

Occupational health in physiotherapy: General health and reproductive outcomes

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Physiotherapists are exposed to many risk factors in their work environment. Their general health status is largely unknown, and conflicting studies suggest possible adverse reproductive effects of electromagnetic radiation to which they may be exposed. As part of a larger study, a systematic sample of one in four physiotherapists on a state register (N = 824) was surveyed. Each subject completed an eight page questionnaire, answering questions about musculoskeletal and general health, exposure to risk factors, exposure to electrophysical agents and reproductive outcomes. The response rate was 67.8%. The incidence of congenital malformations and miscarriage among physiotherapists was lower than that in the general community. However, physiotherapists who performed hydrotherapy were more likely to report dermatitis, rashes and fungal skin infections. The prevalence of these conditions increased with the number of hours spent doing hydrotherapy. These findings suggest that physiotherapists are unlikely to have an increased risk of negative reproductive outcomes because of their exposure to electrophysical agents. Physiotherapists who perform hydrotherapy, however, have an increased risk of skin complaints. [Cromie JE, Robertson VJ and Best MO (2002): Occupational health in physiotherapy: General health and reproductive outcomes. *Australian Journal of Physiotherapy* 48: 287-294]

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Introduction

Physiotherapy practice exposes therapists to potential risks. Practitioners risk exposure to infections, harmful chemicals, radiofrequency electromagnetic radiations and work-related musculoskeletal disorders. Some documentation exists of the work-related musculoskeletal disorders injuries practising physiotherapists develop and the precipitating circumstances (Bork et al 1996, Cromie et al 2000, Holder et al 1999, Mierzejewski and Kumar 1997; Molumphy et al 1985; Scholey and Hair 1989). There are conflicting reports of the possible adverse reproductive effects of exposure to electromagnetic radiation. Of the others, little is known of their implications for practising physiotherapists.

Many of the risks to which physiotherapists might be exposed are the same as those for other health care workers. There also are other risks more common to the profession, such as those associated with hydrotherapy, lifting and using electrophysical agents. The following discussion addresses both categories of possible risks for practising physiotherapists.

Risks to general health care workers Workers in health care facilities are exposed to a range of pathogens including HIV, hepatitis B virus, mycobacterium tuberculosis and rubella (Guidotti 1987). Not all affected patients will have always been identified and appropriate precautions taken. For example, tuberculosis can remain undiagnosed (Moore and Kaczmarek 1991) leaving workers with a risk of airborne exposure. Also, the risk of

exposure to body fluids means physiotherapy is among the "high risk" occupations for hepatitis B (Stanford et al 1995).

Some chemicals used in health care settings are associated with risks to users. Examples include derivatives of formaldehyde (Ahlborg and Hemminki 1995, Moore and Kaczmarek 1991) and hexachlorophene (Hardell 1992), both used for disinfection purposes. The extent to which physiotherapists are affected by exposure to such chemicals, or to the many pathogens in the health care environment, is not known.

Risks to physiotherapists Hydrotherapy, electrophysical agents and lifting are, anecdotally, the most commonly reported work hazards for physiotherapists. While these risks are not exclusive to physiotherapists, many physiotherapists are exposed to these particular risks at work. Other problems reported as associated with work performed by physiotherapists include hearing loss (Wiernicki and Karoly 1985) and asthma (Christiani and Kern 1993).

Hydrotherapy exposes the skin to water and its constituent chemicals and contaminants. These may produce irritations which can become dermatitis or fungal infections (Favero 1985, Mandojana and Sims 1987, Meakins 1992, New South Wales Department of Health 1992, Roberts 1981, Sorensen 1993). The extent to which physiotherapists are affected by these is unknown.

Electrophysical agents accepted as having risks for users are shortwave and microwave diathermy. Both are

radiofrequency electromagnetic radiations and users, as well as patients, are exposed to risks associated with fields surrounding this type of equipment (Delpizzo and Joyner 1987, Martin et al 1991). The extent to which users are exposed to this hazard is not known. The implications of repeated or long term exposure are also not well understood. Although both shortwave and microwave diathermy units are used frequently, they are available in fewer clinics than was once the case (Lindsay et al 1990, Pope et al 1995, Robertson and Spurritt 1998). This may make identification of dangers increasingly difficult and less relevant.

