

## Importance of heat therapy in the treatment of pain in the daily clinical practice

Thilo Hotfiel<sup>a,\*</sup>, Pablo Fanlo-Mazas<sup>b</sup>, Miguel Malo-Urries<sup>b</sup>, Ema Paulino<sup>c</sup>, Luis Sequeira de Medeiros<sup>d</sup>, Massimo Blondett<sup>e</sup>, Mario Vetrano<sup>f</sup>, Juergen Freiwald<sup>g</sup>

<sup>a</sup> Friedrich-Alexander University Erlangen-Nuremberg, Department of Orthopaedic and Trauma Surgery, Erlangen, DE, 91054, Germany

<sup>b</sup> University of Zaragoza, Department of Physiatry and Nursing, Zaragoza University, Aragón, ES, 50009, Spain

<sup>c</sup> Farmácia Nuno Álvares, Almada, PT, Portugal

<sup>d</sup> NOVA Medical School, Universidade Nova de Lisboa, Lisboa, PT, 1169-056, Portugal

<sup>e</sup> ASL 3 Genovese, Genova, IT, Italy

<sup>f</sup> Sant'Andrea Hospital, Department of Medical and Surgical Sciences and Translational Medicine, "Sapienza" University of Rome, Roma, Lazio, IT, 00189, Italy

<sup>g</sup> Bergische Universität Wuppertal, Research Center for Performance Diagnostics and Training Advice (FLT), Gaußstrasse 10, Wuppertal, Nordrhein-Westfalen, DE, 42119, Germany

### ARTICLE INFO

Handling Editor: Dr Jerrilyn Cambron

#### Keywords:

Heat therapy  
MSK pain  
Low back Pain  
Neck Pain

### ABSTRACT

**Background:** Musculoskeletal (MSK) pain includes a wide variety of causes and conditions. Despite the heterogeneity of MSK pain, it is possible to identify some common clinical features and treatments. Heat therapy (HT) is one of the most common and could be a suitable non-pharmacological approach.

**Objective:** To obtain a European overview on the use of non-pharmacological approaches and the role of heat therapy in the treatment of MSK pain.

**Methods:** Through a two-cycle Delphi-like method, an international board of experts reached a consensus on 13 questions for a survey to healthcare professionals who provide direct patient care. Between November 2021 and January 2022, the resulting web survey was distributed to professionals with the collaboration of ten European scientific societies and associations. Univariate and bivariate analyses were performed on collected data.

**Results:** Two hundred eighty-two answers were validated. Most of the respondents had extensive professional experience. Participants were widely distributed throughout Europe. HT is administered to about 50% of patients, with a higher percentage administered to those affected by low back pain (92%) and neck pain (84%). The choice of exogenous HT is based on both personal clinical experience and scientific evidence. HT is primarily chosen due to its relaxation effect, high safety profile and enhancement of tissue perfusion. The use of HT is recommended by 86.5% of respondents.

**Conclusion:** Experts indicate that exogenous HT represents a valid therapeutic choice and is widely used in Europe. Patients should be informed about the use of heat therapy as a valuable self-management therapy option.

### 1. Introduction

Musculoskeletal (MSK) pain is a complex restricting disorder related to more than 150 conditions as listed in the WHO International Statistical Classification of Diseases and Related Health Problems (WHO 2022). The most frequent MSK disorders are low back pain (LBP), neck pain (NP), joint pain, myofascial pain and other widespread chronic pain syndromes.

LBP is probably the most common health problem globally and one of the major causes of individual disability. The lifetime prevalence of

LBP is 84%, of which 23% is defined as chronic LBP (Airaksinen et al., 2006; Balagué et al., 2012; Hoy et al., 2014; Wu et al., 2020). NP is the fourth most common cause of disability and the annual prevalence in the adult population exceeds 30% (Cohen 2015; Popescu and Lee 2020). Myofascial pain syndromes also arise from acute and chronic MSK pain, which are some of the most important and overlooked causes of disability (Jaeger 2013; Weller et al. 2018).

Considering all of these data, one can conclude that MSK pain affects millions of people worldwide and is regarded as a significant social burden, leading to disability and having a severe impact on quality of

\* Corresponding author.

E-mail address: [thilo.hotfiel@fau.de](mailto:thilo.hotfiel@fau.de) (T. Hotfiel).

