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Title: Twenty-five years after the introduction of evidence-based medicine: actual knowledge, use, application and perceived barriers among physiotherapists

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Abstract

Objectives. To explore the actual knowledge, use, application of Evidence-based Medicine, named also Evidence-based Practice (EBP), and perceived barriers to its dissemination among physiotherapists.

Design. Cross-sectional study.

Setting and participants. Members of the Italian Association of Physiotherapists (n=2000) were invited to participate in an online national survey about EBP knowledge and use.

Primary outcome measures. The survey questionnaire comprised four sections: 1) Respondent' characteristics; 2) Knowledge of and ability to critically appraise the literature; 3) Use and perceived effectiveness of EBP; 4) Perceived barriers to implementing EBP in clinical practice.

Results. Out of 2000 physiotherapists, 1289 participated in the survey (response rate 64.5%). Overall, 90% perceived EBP as useful and necessary for clinical practice. More than 85% stated that they were familiar with the principles of EBP, 75% reported that they were able to search online databases for relevant information, and 60% reported that they were able to understand statistical analyses. However, 56% believed that patient preferences and 39% that clinical expertise are not part of the EBP model. Half stated that they understood and could explain the term "meta-analysis", but only 17% knew what a forest plot is, and 20% correctly judged the finding of a given meta-analysis. Lack of time was reported as the main barrier to use EBP.

Conclusions. The majority of Italian physiotherapists overrated their knowledge about EBP, demonstrating that there is a gap between EBP perceived and actual knowledge in this population.

Key Words: Evidence-based Practice; Cross-sectional Studies; Physiotherapy Specialty; Surveys and Questionnaires.

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Article summary

Strengths and limitations of this study

- National web-based survey among Italian physiotherapists to explore knowledge and perceptions on Evidence-based Medicine.
- Relevance of the study to the current evidence based practice among Italian physiotherapists.
- A sample of 2000 physical therapists was recruited with a high-moderate response rate of 64.5%.
- Self-reported data and potential non response bias can affect results and interpretation of this cross-sectional study.
- Generalizability is confined to a selected population.

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Competing interests: The authors declare that they have no competing interests.

Introduction

Evidence-based medicine, also named as Evidence-based Practice (EBP) is an internationally recognized movement and it is defined as "*the conscientious, explicit, and judicious use of current best evidence in making decisions about the care of individual patients. The practice of Evidence-based Medicine means integrating individual clinical expertise with the best available external clinical evidence from systematic research.*" [1] The identification and application of patients' preferences should be part of decision making.[2] This concept of shared decision making has gained attention in the last decade, with physical medicine and rehabilitation clinicians being more likely to involve patients in making informed decisions.[1,3]

Using the best available evidence to make healthcare decisions optimizes health outcomes. Issues in EBP have attracted growing debate and discussion[2], as seen in the increase in the number of scientific articles directly relevant to physiotherapy practice: [4,5]: between 1995 and 2015, randomized controlled trials (RCTs) and systematic reviews (SRs) rose increased from 45.1% to 59.4%, and from 0% to 14.6%, respectively.[6] Taken together, RCTs and SRs accounted for 74% of physiotherapy research publications in 2015 compared to 45% two decades earlier.[6]

Keeping up with this abundance of research may be a big challenge for most clinicians. Not surprisingly, the transfer of research findings into practice is often described as slow, haphazard, and unpredictable.[7] While several studies have investigated the use and the perceived effectiveness of EBP among physiotherapists,[8-16] none to date have explored the gap between their perceived and actual knowledge. In addition, no similar research exists in the Italian context. The present study investigated the

knowledge, use, and application of EBP among physiotherapists, and the barriers they perceived to its implementation. Secondary aims were to investigate the gap between perceived and actual knowledge of EBP principles among physiotherapists, and to analyse the correlation between their perceived and actual knowledge and demographic characteristics.

Methods

Design

For this cross-sectional study we conducted an online closed survey of members of the Italian Association of Physiotherapists (Associazione Italiana Fisioterapisti [AIFI]). We developed a survey questionnaire and posted it on a SurveyMonkey platform[17] for data collection. Written, informed consent was assumed if the respondents completed and submitted the survey. The closed survey was available online via the Internet for a period of six weeks from May to June 2018. This study followed the Guidelines for Reporting Survey-Based Research.[18,19]

Patient and Public Involvement

Although there was no direct involvement of patients or the public, the AIFI assisted in the design and delivery of the study. They also sent the questionnaire directly to participants.

Study sample

Before the survey questionnaire was posted online, the AIFI sent an invitation in their email newsletter to all society members explaining the aim and content of the survey. The invitation explained the purpose of the survey, the time needed to complete it (10 minutes), and the type of questions that the participants could expect to find. The survey was linked to a unique respondent that did not display the survey a second time once completed. The survey questionnaire was posted on 4 May 2018. Two weeks later, the AIFI sent out an e-mail reminder to members who had not yet responded. Responses were treated anonymously.

While the AIFI membership database contains more than 10,000 addresses of physical therapist members, only 2000 are considered socially active by the association.

Sample size calculation

We used the sample size calculator[20] offered by SurveyMonkey. The sample size is the number of completed responses we expected to receive: based on a population size of 10.000 (which is the total number of people we intended to invite to participate in the study, i.e. total number of AIFI members), a margin of error of 5% (how much survey results reflect the views of the overall population) and a sampling confidence level of 95% (how confident we can be that the population would select an answer within a certain range). The calculated sample size of completed responses was of 370 completed answers. Thus, we expected that sending the survey to a target sample of 2000 socially active members would guarantee 370 completed responses.

Survey questionnaire

The questionnaire was developed based on similar questionnaires reported in the literature.[10,13,21] Before sending the survey, we piloted the questionnaire with six expert physiotherapists in EBP (four senior and two junior researchers, with an average of 8 and 3 years of EBP expertise) to assess its clarity and accuracy. After revision, the final questionnaire version consisted of 26 items divided into 4 sections: 1) Respondents' characteristics (items 1 to 8); 2) Knowledge and ability to critically appraise the literature (items 9 to 16); 3) Use and perceived effectiveness of EBP (items 17 to 24); 4) Perceived barriers to the implementation of EBP in clinical practice (items 25 and 26). Response to all items was mandatory. The questionnaire was written in Italian to make it more suitable for this sample (**Supplementary File 1** – questionnaire, English version).

Section 1 covered demographic characteristics; Section 2, item 9, asked respondents to indicate the origin of their knowledge about EBP basics. If they stated that they did not know the EBP model, the questionnaire terminated; otherwise, for the following items, the respondents were asked where they had acquired their knowledge of EBP and if they were confident with it. The final questions in this section assessed the respondent's actual knowledge of EBP. For instance, item 14 investigated familiarity with some terms often found in the literature, item 15 asked which study design is considered the most reliable, and item 16 investigated whether the respondent understood the results of a meta-analysis from a given forest-plot. Most of the items in Section 3 were statements to which respondents had to express their agreement on a five-point-Likert scale, with "strongly agree" and "strongly disagree" as anchors, about their perception and use of EBP. In Section 4, item 25, the respondents had to state

whether or not they felt barriers to the utilization of EBP exist. If they stated there were no barriers to its utilization, the questionnaire terminated as a conditional question. Otherwise, for item 26, the respondents had to express their opinion about the presence of barriers to the implementation of EBP and to rank them from the most to the least important.

Statistical analyses

Descriptive statistics are presented as medians and interquartile ranges (IQR) or absolute values, percentages and frequencies, when appropriate. The response frequencies were represented and analysed in tabular and graphic formats using Microsoft Excel or Power Point 2010. An automated count of response rate was acquired for each of the four sections in order to determine whether the questionnaires were terminated earlier (i.e., users did not go through all four questionnaire sections). We dichotomized the responses to the 5-point items as "disagree" versus "agree" ("strongly disagree, disagree and neutral" versus "agree and strongly agree" categories). Demographic characteristics (e.g., sex, age, and level of education) were collapsed into categories. We performed logistic regression analysis to examine the association between knowledge of components of the EBP model (questions related to whether patient values and clinical expertise are considered in the EBP model) and demographic characteristics of the respondent (age, sex, working time, and level of education). Results were considered statistically significant when $p < 0.05$. Odds ratios and their 95% confidence intervals were determined for each level of the independent variables. Odds ratios in this context describe the likelihood of

demonstrating a particular behaviour and use (e.g., understanding that the EBP model comprises patient values) given a particular characteristic (e.g., age). One level of each demographic characteristic was used as the reference group against which the odds of demonstrating the behaviour and use at all other levels of the variable were measured. The reference group was the last category to allow the most salient interpretation of results. Confidence intervals provided information about the precision of the estimates. We chose to examine univariate rather than multivariate associations for presenting our data at its most simple level so as to have a foundation for future hypothesis testing. Data were exported from the SurveyMonkey and analysed with STATA software [22].

Results

Respondents' characteristics

2000 physiotherapists constitute the number of the survey questionnaire respondents. Considering this number, the response rate was moderate (1289/2000, 64.5%). The number of respondents was far higher than our target sample (n=323). The response rate decreased from section 1 to section 3 due to the presence of conditional branching logic items (item 9 and item 25) in the questionnaire survey. Indeed, the response rate for each completed section differed: 56% response rate for Section 1(demographic characteristics); 42% response for Section 2 (knowledge of EBP); and 41% for Section 3 (use and perceived effectiveness of EBP). The sample included in each section is reported in Figure 1.

[Figure 1]

Figure 1. Flow diagram of the study.

The median age of the respondents was 35 years (IQR 28-47), and 52% were women. Around 60% of participants worked in a private practice (653/1113), and 27% in a hospital (305/1113), and 87% spent most of their work time in clinical practice (968/1113). **Table 1** presents the demographic characteristics of the sample.

[Table 1]

Table 1. Sample Characteristics.

EBP Knowledge and ability to critically appraise literature

Two respondents skipped this section. A total of 1111 respondents answered the item investigating knowledge of EBP principles. The majority stated they knew the EBP model (85%). The most frequent channels for learning the principles of EBP were conferences/meetings (48%), distance and residential learning courses (35%), and advanced continuing professional educational courses (35%). Only 23% of respondents stated they learned about EBP during their undergraduate studies (**Supplementary file 2**).

Regarding the sources physical therapist consult to solve clinical problem, the majority of respondents stated that their preferred information channels were discussion with peers (80%) and literature search (86%); and the 30% stated that they relied on their

own experience. In addition, 78% of respondents stated they felt competent about EBP, and 1.2% stated they felt completely unable. More than half (61%) were confident in their ability to critically appraise quality assessments of study design and statistical analysis. However, many of respondents stated they understood the meaning of the terms “RCTs” (72%), “statistical significance” (65%), and “meta-analysis” (52%); but, few could explain the terms “forest plot” (17%) and “confidence intervals” (38%) (**Table 2**). In addition, 82% correctly identified the best study design to evaluate an intervention, but only 20% was able to identify the result from the overall estimate of a given meta-analysis.

[Table 2]

Table 2. Self-reported comprehension of terms (837 responded, 453 skipped).

Use and perceived effectiveness of EBP

From questions regarding how physical therapist perceived EBP, if useful, comprehensive of patient values and effective, the respondents showed an overall positive attitude towards EBP and agreed that its application is both useful and necessary (90%). While 90% knew that scientific literature is part of the EBP, 56% did not agree that patients’ preference and 39% that clinical expertise are part of the EBP process (**Figure 2**).

[Figure 2]

Figure 2. Perceived knowledge of EBP basic principles of patients' desire, clinical expertise and scientific literature.

In a typical month, 59% of the respondents read between 1 and 5 articles, and only 9% did not. In addition, 55% stated that they make clinical decisions based on their scientific readings, 80% expressed the need to increase the use of EBP, and 69% reported that it would benefit their career.

Association between sample characteristics and EBP knowledge

We found a statistically significant association between questions related to how physical therapist perceived EBP comprehensive of patient values and clinical expertise, and sample demographics: age, sex, working time, level of education (variables entered into the model) (**Table 3**). Considering the question related to patients' values as part of EBP model, young physiotherapists seems to be more conscious about patient's value in EBP model than adults > 49 years (OR 1.57, 95% CI 1.02 - 2.42) as well, being male (0.50, 95% CI 0.38 – 0.67). Who works in patient care (OR 0.99, 95% CI 0.98 – 0.99) seems to be less likely able to understand the EBP model more than who does not work in this area. On the contrary, who works in research (OR 1.02, 95% CI 1.01 – 1.03) and teaching (OR 1.01, 95% CI 1.002 – 1.02) is more likely able to recognize patient's value as part of the EBP model. Whereas, who had a Master's of Science (IC 2.06, 95% CI 1.31 – 3.21) is twice more conscious about it against who did not have the same title. The same

interpretation is for who had a 1st level Specialist Master's degree (OR 2.69, 95% CI 1.98 – 3.64) and a Doctor of philosophy (PhD) (OR 10.33, 95% CI 1.28 – 83.00).

Regarding the question related to clinical expertise as part of the EBP model, being male is more likely associated to consider expertise in EBP model (OR 0.65, 95% CI 0.49 – 0.86). Who works in patient care (OR 0.99, 95% CI 0.98 – 0.99) seems to be less likely able to understand the EBP model more than who does not work with patient (OR 0.65, 95% CI 0.49 – 0.86). To have a Master's degree title (OR 2.16, 95% CI 1.31 – 3.58) and a 1st level Specialist Master's degree (OR 1.99, 95% CI 1.45 – 2.75) seems to be twice favourable to consider clinical expertise in the model against who did not have this titles. (**Table 3**).

[Table 3]

Table 3. Association between actual knowledge of EBP and selected variables.

Perceived barriers to using EBP in clinical practice

Respondents stated that major barriers to applying EBP exist (570/815, 75%): lack of time and lack of ability to critically appraise the literature were rated as the top two barriers. Lack of time was ranked as the most important (Table 4).

[Table 4]

Table 4. Barriers to applying EBP in order of importance (%).