One study of male physiotherapists indicated that the relationship between radiofrequency electromagnetic radiation and a high exposure was significant for heart disease, but not for ocular effects or cancer. Exposure was categorised as either high or low, based on the mean number of years of employment and the mean frequency of treatments delivered per week (Hamburger et al 1983). Another study, on reproductive outcomes of paternal exposure to microwave diathermy, shortwave and ultrasound in the three months prior to conception (Logue et al 1985), also found "higher than expected" congenital abnormalities in the total sample. However, this finding was not statistically significant. A response rate of 58% and a lack of knowledge of the characteristics of the non-respondent population mean the non-significant finding could indicate a Type 2 error or be an accurate reflection of the lack of importance of male exposure.

With female physiotherapists, the focus of the hazards of exposure when using electrophysical agents is on reproductive outcomes. The prevalence of congenital malformation in the general community is 3.1% (Riley and Halliday 1996) and includes all malformations, major and minor. While a tendency for offspring of female physiotherapists exposed to shortwave diathermy and microwave radiation in the first trimester to have birth defects has been reported (Källén et al 1992) other studies have shown no such relationship (Gubéran et al 1994, Larsen 1991). The percentage of pregnancies that end in miscarriage is somewhat uncertain, as they may not all be reported, but is estimated at 13.5% (Nybo et al 2000) or at 10-15%, with most (65%) occurring between six and 10 weeks gestation (Llewellyn-Jones 1990). One study of physiotherapists found a statistically significant, dose-related correlation between miscarriage and exposure to shortwave diathermy and ultrasound in the first weeks of pregnancy (Taskinen et al 1990). Another found a relationship between early foetal loss and the use of TENS and ultrasound but not shortwave diathermy (Oullet-Hellstrom and Stewart 1993). A greater proportion of female offspring was attributed to exposure to shortwave diathermy in the first month of pregnancy (Larsen et al 1991). A replication of this study found no such gender imbalance (Gubéran et al 1994).

Methodological issues Closer scrutiny of existing studies of the risks of electrophysical agents for physiotherapists raises a number of methodological issues. For example, the

significance of the threefold increased risk of late spontaneous abortion associated with Finnish physiotherapists' use of shortwave diathermy and ultrasound disappeared when all variables were controlled (Taskinen et al 1990). Further, the lack of a dose-response relationship precluded any inference of a causal relationship between low levels of exposure to shortwave diathermy or ultrasound and adverse reproductive outcomes. Another finding in that same study of a statistically significant relationship between the use of TENS (≥ 5 hours/week) and congenital malformations is questionable, because of the very small number of cases involved (Taskinen et al 1990).

Probably of more importance is the difficulty in demonstrating any theoretical basis for a causal link between maternal exposure to patients being treated with TENS or ultrasound, and foetal outcomes. The apparent significance of the relationship between maternal exposure and foetal outcome, in the absence of a currently probable theoretical basis, highlights the difficulties in investigating the outcomes for physiotherapists of exposure to different electrophysical agents.

Other hazards in the work environment may be contiguous causal variables or even potentiators of actual causal agents but their effects can be difficult to distinguish. For example, heavy lifting (undefined) is a contiguous variable in the clinical context now known to be associated with an increased risk of spontaneous abortion (Goulet and Thériault 1987, McDonald et al 1986). The risk has since been quantified (OR = 3.4; 95% CI 1.3 to 8.7) for therapists doing heavy lifting (more than 10kg, more than 50 times per week; Taskinen et al 1990). The work environment is very complex and it is difficult to isolate and demonstrate the contributions of different variables to particular outcomes.

Other methodological issues relate to the timing of the investigation and the period of exposure investigated. In many cases, the conception and pregnancy occurred months, and sometimes years, previously. Recall is clearly a potential problem, possibly further affected by the pregnancy outcome. This was explicitly acknowledged as a source of potential bias in the studies by Larsen (1991), Oullet-Hellstrom and Stewart (1993), Logue (1985) and Källén et al (1992). Another issue is the duration for which exposure should be investigated, whether just prior to conception, from only post-conception, or for a longer period.

Reliable exposure data for physiotherapists are not available. Cumulative dosimetry for shortwave diathermy or microwave diathermy is not possible for clinical users. Further, most studies used self-administered questionnaires to obtain estimates of usage, often years later. Recall bias can only be removed by using reliable measures of exposure and conducting longitudinal studies with large numbers of therapists.

