาควิชาทางปรีคลินิกมีความถี่ (จำนวนวันต่อสัปดาห์) ในการใช้ถุงมือน้อยกว่าบุคลากรทางการแพทย์ในภาควิชาทางคลินิกอย่างมีนัยสำคัญทางสถิติ บุคลากรทางการแพทย์ในภาควิชาทางปรีคลินิกใช้ถุงมือเป็นระยะเวลาต่อวันนานกว่า ในขณะที่จำนวนถุงมือที่ใช้ต่อวันสูงกว่าในบุคลากรทางการแพทย์ในภาควิชาทางคลินิก อุบัติการณ์ของการแพ้ถุงมือสูงที่สุดในบุคลากรทางการแพทย์ที่ปฏิบัติงานในภาควิชาพยาธิวิทยาคลินิก*
สรุป: *ลักษณะการทำงานและวิธีการใช้ถุงมือของบุคลากรทางการแพทย์ในแต่ละแผนกมีผลต่อการแพ้ถุงมือทั้งอาการทางผิวหนัง และอาการทางระบบอื่น ๆ การศึกษานี้พบว่าการแพ้ถุงมือจากการทำงานของบุคลากรทางการแพทย์มีอุบัติการณ์สูงที่สุดในภาควิชาพยาธิวิทยาคลินิก ซึ่งคาดว่าเกิดจากลักษณะและวิธีการใช้ถุงมือ*

Appendix: Questions included in the questionnaire

Part 1: Demographic data

1. Age……. Years
2. Sex ☐ Male ☐ Female
3. Occupation ☐ Physician ☐ Dentist ☐ Dentist assistant
   ☐ Registered nurse ☐ Practical nurse ☐ Laboratory technician
   ☐ Other (please defined)…….....
4. Department…….....……

Part 2: Risk factor assessment

1. In daily life, you use rubber gloves
   ☐ At work ☐ At home ☐ Both
2. How many days of rubber gloves use per week?
   ☐ 1-2 days/week ☐ 3-4 days/week ☐ 5-7 days/week
3. How many hours of rubber gloves use per day?
   ☐ < 2 hours/day ☐ 2-6 hours/day ☐ >6 hours/day
4. How many pairs of rubber gloves use per day?
   ☐ < 1 pair/day ☐ 1-5 pairs/ day ☐ > 5 pairs/day
5. Type of rubber gloves use
   ☐ Powdered gloves ☐ Non-powdered gloves ☐ Both
6. Do you have a history of hay fever, asthma, or childhood eczema?
   ☐ Yes ☐ No
7. Do you have a medical history of frequent surgery (>2 times)? ☐ Yes ☐ No
   Did these take place when you were an infant? ☐ Yes ☐ No
8. Check any foods below that cause hives, itching of the lips or throat when you eat them
   ☐ Banana ☐ Papaya ☐ Pineapple ☐ Kiwi ☐ Grape
   ☐ Chestnut ☐ Apple ☐ Passion fruit ☐ Tomato ☐ Potato
   ☐ Carrot

Part 3: Contact Dermatitis/ Contact Urticaria Assessment

1. Do you have any hands discomfort after rubber gloves use?
   ☐ Yes ☐ No (skip to part 4)
2. Do you have rash, itching, cracking, chapping, scaling, or weeping of the skin from rubber gloves use?
   ☐ Yes ☐ No
3. Do these symptoms occur within 30 minutes after rubber gloves use?
   ☐ Yes ☐ No
4. Do these symptoms recur when you wearing rubber gloves?
   ☐ Yes ☐ No
5. Do these symptoms improve or cure when you stop wearing rubber gloves?
   ☐ Yes ☐ No
6. Have these symptoms ever occurred after wearing non-rubber gloves (PVC/ plastic/ leather gloves)?
   ☐ Yes ☐ No

Part 4: Aerosol Assessment

When you wear or are around others wearing latex gloves, have you noted any:

1. Itching of eyes, eyes irritation, red eyes
   ☐ Yes ☐ No
2. Fits of sneezing, runny or stuffy nose, itching of the nose or palate
   ☐ Yes ☐ No
3. Shortness of breath, wheezing, chest tightness or difficulty breathing?
   ☐ Yes ☐ No

Part 5: History of Reactions Suggestive of Latex Allergy

1. Have you had itching, swelling following dental or pelvic exams?
   ☐ Yes ☐ No
2. Do you have a history of anaphylaxis or of intra-operative shock?
   ☐ Yes ☐ No
3. Have you experienced difficulty breathing after blowing up a balloon?
   ☐ Yes ☐ No
4. Do rubber handles, condom, rubber bands or elastic bands, or clothing cause any rash, itching, swelling, or discomfort?
   ☐ Yes ☐ No