<https://doi.org/10.1016/j.jbmt.2024.01.015>

Received 15 June 2022; Received in revised form 18 July 2023; Accepted 13 January 2024

Available online 28 January 2024

1360-8592/© 2024 Published by Elsevier Ltd. This is an open access article under the CC BY license (<http://creativecommons.org/licenses/by/4.0/>).

life (Hawker 2017; Treede et al. 2019). All these effects may represent a severe problem in terms of work productivity. The estimated annual cost of lost productivity in the Australian population is more than nine million working days (Hawker 2017). In Europe, the estimated costs could be up to 2% of gross domestic product (GDP) among working-age people (Bevan 2015).

Among the various therapeutic strategies, heat therapy is one of the most traditional and frequent treatments proven to relieve pain and other symptoms in certain MSK conditions (Papaioannou et al. 2016). Recently, the efficacy of heat in improving pain and joint functionality has been demonstrated on knee osteoarthritis (Ariana et al., 2021). Furthermore, a meta-analysis compared 32 randomised clinical trials involving 1098 patients and demonstrated the efficacy of heat therapy in treating overuse-related muscle pain in the context of delayed onset muscle soreness (DOMS) (Wang et al., 2021). In addition, heat wrap therapy for several hours per day can be recommended to enhance strength parameters (Freiwald et al., 2018).

Due to its value and availability, heat therapy has become a very popular choice in daily practice, frequently recommended by physicians, physical therapists, pharmacists and sports scientists. Despite the fact that the physiological mechanisms of HT are well known and there is scientific evidence on its clinical utility (Nadler et al. 2004), there is a lack of guidance on its use, particularly on indications and contraindications, dosage, frequency, precautions and other treatment routines (Lubrano et al. 2023; French et al. 2006). Furthermore, recent recommendations aim to develop a more patient-centred approach that incorporates effective communication, education and a shared decision-making process (Lin et al. 2020; Ndlovu et al., 2014). Therefore, there is a need to develop an international consensus on recommendations on the clinical utility and patient-centred approach of HT in MSK pain.

In order to obtain a reliable and comprehensive overview of the use of non-pharmacological approaches and the role of heat therapy in the treatment of MSK pain in Europe, an international advisory board was established, comprised of health professionals experienced in the use of heat therapy as part of a multimodal approach. A web survey was developed and conducted in five European countries, with the collaboration of ten scientific societies and associations, involving various health professionals.

### 1.1. Key sentences

- MSK pain affects millions of people worldwide, with a high socio-economic and quality of life impact.
- HT is one of the most recommended treatments to alleviate MSK pain.
- There is a lack of international consensus on HT use, particularly on indications and contraindications, dosage, frequency, precautions, and other treatment routines.
- To obtain an overview of the use of non-pharmacological approaches for the treatment of MSK pain in Europe, including HT, an international advisory board was established.
- A web survey was developed and conducted in five European countries, with the collaboration of several scientific societies and associations, involving various health professionals.
- HT is a valid therapeutic choice, especially for low back and neck pain, widely used by European healthcare professionals, based on its high-security profile, myorelaxant and metabolic effect.

## 2. Methods

### 2.1. Survey design

The Board, formed by the ten authors of this paper, participated actively in the development of the survey, reaching a consensus on 13 closed questions through a two-cycle Delphi-like method. This method

aims to facilitate the achievement of a consensus on a specific topic in a group of experts (Giannarou et al. 2014; Hasson et al. 2000; McPherson et al. 2018). The structure was designed to have three distinct sections: 1) characteristics of the respondents (who); 2) characteristics of the pain and patients (to whom); 3) characteristics of the pain management (how). All survey questions and data are shown in Tables 1–3.

Most of the questions (q) required a single answer (q1–5, 13); some offered the possibility of multiple choice (q6, 11), and on the others (q7–10, 12), a scale was used for a score (range 0–10). The questions relating to the characteristics of the respondents and the type of pain were univocal, whereas questions describing therapy provided multiple answers. No prior analysis of the reliability and validity of the survey was carried out.

### 2.2. Recruitment of respondents

The survey was distributed to a broad panel of experts from the same countries as the members of the Board, involving ten scientific societies and associations (Table 6) in order to ensure broader and more qualified participation. Each scientific society or association was involved in sharing the initiative, publishing and publicising the link to the web survey, and inviting their members to participate.