Summary Surprisingly little is known of the work-related

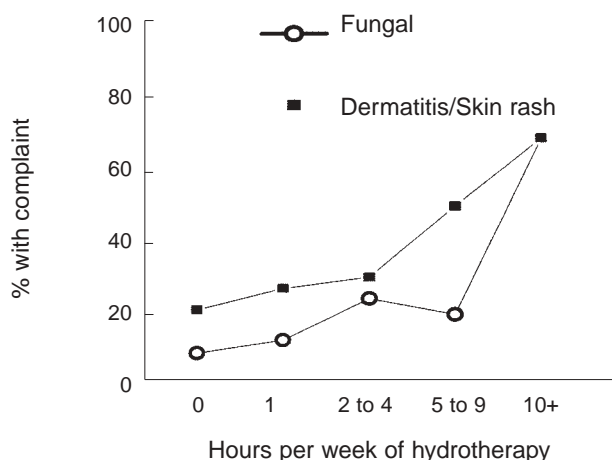


Figure 1. Hydrotherapy exposure and skin complaints amongst physiotherapists.

general health risks for physiotherapists. They can be exposed to a range of infections and chemicals, as well as the output of different electrophysical agents. The complexity of the work environment makes establishing causation very difficult.

One way of identifying patterns that may indicate causal relations is to investigate a large sample. This paper reports answers by physiotherapists to questions on their general health and reproductive outcomes. These questions were part of a broader study also investigating the extent of musculoskeletal problems among physiotherapists and reported elsewhere (Cromie et al 2000).

Method

Ethical approval for the study was granted by the Faculty Human Ethics Committee, La Trobe University. Using the compulsory state register of all physiotherapists in Victoria, a systematic sample of 824 was chosen by taking every fourth therapist currently resident in Australia (N = 3296). The starting point was randomly selected.

Prevalence Respondents were asked to indicate whether they had experienced hearing loss, asthma, skin infections (bacterial or fungal), dermatoses and infections such as tuberculosis, hepatitis B and C, HIV/AIDS, and influenza in the course of their work as a physiotherapist. They were also asked to estimate their levels of exposure for work-related conditions, and if they had other conditions, not necessarily work related, such as cataracts, skin lesions, heart disease and malignancies. Those reporting a skin lesion or malignancy were asked to specify the type.

Both male and female physiotherapists were asked to

complete questions on reproductive outcomes. They were asked if they had ever tried to conceive for more than 12 months without success, and if they (or their partner) had ever been pregnant. Those who had ever had a pregnancy were asked to complete a chart documenting the outcome for each pregnancy and the levels of concurrent exposure to electrotherapy agents and heavy lifting prior to (and during each pregnancy, for females).

Reproductive outcomes including live birth, stillbirth, abortion (spontaneous or surgical), gender, birth weight, perinatal death, and various congenital malformations were recorded. Respondents were invited to make any other relevant comments.

Distribution The questionnaire was mailed to 824 physical therapists, with a letter of explanation and a postage paid return envelope. All questionnaires were numbered, with numbers corresponding to names on a master list, to allow follow-up of non-respondents. To ensure the anonymity of respondents, the numbered section was removed from the remainder of the questionnaire and returned sealed in a blank envelope. These were opened independently, and respondents' names removed from the master list. (Due to the personal nature of some of the data, it was necessary to make the questionnaire anonymous to encourage frank responses.) Subjects who did not wish to complete the questionnaire indicated this by simply returning the numbered slip. Non-respondents received a reminder letter after two weeks, requesting return of the completed questionnaires, and a second reminder after a further three weeks. Respondents were informed that return of the completed questionnaire constituted informed consent.

Data analysis Data were analysed using SPSS 7.0 for Windows^(a).

The incidence of various reproductive outcomes was determined by dividing the number of therapists who reported a given pregnancy outcome by the total number of pregnancies. Mantel-Haenszel odds ratios and 95% confidence intervals were calculated for each pregnancy outcome, based on exposure to electrotherapy agents and heavy lifting. The odds ratios were calculated for male and female therapists separately. Following the univariate analysis, logistic regression was performed to determine whether the relationships remained significant when multiple variables were analysed, and to control for maternal age.

Therapists indicated the number of hours per week they spent performing various treatments including hydrotherapy. Prevalence of general health outcomes was calculated. Chi square analysis and Mantel-Haenszel odds ratios with 95% confidence intervals were calculated to determine the relative risk of physiotherapists doing hydrotherapy developing dermatitis, skin rashes or fungal skin infections. The prevalence of symptoms with increasing exposure (hours per week) was also calculated to identify any dose-response relationships.

Table 1. Adverse health outcomes reported by physiotherapists.

