

## ORIGINAL ARTICLE

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## THE USE OF PROTECTIVE GLOVES IN OCCUPATIONAL SKIN DISEASE PREVENTION: FEASIBILITY AND CUSTOMER ACCEPTANCE IN PHYSIOTHERAPY

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## ABSTRACT

**Background:** Physiotherapists have an occupationally elevated risk of dermatoses. One aim of skin care seminars for specific professional groups in individual prevention programme in Germany is to ensure appropriate use of safety measures during patient treatment. Initially physiotherapists often think skeptically about the use of gloves and patients' acceptance of this protective measure. So the objective of this study was to assess the practicality of glove use during physiotherapy (qualitative investigation) and customer acceptance of them during massage (quantitative investigation).

**Methods:** Structured problem-focused interviews about glove usage were held with 20 skin diseased physiotherapists and masseurs after skin care seminars. The data was evaluated inductively using Mayring's qualitative content analysis. The clients' acceptance was tested in a controlled randomized three setting study with 120 subjects who received a back massage and evaluated quality aspects of their massage in a questionnaire. The physiotherapist was wearing either gloves of PVC, gloves made of nitrile rubber or no gloves at all. A non-inferiority test was used to test group differences.

**Result:** The majority of participating physiotherapists considered the use of protective gloves a practical and useful measure. However, occasional problems in everyday practice and in special therapy methods were reported. The analysis of 120 questionnaires (100% response rate) for quality aspects and the willingness to pay regarding client acceptance in a massage - with or without gloves - showed a non-inferiority result for massages with gloves.

**Conclusion:** Convincing individual physiotherapists of the benefits of wearing gloves is crucial for implementation of this preventive measure. It is improbable that patients would refuse services because therapists wear gloves during treatments. Consequently, the usage of gloves is unlikely to result in a loss of practice custom.

**Keywords:** gloves, individual prevention, hand eczema, massage, occupational exposure, occupational health, occupational skin diseases, protection measure

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## INTRODUCTION

The skin is the organ that is most affected by work in every occupational sector, in Germany as well as in nearly all other western industrial nations [1]. Health care workers especially are at high risk of suffering from occupational dermatoses because of the increased strain on their skin [2-5]. The prevalence of skin diseases is about twice as high in health care workers as in the rest of the population [6,7]. Of all occupational diseases reported in 2014 to German Social Accident Insurance Institution of the Health and Welfare Services, 57.4% were classified as skin-related occupational diseases (No. 5101:severe or recurrent skin diseases which have forced the person to discontinue all occupational activities that caused or could cause the development, worsening, or recurrence of the disease) [8]. Among physiotherapists, the rate of skin-related occupational diseases rises to 73% [9]. The main manifestation of those dermatoses is on the hands, which are frequently used in physiotherapy.

Physiotherapists (including masseurs and balneotherapists here in this paper) are a large and steadily growing professional group in the German healthcare system. In 2014, 138,624 physiotherapists were employed in Germany, about three-quarters of whom were female [10]. The wide spectrum of tasks and responsibilities in prevention as well as curative and rehabilitative therapies include wet work, mechanically irritating strains to the skin, and intensive contact with work-related irritants and allergens, such as fragrances, preservatives, essential oils, topical medication, and rubber materials [11-16]. In Germany, the statutory accident insurance should be informed if an occupational skin dermatosis is suspected [17,18]. Measures of interdisciplinary secondary individual prevention in patients with occupational skin diseases have been proven to be effective on various occasions [19-21].

Diseased physiotherapists may participate in special skin-care seminars, which are part of the individual prevention program for employees in the healthcare sector of BGW, for preventing deterioration and maintaining or re-establishing the ability to work. The contents of the seminars include knowledge about the causes, prevention, and therapy of work-related dermatoses, as well as practical advice for skin protection in occupational and private life, e.g. use of moisturizers and the purposeful use of gloves as a protective measure during treatment of patients. Initially, physiotherapists often cannot imagine working with gloves during patient treatment, especially employees in the ambulant sector because it is unusual [22]. So during the practical part of the seminar, they are given the opportunity to test the usage of various protective gloves in a simulation treatment, both from the therapist's perspective and also from the patient's perspective by receiving a massage by one of the other participating therapists who is wearing gloves.