### 2.3. Measurements and analyses

Data collection was active from 11/11/2021 to 27/01/2022 and 296

**Table 1**  
Survey analysis data – Characteristics of responders.

Question No.	Modality	Frequency N =	Value %
1 Gender	Male	175	59.1
	Female	121	40.9
2 Age	<30 yrs	27	9.12
	30–35 yrs	44	14.86
	36–40 yrs	40	13.51
	41–45 yrs	30	10.14
	46–50 yrs	24	8.11
	51–56 yrs	21	7.09
	56–60 yrs	33	11.15
	60–65 yrs	39	13.18
3 Years of professional experience	<5 yrs	30	10.14
	5–10 yrs	54	18.24
	>10 yrs	212	71.62
4 Profession	General Practitioner	87	29.39
	Orthopedic surgeon	22	7.43
	Pharmacist	51	17.23
	Physiatrist	17	5.74
	Physiotherapist	43	14.53
	Rheumatologist	0	0
	Sports Medicine Specialist	1	0.34
	Sports instructors/trainers	54	18.24
	Other	21	7.09
	5 Working place in (Country)	Austria	1
Germany		28	9.46
Italy		164	55.41
Portugal		62	20.95
Spain		35	11.82
Switzerland		1	0.34
Other		5	1.69

**Table 2**  
Survey analysis data – Characteristics of pain.

Question No.	Parameter	Modality	Frequency (N = 296)	Value %
6 What musculoskeletal disorder do you usually see in your clinical practice? (associated to each age range)	Acute pain	Younger person	163	36.0
		Adult	214	47.2
		Older	64	14.1
		No choice	12	2.7
	Chronic back pain	Younger person	33	7.5
		Adult	195	44.1
		Older	201	45.5
		No choice	13	2.9
	Muscle pain or spasm	Younger person	191	38.7
		Adult	218	44.1
		Older	71	14.4
		No choice	14	2.8
Osteoarthritis	Younger person	25	6.7	
	Adult	112	30.0	
	Older	203	54.3	
	No choice	34	9.1	
Myofascial pain syndrome	Younger person	120	28.8	
	Adult	197	47.2	
	Older	65	15.6	
	No choice	35	8.4	
	<b>Parameter</b>	<b>Mean Score</b>	<b>SD</b>	
7 How often do you observe the following causes of musculoskeletal pain?	Bad posture	6.6	2.16	
	Overuse	6.6	1.95	
	Sedentary life	6.9	2.19	
	Trauma	5.8	2.4	
	Psychological component	4.9	2.3	

valid answers were collected and grouped according to their nature. In the univariate analyses, each question's data are presented as a summary (n, mean, SD, median and min/max) for the continuous variables and as frequency tables for the categorical variables (Tables 1–3). The bivariate analyses (Table 4 and 5) indicated the respondents' specific characteristics as a factor on the respondents' recommendation for HT (question 13, categorised as a Yes/No variable).

In order to obtain consistent data for the bivariate analyses, we had to make some assumptions. The respondent was free to provide answers without any control in this survey. Therefore, we adopted a conservative approach, excluding from the bivariate analyses all respondents classified as "not a user" (who provided a score of 0–1 to question 10 and answered "No never" or "I never will recommend" to question 13) and "habitual user" (who provided a score in the range 9–10 to question 10 and answered "I recommend in specific cases" or "I always recommend" to question 13). After that data cleaning, 282 respondents were validated for the bivariate analyses.

The chi-square test was carried out to identify possible associations between the factors and the outcome. All the analyses were conducted with SAS® Version 9.4.

### 3. Results

All results of the descriptive analyses are summarised in Tables 1–3. The first 5 questions were designed to provide the demographic and professional characteristics of the respondent population (Table 1). The gender representation (question 1) is unbalanced, with a prevalence of males. The age group (question 2) shows a bimodal distribution, with a cluster consisting of two classes (30–35 and 36–40) as 27 % of the sample and a cluster over 61 (61–65 and >65) as 26% of the sample (see Fig.1). Most of the respondents (72 %) had more than 10 years of