Health outcome	Attributed to physiotherapy work n (%)	Not attributed to physiotherapy work n (%)
Skin - fungal infection	57 (10.6)	5 (0.9)
Skin - bacterial and viral infection	19 (3.5)	4 (0.7)
Skin - dermatitis/rash	122 (22.8)	10 (1.9)
Skin - eczema	0	6 (1.1)
Skin - basal/squamous cell carcinoma	0	9 (1.7)
Skin - other (abrasions, psoriasis, keratoses, moles, neurofibroma)	0	13 (2.4)
Infections - HIV/AIDs	0	0
Infections - tuberculosis	3 (0.6)	0
Infections - other (unspecified)	67 (12.5)	0
Infections - influenza	188 (35.1)	0
Infections - hepatitis B or C	1 (0.2)	0
Asthma	9 (1.7)	0
Malignancy - breast	0	7 (1.3)
Malignancy - melanoma	0	6 (1.1)
Malignancy - other (cervical, prostate, thyroid, non-specific)	0	5 (0.9)
Cataracts	0	0
Heart disease	0	5 (0.9)
Hearing loss	3 (0.6)	0 (0)

Results

Of the 824 questionnaires distributed, 35 were returned because the physiotherapists were not currently resident in Australia, and were therefore ineligible to participate. Correctly completed questionnaires were returned by 536 respondents, giving a response rate of 67.9%. Seventy eight per cent were female, 22% were male. There were no significant differences between respondents and non-respondents (Cromie et al 2000).

More than half (59.5%) the respondents (n = 319) indicated having had some adverse health outcome as a consequence of working as a physiotherapist. Table 1 shows that these were skin problems, infections or hearing loss. A number of skin lesions not attributed to work were also reported, along with different malignancies and heart disease. Infections unrelated to work were not reported.

Skin complaints and tasks Figure 1 shows a dose-response outcome between hours doing hydrotherapy and skin complaints. Consistent with this, physiotherapists who provided any hydrotherapy treatments at all were more likely to get dermatitis or a rash as a result of their work than those who did none ($\chi^2 = 9.70$, $p = 0.002$, OR 1.9, 95% CI 1.3 to 3.0). The odds were even higher for those doing any hydrotherapy getting a fungal skin infection ($\chi^2 = 18.68$, $p < 0.001$, OR 3.3, 95% CI 1.9 to 5.7).

Pregnancy outcomes Of the 418 female and 118 male

respondents, 250 (59.8%) females had been pregnant, and 65 (55.1%) males had been partners of pregnant women. Between the 315 (58.8%) there were 809 pregnancies. Sixty two (11.6%) of the total respondents had tried to conceive for at least 12 months without success. Fifty-four (87.1%) of these were female, and eight male, but the difference was not significant ($p = 0.07$). Of those unable to conceive for more than 12 months, 49 (80.3%) had a pregnancy at some time. Of the 221 who had never had a pregnancy, 12 (5.5%) had tried unsuccessfully for at least 12 months to conceive.

Male physiotherapists Male physiotherapists were responsible for 152 pregnancies. Of these, 138 resulted in a live birth. More male offspring were born (59.3%, n = 80) than female (40.7%, n = 55), but the difference was not statistically significant from the birth outcomes for female physiotherapists (three missing data). No male physiotherapists reported having offspring with heart defects, spina bifida, cerebral palsy, cleft palate, limb deformities, childhood malignancies, stillborn or dead within 12 months of birth. The congenital defects they did report were talipes equinovarus (n = 1, 0.7%), congenital dislocation of the hip (n = 1, 0.7%) and herniated diaphragm (n = 1, 0.7%).

Five pregnancies involving a male physiotherapist ended in early miscarriage (before 10 weeks), six in a late miscarriage (10-24 weeks gestation), and three were surgically terminated. A total of 7.2% pregnancies in which

Table 2. Exposure of female physiotherapists to electrophysical agents in the first six months prior to pregnancy or in the first trimester of pregnancy, and miscarriage.

Modality	Miscarriage	No Exposure		Exposure		Missing data*	OR	CI
		No	Yes	No	Yes			
Shortwave	Early	499	31	62	4	61	1.04	0.36 to 3.04
	Late	479	32	59	6	81	1.52	0.61 to 3.79
Ultrasound	Early	462	27	99	8	61	1.38	0.61 to 3.13
	Late	443	32	95	6	81	0.87	0.36 to 2.15
TENS	Early	544	31	21	5	56	4.18	1.48 to 11.82
	Late	521	38	21	0	77	**	**
Interferential	Early	513	26	52	10	56	3.79	1.73 to 8.30
	Late	491	36	51	2	77	0.54	0.13 to 2.29
Low-level laser	Early	549	33	16	3	56	3.12	0.87 to 11.24
	Late	526	38	16	0	77	**	**
Interferential***	Early	494	24	70	10	59	2.94	1.35 to 6.41
	Late	473	35	68	3	78	0.60	0.18 to 1.99

"Early" miscarriages occurred before 10 weeks and "late" miscarriages occurred at 11-24 weeks.