Discussion

Main findings

Overall, survey questionnaire respondents stated they had a positive attitude towards EBP and that their knowledge about it was extensive. The majority overrated their knowledge, however, and demonstrated a shallow awareness of EBP, compared to the original model described by David Sacket [23]. The gap between perceived and actual knowledge of EBP is relevant and can result in inadequate practice, potentially increasing the risk of chronic disability[24].

Our survey findings are similar to those obtained among American physiotherapists 15 years ago [10] and, more recently, among Ghanaian physiotherapists who demonstrated an inadequate knowledge of EBP [12]. In contrast, Brazilian physiotherapists showed they were better acquainted with EBP since they considered patients' preferences part of the decision-making process [13]. In Europe, Swedish physiotherapists consider patients' preferences when treating according to guidelines, thus carrying out the EBP process[25]. In our sample, the younger respondents were noted to be more familiar with EBP than their older colleagues with more experience. Our findings are shared by similar observations that the level of EBP knowledge is influenced by the time since graduation from school. In general, recent graduates are more likely to follow the steps of EBP than those with more clinical experience[9]. We also observed that knowledge about EBP differed depending on the respondent's level of education and workplace setting. [9-11]. Indeed, personal and organizational characteristics can significantly influence attitudes, beliefs, use of EBP, and perceived support [26].

Of the total of respondents with a Bachelor's degree, only one fifth had received education in EBP. The levels of education most closely associated with EBP knowledge are the graduate and postgraduate levels. The teaching of EBP principles in undergraduate courses remains scarce, although it is widely considered essential for improving the quality of health care and patient outcomes. In many countries, studies have highlighted that physiotherapists require more training in EBP in order to acquire confidence in using it[9]; however, the teaching of EBP-oriented skills in undergraduate physiotherapy programmes is relatively recent[27-29]. Over the last 20 years EBP has been increasingly integrated into the core curriculum of undergraduate and postgraduate health care programs and continuing professional education[30-32]. In Italy, the teaching of EBP has been included as an integral part of the core curriculum of physiotherapy since 2005 [20].

The perceived and actual knowledge and use of evidence from the scientific literature differed among respondents. While the majority felt able to conduct a literature search and to critically appraise a statistical analysis in a scientific article, few demonstrated that they understood the results of a meta-analysis from a given forest plot. Nevertheless, the respondents appeared to have great confidence in the authority of published scientific literature and stated that their clinical decisions rarely relied on their experience alone: the attitude and the attempt to introduce findings from the scientific literature in the clinical context is congruent with their positive attitude towards EBP.

The discrepancy between actual knowledge and practice of EBP could be a consequence of the myriad information sources accessible in scientific databases and

non-scientific channels, such as Doctor Google or social networks. Health care professionals, including physiotherapists, need to develop their skills to confront this overabundance of information in their professional life: exercising a careful selection of what to read and what not to, both in terms of quality and quantity [33]. Indeed, three quarters of our respondents perceived barriers that limit their ability to critically appraise the literature [9-11,25,34,35].

Strengths and limitations

This is the first study examining knowledge and perceptions on EBP among physiotherapists in Italy. Although our response rate was high-moderate (64.5%), several limitations should be considered when analysing the study results. First, our sample included only AIFI members, who may not be representative of the population of Italian physiotherapists, as it might be that AIFI members are more likely to participate in a survey about their profession. Nonetheless, before the professional registry of Italian physiotherapists was established in 2018, the AIFI was the only professional society for physiotherapists in Italy. Second, sending out only one reminder to participate in the survey might have limited the number of potential respondents. However, the final percentage of respondents did not seem to bias our results, as we reached the planned sample target up to the last survey questionnaire items. Third, we dichotomized the dependent variables, conflating all responses into positive/negative categories. This might have resulted in a loss of some information, though we replicated what previous studies of the same design have done [10] in order

to report useful findings. Finally, the accuracy of data on perceived knowledge is uncertain as the data were collected via a self-reported survey.

Implication for research, practice and education

We believe that research can help to increase the dissemination of knowledge about and the adoption of EBP among physiotherapists. A focus for future research should be to concentrate efforts in conducting high-quality research and teaching master classes devoted to of EBP topics [36] and promoting research learning programmes as knowledge translation interventions to improve the use of EBP and clinical practice guidelines (CPGs) in physiotherapy [37]. CPGs, defined as "systematically developed statements to assist practitioner and patient decisions about appropriate health care for specific clinical circumstances" (definition adopted by the European Region of the World Confederation for Physiotherapy), can be used to bridge the research-to practice gap and promote EBP and present research findings to clinicians in a synthetic format without missing any elements of the EBP model [7]. Indeed, CPGs based on the Grades of Recommendation, Assessment, Development and Evaluation approach (GRADE approach) are conducted in a standardized and transparent way: GRADE rates the quality of evidence and provides the strength of recommendations by considering the "estimates of effect for desirable and undesirable outcomes of interest", the "confidence in the estimates of effect", the "estimates of values and preferences" and the "resource use" [38]. This approach helps the reader interpret a CPG and enhance CPG adherence by health professionals. Some countries have laws that regulate professional liability and place great importance on adherence to CPGs in clinical

practice, defining compliance with the CPG as an element in attributing professional responsibility in case of adverse events. Furthermore, to improve physiotherapists' adherence to CPGs, computerized decision support systems could provide actionable recommendations or management options that are intelligently filtered or presented at appropriate times to improve efficiency in health care[39].

For these reasons, both national and international initiatives are warranted for the implementation of CPGs in physiotherapy. The production of CPGs, or at least a synthesis of the evidence underpinning them, could be (and is to some extent) coordinated on a national level, while implementation may be more suitable for local adaptation[40]. For instance, the recently created Italian National Guidelines System [41] includes a list of scientific societies that can contribute to drafting CPGs (including the AIFI), a process based on the GRADE method for the production, adaptation, and updating of CPG. In this a database health professionals can find continuously updated CPGs and good quality practices.

We appeal for a critical use and appraisal of EBP. EBP should be included in the professional education of physical therapist, starting at the undergraduate level. Investing in the training of physiotherapists is essential for growing the skills of critical appraisal of evidence-based physiotherapy, and to reduce waste of obsolete, futile or harmful interventions [6]. For instance, initiatives such as INQUIRE (INcreasing QUality In patient-oriented academic clinical Research) has resulted in a roadmap that provides guidance for academic institutions and researchers in developing quality enhancement initiatives [42]. The PEAK (The Physical therapist-driven Education for Actionable Knowledge translation) educational program was designed to promote integration of

474 physiotherapists' research evidence into clinical decision making [17,43,44]. Finally,

475 engaging in research can contribute to being an attractive employer and boost

476 application of EBP [45].

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Declarations:

Ethical approval: not applicable.

Availability of data and material: All data generated or analysed during this study are available at https://osf.io/8xb6p/?view_only=1c6fd76403c04a82942799b9dee952c8 .

Authors' contributions: SG and GC were primarily responsible for study conception and design and for data analysis and interpretation. All authors had full access to all of the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis. DC led the writing of the first draft of the manuscript and all authors contributed to drafting and revising the manuscript. SG is the guarantor. All authors read and approved the final manuscript.

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Table 1. Sample Characteristics.

Characteristics *		Frequency (%)
Sex (n=1289)	Male	48
	Female	52
Age, yrs (n=1289)	<29	28
	29-38	31
	39-49	18
	>49	23
Workplace** (n=1113)	Private office	59
	Teaching Hospital	7
	Hospital	20
	Nursing home	15
	Unemployed	2
	Other	17
Working time spent in: (average) (n=1113)	Clinical practice	87
	Research	11
	Teaching	6
	Management/Leadership	2

*The absolute number of respondents varies for each variable due to missing data.

**Percentage may exceed 100% because some items allowed more than one answer

Table 2. Self-reported comprehension of terms (837 responded, 453 skipped).

	Understood and could explain No. (%)	**Understood somewhat No. (%)**	**Did not understand No. (%)**	**Unknown No. (%)**
Randomized-controlled trials	604 (72)	192 (23)	41 (5)	0 (0)
Meta-analysis	439 (52)	304 (37)	86 (10)	8 (1)
Relative risk	250 (30)	428 (51)	135 (16)	24 (3)
Statistical significance	543 (65)	246 (29)	41 (5)	7 (1)
Forest plot	144 (17)	197 (24)	147 (17)	349 (42)
Intention to treat	255 (30)	223 (27)	167 (20)	192 (23)
Confidence interval	316 (39)	271 (32)	176 (18)	104 (11)

Table 3. Association between actual knowledge of EBP and selected variables. References category are reported in legend.

	Characteristics			Odds ratio (95% CI)	Model P*
In your opinion, are patients' values and preferences a part of the EBP model?	**Age (yrs)**[a]	(n=818)	<29	1.57 (1.02 - 2.42)**	0.001
			29-38	1.03 (0.66 - 1.59)	
			39-49	0.68 (0.39 - 1.17)	
			>49	Reference	
	Sex[b]	(n=818)	Female	0.50 (0.38 – 0.67)**	0.000
			Male	Reference	
	Working time [c]	(n=814)	Patient care	0.99 (0.98 – 0.995)**	0.002
		(n=567)	Research	1.02 (1.01 – 1.03)**	0.001
		(n=609)	Teaching	1.01 (1.002 – 1.02)**	0.015
		(n=492)	Management	1.00 (0.98 – 1.02)	0.62
	Level of education[c]	(n=818)	Bachelor's degree	1.04 (0.75 – 1.45)	0.81
			Master of Science degree	2.06 (1.31 – 3.21)**	0.001
			1st level Specialist Master's degree	2.69 (1.98 – 3.64)**	0.000
			2nd level Specialist Master's degree	0.84 (0.14 – 5.07)	0.85
			Advanced continuing professional education	1.06 (0.80 – 1.42)	0.67
			Doctor of philosophy (PhD)	10.33 (1.28 – 83.00)**	0.005
			Distance and residential learning course	1.00 (0.75 – 1.34)	0.99
			Conferences/Meetings	1.40 (1.06 – 1.85)**	0.015
In your opinion, is clinical	**Age (yrs)** [a]	(n=818)	<29	1.43 (0.93 - 2.21)	0.11
			29-38	1.00 (0.65 - 1.55)	

expertise a part of the EBP model?			39-49	0.97 (0.57 - 1.64)	
			>49	Reference	
	Sex[b]	(n=818)	Female	0.65 (0.49 – 0.86)**	0.008
			Male	Reference	
	Working time [c]	(n=814)	Patient care	0.99 (0.98 – 0.99)**	0.032
		(n=567)	Research	1.01 (0.99 – 1.02)	0.24
		(n=609)	Teaching	1.01 (0.99 – 1.02)	0.14
		(n=492)	Management	0.98 (0.97 – 1.01)	0.32
	Level of education[c]	(n=818)	Bachelor's degree	1.25 (0.89 – 1.76)	0.19
			Master of Science degree	2.16 (1.31 – 3.58)**	0.002
			1st level Specialist Master's degree	1.99 (1.45 – 2.75)**	0.000
			2nd level Specialist Master's degree	0.97 (0.16 – 5.86)	0.98
			Advanced continuing professional education	0.90 (0.67 – 1.21)	0.49
			Doctor of philosophy (PhD)	0.26 (0.65 – 42.27)	0.06
			Distance and residential learning course	1.08 (0.80 – 1.45)	0.61
			Conferences/Meetings	1.20 (0.91 – 1.59)	0.20

Legend:

* Chi-square test

** Statistically significant (p <0.05)

[a] Odds ratio are calculated using the variable >49 years as reference.

[b] Odds ratio are calculated using the variable male as reference.

[c] Odds ratio are calculated as the ratio between the odds in the presence of characteristics' variable against the odds in the absence of the same variable. (I.e., characteristic: working time; variable: patient care. The odds ratio rapresents the ratio between the odds of working in patient care against the odds of not working in patient care.)

Table 4. Barriers to applying EBP in order of importance (%).

Type of barrier	Order of importance from the most to the least (%)									
	1st	2nd	3nd	4th	5th	6th	7th	8th	9th	10
Lack of interest	10,7	8,3	5,6	6,9	6,2	7,0	10,2	10,7	10,7	23,7
Applicability of EBP findings to clinical practice	11,1	12,8	9,7	8,4	13,5	9,8	9,5	8,8	7,6	8,8
Lack of time	23,0	13,2	15,1	10,0	9,0	9,0	5,8	5,5	5,8	3,7
Difficulty in searching literature in databases	9,5	11,8	14,4	15,1	13,7	14,6	10,5	7,6	0,0	0,9
Difficulty in critically appraising literature and statistical analysis	9,7	17,8	16,5	16,7	16,9	9,3	6,0	4,0	2,1	1,1
Difficulty applying literature findings to individual patients	9,5	11,4	12,7	14,1	12,7	16,9	11,3	5,6	5,5	0,5
Lack of financial and organizational support (computer, access to databases)	8,4	7,4	8,6	8,8	8,8	10,5	20,6	12,8	7,4	6,7
Workplace does not use EBP	12,0	11,3	9,7	9,8	9,8	9,5	10,0	17,8	6,0	4,2
Language of scientific publications	4,8	3,0	5,1	6,3	7,4	8,6	10,0	15,6	30,8	8,4
Unfamiliarity with using the computer/technology	1,4	3,2	2,6	3,9	2,1	4,8	6,2	11,6	22,3	42,0

Figure Legend

Figure 1. Flow diagram of the study.

Figure 2. Perceived knowledge of EBP basic principles of patients' desire, clinical expertise and scientific literature.