One of the BGW's recommendations to the group of physiotherapists is the usage of single-use gloves for massages

when such skin protection is necessary, e.g. because of poor skin condition or sensitization to avoid direct skin contact with irritable substances and intensive hand-washing after patients' treatments. Employees in the professional field of physiotherapists are recommended to wear gloves made of either nitrile rubber or polyvinyl chloride (PVC), depending on their preference and subjective comfort. If gloves must be worn for a longer duration, moisture-absorbing gloves which are made of cotton should be worn underneath the single-use gloves [23] (Figure 1). Cotton gloves should be seamless and thin to allow sensation.

**Figure 1:** Single use gloves made of polyvinyl chloride with cotton gloves worn underneath in a standard massage.



The main reason physiotherapists give for their reluctance to wear protective gloves is their belief (which is usually an untested assumption on their part) that patients will not accept the use of protective gloves during treatment [12]. So the two main aims of this two-part study were:

- I. to describe the physiotherapist's point of view about the use of protective gloves in case of skin diseases in that special occupational fields and
- II. to identify potential differences in treatment quality from a client's point of view during massages with or without gloves.

### Study Part I (Qualitative study on the feasibility of wearing protective gloves from the physiotherapist's point of view)

## METHODS

In the 3<sup>rd</sup> quarter of 2012, 20 physiotherapists (table 1) with an occupational skin disease – allergic and/or irritant and/or work-triggered and/or atopic eczema, diagnosed by a dermatologist – were included in this part of the study. As a tool for this investigation, a structured problem-centered interview was used to obtain first information on working with gloves during patient treatment [24]. Two pre-tests were carried out with physiotherapists, in order to refine the interviewing guide and focus relevant questions on this issue. The physiotherapists were interviewed by phone four to eight weeks after participation in a skin care seminar of BGW.

	n = 20
sex	
female	17
male	3

<b>age</b> mean (min-max)	33 (21-56)
<b>occupation</b> physiotherapist masseur and balneotherapist	15 5
<b>years working in the profession</b> mean (min-max)	11.6 (1-35)
<b>type of employment</b> employed by a company / practice self-employed	17 3
<b>place of work</b> outpatient inpatient both	16 3 1
<b>previous experience using protective gloves</b> yes no	12 8

**Table 1:** Sociodemographic data of the interviewed physiotherapists (study part I).

The interviewing guide contained questions about: a) the physiotherapists' own experiences, attitudes, and evaluation of wearing gloves as a protective measure especially in situations involving patient contact; b) dealing as a matter of routine; c) assessment of quality aspects; d) the subjective effect of gloves on the skin; e) the responses of patients, clients, and employers; and f) the possibility of implementing this measure on a long-term basis.

Potential problems that could arise while wearing gloves during patient treatment could be asked about in greater detail by further questions during the interviews. The responses were evaluated inductively in accordance with Mayring's qualitative contents analysis [25], using the computer supported analysis software MAXQDA 10. In a multistage procedure, a category system was created, which consisted of eleven research-relevant codes, each as a subjective block.

## RESULTS

Fourteen out of 20 interviewed physiotherapists stated that after the skin protection seminar they have been wearing gloves more often while giving treatment to patients. The others did not see the use of gloves as necessary, due to their good skin condition (n=5) or reported inability to work (n=1). The employers' attitude and approach towards protective gloves and the placement of gloves in close proximity to where therapies are carried out had a higher impact on usage during treatments. The most interviewed physiotherapists considered the use of gloves necessary and often feasible for standard massages, for the treatment of patients with increased perspiration and hair growth in the massage area and when working with products that contain fragrances or cause skin irritations. Cotton gloves, which can be worn underneath protective gloves, are seen as beneficial for maintaining good skin condition and comfort by

all physiotherapists in this investigation. Because sensation is reduced while wearing gloves, the use of gloves is not considered practical for delicate therapy methods (manual therapy, osteopathic techniques). But usually there is no necessity for wearing gloves while carrying out these therapies, because no mechanical strains to the hands and no massage products are used, which could cause irritation of the skin.