*Pregnancies and miscarriages and exposure data incompletely reported by respondents.

**Not calculated because no miscarriages were recorded by therapists who were exposed.

***Exposure in first trimester of pregnancy.

a male therapist was involved resulted in miscarriage. Of the three surgically terminated, there was no indication that this was because of any difficulty with the developing foetus. No statistically significant relationship was found between exposure to electrophysical agents of male physiotherapists in the six months before conception with miscarriage, stillbirth or gender of the child.

Female physiotherapists Female physiotherapists reported a total of 657 pregnancies resulting in 550 live births. Of these, 272 of the children were female (49.5%) and 278 were male (50.5%). No spina bifida, cleft palate or childhood malignancies were reported in the offspring of female physiotherapists. Only one case each of stillbirth, limb malformations and cerebral palsy were reported (0.2% each), along with three cases (0.5%) of talipes equinovarus, 7 (1.3%) of heart abnormalities, and four deaths (for any reason) in the first year of life (0.7%). Minor abnormalities were recorded in fewer than 3% of the offspring.

Three pregnancies (0.5%) resulted in offspring with genetic disorders. One of these children died at nine months of age and a subsequent pregnancy was terminated as the foetus had the same autosomal recessive disorder. Female physiotherapists reported that 37 pregnancies (5.6%) ended with an early miscarriage, and 45 (6.8%) a late one. In all 13.0% of pregnancies ended in a miscarriage. Of these, 54.9% occurred after 10 weeks.

Outcome with electrophysical agent usage Physiotherapists using electrophysical agents prior to

pregnancy (and in the first trimester for female therapists) were compared with those who reported no exposure. Table 2 shows a significant risk of early miscarriage among female physiotherapists exposed to interferential prior to and during the first trimester of a pregnancy. Exposure to TENS before pregnancy appears to contribute to a significant risk of miscarriage in the first 10 weeks. However, further analysis of these findings showed there was no dose-response pattern evident. At the highest levels of exposure reported, the frequency of miscarriage actually decreased but when these variables were entered into a logistic regression, they no longer were statistically significant. This is possibly because the actual number of cases was small. A larger sample may yield more accurate and meaningful results.

The differences in outcomes for males and females were not significantly different for early (OR = 0.6, 95% CI 0.2 to 1.6, $p = 0.31$) or late (OR = 0.6, 95% CI 0.2 to 1.4, $p = 0.22$) miscarriage. Similarly, (self defined) heavy lifting by females in the first trimester of pregnancy was not significantly associated with early (OR = 1.8, 95% CI 0.6 to 3.6, $p = 0.47$), or late (OR = 1.2, 95% CI 0.5 to 2.8, $p = 0.83$) miscarriage in this study.

Discussion

The self-reported general health of physiotherapists indicates that they are not at increased risk of illness caused by infections encountered in the course of their work. Nor, apparently, are they at increased risk of other conditions,

such as cataracts or malignancy. The major general health risks associated with being a physiotherapist are for those doing hydrotherapy. With a dose-related response, the increasing prevalence of dermatitis or rashes and fungal skin complaints among therapists doing more than five hours per week suggests a need to identify a duration beyond which the risk becomes unacceptable. This needs further investigation and the development of empirically based guidelines for practitioners.

Electrophysical agents and birth outcomes Some electrophysical agents were statistically significantly associated with adverse pregnancy outcomes. Of the 809 reported pregnancies, 42 (5.2%) ended in early miscarriage, and 51 (6.3%) in late miscarriage. However, the total percentage of miscarriages (11.5%) was similar to that reported in the general population (13.5% Nybo-Anderson et al 2000; 10 to 15%, Llewellyn-Jones 1990). Only 1.9% of the offspring had a birth defect, compared with 3.0% of the births in the general population (Riley and Halliday 1996). This suggests that physiotherapists do not have an increased risk of giving birth to offspring with birth defects or of having miscarriages.