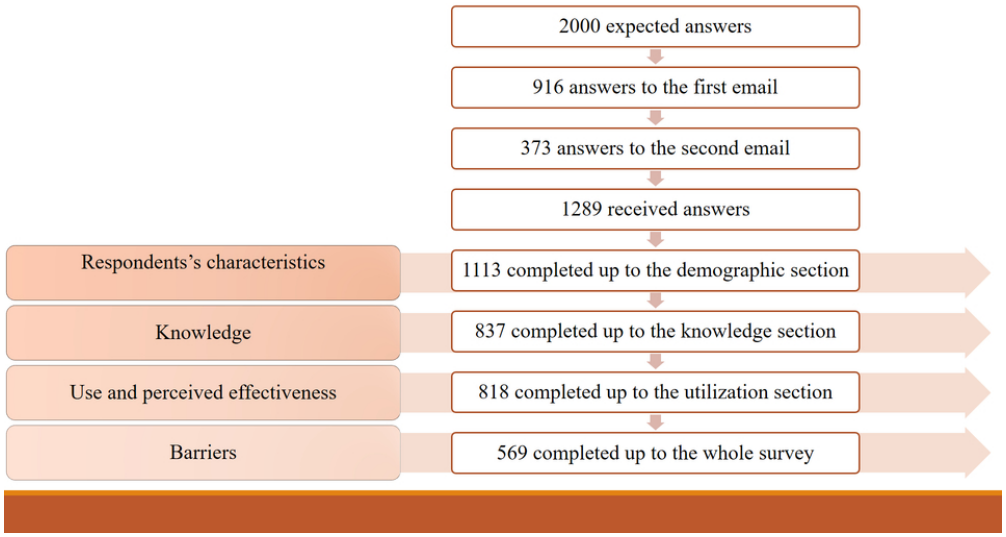


Figure 1.

81x45mm (300 x 300 DPI)

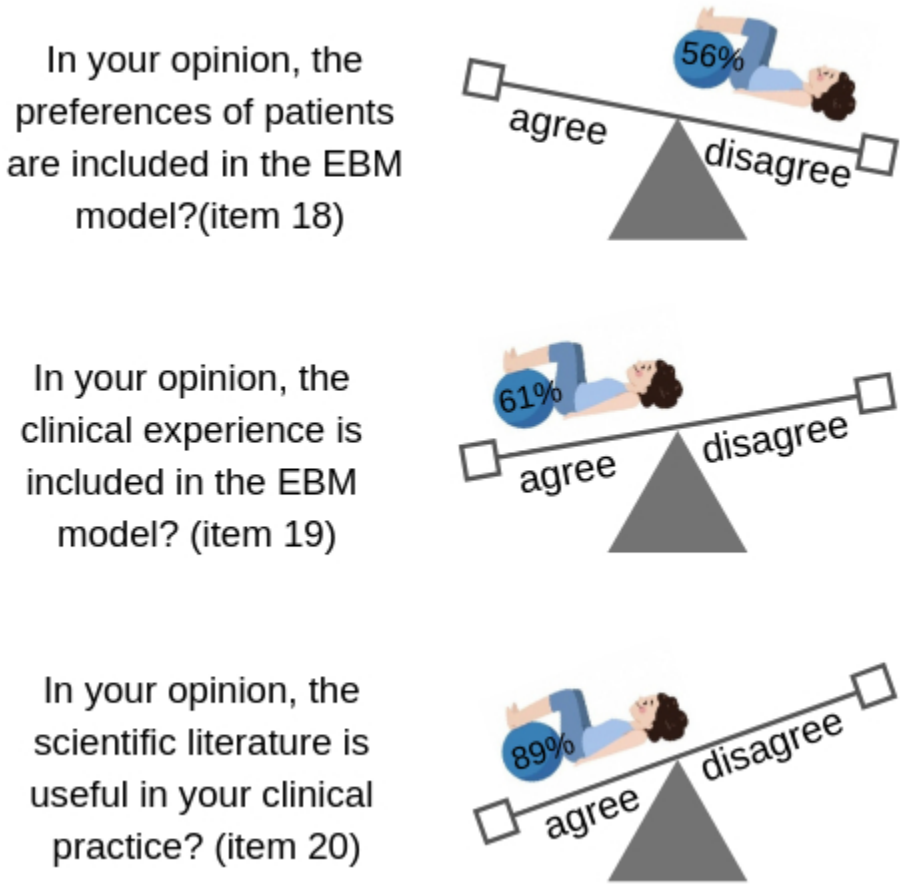

In your opinion, the preferences of patients are included in the EBM model?(item 18)
56%
agree
disagree
In your opinion, the clinical experience is included in the EBM model? (item 19)
61%
agree
disagree
In your opinion, the scientific literature is useful in your clinical practice? (item 20)
89%
agree
disagree

Figure 2.

Evidence-Based Practice (EBP) Questionnaire[a]

SECTION 1. General information

For the following items, place a mark x *in the appropriate box next that indicates your response.*

1.What is your sex?

□ Male □ Female

2. What is your age? ____

3. Where did you acquire the license to practice as Physical Therapist (PT)?

□ Italy □ Abroad

4. In which Italian region did you acquire your physical therapist's degree (degree or equivalent title)?

_____

5. In which University (eg., Università degli Studi di Genova) o other (e.g.,. Scuola Dirette ai Fini Speciali/Scuole Regionali) did you acquire your PT title?

_____

6. When did you acquire your title to practice as physical therapist (e.g., 2005)

_____

7. Where did you mostly practice your profession?

□ Private practice

□ Research Hospital

□ Clinical Hospital

□ Residential and nursing home

□ Unemployed (e.g. student)

□ Others _____

8. Please indicate the percentage of your total work time that you spend in each type of activity during an average month.

a) Patient care □ %

b) Research □ %

c) Teaching □ %

d) Management (as Director) □ %

SECTION 2. Knowledge of EBP principles

9. Do you know the Evidence Base Practice (EBP) model?

□ Yes □ No

10. Where did you learn the foundations of EBP

- Bachelor's degree
- Master of Science degree
- 1st level Specialist Masters degree
- 2nd level Specialist Masters degree

- Advanced continuing professional education
- Doctor of philosophy (PhD)
- Distance and residential learning course
- Conferences/Meetings

11. When you did not know how to manage a clinical issue, how did you behave?

- I rely on my experience
- I discuss with colleagues
- I consult the scientific literature
- It has never happened

12. I'm able to launch search strategies for finding research relevant to my practice (e.g., Pubmed)

□ Strongly Disagree □ Disagree □ Neutral □ Agree □ Strongly Agree

13. I am confident in my ability to critically review the literature (quality assessment, statistical and clinical significance).

□ Strongly Disagree □ Disagree □ Neutral □ Agree □ Strongly Agree

For the following item, place a mark v *in one box in the row for each term.*

14. My understanding of the following terms is:

Term	**Understand Completely**	**Understand Somewhat**	**Do Not Understand**
a) Randomized controlled trial	□	□	□
b) Meta-analysis	□	□	□
c) Relative risk	□	□	□
d) statistical significance	□	□	□
e) Forest plot	□	□	□
d) Intention to treat	□	□	□
f) Confidence interval	□	□	□

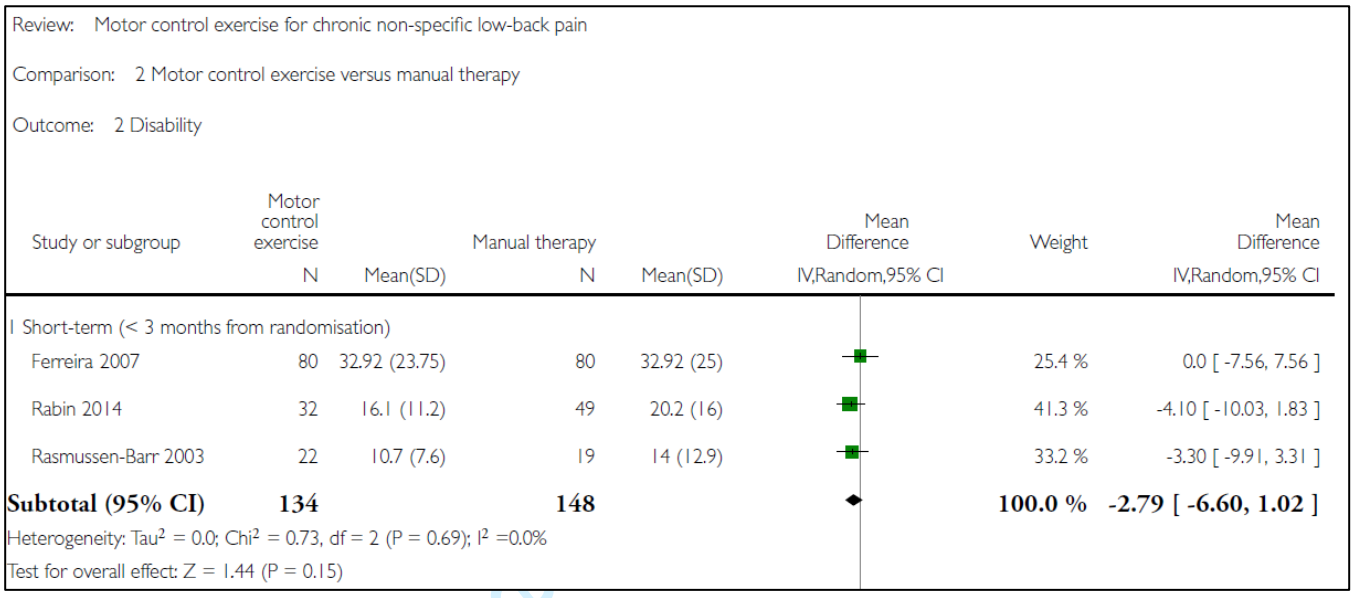
15. In your experience, which is the best study design to assess the efficacy of a rehabilitative intervention?

- Case report/case series
- Cohort observational study
- Case – control observational study
- Controlled clinical study
- Randomized controlled clinical study
- I don't know

16. A systematic review, comparing exercise versus manual therapy in acute low back pain for reducing disability at 3 months of follow-up, reports the following result (please, see the figure below). What is your interpretation?

- I don't know
- Esercise is more efficacious than manual therapy
- Exercise is less efficacious than manual therapy

- Both have the same efficacy



SECTION 3: Personal attitudes toward, use of, and perceived benefits and limitations of EBP.

For the following items, place a mark x *in the appropriate box that indicates your response.*

17. Application of EBP is necessary in the practice of physiotherapy.

□ Strongly disagree □ Disagree □ Neutral □ Agree □ Strongly Agree

18. EBP takes into account the patient's preferences and values.

□ Strongly disagree □ Disagree □ Neutral □ Agree □ Strongly Agree

19. EBP takes into account the clinical experience.

□ Strongly disagree □ Disagree □ Neutral □ Agree □ Strongly Agree

20. Literature and research findings are useful in EBP in my daily practice.

□ Strongly disagree □ Disagree □ Neutral □ Agree □ Strongly Agree

21. Read/review research/literature related to my clinical practice (a typical month).

□Never □ 1–5 articles □ 6–10 articles □ 11–15 articles □ 16 articles

22. Use literature and research findings in the process of clinical decision making (a typical month).

□Never □ few times □ the majority of times □ always

23. I need to increase the use of EBP in my daily practice.

□ Strongly Disagree □ Disagree □ Neutral □ Agree □ Strongly Agree

24. My career will benefit from a more uptake of EBP into my clinical practice.

□ Strongly Disagree □ Disagree □ Neutral □ Agree □ Strongly Agree

SECTION 4: Barriers of EBP.

25. Do you think there are limitations in using EBP in clinical practice?

□ Yes □ No □ Do Not Know

For the following items, rank from 1 to 10 by placing numbers in the appropriate boxes (1most important).

26. Rank from 1 (most important) to 10 (least important) the barriers to the use of EBP in your clinical practice.

□ The adoption of EBP is inapplicable in physiotherapy

□ Insufficient time

□ Lack of instrumental resources in my facility (PCs, free scientific databases)

□ Poor ability to use the computers/techonology

□ Poor ability to systematically search the literature

□ Poor ability to critically appraise the literature

□ Lack of generalizability of the literature findings to my patient population

□ Lack of understanding English language

□ Lack of collective support among my colleagues in my facility, lack of a stimulating environment

□ Lack of interest

[a] The questionnaire published by Jette et al. 2003 was adapted by the authors and contains elements as reported by McColl et al.

Supplementary file 2. Reponses to question regarding the contribution of education to learning the principles of EBP (837 answered, 453 did not).

	A lot No. (%)	A little No. (%)	Not at all No. (%)	Omitted No. (%)
Bachelor's degree	194 (23)	409 (49)	201 (24)	33 (4)
Master's of Science degree	93 (11)	61 (7)	18 (2)	665 (79)
1st level Specialist Master's degree	256 (31)	60 (7)	18 (2)	503 (60)
2nd level Specialist Master's degree	(1)5	8 (1)	11 (1)	813 (97)
Advanced continuing professional education	293 (35)	187 (22)	31 (4)	326 (39)
Doctor of philosophy (PhD)	9 (1)	8 (1)	14 (2)	806 (96)
Distance and residential learning course	292 (35)	272 (32.5)	39 (4.7)	234 (28)
Conferences/Meetings	404 (48)	354 (42)	30 (4)	49 (6)

Supplementary 1. Checklist items for reporting survey research.

	Section & Topic	Reported on page #
	Background	
1	Justification of research method	5-6
2	Background literature review	5-6
3	Explicit research question	5-6
4	Clear study objectives	5-6
	Methods	
5	Description of methods used for data analysis	9
6	Method of questionnaire administration	7-8
7	Location of data collection	6-7
8	Dates of data collection	6-7
9	Number and types of contact	6-7
10	Methods sufficiently described for replication	6-8
11	Evidence of reliability	7
12	Evidence of validity	7
13	Methods for verifying data entry	na
14	Use of a codebook	na
15	Sample selection	7
16	Sample size calculation	7
17	Representativeness	7
	Method of sample selection	
18	Description of population and sample frame	7
19	Research tool	7-8
20	Description of the research tool	7-8
21	Description - development of research tool	7-8
22	Instrument pretesting	Na
23	Instrument reliability and validity	Na
24	Scoring methods	7-8
	Results	
25	Results of research presented	10-14
26	Results address objectives	10-14
27	Clear description - results based on part sample	10-14
28	Generalisability	10-14
	Response rates	
29	Response rate stated	10
30	How response rate was calculated	10
31	Discussion of nonresponse bias	17
32	All respondents accounted for	
	Interpretation and discussion	
33	Interpret and discuss findings	14-17
34	Conclusions and recommendations	14-17
35	Limitations	17
	Ethics and disclosure	
36	Consent	6
37	Sponsorship	20
38	Research ethics approval	20
39	Evidence of ethical treatment of human subjects	Na

PLoS Med. 2010 Aug;8(8):e1001069. doi: 10.1371/journal.pmed.1001069. Epub 2011 Aug 2. Reporting guidelines for survey research: an analysis of published guidance and reporting practices. Bennett C1, Khangura S, Brehaut JC, Graham ID, Moher D, Potter BK, Grimshaw JM.