**Table 3**  
Survey analysis data – Treatments

Question No.	Parameter	Mean Score	SD	
8 How do you manage musculoskeletal pain in your clinical practice? (ACUTE)	Pharmacological intervention	4.9	2.31	
	Heat therapy	5.0	2.78	
	Cold therapy	4.3	2.69	
	Exercise	5.7	2.91	
	ESWT/ultrasound	3.5	2.67	
	Physical or occupational therapy	3.5	2.67	
	Manual therapy	5.5	2.85	
	Relaxation techniques	4.5	2.85	
	Electrotherapy	3.8	2.57	
	Advice	7.1	2.44	
8 How do you manage musculoskeletal pain in your clinical practice? (CHRONIC)	Pharmacological intervention	3.8	2.54	
	Heat therapy	6.2	2.31	
	Cold therapy	3.0	2.66	
	Exercise	6.9	2.66	
	ESWT/ultrasound	3.8	2.66	
	Physical or occupational therapy	3.8	2.75	
	Manual therapy	6.0	2.85	
	Relaxation techniques	5.1	2.70	
	Electrotherapy	4.1	2.52	
	Advices	7.1	2.76	
9 How important are the following factors in choosing the therapy?	Clinical guidelines	7.3	2.25	
	Personal clinical experience	8.0	1.67	
	Contraindications	7.2	2.42	
	Easy to find/to use	6.7	2.40	
	Costs	5.8	2.50	
	Patients preference	6.4	2.37	
	Scientific evidence	7.9	1.93	
		<b>Parameter</b>	<b>Statistics</b>	<b>Results</b>
	10 In general, in how many treatments/patients/cases (i.e. percentage of treatments or cases %) do you use the exogenous HT in your clinical practice?	Use of exogenous HT	N	296
			Mean ± SD	5.1 ± 2.4
		Median	5.0	
		Q1; Q3	3; 7	
		Min - Max	0; 10	
11 In which musculoskeletal condition do you use the exogenous HT?		<b>Parameter</b>	<b>Frequency (N = 296)</b>	<b>Value %</b>
	Low back pain		273	92.2
	Neck pain		249	84.1
	Osteoarthritis pain		117	39.5
	Localized myalgia			
	Myofascial pain syndrome		172	58.1
12 From the point of view of the healthcare professional,		<b>Parameter</b>	<b>Mean Score</b>	<b>SD</b>
	Tissue perfusion		6.7	2.24
	Local metabolism		6.3	2.37

(continued on next page)

**Table 3** (continued)

Question No.	Parameter	Mean Score	SD
what important benefit could exogenous heat therapy provide?	Healing promotion	6.0	2.34
	Neuromuscular function	5.8	2.44
	Biomechanics	5.6	2.51
	Relaxation	7.2	2.14
	Pain relief	6.7	2.01
	Psychological aspect	5.7	2.62
	Excellent safety profile	6.9	2.41
	Parameter	Frequency (N = 296)	Value %
13 Do you recommend using heat therapy patches in combination with other therapies?	Yes, always	61	20.6
	Yes, in specific cases	195	65.9
	I do not use HT	17	5.7
	No, never	23	7.8

**Table 4**

Bivariate analysis – profession Vs. recommendation in use of HT.

Profession	Recommend	Does not recommend	Total
Prescribers	140 (89.7 %)	16 (10.3 %)	156
Non prescribers	102 (81.0 %)	24 (19.0 %)	126
Total	242	40	282

professional experience (question 3), 18% had between 5 and 10 years of experience and 10% had less than five years of experience (see Fig. 2). Professions (question 4) were widely distributed, with a higher prevalence of general practitioners (29%), pharmacists (17%) and sports medicine specialists (18%). The respondents' workplace distribution (question 5) was inhomogeneous; Italy (55%) and Portugal (21%) were the countries with the most significant number of respondents.

The questions 6 and 7, presented in Table 2, were aimed at the characteristics of the patients that the respondents usually see in their clinical practice. The type of musculoskeletal disorder (question 6) was assessed as acute and chronic and related to age. Acute back pain and muscle pain or spasm were more frequent in the younger population and adults (83% of each kind of pain). A similar distribution was observed in myofascial pain syndrome (76%). On the other hand, we observed a shift toward adults and the elderly in chronic back pain (89%) and osteoarthritis (74%). The analysis of perceived causes of the MSK disorder (question 7) showed a wide distribution, but sedentary lifestyle (mean 6.9 ± 2.19 SD), bad posture (mean 6.6 ± 2.16 SD) and overuse (mean 6.6 ± 1.95 SD) had the highest mean score values. Trauma (mean 5.8 ± 2.4 SD) and psychological components (mean 4.9 ± 2.3 SD) were reported less frequently. The third section (see Table 3) aimed at the management of MSK pain in different conditions. On the treatment of acute MSK pain, Question 8 showed Advice as the most frequent choice (mean 7.1 ± 2.44 SD), followed by Exercise (mean 5.7 ± 2.91 SD), Manual therapy (mean 5.5 ± 2.85 SD) and Heat therapy (mean 5 ± 2.78 SD).

Other treatments had a mean score of less than 5. Again, in Question 8, but regarding the treatment of Chronic MSK pain, Advice (mean 7.1 ± 2.76 SD) was the preferred choice, followed by exercise (mean 6.9 ± 2.66 SD), Heat therapy (mean 6.2 ± 2.31 SD), Manual therapy (mean 6 ± 2.85 SD) and relaxation techniques (mean 5.1 ± 2.70 SD). Other treatments had a mean score of less than 5. Analysing the influencing factors on the therapy choice (question 9), respondents indicated "personal clinical experience" as the most frequent factor (mean 8.0 ± 1.67 SD), followed by "Scientific evidence" (mean 7.9 ± 1.93 SD), "Clinical guidelines" (mean 7.3 ± 2.25 SD) and "Contraindications" (mean 7.2 ± 2.42 SD). The other factors had a mean score of less than 7.