Early miscarriage and maternal exposure to TENS and interferential therapy in the six months before conception, and to interferential in the first trimester, were statistically significant. However, several factors suggest that the finding is not clinically meaningful. First, the number of therapists reporting an early miscarriage in each exposure group was very low ($\leq 1.6\%$ of the reported pregnancies). Second, the level of missing data is higher in each instance than the number of miscarriages reported. This raises questions about the validity of using these data to draw inferences about specific modalities. Third, the lack of a dose-response relationship (indeed, a lesser response as the exposure increased) suggests this is a spurious finding. An application of the epidemiological test of association proposed by Bradford-Hill strengthens this contention (Christie et al 1990). Fourth, the associations between early miscarriage and exposure to TENS and interferential therapy lack biological plausibility. Attributing causation and identifying exposure to electrophysical agents required therapist recall, often long after the event, and could not exclude the possibility that negative outcomes affected responses to questions about the electrophysical agents used at the time of a miscarriage. Contiguous factors such as lifting may have increased the probability of a miscarriage in some therapists but are similarly difficult to quantify and effectively examine. The final factor suggesting that the present findings are not clinically meaningful is a possible ambiguity in the questionnaire, discussed below, that may have affected some therapists' answers.

No association with either microwave or shortwave diathermy and miscarriage were identified in this study. This contrasts with the findings of Oullet-Hellstrom (1993) who identified an increased risk of miscarriage in physiotherapists exposed to microwave diathermy use in

the six months prior to pregnancy or in the first trimester.

The finding by Larsen et al (1991) of a gender imbalance in the offspring of physiotherapists exposed to non-ionising radiation was not confirmed by this study. The present result is consistent with that of Gubéran et al (1994) who also did not find any such imbalance.

Limitations of the study of electrophysical agents and birth outcomes As with all studies cited, a limiting factor of this study is that it required respondents to report recalled information. Some births had occurred many years previously. This introduces recall and non-respondent biases. Additionally, male therapists may not have had as accurate recall of miscarriage as their female counterparts.

In addition, self-reported data obtained this way are not independently verifiable. While there probably is little doubt as to the birth outcomes, neither they nor the exposure details have been validated. Exposure data are also possibly subject to an additional source of bias. Those with an adverse birth outcome most likely considered possible causes, such as their use of electrophysical agents, while those with a normal outcome had no reason to do so. Potentially confounding variables such as drug and alcohol use, parental disease and smoking were not considered in this study. These may have affected the results.

Small numbers Very few therapists used any types of electrophysical agents during a pregnancy. For example, four individuals reported using TENS more than 20 hours per week; one for 10-20 hours per week; 21 for 5-10 hours per week; and 575 not at all or for less than five hours per week. Such a distribution of usage makes "significant" findings difficult to accept without a strong supporting theoretical framework.

Design of questions An unexpected result was the high number of respondents who recorded no exposure as "1". An ambiguity in the question meant that "1" could be interpreted as meaning anything up to five hours per week, including zero exposure. This possibility was not identified by any of the therapists who pilot tested the survey instrument, or until after data collection had commenced.

To redress this, data were re-categorised into "minimal" (0 exposure and less than five hours per week) or "some" exposure categories (more than five hours per week). Chi squared analyses were conducted. Initially, all who indicated minimal exposure but gave no details were included and then treated as missing data. The different analyses did not change the statistical significance.

In addition, the question asking physiotherapists to indicate whether they had been exposed to heavy lifting in their pregnancies did not define heavy lifting. Physiotherapists were expected to decide for themselves if what they had done constituted "heavy lifting". Better definition of the term might have strengthened the study but could not have redressed the issues of recall bias.

Conclusion

Skin complaints among physiotherapists using hydrotherapy were high. Two thirds who performed hydrotherapy for more than 10 hours per week reported having dermatitis and fungal skin infections. This suggests a need for further research and the development of appropriate guidelines to prevent this.

In the absence of a dose-response relationship, the relationships identified between miscarriage and the use of electrophysical agents prior to and during the first trimester of pregnancy appear spurious. This is consistent with the lack of any probable theoretical basis for such findings and suggests they probably represent Type I errors or are related to problems inherent in surveys dependent on recalled information. Future research into the general health and reproductive outcomes for physiotherapists ideally would use a longitudinal design and annual or semi-annual data collections. In addition, the data need to be collected using improved methods of identifying and recording exposure to the different infections, chemicals, electrophysical agents and other factors in the work environments of physiotherapists. Future studies would be strengthened by including variables such as smoking, alcohol and drug use and parental disease.

Footnote (a) SPSS Inc, 444 North Michigan Avenue, Chicago IL 60611 USA.

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