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Twenty-five years after the introduction of evidence-based medicine: knowledge, use, attitudes, and barriers among physiotherapists

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Keywords:	MEDICAL EDUCATION & TRAINING, REHABILITATION MEDICINE, EPIDEMIOLOGY

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Title: Twenty-five years after the introduction of evidence-based medicine: knowledge, use, attitudes, and barriers among physiotherapists

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Abstract

Objectives. To explore the knowledge, use, attitudes towards Evidence-based Medicine, named also Evidence-based Practice (EBP), and perceived barriers to its dissemination among physiotherapists.

Design. Cross-sectional study.

Setting and participants. Members of the Italian Association of Physiotherapists (n=2000) were invited to participate in an online survey about EBP knowledge and use.

Primary outcome measures. The survey questionnaire comprised four sections: 1) Respondent' characteristics; 2) Knowledge of EBP principles; 3) Attitude, use and perceived effectiveness of EBP; 4) Perceived barriers to implementing EBP in clinical practice.

Results. Out of 2000 physiotherapists, 1289 participated in the survey (response rate 64.5%). Overall, 90% perceived EBP as useful and necessary for clinical practice. More than 85% stated that they were familiar with the principles of EBP, 75% reported that they were able to search online databases for relevant information, and 60% reported that they were able to understand statistical analyses. However, 56% believed that patient preferences and 39% that clinical expertise are not part of the EBP model. Half stated that they understood and could explain the term "meta-analysis", but only 17% knew what a forest plot is, and just the 20% correctly judged the finding of a given meta-analysis. Lack of time was reported as the main barrier towards EBP.

Conclusions. The majority of Italian physiotherapists overrated their knowledge about EBP, demonstrating that there is a gap between perceived and actual knowledge of EBP in this population.

Key Words: Evidence-based Practice; Cross-sectional Studies; Physiotherapy Specialty; Surveys and Questionnaires.

Abstract word count: 237 words.

Manuscript word count: 3814 words.

Article summary

Strengths and limitations of this study

- National web-based survey among Italian physiotherapists to explore knowledge, use and attitude towards Evidence-based Medicine.
- Relevance of the study to the current evidence based practice among Italian physiotherapists.
- A sample of 2000 physiotherapists was recruited with a high-moderate response rate of 64.5%.
- Self-reported data and potential non response bias can affect results and interpretation of this cross-sectional study.
- Generalizability is confined to a selected population.

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funding sources had no controlling role in the study design, data collection, analysis, interpretation, or report writing.

Competing interests: The authors declare that they have no competing interests.

Introduction

Evidence-based medicine, also named as Evidence-based Practice (EBP) is an internationally recognized movement and it is defined as "*the conscientious, explicit,*

and judicious use of current best evidence in making decisions about the care of individual patients. The practice of Evidence-based Medicine means integrating individual clinical expertise with the best available external clinical evidence from systematic research." (1) The identification and application of patients' preferences should be part of decision making.(2) This concept of shared decision making has gained attention in the last decade, with physical medicine and rehabilitation clinicians being more likely to involve patients in making informed decisions.(1, 3)

Using the best available evidence to make healthcare decisions optimizes health outcomes. Issues in EBP have attracted growing debate and discussion(2, 4, 5), as seen in the increase in the number of scientific articles directly relevant to physiotherapy practice: (6, 7): between 1995 and 2015, randomized controlled trials (RCTs) and systematic reviews (SRs) rose increased from 45.1% to 59.4%, and from 0% to 14.6%, respectively.(8) Taken together, RCTs and SRs accounted for 74% of physiotherapy research publications in 2015 compared to 45% two decades earlier.(8)

Keeping up with this abundance of research may be a big challenge for most clinicians. Not surprisingly, the transfer of research findings into practice is often described as slow, haphazard, and unpredictable.(9) While several studies have investigated the use and the perceived effectiveness of EBP among physiotherapists,(10-18) none to date have explored the gap between their perceived and actual knowledge. In addition, no similar research exists in the Italian context which is relatively recent: university courses for physiotherapy were established in 2006 with three-year full-time degree. The course is an intensive mix of class time and mandatory internship right from the

first year. Consequently, student can apply to the "Laurea Magistrale" (equivalent to the European Master of Science) and a Doctoral Program.

Based on this context, the present study investigated the knowledge, the use of and the attitude towards EBP among Italian physiotherapists, and the barriers they perceived to its implementation. Secondary aims were to investigate the gap between perceived and actual knowledge of EBP principles among physiotherapists, and to analyse the association between their perceived and actual knowledge and demographic characteristics.

Methods

Design

For this cross-sectional study we conducted an online closed survey of members of the Italian Association of Physiotherapists (Associazione Italiana Fisioterapisti [AIFI]). We developed a survey questionnaire and posted it on a SurveyMonkey platform(19) for data collection. Written, informed consent was assumed if the respondents completed and submitted the survey. The closed survey was available online via the Internet for a period of six weeks from May to June 2018. This study followed the Guidelines for Reporting Survey-Based Research.(20, 21)

Patient and Public Involvement

Although there was no direct involvement of patients or the public, the AIFI assisted in the design and delivery of the study. They also sent the questionnaire directly to participants.

Study sample

Before the survey questionnaire was posted online, the AIFI sent an invitation in their email newsletter to all society members explaining the aim and content of the survey. The invitation explained the purpose of the survey, the time needed to complete it (10 minutes), and the type of questions that the participants could expect to find. The time of 10 minutes was a median based on a priori piloted questionnaire with six expert physiotherapists in EBP. The survey was linked to a unique respondent that did not display the survey a second time once completed. The survey questionnaire was posted on 4 May 2018. Two weeks later, the AIFI sent out an e-mail reminder to members who had not yet responded. Responses were treated anonymously.

AIFI membership database contains more than 10,000 addresses of physiotherapists members (12,514 at the end of 2019) out of an estimate of 65,000 physiotherapists. Of those, the association considers that only 2000 are . socially active members defined as who, according to the secretariat of the association, received e-mails, constantly exchange and share links on social website and app and are actual reader of the newsletter being interactive with the AIFI channels.

Sample size calculation

We used the sample size calculator(22, 23) offered by SurveyMonkey. The sample size is the number of completed responses we expected to receive: based on a population size of 10.000 (which is the total number of people we intended to invite to participate in the study, i.e. total number of AIFI members registered at the time of the survey), a

margin of error of 5% (how much survey results reflect the views of the overall population) and a sampling confidence level of 95% (how confident we can be that the population would select an answer within a certain range). The calculated sample size of completed responses was of 370 completed answers. Thus, we expected that sending the survey to a target sample of 2000 socially active members would guarantee 370 completed responses.

Survey questionnaire

The questionnaire was developed based on similar questionnaires reported in the literature.(12, 15, 24) Before sending the survey, we piloted the questionnaire with six expert physiotherapists in EBP (four senior and two junior researchers, with an average of 8 and 3 years of EBP expertise) to assess its clarity and accuracy. After revision, the final questionnaire version consisted of 26 items divided into 4 sections: 1) Respondents' characteristics (items 1 to 8); 2) Knowledge and ability to critically appraise the literature (items 9 to 16); 3) Use and perceived effectiveness of EBP (items 17 to 24); 4) Perceived barriers to the implementation of EBP in clinical practice (items 25 and 26). Response to all items was mandatory. The questionnaire was written in Italian to make it more suitable for this sample (**Supplementary File 1** – questionnaire, English version).

Section 1 covered demographic characteristics; Section 2, item 9, asked respondents to indicate the origin of their knowledge about EBP basics. If they stated that they did not know the EBP model, the questionnaire terminated; otherwise, for the following items, the respondents were asked where they had acquired their knowledge of EBP and if

they were confident with it. The final questions in this section assessed the respondent's actual knowledge of EBP. For instance, item 14 investigated familiarity with some terms often found in the literature, item 15 asked which study design is considered the most reliable, and item 16 investigated whether the respondent understood the results of a meta-analysis from a given forest-plot. Most of the items in Section 3 were statements to which respondents had to express their agreement on a five-point-Likert scale, with "strongly agree" and "strongly disagree" as anchors, about their perception and use of EBP. In Section 4, item 25, the respondents had to state whether or not they felt barriers to the utilization of EBP exist. If they stated there were no barriers to its utilization, the questionnaire terminated as a conditional question. Otherwise, for item 26, the respondents had to express their opinion about the presence of barriers to the implementation of EBP and to rank them from the most to the least important.

Statistical analyses

Descriptive statistics are presented as medians and interquartile ranges (IQR) or absolute values, percentages and frequencies, when appropriate. The response frequencies were represented and analysed in tabular and graphic formats using Microsoft Excel or Power Point 2010. An automated count of response rate was acquired for each of the four sections in order to determine whether the questionnaires were terminated earlier (i.e., users did not go through all four questionnaire sections). We dichotomized the responses to the 5-point items as "disagree" versus "agree" ("strongly disagree, disagree and neutral" versus "agree and

strongly agree" categories). Demographic characteristics (e.g., sex, age, and level of education) were collapsed into categories. We performed logistic regression analysis to examine the association between knowledge of components of the EBP model (questions related to whether patient values and clinical expertise are considered in the EBP model) and demographic characteristics of the respondent (age, sex, working time, and level of education). Results were considered statistically significant when $p < 0.05$. Odds ratios and their 95% confidence intervals were determined for each level of the independent variables. Odds ratios in this context describe the likelihood of demonstrating a particular behaviour and use (e.g., understanding that the EBP model comprises patient values) given a particular characteristic (e.g., age). One level of each demographic characteristic was used as the reference group against which the odds of demonstrating the behaviour and use at all other levels of the variable were measured. The reference group was the last category to allow the most salient interpretation of results. Confidence intervals provided information about the precision of the estimates. We chose to examine univariate rather than multivariate associations for presenting our data at its most simple level so as to have a foundation for future hypothesis testing. Data were exported from the SurveyMonkey and analysed with STATA software (25).

Results

Respondents' characteristics

2000 physiotherapists constitute the number of the survey questionnaire respondents. Considering this number, the response rate was moderate (1289/2000, 64.5%). The

number of respondents was far higher than our target sample (n=323). The response rate decreased from section 1 to section 3 due to the presence of conditional branching logic items (item 9 and item 25) in the questionnaire survey. Indeed, the response rate for each completed section differed: 56% (n=1113) response rate for Section 1(demographic characteristics); 42% (n=837) response for Section 2 (knowledge of EBP); and 41% (n=818) for Section 3 (use and perceived effectiveness of EBP). The sample included in each section is reported in Figure 1.

[Figure 1]

Figure 1. Flow diagram of the study.

The median age of the respondents was 35 years (IQR 28-47), and 52% were women. Around 60% of participants worked in a private practice (653/1113), and 27% in a hospital (305/1113), and 87% spent most of their work time in clinical practice (968/1113). **Table 1** presents the demographic characteristics of the sample.

[Table 1]

Table 1. Sample Characteristics.

EBP Knowledge and ability to critically appraise literature

Two respondents skipped this section. A total of 1111 respondents answered the item investigating knowledge of EBP principles. The majority stated they knew the EBP

model (85%). The most frequent channels for learning the principles of EBP were conferences/meetings (48%), distance and residential learning courses (35%), and advanced continuing professional educational courses (35%). Only 23% of respondents stated they learned about EBP during their undergraduate studies (**Supplementary file 2**).

Regarding the sources physiotherapists consult to solve clinical problem, the majority of respondents stated that their preferred information channels were discussion with peers (80%) and literature search (86%); and the 30% stated that they relied on their own experience. In addition, 78% of respondents stated they felt competent about EBP, and 1.2% stated they felt completely unable. More than half (61%) were confident in their ability to critically appraise quality assessments of study design and statistical analysis. However, many of respondents stated they understood the meaning of the terms "RCTs" (72%), "statistical significance" (65%), and "meta-analysis" (52%); but, few could explain the terms "forest plot" (17%) and "confidence intervals" (38%) (**Table 2**). In addition, 82% correctly identified the best study design to evaluate an intervention, but only 20% was able to identify the result from the overall estimate of a given meta-analysis.

[Table 2]

Table 2. Self-reported comprehension of terms (837 responded, 453 skipped).

Use and perceived effectiveness of EBP

The 90% of respondents agree that EBP is useful, comprehensive of patient values and effective, showing an overall positive attitude towards its use (90%). While 90% knew that scientific literature is part of the EBP, 56% did not agree that patients' preference and 39% that clinical expertise are part of the EBP process (**Figure 2**).

[Figure 2]

Figure 2. Perceived knowledge of EBP basic principles of patients' desire, clinical expertise and scientific literature.

In a typical month, 59% of the respondents read between 1 and 5 articles, and only 9% did not. In addition, 55% stated that they make clinical decisions based on their scientific readings, 80% expressed the need to increase the use of EBP, and 69% reported that it would benefit their career.

Association between sample characteristics and EBP knowledge

We found a statistically significant association between questions related to how physiotherapists perceived EBP principles (patient values and clinical expertise), and sample demographic variables entered into the model (age, sex, working time, level of education) (**Table 3**). Thus, Considering the question related to patients' values as part of EBP model, young physiotherapists < 29 years seems to be more conscious about patient's value in EBP model than adults > 49 years (OR 1.57, 95% CI 1.02 - 2.42) as well,

being male increased the odds (0.50, 95% CI 0.38 – 0.67). Physiotherapists who work in patient care (e.g. clinical practices) are less likely to report understanding the model of EBP (OR 0.99, 95% CI 0.98 – 0.99) compared to who does not work in this area. On the contrary, who works in research (OR 1.02, 95% CI 1.01 – 1.03) and teaching (OR 1.01, 95% CI 1.002 – 1.02) is more likely able to recognize patient's value as part of the EBP model. Whereas, who had a Master's of Science (IC 2.06, 95% CI 1.31 – 3.21) is twice more conscious about it against who did not have the same title. The same interpretation is for who had a 1st level Specialist Master's degree (OR 2.69, 95% CI 1.98 – 3.64) and a Doctor of philosophy (PhD) (OR 10.33, 95% CI 1.28 – 83.00).