Respondents indicated that they use exogenous HT in their clinical practice (question 10) in at least 50% of cases (mean 5.1 ± 2.4 SD;

**Table 5**

Bivariate analysis – user Vs. recommendation for using HT patches.

HT User/non user	Recommend HT patches	Does not recommend HT patches	Total
Exogenous HT user	120 (93.7%)	8 (6.3%)	128
Exogenous HT non user	136 (81.0%)	32 (19.0%)	168
Total	256	40	296

**Table 6**

Scientific societies involved. Members answered to survey.

EUROPE	
EFSMA	European Federation of Sports Medicine Associations
GOTS	German-Austrian-Swiss Society for Orthopedic Traumatologic Sports Medicine
AUSTRIA	
	Austrian Society of sport medicine
GERMANY	
DGSP	German federation of sport medicine and prevention
ITALY	
SIMFER	Societa Italiana Medicina Fisica e Riabilitativa
FMSI	Federazione Medico sportiva italiana
MEDICOOP	Cooperativa Medici di Base Liguria
PORTUGAL	
SPMD	Sociedade Portuguesa de medicina desportiva
ANF	National Association of Pharmacies
SPAIN	
SEMED/ FEMEDE	Federación Española de Medicina del Deporte

median 5.0) and that HT (question 11) is used mainly in low back pain (92%), neck pain (84%), myofascial pain syndrome (58%) and osteoarthritis pain, localised myalgia (39%).

The analysis of the importance of exogenous HT, according to the healthcare professionals (question 12), indicates a wide range of benefits such as: myorelaxation (mean 7.2 ± 2.14 SD); excellent safety profile (mean 6.9 ± 2.41 SD); tissue perfusion (mean 6.7 ± 2.24 SD), pain relief (mean 6.7 ± 2.01 SD); local metabolism (mean 6.3 ± 2.37 SD) and healing promotion (mean 6 ± 2.34 SD). Other effects, such as neuromuscular function, psychological aspects and biomechanics, have a mean score of less than 6 (5.8; 5.7; 5.6 respectively). Finally, regarding the recommendation to use HT patches in combination with other therapies (question 13), always (21%) and in specific cases (66%) were the most frequent answers.

In the bivariate analysis (Tables 4 and 5), neither gender (p-value = 0.1224), age (p-value = 0.0968), nor years of professional experience (p-value = 0.2626) showed a significant association with the use of HT. When the professions were classified according to their ability to prescribe (Table 4), we found that the "prescribers" (general practitioners, orthopaedic surgeons, sports medicine specialists and physiatrists) recommend the use of HT (140–89.7% – out of 156) more than the "non-prescribers" (102–81.0% – out of 126; p-value = 0.0354).

Answers to question 10 ("In general, in how many treatments/patients/cases [i.e. percentage of treatments or cases %] do you use exogenous HT in your clinical practice?") allowed the creation of two subgroups of specialists: "HT users" and "HT non-users". The same was done to the results of question 13 ("Do you recommend using heat therapy patches in combination with other therapies?"), resulting in two classes – i.e. "HT recommended" and "HT not recommended". The association of the two subgroups and the results of question 13 was significant (p-value = 0.0014), showing that the specialists who use exogenous HT in their clinical practice tend to recommend using heat therapy patches in combination with other therapies (Table 5).

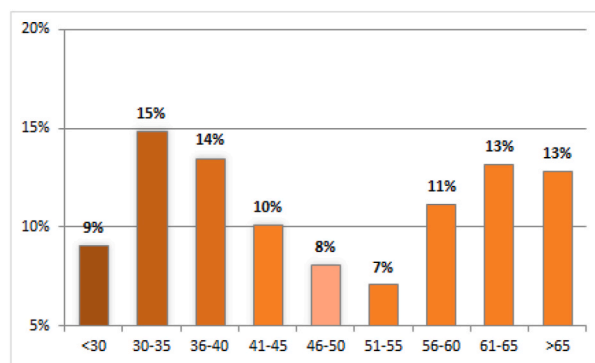
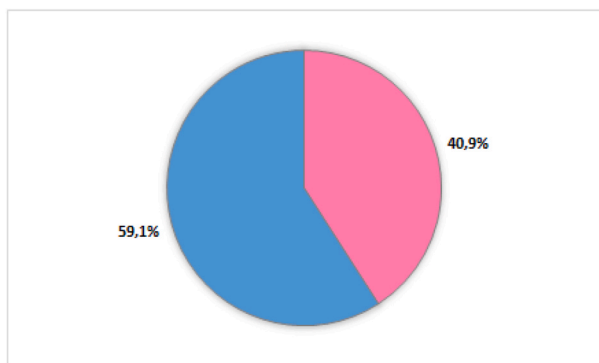


Fig. 1. Distribution of responders by gender and age class.