In order to provide therapeutic services of the same quality while wearing protective gloves, an individual choice of gloves for close fit plus familiarization and practice in this occupational method are necessary for safety working. It is important that therapists find this protective measure beneficial for their skin condition and feel comfortable while working with gloves. These aspects had an influence on patients' acceptance. Their reaction to the use of gloves during treatment was more positive than the interviewed physiotherapists had expected. Communication with other physiotherapists in the seminar about their views on this subject and also the experience in the role of a "patient" and then scoring treatment with gloves as well as treatment without gloves had a positive effect on their opinion of the implementation of wearing protective gloves. An appropriate and confident explanation of the skin issue helped patients to understand and accept this measure.

The quality of the treatment with gloves was generally rated equivalent to the quality of the usual method. Two out of 14 interviewed therapists even preferred the treatment with gloves to the usual treatment because it was less painful and irritating on their hand eczema. Therefore, the hand movement is freer, and the patients' muscles and bone structures can be palpated more thoroughly. Loss of sensation was the most criticized issue of this protective measure. In this investigation, physiotherapists mostly preferred colorless gloves, in order to draw less attention to their hands or rather this protective measure. This often enabled them to avoid needing to provide explanations to colleagues and patients for wearing protective gloves. In general, physiotherapists explained that the use of gloves is less problematic when treating in-patients. In-patients are already accustomed to receiving care and treatments with gloves, so there is a greater acceptance of gloves in the in-patient setting by the patients, but also by colleagues and employers.

## Study Part II (Quantitative study – the influence of the use of gloves on the clients' rating of a standard back massage)

### METHODS

In a randomized controlled three setting study, which was carried out in the fourth quarter of 2012, 120 study subjects received a standard back massage and rated various aspects of its quality in a questionnaire. Inclusion criteria were a minimum age of 18, willingness to complete a questionnaire, written consent, and sufficient German language skills. Exclusion criteria were contraindications for back massages, e.g. acute inflammation and febrile illness



on the day of treatment; pain in the back, pelvic area, or head without knowing the cause; acute or decompensated cardiopulmonary disease.

The duration of the massage was 15-20 minutes. One physiotherapist, who was neutral related to wear gloves during massage, applied the same massage technique for all 120 massages and used a massage product that was free of fragrance and preservatives (Mega Silk Massage Fluid, Megasol Cosmetic GmbH, Föhren/ Germany). The study subjects were randomized into three groups at the time when the appointments were arranged. For the first group, the physiotherapist was not wearing gloves while massaging the study subjects. For the second group, she was wearing gloves made of polyvinyl chloride (Vinyl 300 powderfree, NeW-Glovese.K., Vöhringen/ Germany). For the third study group, the physiotherapist wore gloves made of nitrile rubber (AlfatexNitrilEinmalhandschuh, Sängler GmbH, Schrozberg/ Germany). The study subjects were not informed of the specific aim of this study. The physiotherapist was instructed to mention skin problems as the reason for wearing gloves, in case someone asked.

Directly after the massages, the test persons were asked to rate the quality of the massage. A questionnaire had been developed for this purpose which covered the different quality aspects of a massage, using 12 items related to cognitive, affective, and behavioural criteria (table 2).

How satisfied were you with the back massage in general? (1)
How satisfied were you with the quality of the massage? (1)
How satisfied were you with the organization (appointment-making, directions how to get here, etc.)? (1)
How did you perceive the intensity of the massage? (2)
How did you perceive the grasp of the masseuse? (2)
How did you perceive the hand contact of the masseuse on your back? (2)
How did you perceive the massage oil used? (2)
How did you perceive the atmosphere during the massage? (2)
Would you recommend the masseuse to other people? (3)
Would you make an appointment for another massage? (3)
How do you feel in comparison to before the massage? (4)
How well did the massage meet your expectations? (5)
<b>Likert Scales with Five Parameter Values</b>
1) very satisfied - satisfied - mediocre - unsatisfied - very unsatisfied
2) very pleasant - pleasant - mediocre - unpleasant - very unpleasant
3) definitely - probably - possibly - probably not - in no case
4) much better - somewhat better - unchanged - somewhat worse - much worse
5) very strongly - strongly - barely - mostly not - not at all