Regarding the question related to clinical expertise as part of the EBP model, being male is more likely associated to consider expertise in EBP model (OR 0.65, 95% CI 0.49 – 0.86). Who works in patient care (OR 0.99, 95% CI 0.98 – 0.99) seems to be less likely able to understand the EBP model more than who does not work with patient (OR 0.65, 95% CI 0.49 – 0.86). To have a Master's degree title (OR 2.16, 95% CI 1.31 – 3.58) and a 1st level Specialist Master's degree (OR 1.99, 95% CI 1.45 – 2.75) seems to be twice favourable to consider clinical expertise in the model against who did not have this titles. (**Table 3**).

[Table 3]

Table 3. Association between actual knowledge of EBP and selected variables.

Perceived barriers to using EBP in clinical practice

Respondents stated that major barriers to applying EBP exist (570/815, 75%): lack of time and lack of ability to critically appraise the literature were rated as the top two barriers. Lack of time was ranked as the most important (Table 4).

[Table 4]

Table 4. Barriers to applying EBP in order of importance (%).

Discussion

Main findings

We obtained a response rate of 64.5% corresponding to a total of 1289 physiotherapists out of 2000 involved. This rate, being superior than the required sample size of 370, can be considered representative of all physiotherapists AIFI members. Overall, survey questionnaire respondents stated they had a positive attitude towards EBP and that their knowledge about it was extensive. The majority overrated their knowledge, however, and demonstrated a shallow awareness of EBP, compared to the original model described by David Sackett (26). The gap between perceived and actual knowledge of EBP is relevant and can result in inadequate practice, potentially increasing the risk of chronic disability(27).

Our survey findings are similar to those obtained among American physiotherapists 15 years ago (12) and, more recently, among Ghanaian physiotherapists who demonstrated an inadequate knowledge of EBP (14). In contrast, Brazilian physiotherapists showed they were better acquainted with EBP since they considered

patients' preferences part of the decision-making process (15). In Europe, Swedish physiotherapists consider patients' preferences when treating according to guidelines, thus carrying out the EBP process(28). However, the international context in which physiotherapists act their health care assistance might be different from Italy where a direct access is not still completely implemented and a lower number of years of education for becoming a physiotherapist are needed compared to other countries (29, 30).

In our sample, the younger respondents were noted to be more familiar with EBP than their older colleagues with more experience. Our findings are shared by similar observations that the level of EBP knowledge is influenced by the time since graduation from school. In general, recent graduates are more likely to follow the steps of EBP than those with more clinical experience(11). We also observed that knowledge about EBP differed depending on the respondent's level of education and workplace setting. (11-13). Indeed, personal and organizational characteristics can significantly influence attitudes, beliefs, use of EBP, and perceived support (31).

Of the total of respondents with a Bachelor's degree, only one fifth had received education in EBP. The levels of education most closely associated with EBP knowledge are the graduate and postgraduate levels. The teaching of EBP principles in undergraduate courses remains scarce, although it is widely considered essential for improving the quality of health care and patient outcomes. In many Countries, studies have highlighted that physiotherapists require more training in EBP in order to acquire confidence in using it(11); however, the teaching of EBP-oriented skills in undergraduate physiotherapy programmes belongs to the past two decades (32-34).

Since then EBP has been increasingly integrated into the core curriculum of undergraduate and postgraduate health care programs and continuing professional education(35-37). Italy is not an exception, the teaching of EBP has been included as an integral part of the core curriculum of physiotherapy in 2005 (22). This statement is in accordance with the study's finding that Italian physiotherapists <29 years show higher odds of better attitudes towards EBP therefore, we are positive regarding the future generation of better adoption of EBP. Moreover, improving knowledge, use, and attitudes towards EBP may be most strongly determined by upgrading to Master's degrees while short continued educational courses may be of limited effectiveness. Thus, it would be appropriate to support the access at Master's degree courses at national leveland to improve the quality of short educational courses in order to shape them into an EBP structure.

The perceived and actual knowledge and use of evidence from the scientific literature differed among respondents. While the majority felt able to conduct a literature search and to critically appraise a statistical analysis in a scientific article, few demonstrated that they understood the results of a meta-analysis from a given forest plot. Nevertheless, the respondents appeared to have great confidence in the authority of published scientific literature and stated that their clinical decisions rarely relied on their experience alone: the attitude and the attempt to introduce findings from the scientific literature in the clinical context is congruent with their positive attitude towards EBP.

The discrepancy between actual knowledge and practice of EBP could be a consequence of the myriad information sources accessible in scientific databases and

non-scientific channels, such as Doctor Google or social networks. Health care professionals, including physiotherapists, need to develop their skills to confront this overabundance of information in their professional life: exercising a careful selection of what to read and what not to, both in terms of quality and quantity (38). Indeed, three quarters of our respondents perceived barriers that limit their ability to critically appraise the literature (11-13, 28, 39, 40).

Strengths and limitations

This is the first study examining perceived and actual knowledge on EBP among physiotherapists in Italy. Although our response rate was high-moderate (64.5%), several limitations should be considered when analysing the study results. First, our sample included only AIFI members, who may not be representative of the population of Italian physiotherapists, as it might be that AIFI members are more likely to participate in a survey about their profession. Moreover, it is possible that respondents, as members of AIFI, were those more prone towards EBP giving an overestimated knowledge on EBP: the self-reported nature of the data might have influenced the gap between perceived and actual knowledge. This gap was only a little part of the broader scope of the study aiming to test preliminary hypothesis about the gap and to report a concise snapshot view that can be better assessed in a further study by validated instruments such as the Fresno Test or the Berlin Questionnaire (41, 42). Nonetheless, before the professional registry of Italian physiotherapists was established in 2018, the AIFI was the only professional society for physiotherapists in Italy and specifically not a scientific society. Second, sending out only one reminder to

participate in the survey might have limited the number of potential respondents. Potential non response bias might have affected results and interpretation of this cross-sectional study. Factors such as the length of the questionnaire, the term 'survey' in the body of the mail, and the non-inclusion of incentives might have influenced the rate response: a Cochrane review showed as odds of response are reduced in these situations(43).

However, the final percentage of respondents did not seem to bias our results, as we reached the planned sample target up to the last survey questionnaire items. Third, we dichotomized the dependent variables, conflating all responses into positive/negative categories. This might have resulted in a loss of some information, though we replicated what previous studies of the same design have done (12) in order to report useful findings. Finally, the accuracy of data on perceived knowledge is uncertain as the data were collected via a self-reported survey.

Implication for research, practice and education

We believe that research can help to increase the dissemination of knowledge about and the adoption of EBP among physiotherapists. A focus for future research should be to concentrate efforts in conducting high-quality research and teaching master classes devoted to of EBP topics (44) and promoting research learning programmes as knowledge translation interventions to improve the use of EBP and clinical practice guidelines (CPGs) in physiotherapy (45). CPGs, defined as "systematically developed statements to assist practitioner and patient decisions about appropriate health care for specific clinical circumstances" (definition adopted by the European Region of the

World Confederation for Physiotherapy), can be used to bridge the research-to practice gap and promote EBP and present research findings to clinicians in a synthetic format without missing any elements of the EBP model (9). Indeed, CPGs based on the Grades of Recommendation, Assessment, Development and Evaluation approach (GRADE approach) are conducted in a standardized and transparent way: GRADE rates the quality of evidence and provides the strength of recommendations by considering the "estimates of effect for desirable and undesirable outcomes of interest", the "confidence in the estimates of effect", the "estimates of values and preferences" and the "resource use" (46). This approach helps the reader interpret a CPG and enhance CPG adherence by health professionals. Some countries have laws that regulate professional liability and place great importance on adherence to CPGs in clinical practice, defining compliance with the CPG as an element in attributing professional responsibility in case of adverse events. Furthermore, to improve physiotherapists' adherence to CPGs, computerized decision support systems could provide actionable recommendations or management options that are intelligently filtered or presented at appropriate times to improve efficiency in health care(47).

For these reasons, both national and international initiatives are warranted for the implementation of CPGs in physiotherapy. The production of CPGs, or at least a synthesis of the evidence underpinning them, could be (and is to some extent) coordinated on a national level, while implementation may be more suitable for local adaptation(48). For instance, the recently created Italian National Guidelines System (49) includes a list of scientific societies that can contribute to drafting CPGs (including the AIFI), a process based on the GRADE method for the production, adaptation, and

updating of CPG. In this a database health professionals can find continuously updated CPGs and good quality practices.

We appeal for a critical use and appraisal of EBP. EBP should be included in the professional education of physiotherapist, starting at the undergraduate level. Investing in the training of physiotherapists is essential for growing the skills of critical appraisal of evidence-based physiotherapy, and to reduce waste of obsolete, futile or harmful interventions (8). For instance, initiatives such as INQUIRE (INcreasing QUality In patient-oriented academic clinical Research) has resulted in a roadmap that provides guidance for Academic institutions and researchers in developing quality enhancement initiatives (50). The PEAK (The Physical therapist-driven Education for Actionable Knowledge translation) educational program was designed to promote integration of physiotherapists' research evidence into clinical decision making (19, 51, 52). Finally, engaging in research can contribute to being an attractive employer and boost the application of EBP(13). Not only that, promoting education must be an imperative to minimize "the mismatch between what clinical researchers do and what patients need" (53).

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Declarations

Ethical approval: We conducted our study in compliance with the principles outlined in the Declaration of Helsinki. The survey was filled out anonymously, and responses could not be traced back to the respondents. Written, informed consent was assumed if the respondents completed and submitted the survey since a statement before starting the questionnaire informed the respondents of the purpose of the study. Ethics approval was not necessary.

Availability of data and material: All data generated or analysed during this study are available at https://osf.io/8xb6p/?view_only=1c6fd76403c04a82942799b9dee952c8 .

Authors' contributions: SG and GC were primarily responsible for study conception and design and for data analysis and interpretation. All authors (SG, GC, DC, SC) had full access to all of the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis. DC led the writing of the first draft of the manuscript. DC and SC authors contributed to drafting and revising the manuscript. SG is the guarantor. All authors (SG, GC, DC, SC) read and approved the final manuscript.

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Table 1. Sample Characteristics.

Characteristics *		Frequency (%)
Sex (n=1289)	Male	48%
	Female	52%
Age, yrs (n=1289)	<29	28%
	29-38	31%
	39-49	18%
	>49	23%
Workplace** (n=1113)	Private office	59%
	Teaching Hospital	7%
	Hospital	20%
	Nursing home	15%
	Unemployed	2%
	Other	17%
Working time spent in: (average) (n=1113)	Clinical practice	87%
	Research	11%
	Teaching	6%
	Management/Leadership	2%

*The absolute number of respondents varies for each variable due to missing data.

**Percentage may exceed 100% because some items allowed more than one answer

Table 2. Perceived knowledge of terms (837 responded, 453 skipped).

	Understood and could explain No. (%)	**Understood somewhat No. (%)**	**Did not understand No. (%)**	**Unknown No. (%)**
Randomized-controlled trials	604 (72)	192 (23)	41 (5)	0 (0)
Meta-analysis	439 (52)	304 (37)	86 (10)	8 (1)
Relative risk	250 (30)	428 (51)	135 (16)	24 (3)
Statistical significance	543 (65)	246 (29)	41 (5)	7 (1)
Forest plot	144 (17)	197 (24)	147 (17)	349 (42)
Intention to treat	255 (30)	223 (27)	167 (20)	192 (23)
Confidence interval	316 (39)	271 (32)	176 (18)	104 (11)

Table 3. Association between actual knowledge of EBP and selected variables. References category are reported in legend.

	Characteristics			Odds ratio (95% CI)	Model P*
In your opinion, are patients' values and preferences a part of the EBP model?	**Age (yrs)**[a]	(n=818)	<29	1.57 (1.02 - 2.42)**	0.001
			29-38	1.03 (0.66 - 1.59)	
			39-49	0.68 (0.39 - 1.17)	
			>49	Reference	
	Sex[b]	(n=818)	Female	0.50 (0.38 – 0.67)**	0.000
			Male	Reference	
	Working time [c]	(n=814)	Patient care	0.99 (0.98 – 0.995)**	0.002
		(n=567)	Research	1.02 (1.01 – 1.03)**	0.001
		(n=609)	Teaching	1.01 (1.002 – 1.02)**	0.015
		(n=492)	Management	1.00 (0.98 – 1.02)	0.62
	Level of education[c]	(n=818)	Bachelor's degree	1.04 (0.75 – 1.45)	0.81
			Master of Science degree	2.06 (1.31 – 3.21)**	0.001
			1st level Specialist Master's degree	2.69 (1.98 – 3.64)**	0.000
			2nd level Specialist Master's degree	0.84 (0.14 – 5.07)	0.85
			Advanced continuing professional education	1.06 (0.80 – 1.42)	0.67
			Doctor of philosophy (PhD)	10.33 (1.28 – 83.00)**	0.005
			Distance and residential learning course	1.00 (0.75 – 1.34)	0.99
			Conferences/Meetings	1.40 (1.06 – 1.85)**	0.015
In your opinion, is clinical	**Age (yrs)** [a]	(n=818)	<29	1.43 (0.93 - 2.21)	0.11
			29-38	1.00 (0.65 - 1.55)	

expertise a part of the EBP model?			39-49	0.97 (0.57 - 1.64)	
			>49	Reference	
	Sex[b]	(n=818)	Female	0.65 (0.49 – 0.86)**	0.008
			Male	Reference	
	Working time [c]	(n=814)	Patient care	0.99 (0.98 – 0.99)**	0.032
		(n=567)	Research	1.01 (0.99 – 1.02)	0.24
		(n=609)	Teaching	1.01 (0.99 – 1.02)	0.14
		(n=492)	Management	0.98 (0.97 – 1.01)	0.32
	Level of education[c]	(n=818)	Bachelor's degree	1.25 (0.89 – 1.76)	0.19
			Master of Science degree	2.16 (1.31 – 3.58)**	0.002
			1st level Specialist Master's degree	1.99 (1.45 – 2.75)**	0.000
			2nd level Specialist Master's degree	0.97 (0.16 – 5.86)	0.98
			Advanced continuing professional education	0.90 (0.67 – 1.21)	0.49
			Doctor of philosophy (PhD)	0.26 (0.65 – 42.27)	0.06
			Distance and residential learning course	1.08 (0.80 – 1.45)	0.61
			Conferences/Meetings	1.20 (0.91 – 1.59)	0.20

Legend:

* Chi-square test

** Statistically significant (p <0.05)

[a] Odds ratio are calculated using the variable >49 years as reference.