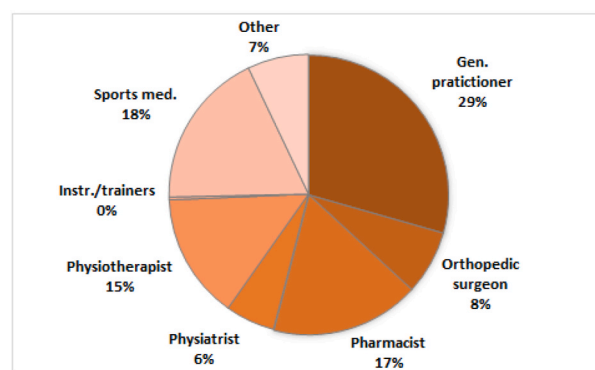
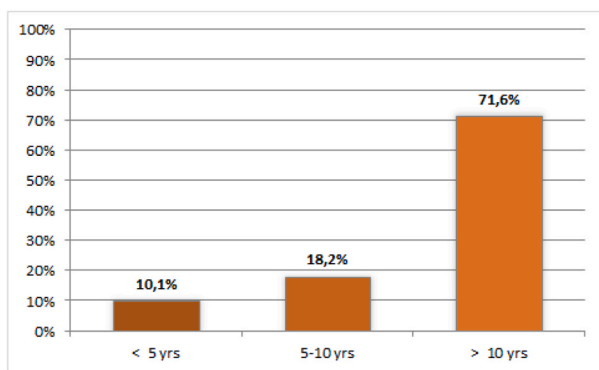


Fig. 2. Distribution of specialists by years of practice and type.

#### 4. Discussion

This is the first study involving specialists from different European countries that developed, through a Delphi-like method, a web survey on the use of HT. The survey was subsequently widely distributed amongst healthcare professionals who provide direct patient care in Europe.

Working summary – main findings

- The respondents were widely distributed throughout Europe. Most of them had extensive professional experience.
- According to the respondents' perception, the specified MSK disorders had an expected age group distribution.
- HT is more frequently recommended in chronic disorders.
- Personal experience, scientific evidence, clinical guidelines and contraindications were the main factors considered when deciding to treat MSK pain.
- LBP (92%) and NP (84%) were the disorders most frequently treated with HT.
- Bivariate analysis on the use of HT didn't show significant differences related to age, profession or working experience. Nevertheless, we observed that general practitioners, orthopaedic surgeons, sports medicine specialists and physiatrists recommended the use of HT more than the other participants (p-value = 0.0354). Moreover, those who use exogenous HT in their clinical practice tend to recommend the use of heat therapy patches in combination with other therapies (p-value = 0.0014).

This survey intended to: 1) Characterise the specialists that participated, regarding demographics, professional experience and field; 2) evaluate the respondents' perception of the frequency of the main MSK disorders, their causes and association to age groups; and 3) understand

the frequency of use of different therapeutic choices, the factors considered for this decision, and how HT is used in MSK pain management, regarding its frequency, indications, benefits and combination with other therapies.

The panel of respondents was varied, with a wide distribution of health professionals. General practitioners and pharmacists were the most represented professionals. Most respondents indicated extensive professional experience, exceeding ten years. According to the respondents' perception, acute and chronic MSK pain had a different and predictable distribution on age groups, with chronic disorders affecting adults and older patients more frequently.

To manage MSK pain, respondents indicated giving advice to most patients and also using HT in their clinical practice in about 50% of cases, showing a higher likelihood to use HT in patients with chronic MSK pain, especially those affected by low back pain and neck pain. According to the survey answers, the choice of exogenous HT is based on both personal clinical experience and scientific evidence and is primarily chosen due to its myorelaxation effect.

To the authors' knowledge, this is the first Europe-wide survey on the use of heat therapy in the treatment of MSK pain. Previously, an international multidisciplinary Delphi-based consensus on HT in musculoskeletal pain was published, recognising the role of HT in chronic MSK pain (Lubrano et al., 2023). This study exclusively included European experts from different fields and professions (physiatrists, physiotherapists, sport physicians, rheumatologists and family physicians) and highlights the need for more scientific evidence on the use of HT, including details on its use by professionals.

