

## Title page

Title: Fire and burns risk with emollients

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## Contributorship Statement

MJR was invited to write the article, enlisted the help of the co-authors, wrote the first draft and subsequent revisions. SH, ML, AR and HCW commented on all draft versions and approved the final manuscript.

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*A 72 year-old man with poor mobility secondary to Parkinson's disease and dementia attends an Emergency Department with burns to his upper body. He is a smoker and his carer applies emollients to most of his body daily, as a long-term maintenance treatment for eczema. The attending clinician established that the patient's burns were sustained when his cigarette came into contact with the right arm of his pyjamas, which quickly caught fire.*

Emollients are not flammable in themselves, in their container or on the skin. Fire risk stems from fabric that has become impregnated with emollient residue. A naked flame is needed to ignite. The residue acts as an accelerant, increasing the speed of ignition and intensity of a fire, reducing the time available to extinguish it.

Emollients are generally safe; however, awareness of fire risks is low. UK survey data suggests that patients in secondary care are more aware of the fire risks than those in primary care; in primary care, those at dispensing practices more so than those at non-dispensing practices.<sup>1,2</sup> In 2019, freedom of information requests in the UK revealed that 63% of Fire and Rescue Services, 32% of Clinical Commissioning Groups and 72% of Local Health Boards gave no safety advice within their website or formularies, and only a minority were up to date.<sup>3</sup>

## What are emollients?

Emollients are moisturising treatments used for dry skin conditions like atopic eczema and psoriasis. They come in different formulations (lotions, creams, gels, ointments and sprays) and broadly are petroleum (paraffin) or non-petroleum based. Applied directly to the skin, typically on an "at least daily and as required" basis (up to 250-500g per week),<sup>4</sup> emollients act to soothe and hydrate. In conditions like atopic eczema, they are usually used alongside anti-inflammatory treatments such as topical corticosteroids to treat or prevent inflamed areas of skin. Eczema treatment for a minority of patients might involve wearing bandages or body suits impregnated with emollient.

Emollient can transfer from skin onto clothing, furniture, and bedding which accumulates over time—even with regular washing, some residue remains.

Transient application site reactions such as stinging or redness are common occurring in around one third of users.<sup>5</sup>

While, generally, most emollients will lose moisture ("dry"), most (but not all) ointments that are nearly 100% paraffin base will not do so. Tests with wet emollients have resulted in longer time to ignition compared to just the fabric itself.<sup>3,6</sup>

## How do patients with this adverse reaction present?

Patients may present to primary care or Emergency Departments with minor, major, or life-threatening burns; or may die in their home due to fire or smoke.

## How common are these reactions?

International data linking emollient use with burns, fires or fatal incidents are limited. There are no systems internationally for reporting. In England, between 2010 and 2018, fire and rescue services recorded more than 50 fatal fire incidents in which emollients were known to have been used by the victim or were present at the scene of the fire.<sup>7</sup> Between 2010 and 2017, there were at least 37 fire

deaths in England linked to emollient use.<sup>8</sup> While emollient use is widespread and the number of recorded incidents low, under-reporting is likely.

## What are the risk factors?

The risk applies equally to all types of emollients, petroleum and non-petroleum based, and fabrics.<sup>9</sup> Those using emollient over large areas are at increased risk, especially if there is repeated impregnation of clothing and reduced washing or changing of clothes.<sup>10</sup> Those most at risk are older people who smoke, have reduced mobility, and/or have dementia because of the presence of an ignition source (lit match or cigarette) and diminished physical capacity to dampen flames or remove clothing if they catch fire.<sup>10</sup> However, risk is present for all age groups who use emollients, e.g. young children with eczema standing next to an open fire or in the presence of a carer's cigarette. The common risk is a reduced ability to react quickly enough once an emollient-impregnated material or fabric they are wearing, lying or sitting on is exposed to a naked flame. Risk is not markedly mitigated by flame-retardant properties of blended fabrics (see table 1).<sup>6</sup> The authors are not aware of any evidence linking fan heaters or other heat sources to emollient-related fires/burns. However, a higher temperature could be a contributory factor to a quicker ignition with a flame and heat can also increase the volatility of the components in the emollients.<sup>11</sup>

Supplemental oxygen increases the risk and some deaths have been linked to the use of an airflow mattress or cushion.<sup>10</sup>