[b] Odds ratio are calculated using the variable male as reference.

[c] Odds ratio are calculated as the ratio between the odds in the presence of characteristics' variable against the odds in the absence of the same variable. (I.e., characteristic: working time; variable: patient care. The odds ratio rapresents the ratio between the odds of working in patient care against the odds of not working in patient care.)

First level master degree: equivalent to post graduate diploma: program at which students with a bachelor's degree can have the access.
Second level master degree: postgraduate level at which only student with master of science degree can have the access.
Advanced continuing professional education: post graduate certificate

Table 4. Barriers to applying EBP in order of importance (%).

Type of barrier	Order of importance from the most to the least (%)									
	1st	2nd	3nd	4th	5th	6th	7th	8th	9th	10
Lack of interest	10.7	8.3	5.6	6.9	6.2	7.0	10.2	10.7	10.7	23.7
Applicability of EBP findings to clinical practice	11.1	12.8	9.7	8.4	13.5	9.8	9.5	8.8	7.6	8.8
Lack of time	23.0	13.2	15.1	10.0	9.0	9.0	5.8	5.5	5.8	3.7
Difficulty in searching literature in databases	9.5	11.8	14.4	15.1	13.7	14.6	10.5	7.6	0.0	0.9
Difficulty in critically appraising literature and statistical analysis	9.7	17.8	16.5	16.7	16.9	9.3	6.0	4.0	2.1	1.1
Difficulty applying literature findings to individual patients	9.5	11.4	12.7	14.1	12.7	16.9	11.3	5.6	5.5	0.5
Lack of financial and organizational support (computer, access to databases)	8.4	7.4	8.6	8.8	8.8	10.5	20.6	12.8	7.4	6.7
Workplace does not use EBP	12.0	11.3	9.7	9.8	9.8	9.5	10.0	17.8	6.0	4.2
Language of scientific publications	4.8	3.0	5.1	6.3	7.4	8.6	10.0	15.6	30.8	8.4
Unfamiliarity with using the computer/technology	1.4	3.2	2.6	3.9	2.1	4.8	6.2	11.6	22.3	42.0

Figure Legend

Figure 1. Flow diagram of the study.

Figure 2. Perceived knowledge of EBP basic principles of patients' desire, clinical expertise and scientific literature.

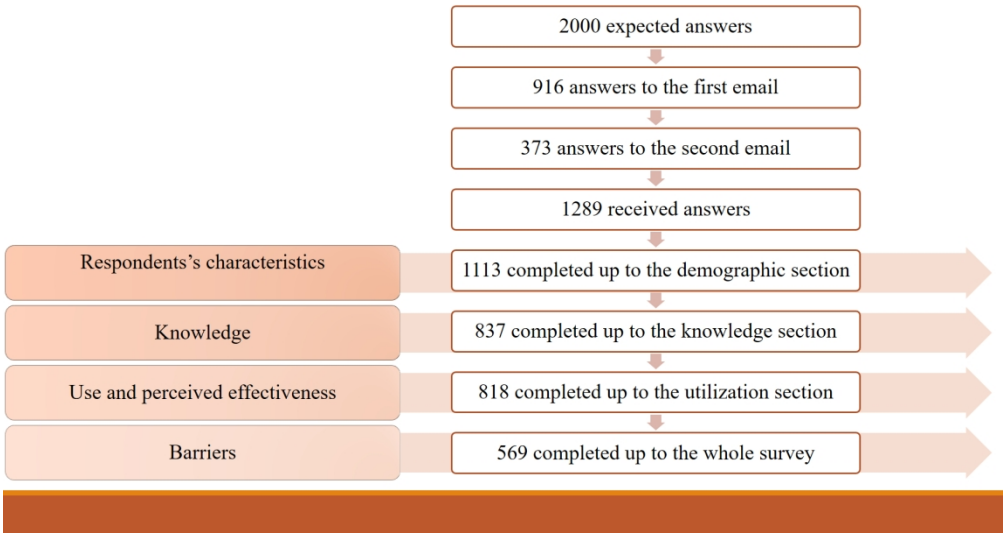

Figure 1.

81x45mm (600 x 600 DPI)

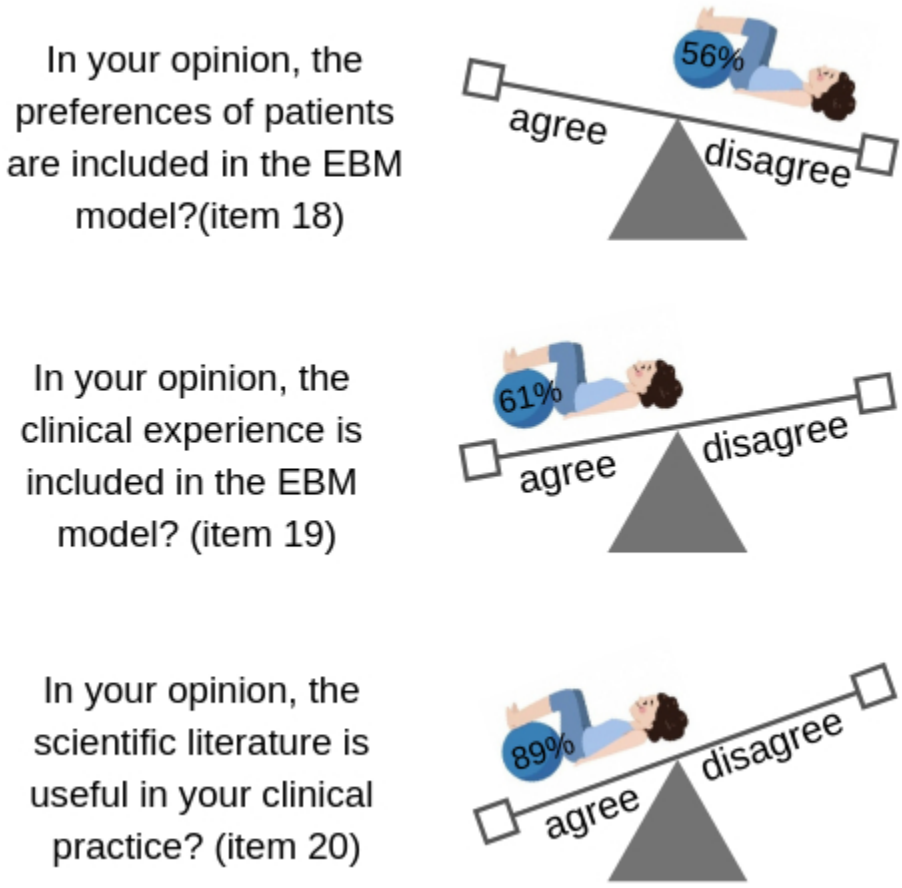
In your opinion, the preferences of patients are included in the EBM model?(item 18)
56%
agree
disagree
In your opinion, the clinical experience is included in the EBM model? (item 19)
61%
agree
disagree
In your opinion, the scientific literature is useful in your clinical practice? (item 20)
89%
agree
disagree

Figure 2.

Evidence-Based Practice (EBP) Questionnaire[a]

SECTION 1. General information

For the following items, place a mark x *in the appropriate box next that indicates your response.*

1.What is your sex?

□ Male □ Female

2. What is your age? ____

3. Where did you acquire the license to practice as Physiotherapist (PT)?

□ Italy □ Abroad

4. In which Italian region did you acquire your physiotherapist's degree (degree or equivalent title)?

_____

5. In which University (eg., Università degli Studi di Genova) o other (e.g.,. Scuola Dirette ai Fini Speciali/Scuole Regionali) did you acquire your PT title?

_____

6. When did you acquire your title to practice as physiotherapist (e.g., 2005)

_____

7. Where did you mostly practice your profession?

□ Private practice

□ Research Hospital

□ Clinical Hospital

□ Residential and nursing home

□ Unemployed (e.g. student)

□ Others _____

8. Please indicate the percentage of your total work time that you spend in each type of activity during an average month.

a) Patient care □ %

b) Research □ %

c) Teaching □ %

d) Management (as Director) □ %

SECTION 2. Knowledge of EBP principles

9. Do you know the Evidence Base Practice (EBP) model?

□ Yes □ No

10. Where did you learn the foundations of EBP

- Bachelor's degree
- Master of Science degree
- 1st level Specialist Masters degree
- 2nd level Specialist Masters degree

- Advanced continuing professional education
- Doctor of philosophy (PhD)
- Distance and residential learning course
- Conferences/Meetings

11. When you did not know how to manage a clinical issue, how did you behave?

- I rely on my experience
- I discuss with colleagues
- I consult the scientific literature
- It has never happened

12. I'm able to launch search strategies for finding research relevant to my practice (e.g., Pubmed)

□ Strongly Disagree □ Disagree □ Neutral □ Agree □ Strongly Agree

13. I am confident in my ability to critically review the literature (quality assessment, statistical and clinical significance).

□ Strongly Disagree □ Disagree □ Neutral □ Agree □ Strongly Agree

For the following item, place a mark v *in one box in the row for each term.*

14. My understanding of the following terms is:

Term	**Understand Completely**	**Understand Somewhat**	**Do Not Understand**
a) Randomized controlled trial	□	□	□
b) Meta-analysis	□	□	□
c) Relative risk	□	□	□
d) statistical significance	□	□	□
e) Forest plot	□	□	□
d) Intention to treat	□	□	□
f) Confidence interval	□	□	□

15. In your experience, which is the best study design to assess the efficacy of a rehabilitative intervention?

- Case report/case series
- Cohort observational study
- Case – control observational study
- Controlled clinical study
- Randomized controlled clinical study
- I don't know

16. A systematic review, comparing exercise versus manual therapy in acute low back pain for reducing disability at 3 months of follow-up, reports the following result (please, see the figure below). What is your interpretation?

- I don't know
- Esercise is more efficacious than manual therapy
- Exercise is less efficacious than manual therapy

- Both have the same efficacy

Review: Motor control exercise for chronic non-specific low-back pain

Comparison: 2 Motor control exercise versus manual therapy

Outcome: 2 Disability

Study or subgroup	Motor control exercise N	Mean(SD)	Manual therapy N	Mean(SD)	Mean Difference IV,Random,95% CI	Weight	Mean Difference IV,Random,95% CI
1 Short-term (< 3 months from randomisation)							
Ferreira 2007	80	32.92 (23.75)	80	32.92 (25)		25.4 %	0.0 [-7.56, 7.56]
Rabin 2014	32	16.1 (11.2)	49	20.2 (16)		41.3 %	-4.10 [-10.03, 1.83]
Rasmussen-Barr 2003	22	10.7 (7.6)	19	14 (12.9)		33.2 %	-3.30 [-9.91, 3.31]
Subtotal (95% CI)	**134**		**148**			**100.0 %**	**-2.79 [-6.60, 1.02]**

Heterogeneity: $Tau^2 = 0.0$; $Chi^2 = 0.73$, df = 2 (P = 0.69); $I^2 = 0.0\%$

Test for overall effect: Z = 1.44 (P = 0.15)

SECTION 3: Personal attitudes toward, use of, and perceived benefits and limitations of EBP.

For the following items, place a mark x *in the appropriate box that indicates your response.*

17. Application of EBP is necessary in the practice of physiotherapy.

□ Strongly disagree □ Disagree □ Neutral □ Agree □ Strongly Agree

18. EBP takes into account the patient's preferences and values.

□ Strongly disagree □ Disagree □ Neutral □ Agree □ Strongly Agree

19. EBP takes into account the clinical experience.

□ Strongly disagree □ Disagree □ Neutral □ Agree □ Strongly Agree

20. Literature and research findings are useful in EBP in my daily practice.

□ Strongly disagree □ Disagree □ Neutral □ Agree □ Strongly Agree

21. Read/review research/literature related to my clinical practice (a typical month).

□Never □ 1–5 articles □ 6–10 articles □ 11–15 articles □ 16 articles

22. Use literature and research findings in the process of clinical decision making (a typical month).

□Never □ few times □ the majority of times □ always

23. I need to increase the use of EBP in my daily practice.

□ Strongly Disagree □ Disagree □ Neutral □ Agree □ Strongly Agree

24. My career will benefit from a more uptake of EBP into my clinical practice.

□ Strongly Disagree □ Disagree □ Neutral □ Agree □ Strongly Agree

SECTION 4: Barriers of EBP.

25. Do you think there are limitations in using EBP in clinical practice?

□ Yes □ No □ Do Not Know

For the following items, rank from 1 to 10 by placing numbers in the appropriate boxes (1most important).

26. Rank from 1 (most important) to 10 (least important) the barriers to the use of EBP in your clinical practice.

□ The adoption of EBP is inapplicable in physiotherapy

□ Insufficient time

□ Lack of instrumental resources in my facility (PCs, free scientific databases)

□ Poor ability to use the computers/techonology

□ Poor ability to systematically search the literature

□ Poor ability to critically appraise the literature

□ Lack of generalizability of the literature findings to my patient population

□ Lack of understanding English language

□ Lack of collective support among my colleagues in my facility, lack of a stimulating environment

□ Lack of interest

[a] The questionnaire published by Jette et al. 2003 was adapted by the authors and contains elements as reported by McColl et al.

Supplementary file 2. Reponses to question regarding the contribution of education to learning the principles of EBP (837 answered, 453 did not).