Moreover, respondents also consider the high safety profile and enhancement of tissue perfusion associated with HT. The use of HT is not correlated to any specific profession, but the analysis shows that "prescribers" are 1.1 times more likely to use it than the "non-prescribers" group.

According to this data, exogenous heat therapy is recommended by 86.5% of respondents. In a context where patients should receive information about their condition and management option in accordance with their preferences (Lin et al., 2020; Wright and Sluka 2001), according to the specialists' answers, HT may be a valuable self-management treatment.

#### 4.1. Study limitations and future directions

For the first time, we are able to provide the results of a survey which was developed and conducted in five European countries, with the collaboration of several scientific societies and associations involving various healthcare professionals. However, this study has several limitations which must be considered. First, the survey items were developed using a two-cycle Delphi method through a multi-disciplinary and multi-country panel of experts. However, an analysis of its reliability and validity was not carried out. Thus, it remains unclear whether the developed survey is time-independent (intra-respondent reliability) and ultimately valid. We are aware that results may be biased by a selective cohort of respondents who predominantly agree to participate. It is known that participants who are familiar or generally agree with a treatment predominantly agree to participate in a survey focusing on their preferred field. Hence, critical or sceptical respondents may be underrepresented. Our results demonstrate that “giving advice” is one of the essential activities in managing patients in the context of heat therapy. The method of analysis decided by the board was descriptive. Given the exploratory nature of the survey, we are not able to provide detailed statistical analyses, controls, sampling mechanism, or statistical reporting (e.g., P-values, CIs, effect sizes).

Further studies should be implemented to develop guidance and strategies to improve patients' knowledge and self-care strategies of a safe and targeted heat-therapy.

#### 4.2. Clinical relevance

The findings from this study outline the role of exogenous heat therapy as a valid therapeutic choice, widely used in Europe by various healthcare professionals, especially for treating low back pain and neck pain. Our data may contribute to the ongoing discussion and understanding of exogenous heat therapy. Besides the high acceptance and establishment of heat therapy amongst healthcare professionals, there is a compelling need for patients to be informed about HT as a valuable and straightforward self-management therapy option, including its strengths and limitations.

### 5. Conclusion

The international panel of healthcare professionals who participated in this survey indicated that exogenous heat therapy represents a valid therapeutic choice, widely used in Europe by various healthcare professionals, especially for treating low back pain and neck pain.

Justified by the high-security profile, the myorelaxation effect and its efficacy in improving tissue perfusion, most of the respondents indicated that they regularly use heat therapy, almost always in the treatment of LBP. Furthermore, the healthcare professionals suggest that “giving advice” is one of the essential activities in managing their patients. Consequently, it could be helpful to inform patients about the use of heat therapy as a valuable self-management therapy option.

#### Credit authorship contribution statement

All authors contributed to Conceptualization; Writing – review and editing; Validation. Hotfiel T also contributed to Writing the original draft.

### Declaration of competing interest

Emma Paulino has received consulting fees or honorarium from Pfizer - Bayer - Boehringer Ingelheim - Biocodex - Novo Nordisk - National Association of Pharmacies Portuguese Pharmacists Society.

Luís Sequeira de Medeiros and Thilo Hotfiel have received consulting fees from Angelini Pharma.

### Acknowledgements

The survey was sponsored by Angelini Pharma which supported the publication.