**Table 2:** The 12 items of the questionnaire (study part II).

The cognitive criteria related to the general satisfaction with the massage, including quality, organization, and personal expectations. The affective criteria related to the percep-

tion of intensity, the masseur's grip and hand contact, the massage product, the atmosphere during the massage, and the study subject's state of well-being before and after the massage. The behavioral criteria were whether participants would recommend the masseur to others and whether they would come back for another massage. All 12 items had to be rated on a 5-point-rating-scale: number one indicating strongest agreement, number five indicating strongest disagreement, with a neutral rating point in the middle (table 2). A question regarding the "willingness-to-pay" as another method to measure quality was added [26]. It is assumed that a higher perception of quality means the customer is willing to pay a higher price and also that a higher price suggests good quality.

SPSS Statistics 21 (IBM; Poughkeepsie, NY; USA) program was used for statistical analysis to carry out univariate and bivariate analysis of the data. The homogeneity of all three groups was tested in regards to the distribution of sociodemographic characteristics, in order to rule out confounding. Cronbach's alpha was calculated to evaluate the items' internal consistency. Then the items were joined to a score by averaging all 12 items. The scores of the three groups' satisfaction questionnaire were compared by using non-inferiority analysis [27,28] applying the principle of confidence interval inclusion. The inferiority limit was set as 10% deviation of the average score of the comparison group (without gloves) towards the direction of the less satisfied rating (higher scores). The willingness-to-pay-analysis was carried out in an analogous manner.

## RESULTS

All 120 questionnaires were completed for a response rate of 100%. There were no statistically significant differences in terms of sociodemographic characteristics between the groups with or without gloves (table 3).

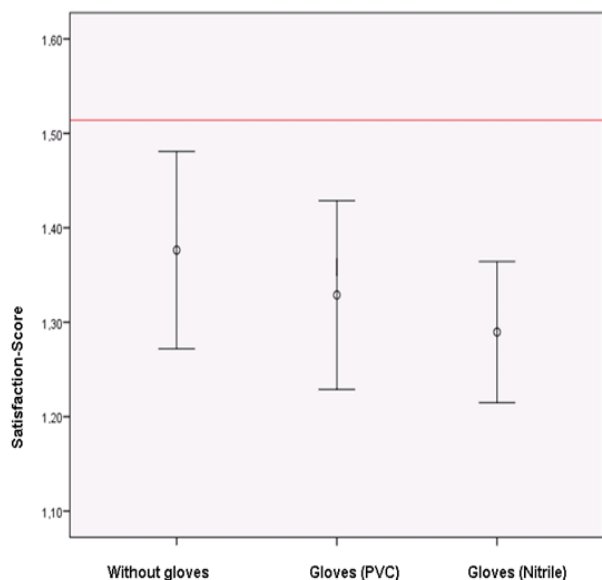
	without gloves(n=40)	PVC gloves (n=40)	nitrile gloves (n=40)
<b>sex</b>			
female	28(70.0%)	31(77.5%)	33(82.5%)
male	12(30.0%)	8(20.0%)	7(17.5%)
noinformation	-	1(2.5%)	-
<b>age</b>			
mean	45.8	45.8	40.6
range	22-86	25-70	25-67
<b>health insurance</b>			
statutory	36(90.0%)	35(87.5%)	35(87.5%)
private	4(10.0%)	4(10.0%)	5(12.5%)
noinformation	-	1(2.5%)	-
<b>workstatus</b>			
intraining	7(17.5%)	5(12.5%)	6(15.0%)
employed	25(62.5%)	30(75.0%)	32(80.0%)
unemployed	7(7.5%)	3(7.5%)	2(5.0%)
noinformation	1(2.5%)	2(5.0%)	-
<b>employment in the medicalsector</b>			
yes	5(12.5%)	9(22.5%)	10(25.0%)
no	32(80.0%)	30(75.0%)	29(72.5%)
noinformation	3(7.5%)	1(2.5%)	1(2.5%)
<b>massageexperience</b>			
none	1(2.2%)	5(12.5%)	2(5.0%)
≤10x	15(37.5%)	6(15.0%)	14(35.0%)
>10x	24(60.0%)	29(72.5%)	24(60.0%)