	A lot **No. (%)**	**A little** **No. (%)**	**Not at all** **No. (%)**	**Omitted** **No. (%)**
Bachelor's degree	194 (23)	409 (49)	201 (24)	33 (4)
Master's of Science degree	93 (11)	61 (7)	18 (2)	665 (79)
1st level Specialist Master's degree	256 (31)	60 (7)	18 (2)	503 (60)
2nd level Specialist Master's degree	(1)5	8 (1)	11 (1)	813 (97)
Advanced continuing professional education	293 (35)	187 (22)	31 (4)	326 (39)
Doctor of philosophy (PhD)	9 (1)	8 (1)	14 (2)	806 (96)
Distance and residential learning course	292 (35)	272 (32.5)	39 (4.7)	234 (28)
Conferences/Meetings	404 (48)	354 (42)	30 (4)	49 (6)

Supplementary 1. Checklist items for reporting survey research.

	Section & Topic	Reported on page #
	Background	
1	Justification of research method	5-6
2	Background literature review	5-6
3	Explicit research question	5-6
4	Clear study objectives	5-6
	Methods	
5	Description of methods used for data analysis	9
6	Method of questionnaire administration	7-8
7	Location of data collection	6-7
8	Dates of data collection	6-7
9	Number and types of contact	6-7
10	Methods sufficiently described for replication	6-8
11	Evidence of reliability	7
12	Evidence of validity	7
13	Methods for verifying data entry	na
14	Use of a codebook	na
15	Sample selection	7
16	Sample size calculation	7
17	Representativeness	7
	Method of sample selection	
18	Description of population and sample frame	7
19	Research tool	7-8
20	Description of the research tool	7-8
21	Description - development of research tool	7-8
22	Instrument pretesting	Na
23	Instrument reliability and validity	Na
24	Scoring methods	7-8
	Results	
25	Results of research presented	10-14
26	Results address objectives	10-14
27	Clear description - results based on part sample	10-14
28	Generalisability	10-14
	Response rates	
29	Response rate stated	10
30	How response rate was calculated	10
31	Discussion of nonresponse bias	17
32	All respondents accounted for	
	Interpretation and discussion	
33	Interpret and discuss findings	14-17
34	Conclusions and recommendations	14-17
35	Limitations	17
	Ethics and disclosure	
36	Consent	6
37	Sponsorship	20
38	Research ethics approval	20
39	Evidence of ethical treatment of human subjects	Na

PLoS Med. 2010 Aug;8(8):e1001069. doi: 10.1371/journal.pmed.1001069. Epub 2011 Aug 2. Reporting guidelines for survey research: an analysis of published guidance and reporting practices. Bennett C1, Khangura S, Brehaut JC, Graham ID, Moher D, Potter BK, Grimshaw JM.

BMJ Open

Twenty-five years after the introduction of Evidence-based Medicine: knowledge, use, attitudes, and barriers among physiotherapists in Italy. A cross-sectional study.

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Keywords:	MEDICAL EDUCATION & TRAINING, REHABILITATION MEDICINE, EPIDEMIOLOGY

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Title: Twenty-five years after the introduction of Evidence-based Medicine: knowledge, use, attitudes, and barriers among physiotherapists in Italy. A cross-sectional study.

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Abstract

Objectives. To explore the knowledge, use, attitudes towards Evidence-based Medicine, also known as Evidence-based Practice (EBP), and perceived barriers to its dissemination among physiotherapists.

Design. Cross-sectional study.

Setting and participants. Members of the Italian Association of Physiotherapists (n=2000) were invited to participate in an online survey about EBP knowledge and use.

Primary outcome measures. The survey questionnaire comprised four sections: 1) Respondent characteristics; 2) Knowledge of EBP principles; 3) Attitude, use, and perceived effectiveness of EBP; 4) Perceived barriers to implementing EBP in clinical practice.

Results. Out of 2000 physiotherapists, 1289 participated in the survey (64.5% response rate). Overall, 90% perceived EBP as useful and necessary for their clinical practice. More than 85% stated that they were familiar with the principles of EBP, 75% reported that they were able to search online databases for relevant information, and 60% reported that they were able to understand statistical analyses. However, 56% believed that patient preferences and 39% that clinical expertise are not part of the EBP model. Half stated that they understood and could explain the term "meta-analysis" but only 17% knew what a forest plot is and just 20% correctly judged the finding of a given meta-analysis. Lack of time was reported as the main barrier to EBP.

Conclusions. The majority of Italian physiotherapists overrated their knowledge about EBP, demonstrating a gap between perceived and actual knowledge of EBP in this population.

Key Words: Evidence-based Practice; Cross-sectional Studies; Physiotherapy Specialty; Surveys and Questionnaires.

Abstract word count: 231 words.

Manuscript word count: 3814 words.

Article summary

Strengths and limitations of this study

- A national web-based survey within a cross-sectional study of Italian physiotherapists was performed.
- The survey response rate was 64.5% (high-moderate) in this sample of 2000 physiotherapists.
- Self-reported data and potential non response bias may affect the results and interpretation of this cross-sectional study.
- Generalizability is limited to a selected population.

Funding: The study was supported by the Italian Ministry of Health, Linea 3 (Consapevolezza e competenza dei principi dell'Evidence-based Medicine (EBP) in coorti di professionisti sanitari coinvolti nell'ambito dei disordini muscoloscheletrici). The funding sources had no controlling role in the study design, data collection, analysis, interpretation or report writing.

Competing interests: The authors declare that they have no competing interests.

Introduction

Evidence-based medicine, also known as Evidence-based practice (EBP), is an internationally recognized movement defined as "*the conscientious, explicit, and judicious use of current best evidence in making decisions about the care of individual patients. The practice of Evidence-based Medicine means integrating individual clinical expertise with the best available external clinical evidence from systematic research.*" (1) The identification and application of patient preferences should be part of decision making. (2) This concept of shared decision making has gained attention in the last decade, with physical medicine and rehabilitation clinicians being more likely to involve patients in making informed decisions. (1, 3)

Using the best available evidence to make healthcare decisions optimizes health outcomes. Issues in EBP have attracted growing debate and discussion, (2, 4, 5) as seen in the increase in the number of scientific articles directly relevant to physiotherapy practice: (6, 7): between 1995 and 2015, randomized controlled trials (RCTs) and systematic reviews (SRs) rose from 45.1% to 59.4%, and from 0% to 14.6%, respectively.(8) Taken together, RCTs and SRs accounted for 74% of physiotherapy research publications in 2015 compared to 45% two decades earlier. (8)

Keeping up with this abundance of research poses a challenge for most clinicians. Not surprisingly, the transfer of research findings into practice is often described as slow, haphazard, and unpredictable. (9) Several studies have explored the perceived knowledge, use, attitudes, and barriers to EBM among physiotherapists, (10-18) however, no similar research exists in the relatively recent Italian context: three-year, full-time university degree courses in physiotherapy were established in 2006. The courses are a mix of academic studies and mandatory internship starting from the first year. Completion of the bachelor's degree is prerequisite to admission to the "Laurea Magistrale" (equivalent to the European Master of Science) and a Doctoral Program.

In addition, no studies to date have investigated the strength of the link between perceived and actual knowledge or highlighted the possible gap that may explain the difficulty physiotherapists have in applying the principles of EBM in clinical practice.

With these points in mind, we investigated the knowledge, the use of, and the attitude towards EBP among Italian physiotherapists and the barriers they perceived to adopting its implementation. Secondary aims were to investigate the gap between perceived and actual knowledge of EBP principles among physiotherapists and to analyse the association between their perceived and actual knowledge and demographic characteristics.

Methods

Design

For this cross-sectional study we conducted an online closed survey of members of the Italian Association of Physiotherapists (Associazione Italiana Fisioterapisti [AIFI]). We developed a survey

questionnaire and posted it on a SurveyMonkey platform(19) for data collection. The study was conducted in compliance with the principles outlined in the Declaration of Helsinki. The survey was anonymous and responses could not be traced back to respondents. Written, informed consent was assumed if the respondents completed and submitted the survey questionnaire after having read the purpose statement. Ethics approval was not necessary. The survey was e-mailed directly to AIFI members and made available for a period of six weeks from May to June 2018. The study followed the Guidelines for Reporting Survey-Based Research. (20, 21)

Patient and Public Involvement

Although there was no direct involvement of patients or the public, the AIFI assisted in the design and delivery of the study. They also sent the questionnaire directly to participants.

Study sample

Before the survey questionnaire was posted online, the AIFI sent an invitation in their e-mail newsletter to all AIFI members explaining the aim and content of the survey. The invitation explained the purpose of the survey, the time needed to complete it (10 minutes), and the type of questions that participants could expect to find. The time estimation was a median based on a questionnaire piloted with six expert physiotherapists in EBP. The survey was linked to a unique respondent that did not display the survey a second time once completed. The survey questionnaire was posted on 4 May 2018. Two weeks later, the AIFI sent out an e-mail reminder to AIFI members who had not yet responded. Responses were treated anonymously.

The AIFI membership database contains more than 10,000 addresses of physiotherapist members (12,514 as of the end of 2019) out of an estimate of 65,000 physiotherapists. Only 2000 are considered active members, which the AIFI secretariat defines as members who received e-mails, exchange and share links on the AIFI website and app, read the AIFI newsletter, and interact with the AIFI channels.

Sample size calculation

We used the sample size calculator (22, 23) provided by SurveyMonkey. The sample size is the number of completed responses we expected to receive: based on a population size of 10,000 (the total number of people we intended to invite to participate in the study, i.e. total number of AIFI members registered at the time of the survey), a 5% margin of error (how accurately the survey results reflect the views of the overall population) and a sampling confidence level of 95% (how confident we can be that the population would select an answer within a certain range). The calculated sample size of completed responses was 370 completed answers. We expected that sending the survey to a target sample of 2000 active members would guarantee 370 completed responses.

Survey questionnaire

The questionnaire was developed based on similar questionnaires reported in the literature. (12, 15, 24) Since the aim was to investigate several contents (perceived and real knowledge, use attitude and barriers), we adapted the existing instruments to create an ad hoc survey that would reflect the above contents. Before sending out the survey, we piloted the questionnaire with six expert physiotherapists in EBP (four senior and two junior researchers, with an average of 8 and 3 years of EBP expertise, respectively) to assess its clarity and accuracy. After revision, the final questionnaire version consisted of 26 items divided into 4 sections: 1) Respondent characteristics (items 1 to 8); 2) Knowledge and ability to critically appraise the literature (items 9 to 16); 3) Use and perceived effectiveness of EBP (items 17 to 24); 4) Perceived barriers to the implementation of EBP in clinical practice (items 25 and 26). Response to all items was mandatory. The questionnaire was written in Italian to make it more suitable for this sample (**Supplementary File 1** – questionnaire, English version).

Section 1 covered demographic characteristics; Section 2, item 9, asked respondents to indicate the origin of their knowledge about EBP basics. If they stated that they did not know the EBP model, the questionnaire terminated; otherwise, for the following items, the respondents were asked where they had acquired their knowledge of EBP and if they were confident with it. The final questions in this section assessed the respondent's actual knowledge of EBP. For instance, item 14 investigated familiarity with some terms often found in the literature, item 15 asked which study design is considered the most reliable and item 16 investigated whether the respondent understood the results of a meta-analysis from a given forest plot. Most of the items in Section 3 were statements to which respondents had to express their agreement on a five-point-Likert scale, with "strongly agree" and "strongly disagree" as anchors, about their perception and use of EBP. In Section 4, item 25, the respondents had to state whether or not they felt barriers to the utilization of EBP exist. If they stated there were no barriers to its utilization, the questionnaire terminated as a conditional question. Otherwise, for item 26, the respondents had to express their opinion about the presence of barriers to the implementation of EBP and to rank them from the most to the least important.

Statistical analyses

Descriptive statistics are presented as medians and interquartile ranges (IQR) or absolute values, percentages and frequencies, when appropriate. The response frequencies were represented and analysed in tabular and graphic formats using Microsoft Excel or Power Point 2010. An automated count of response rate was acquired for each of the four sections in order to determine whether the questionnaires were terminated earlier (i.e., users did not go through all four questionnaire sections). We dichotomized the responses to the 5-point items as "disagree" versus "agree" ("strongly disagree, disagree and neutral" versus "agree and strongly agree" categories). Demographic characteristics (e.g., sex, age, and level of education) were collapsed into categories. We performed logistic regression analysis to examine the association between knowledge of components of the EBP model (questions related to whether patient values and clinical expertise are considered in the EBP model) and

demographic characteristics of the respondent (age, sex, working time, and level of education). Results were considered statistically significant when p <0.05. Odds ratios and their 95% confidence intervals were determined for each level of the independent variables. Odds ratios in this context describe the likelihood of demonstrating a particular behaviour and use (e.g., understanding that the EBP model comprises patient values) given a particular characteristic (e.g., age). One level of each demographic characteristic was used as the reference group against which the odds of demonstrating the behaviour and use at all other levels of the variable were measured. The reference group was the last category to allow the most salient interpretation of results. Confidence intervals provided information about the precision of the estimates. We chose to examine univariate rather than multivariate associations for presenting our data at its most simple level so as to have a foundation for future hypothesis testing. Data were exported from the SurveyMonkey and analysed with STATA software (25).

Results

Respondent characteristics

A total of 2000 physiotherapists constituted the number of potential survey questionnaire respondents. Based on this number, the response rate was moderate (1289/2000, 64.5%). The number of respondents was far higher than our target sample (n=323). The response rate decreased from Section 1 to Section 3 due to the presence of conditional branching logic items (item 9 and item 25) in the survey questionnaire. The response rate for each completed section differed: 56% (n=1113) response rate for Section 1 (demographics); 42% (n=837) for Section 2 (knowledge of EBP); and 41% (n=818) for Section 3 (use and perceived effectiveness of EBP). The sample included in each section is reported in Figure 1.

[Figure 1]

Figure 1. Flow diagram of the study.

The median age of the respondents was 35 years (IQR 28-47), and 52% were women. Around 60% of respondents worked in a private practice (653/1113) and 27% in a hospital (305/1113); 87% spent most of their work time in clinical practice (968/1113). **Table 1** presents the demographic characteristics of the sample.