### References

- Airaksinen, O., Brox, J.I., Cedraschi, C., Hildebrandt, J., Klüber-Moffett, J., Kovacs, F., Mannion, A.F., Reis, S., Staal, J.B., Ursin, H., Zanoli, G., 2006. Chapter 4. European guidelines for the management of chronic nonspecific low back pain. *Eur. Spine J.* 15 (Suppl. 2), S192–S300.
- Ariana, M., Afrasiabifar, A., Najafi Doulatabad, S., Mosavi, A., Behnammoghadam, M., 2021. 'The effect of local heat therapy versus cold rub gel on pain and joint functions in patients with knee osteoarthritis'. *Clin. Nurs. Res.*, 10547738211035502
- Balagué, Federico, Mannion, Anne F., Pellié, Ferran, Cedraschi, Christine, 2012. 'Non-specific low back pain'. *Lancet* 379, 482–491.
- Bevan, S., 2015. 'Economic impact of musculoskeletal disorders (MSDs) on work in Europe'. *Best Pract. Res. Clin. Rheumatol.* 29, 356–373.
- Cohen, S.P., 2015. 'Epidemiology, diagnosis, and treatment of neck pain'. *Mayo Clin. Proc.* 90, 284–299.
- Freiwald, J., Hoppe, M.W., Beermann, W., Krajewski, J., Baumgart, C., 2018. 'Effects of supplemental heat therapy in multimodal treated chronic low back pain patients on strength and flexibility'. *Clin. Biomech.* 57, 107–113.
- French, S.D., Cameron, M., Walker, B.F., Reggars, J.W., Esterman, A.J., 2006. A Cochrane review of superficial heat or cold for low back pain. *Spine* 31 (9), 998–1006.
- Giannarou, L., Zervas, E., 2014. Using Delphi technique to build consensus in practice. *Int. J. Bus. Sci. Appl. Manag.* 9, 65–82.
- Hasson, F., Keeney, S., McKenna, H., 2000. Research guidelines for the Delphi survey technique. *J. Adv. Nurs.* 32, 1008–1015.
- Hawker, G.A., 2017. 'The assessment of musculoskeletal pain'. *Clin. Exp. Rheumatol.* 35 (Suppl. 107), 8–12.
- Hoy, Damian, March, Lyn, Brooks, Peter, Blyth, Fiona, Anthony, Woolf, Bain, Christopher, Williams, Gail, Smith, Emma, Vos, Theo, Jan, Barendregt, Murray, Chris, Roy, Burstein, Buchbinder, Rachele, 2014. 'The global burden of low back pain: estimates from the Global Burden of Disease 2010 study'. *Ann. Rheum. Dis.* 73, 968–974.
- Jaeger, B., 2013. 'Myofascial trigger point pain'. *Alpha Omegan* 106, 14–22.
- Lin, I., Wiles, L., Waller, R., Goucke, R., Nagree, Y., Gibberd, M., Straker, L., Maher, C.G., O'Sullivan, P.P.B., 2020. 'What does best practice care for musculoskeletal pain look like? Eleven consistent recommendations from high-quality clinical practice guidelines: systematic review'. *Br. J. Sports Med.* 54, 79–86.
- Lubrano, E., Mazas, P.F., Freiwald, J., Krüger, K., Grattagliano, I., Mur, E., Silva, R.Q., Maruri, G.R., de Medeiros, L.S., 2023. An international multidisciplinary delphi-based consensus on heat therapy in musculoskeletal pain. *Pain and therapy* 12 (1), 93–110. <https://doi.org/10.1007/s40122-022-00419-4>.
- McPherson, S., Reese, C., Wendler, M.C., 2018. Methodology update: Delphi studies. *Nurs. Res.* 67 (5), 404–410.
- Nadler, S.F., Weingand, K., Kruse, R.J., 2004. The physiologic basis and clinical applications of cryotherapy and thermotherapy for the pain practitioner. *Pain Physician* 7 (3), 395–399.
- Ndlovu, M., Bedson, J., Jones, P.W., Jordan, K.P., 2014. Pain medication management of musculoskeletal conditions at first presentation in primary care: analysis of routinely collected medical record data. *BMC Musculoskelet. Disord.* 15, 418.
- Papaioannou, T.G., Karamanou, M., Protogerou, A.D., Tousoulis, D., 2016. Heat therapy: an ancient concept re-examined in the era of advanced biomedical technologies. *J. Physiol.* 594, 7141–7142.
- Popescu, Adrian, Lee, Haewon, 2020. Neck pain and lower back pain. *Med. Clin.* 104, 279–292.
- Treede, R.D., Rief, W., Barke, A., et al., 2019. Chronic pain as a symptom or a disease: the IASP classification of chronic pain for the international classification of Diseases (ICD-11). *Pain* 160, 19–27.
- Wang, Y., Li, S., Zhang, Y., Chen, Y., Yan, F., Han, L., Ma, Y., 2021. 'Heat and cold therapy reduce pain in patients with delayed onset muscle soreness: a systematic review and meta-analysis of 32 randomized controlled trials'. *Phys. Ther.* 48, 177–187.
- Weller, J.L., Comeau, D., Otis, J.A.D., 2018. 'Myofascial pain'. *Semin. Neurol.* 38, 640–643.
- WHO, 2022. 'International Statistical Classification of Diseases and Related Health Problems (ICD)'. <https://icd.who.int/en>.
- Wright, A., Sluka, K.A., 2001. 'Nonpharmacological treatments for musculoskeletal pain'. *Clin. J. Pain* 17, 33–46.
- Wu, A., March, L., Zheng, X., Huang, J., Wang, X., Zhao, J., Blyth, F.M., Smith, E., Buchbinder, R., Hoy, D., 2020. Global low back pain prevalence and years lived with disability from 1990 to 2017: estimates from the Global Burden of Disease Study 2017. *Ann. Transl. Med.* 8, 299.