**Table 3:** Socio demographic data of the study subjects(-study part II).

Similarly, there are no significant associations between the socio demographic characteristics and the 12 items. Consequently, confounding can be largely excluded. All 12 items for the evaluation of the quality of the massages demonstrate an alpha-value of 0.796, which indicates that the satisfaction scores have a positive internal consistence. The elimination of any item from the set changes the alpha value minimally by a value in a range between -0.031 to +0.002. Both results ensure that the homogeneity of the items is given and that one single scoring system is enough for measuring the satisfaction of all test persons [29,30].

For all 12 items, the responses were mostly good and very good rating values. In all three groups, this led to average score close to 1. The average scores with the related confidence intervals for all groups are listed in table 4 (page after next). The inferiority-limit of 1.514 results from the average score of the comparison group plus a 10% deviation towards a higher score. Because the higher confidence limits of both groups, whose massages were carried out with gloves, lie below the inferiority-limit, massages with gloves cannot be seen as rated less satisfactory. The confidence intervals of all three groups are overlapping to a large extent (Figure 2), therefore there is no significant inferiority of one treatment approach compared to another treatment approach of those tested in this study.

**Figure 2:** Mean satisfaction-score of study subjects (study part II) with the 95% confidence interval and inferiority-limit of 1.514 (red line).



One hundred and one of 120 participants stated a price they would pay for such a massage (20 minutes). Ten subjects were not willing to pay; seven subjects did not provide an answer; and two subjects gave unrealistically high prices, which were eliminated by means of an outlier test [31]. The average values and the confidence intervals of the remaining subjects' price suggestions are listed in table 4. The inferiority limit with a difference of 10% from the control group's (without gloves) average euro value is 15.20 €.

	withoutgloves (n=40)	PVC gloves (n=40)	nitrile gloves (n=40)
<b>Satisfaction-Score</b>			
mean	1.376	1.329	1.290
standarddeviation	0.327	0.312	0.330
95% confidenceinterval(95%)	1.272-1.481	1.230-1.429	1.215- 1.364
<b>Euros</b>	(n=28)	(n=36)	(n=37)
mean	16.89	15.26	15.73
standarddeviation	6.799	4.020	5.103
95% confidenceinterval(95%)	14.26-19.53	13.90-16.62	14.03-17.43

**Table 4:** Satisfaction scores and price suggestions in euro (study part II).

The lower confidence limit of the control group falls below this value and therefore does not represent a useful basis for comparison. A 20% difference from the average euro value of the comparison group result is 13.51 €. None of the three lower confidence limits fall below this figure. At this weaker level the willingness to pay can be looked as equivalent in all three groups. However, the correlation between price suggestions and satisfaction scores is only  $r = -0.141$ , which is not significantly different to zero ( $p > 0,05$ ). Therefore, there is no relation between the subjects' price suggestions and their quality ratings. So price suggestions are obviously based on other factors, e.g. income differentials or lack of knowledge of usual massage prices.

## DISCUSSION

In the healthcare sector, the usage of gloves is mostly mandatory and accepted by health care workers and patients, especially in hospitals [31,32]. Also publications from the field of dentistry reveal that patients have since the 1990s expected dentists to carry out treatments with the use of gloves [33-35]. During massages, gloves must be worn only if either the patient or the therapist has an open wound on parts of the body which are involved in the treatment or if infection control measures must be taken [31]. Consequently, the use of gloves during massages, e.g. for therapists' skin protection, is rather uncommon, and hardly any research about the therapists' or customers' acceptance of this method were found.

To include every physiotherapist's point-of-view in this new and applied research area, this exploratory approach was particularly suitable with respect to all different working conditions and individual experiences when dealing with protective gloves. The structured problem-centered interviews provided insight into the physiotherapists' perspectives on this issue, while the interview guideline gave oriented structure for comparability between all interviewed therapists. Despite precise scheduling of the telephone interview, 5 of 20 therapists were busy at the scheduled time, which made the phone conversation difficult, and distorted answers cannot be ruled out.