While synthetic fibres ignite less easily, molten polymers can result in painful and dangerous burns which can be difficult to treat.<sup>12</sup>

## Table 1

Table: Example of flammability of sheets with and without emollients

	Mean ignition time in seconds		p value <sup>b</sup>
	No emollient	Emollient <sup>a</sup>	
100% cotton sheet	68.0	6.0	0.001
52% polyester and 48% cotton sheet	336.0	12.2	<0.001

<sup>a</sup>Single application of 14.5% white soft paraffin/12.6% light liquid paraffin base cream, left to dry for 24 hours. <sup>b</sup>Compared with mean ignition time of the respective blank control. Extract from Hall et al 2019.<sup>6</sup>

## What is the evidence?

The earliest report of emollient use leading to burns was in the US in 1984, when burns in a patient were linked to petrolatum-based hair grease.<sup>13</sup>

In the UK, the National Patient Safety Agency first associated emollients with fire hazards in 2007,<sup>14</sup> The initial warning erroneously said the increased risk only applied to products containing > 50% paraffin. Flammability testing under controlled conditions in a laboratory has subsequently shown that fire risk applies to all emollients, including low paraffin (6%) and paraffin-free (with a castor oil or oatmeal base), products.<sup>10 15</sup>

The authors are not aware of other relevant data but have not systematically reviewed the literature.

## How is it diagnosed?

Always ask people presenting with burns about use of emollients.

To improve awareness and reporting of the condition, routinely record emollient use in medical records.

## How is it managed?

Management is the same as burns not related to emollient use.

## How can the risk of harm be minimised?

Advise patients to continue using emollients as they are an important and effective treatment and there is no alternative for dry skin and inflammatory skin conditions; however, make everyone aware that emollient residue gets into materials and increases their flammability.

Clothing such as dressing gowns that are likely to become impregnated need to be changed and washed regularly. However, while washing washable items may reduce risk, some residue remains even after pre-wash treatments, use of biological and non-biological washing powders, and hot water temperatures, especially in fabrics with higher paraffin content .<sup>16</sup>

Advise patients and carers to also take other precautions, such as avoiding long sleeved or loose clothing when cooking, using a safety lighter, avoiding naked flames, and smoking cessation

E-cigarettes and electric hobs are lower-risk alternatives to cigarettes and gas hobs.

Give fire risk advice verbally when prescribing and dispensing and encourage patients to inform their families, friends and carers.

Posters in healthcare settings, patient information leaflets, and warning labels emollient containers are helpful in reducing risk. In the UK, these are available from the MHRA (see fig 1).<sup>17</sup>

Ask patients/carers to contact local fire and risk services for advice when patients might be at high-risk.

Report adverse incidents involving emollients, including fires and burns, to the relevant national authority (UK: MHRA “Yellow Card” <https://yellowcard.mhra.gov.uk/>; US: FDA “MedWatch” <https://www.accessdata.fda.gov/scripts/medwatch/index.cfm>; Europe: various <https://www.adrreports.eu/en/national.html>; India: <https://cdsco.gov.in/opencms/opencms/en/Home/>).

## Fig 1 (UK Regulatory approvals and warnings)

Box: UK MHRA and NFCC emollients alert label\*



The Commission on Human Medicines<sup>10</sup> recommends that this warning is applied to all emollients in the UK (paraffin and paraffin-free)

## What you need to know

- Advise patients to continue using emollients but encourage awareness of the burns risk.
- Emollients are not flammable themselves but when dried on fabric can act as an accelerant.
- People with reduced ability to react quickly when emollient-impregnated fabric is exposed to naked flames are most at risk.
- Some residue remains even after hot washing so also advise naked flame avoidance and smoking cessation.

## Education into Practice

When prescribing emollients, do you check the patient's awareness of the fire risk and whether they smoke?

If you see a patient with burns, do you ask about emollient use?

## How patients were involved in the creation of this article

Co-author Amanda Roberts is a patient with lived experience of using emollients for atopic eczema, both for herself and her children. Amanda has been aware of the lack of patient facing information about this problem from her interactions with patients and carers on Twitter. In particular Amanda helped to emphasise the wider context of the risk, that naked flames are not the only potential hazard, that washed items still posed a threat, and the training implications for doctors, nurses, pharmacists and fire brigade personnel. In addition, we incorporated a patient peer reviewer comments, including amending the title for clarity and noting that when synthetic fibres melt, they can cause unpleasant burn injuries.

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