When therapists suffer from hand eczema or sensitization to substances in massage products, wearing gloves is recommended from a dermatological point-of-view. Thera-

pists need to test several different types of protective gloves directly in the practical part of the seminar, in order to find the size and material of glove that they feel best allows them to do their work and beyond that to feel the patients' perspective. Practical training can result in a better understanding on how to use protective measures correctly [36]. In this connection, the purposeful use of gloves should be focused, in order to prevent additional strains to the skin. Nevertheless, the intention to change behavior is the requirement for using protective gloves as needed during patients' treatments [37-39]. It depends on: a) the attitudes towards this new work measure; b) standards at the work place and social pressure, e.g. reactions of colleagues, patients and employers this new, unfamiliar work measure; and c) the chances of success relating to improvements of the therapists' skin condition, which enables them to continue practicing.

One case-study from Canada investigated which consequences the use of gloves (not further specified which kind) could have when used during massages of HIV-positive patients. Three massages carried out with gloves were judged only 80% as effective at reducing stress as the massages given without gloves. No differences were found in other factors such as stigma (a common issue in the treatment of HIV-positive patients), physical sensation, or overall satisfaction [40]. But it is partially assumed that patients could feel contagious, rejected, and/or isolated when gloves are worn for treatments and other health care performances which do not necessitate the use of gloves. Stigmatization can be felt by patients who do not see another reason for the use of gloves. This could affect the communication with the patient and consequently reduce the quality of care [41]. This can be avoided by explaining why gloves are worn during treatments [32,40].

In regards to the clients' rating, massage with gloves was found to be non-inferior compared to massage without gloves. The overlapping position of the confidence intervals of the average satisfaction score indicates an equivalent rating from all three test groups. The position of the confidence intervals of the average price suggestions also indicates a similarity of the willingness-to-pay and also here an equivalent quality of the massages. The willingness-to-pay approach is often criticized because it shows the ability to pay instead of the willingness to pay [42]. For example, individuals with a higher income are prepared to pay more for an improved service than those with a lower income. This phenomenon appears to be confirmed in some studies [43-45]. However, there are investigations in which no effects related to income could be shown [46,47]. Despite the fact that no differences in sociodemographic characteristics could be detected in the present study, differences in income (not assessed in this study) might have existed and if so could possibly explain that there was no correlation between the willingness-to-pay and quality ratings discussed earlier.

The number of subjects who would either book further

massages or recommend it to others was high in all three groups ( $\geq 90\%$ ). No advantage of one treatment approach (with or without the use of gloves) could be detected. Patients' and clients' acceptance of this protective measure does not seem to be an issue and therefore does not present an obstacle for the implementation of the use of gloves. Consequently, possible loss of income is not to be expected.

The positive attitude toward protective gloves as a health and safety measure after several weeks of practical usage in this study does not allow a judgment of whether this protective measure is sustainable or whether physiotherapists with skin diseases remain in their profession. Therefore a follow-up investigation would be of interest. But it is important to support physiotherapists with skin diseases – e.g. through seminars – to use gloves as a measure for their own skin protection, irrespective of other people's opinions. In addition to that, protective gloves can only be one among several measures of a wider skin protection program.

## CONCLUSION

The usage of protective gloves in physiotherapy is one method to protect skin from harmful substances. Knowledge of the *purposeful* employment of gloves and the therapists' understanding and acceptance of this measure is essential for the implementation of glove usage. According to this study, it is unlikely that a loss of clients will refuse to receive massages by a physiotherapist wearing gloves. The physiotherapist's common point-of-view in the qualitative study showed that the most important factor for patients' satisfaction and success is the quality of the treatment – with or without protective gloves.

## Ethics

Both parts of the study were approved in a combined application by the Medical Association (Ärztchamber) of Berlin (Eth-10/12, 26-6-12). All participating therapists and all study subjects for massages received oral and written information about the study and gave their written consent to participate.

## Conflict of Interest

K Schmidt and U Pohrt are employees of the German Social Accident Insurance Department of the Health and Welfare Services. N Kersten has no competing interests.

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