[Table 1]

Table 1. Sample Characteristics.

EBP Knowledge and ability to critically appraise literature

Two respondents skipped this section. A total of 1111 respondents answered the item investigating knowledge of EBP principles. The majority (85%) stated that they knew the EBP model. The most frequent channels for learning the principles of EBP were conferences/meetings (48%), distance and residential learning courses (35%), and advanced continuing professional educational courses (35%). Only 23% of respondents stated they learned about EBP during their undergraduate studies (**Supplementary file 2**).

Regarding the sources physiotherapists consult to solve clinical problems, the majority of respondents stated that their preferred information channels were discussion with peers (80%) and literature search (86%); 30% stated that they relied on their own experience. In addition, 78% stated they felt competent about applying EBP, whereas 1.2% stated they felt completely unable to apply EBP. More than half (61%) were confident in their ability to critically appraise quality assessments of study design and statistical analysis. Many stated they understood the meaning of the terms "RCTs" (72%), "statistical significance" (65%), and "meta-analysis" (52%),but few could explain the terms "forest plot" (17%) and "confidence intervals" (38%) (**Table 2**). In addition, while 82% correctly identified the best study design to evaluate an intervention only 20% were able to identify the result from the overall estimate of a given meta-analysis.

[Table 2]

Table 2. Self-reported comprehension of terms (837 responded, 453 skipped).

Use and perceived effectiveness of EBP

An overwhelming 90% of respondents agreed that EBP is useful, comprehensive of patient values, and effective, which demonstrated an overall positive attitude towards its use (90%). But while 90% knew that the scientific literature makes up part of the EBP, many respondents failed to consider the role of patients' desire (56%) and clinical expertise (39%) as part of the EBP process (Figure 2).

[Figure 2]

Figure 2. Perceived knowledge of basic principles of EBP: patients' desire, clinical expertise, and scientific literature.

In a typical month, 59% of the respondents stated they read between 1 and 5 articles and only 9% said they did not. In addition, 55% stated that they make clinical decisions based on their scientific readings, 80% expressed a need to increase their use of EBP, and 69% reported that it would benefit their career.

Association between sample characteristics and EBP knowledge

We found a statistically significant association between items related to how physiotherapists perceived EBP principles (patient values and clinical expertise) and sample demographic variables entered into the model (age, sex, working time, level of education) (**Table 3**). With regard to the questionnaire item on patients' values as part of the EBP model, young physiotherapists (age < 29 years) seemed to be more aware of patient's value in the EBP model than their older counterparts (age > 49 years) (odds ratio [OR] 1.57, 95% confidence interval [CI] 1.02 - 2.42); being male increased the odds as well (OR 0.50, 95% CI 0.38 – 0.67). Physiotherapists who work in patient care (e.g., clinical practices) were less likely to report they understood the EBP model (OR 0.99, 95% CI 0.98 – 0.99) than those who work in another setting. In contrast, respondents working in research (OR 1.02, 95% CI 1.01 – 1.03) and teaching (OR 1.01, 95% CI 1.002 – 1.02) were more likely to recognize patient's value as part of the EBP model, and respondents with a MSc degree (OR 2.06, 95% CI 1.31 – 3.21) were twice more likely than those without a MSc degree to recognize it. The same difference was observed for respondents with a higher academic degree (1st level Specialist Master's degree, OR 2.69, 95% CI 1.98 – 3.64; Doctor of philosophy, OR 10.33, 95% CI 1.28 – 83.00).

Regarding the questionnaire item on clinical expertise as part of the EBP model, male respondents were more likely to include expertise in the EBP model (OR 0.65, 95% CI 0.49 – 0.86). Respondents working in patient care (OR 0.99, 95% CI 0.98 – 0.99) seemed less likely to understand the EBP model than respondents not working with patients (OR 0.65, 95% CI 0.49 – 0.86). Finally, having a higher academic degree (MSc, OR 2.16, 95% CI 1.31 – 3.58; 1st level Specialist MSc, OR 1.99, 95% CI 1.45 – 2.75) was associated with twice the likelihood of including clinical expertise in the EBP model (**Table 3**).

[Table 3]

Table 3. Association between actual knowledge of EBP and selected variables.

Perceived barriers to using EBP in clinical practice

Respondents stated that major barriers to applying EBP exist (570/815, 75%): lack of time and lack of ability to critically appraise the literature were rated as the top two barriers. Lack of time was ranked as the most important (Table 4).

[Table 4]

Table 4. Barriers to applying EBP in order of importance (%).

Discussion

Main findings

The questionnaire response rate of 64.5% (1289 physiotherapists out of 2000 invited) was higher than the required sample size of 370, and so can be considered representative of physiotherapists belonging to the AIFI. Overall, the respondents stated they held a positive attitude towards EBP and that their knowledge about it was extensive. The majority overrated their knowledge, however, and demonstrated a shallow awareness of EBP compared to the original model described by David Sackett. (26) The gap between perceived and actual knowledge of EBP is relevant and can result in inadequate practice, potentially increasing the risk "to over-egg the pudding", which indicates the need to achieve the right balance in health care. (27)

Our survey findings are similar to those obtained from American physiotherapists 15 years ago (12) and, more recently, from Ghanaian physiotherapists who demonstrated an inadequate knowledge of EBP (14). In contrast, Brazilian physiotherapists showed that they were better acquainted with EBP since they included patient preferences as part of the decision-making process (15). In Europe, Swedish physiotherapists consider patient preferences when treating according to guidelines, and so adhere to the EBP process(28). However, the international context in which physiotherapists deliver health care might differ from the scenario in Italy, where direct access is not yet completely implemented and fewer years of study than in other countries are required for qualifying as a physiotherapist. (29, 30)

In our sample, younger respondents were noted to be more familiar with EBP than their older, more experienced colleagues. Our findings are shared by similar observations that the level of EBP knowledge is influenced by the time since school graduation. In general, recent graduates are more likely to follow EBP than physiotherapists with more clinical experience. (11) We also observed that EBP knowledge differed depending on the respondent's level of education and workplace setting. (11-13) Indeed, personal and organizational characteristics can significantly influence attitudes, beliefs, use of EBP, and perceived support. (31)

Of the total of respondents with a Bachelor's degree, only one fifth had received education in EBP. The levels of education most closely associated with greater EBP knowledge are the graduate and postgraduate levels. The teaching of EBP principles in undergraduate courses remains scarce, although it is widely considered essential for improving the quality of health care and patient outcomes. In many countries, studies have highlighted that physiotherapists require more training in EBP in order to acquire confidence in using it; (11) however, the teaching of EBP-oriented skills in undergraduate physiotherapy programmes began only two decades ago. (32-34) Since then, EBP has been increasingly integrated into the core curriculum of undergraduate and postgraduate health care programs and continuing professional education. (35-37) Italy is no exception: the teaching of EBP became an integral part of the core curriculum of physiotherapy in 2005. (22) This statement is consistent with our study's finding that younger Italian physiotherapists (age <29 years) are more likely to hold positive attitudes towards EBP, which indicates that EBP will be more widely adopted by future generations of physiotherapists.

Moreover, better informed knowledge, use, and attitudes towards EBP may be most strongly associated with completion of a Master's degree program, whereas short, continuing professional educational courses have limited effectiveness. Accordingly, it might be appropriate to support access to Master's degree courses at the national level and to improve the quality of short training courses and structure them on EBP principles.

The perceived and actual knowledge and the use of evidence from the scientific literature differed among respondents. While the majority felt able to conduct a literature search and to critically appraise the statistical analysis in a scientific article, few demonstrated that they understood the results of a meta-analysis from a given forest plot. Nevertheless, the respondents appeared to have great confidence in the authority of published scientific literature and stated that their clinical decisions rarely relied on their experience alone: the attitude and the attempt to introduce findings from the scientific literature in the clinical context is congruent with their positive attitude towards EBP.

The discrepancy between actual knowledge and practice of EBP could be a consequence of the myriad information sources accessible in scientific databases and non-scientific channels, such as Doctor Google or social networks. Health care professionals, including physiotherapists, need to develop their analytical skills to confront this overabundance of information in their professional life: exercise a careful selection of what to read and what not to for both quality and quantity. (38) Indeed, three quarters of our respondents perceived barriers that limit their ability to critically appraise the literature. (11-13, 28, 39, 40)

Strengths and limitations

This is the first study to examine perceived and actual knowledge of EBP among physiotherapists in Italy. Although the response rate was high-moderate (64.5%), the study has several limitations that need to be considered when analysing the results. First, our sample included only AIFI members who may not be representative of the entire population of Italian physiotherapists, as it might be that AIFI members are more likely to participate in a survey about their profession. Moreover, respondents, as AIFI members, were perhaps more open towards EBP but overestimated their knowledge: the self-reported nature of the data might have influenced the gap between perceived and actual knowledge. This gap constituted a small part of the broader scope of the study, the aim of which is to test our preliminary hypothesis about the gap and to provide a concise snapshot view that can be better assessed by validated instruments, such as the Fresno Test or the Berlin Questionnaire, in a future study,. (41, 42) Nonetheless, before the professional registry of Italian physiotherapists was established in 2018, the AIFI was the only professional society for physiotherapists in Italy and was not constituted as a scientific society. Second, sending out only one reminder to participate in the survey might have limited the number of potential respondents. A potential non response bias might have affected the results and interpretation of this cross-sectional study. Factors such as questionnaire length, the term ”survey” in

the text of the e-mail, and the non-inclusion of incentives might have influenced the rate response: a Cochrane review showed a lower odds of response in such situations. (43)

That said, the final percentage of respondents did not seem to bias our results, as we reached the planned sample target down to the final survey questionnaire items. Third, we dichotomized the dependent variables, conflating all responses into positive/negative categories. This might have resulted in a loss of some information, though we replicated what previous studies of the same design have done (12) in order to report useful findings. Finally, the accuracy of data on perceived knowledge is uncertain as the data were collected via a self-reported survey.

Implication for research, practice and education

We believe that research can help to increase the dissemination of knowledge about and the adoption of EBP among physiotherapists. A focus for future research should be to concentrate efforts in conducting high-quality research and teaching master classes devoted to EBP topics (44) and promoting research learning programmes as knowledge translation interventions to improve the use of EBP and clinical practice guidelines (CPGs) in physiotherapy. (45) CPGs, defined as "systematically developed statements to assist practitioner and patient decisions about appropriate health care for specific clinical circumstances" (definition adopted by the European Region of the World Confederation for Physiotherapy), can be used to bridge the research-to practice gap and promote EBP and present research findings to clinicians in a synthetic format without missing any elements of the EBP model. (9) CPGs based on the Grades of Recommendation, Assessment, Development, and Evaluation (GRADE) approach are conducted in a standardized and transparent manner: GRADE rates the quality of evidence and provides the strength of recommendations by considering the "estimates of effect for desirable and undesirable outcomes of interest", the "confidence in the estimates of effect", the "estimates of values and preferences", and the "resource use". (46) This approach helps readers interpret a CPG and enhances CPG adherence by health professionals. In some countries, professional liability is legally regulated and great importance placed on adherence to CPGs in clinical practice; compliance with CPGs is an element in attributing professional responsibility in adverse events. Furthermore, to improve physiotherapist adherence to CPGs, computerized decision support systems could provide actionable recommendations or management options that are intelligently filtered or presented at appropriate times to improve efficiency in health care. (47)

For these reasons, both national and international initiatives are warranted for the implementation of CPGs in physiotherapy. The production of CPGs, or at least a synthesis of the evidence underpinning them, could be (and is to some extent) coordinated on a national level, while implementation may be more suitable for local adaptation. (48) For instance, the recently created Italian National Guidelines System (49) includes a list of scientific societies that can contribute to drafting CPGs (including the AIFI), a process based on the GRADE method for the production, adaptation, and updating of CPG. By

searching this database, health care professionals can find continuously updated CPGs and good quality practices.

We appeal for a critical use and appraisal of EBP. EBP should be included in the professional education of physiotherapists and introduced at the undergraduate curriculum. Investing in the training of physiotherapists is essential for growing the skills of critical appraisal of evidence-based physiotherapy and a key means to reduce the waste created by obsolete, futile or harmful interventions. (8) For instance, initiatives such as INQUIRE (INcreasing QUality In patient-oriented academic clinical Research) have designed a roadmap that provides guidance for academics and researchers in developing quality enhancement initiatives. (50) The PEAK (The Physical therapist-driven Education for Actionable Knowledge translation) educational program was designed to promote the integration of research evidence from physiotherapy into clinical decision making. (19, 51, 52) Finally, engaging in research can contribute to being an attractive employer and boost the application of EBP. (13) Promoting professional education is key to minimize "the mismatch between what clinical researchers do and what patients need". (53)

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Declarations

Ethical approval: We conducted this study in compliance with the principles outlined in the Declaration of Helsinki. The survey questionnaire was filled out anonymously, and responses could not be traced back to respondents. Written, informed consent was assumed if the respondents completed and submitted the survey after reading the purpose statement of the study. Ethics approval was not required.

Availability of data and material: All data generated or analysed during this study are available at https://osf.io/8xb6p/?view_only=1c6fd76403c04a82942799b9dee952c8 .

Authors' contributions: SG and GC were primarily responsible for study conception and design and for data analysis and interpretation. All authors (SG, GC, DC, SC) had full access to all of the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis. DC led the writing of the first draft of the manuscript. DC and SC authors contributed to drafting and revising the manuscript. SG is the guarantor. All authors (SG, GC, DC, SC) read and approved the final manuscript.

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Table 1. Sample Characteristics.

Characteristic*		Frequency (%)
Sex (n=1289)	Male	48
	Female	52
Age, yrs (n=1289)	<29	28
	29-38	31
	39-49	18
	>49	23
Workplace** (n=1113)	Private office	59
	Teaching hospital	7
	Hospital	20
	Nursing home	15
	Unemployed	2
	Other	17
Working time spent in: (average) (n=1113)	Clinical practice	87
	Research	11
	Teaching	6
	Management/Leadership	2

*The absolute number of respondents varies for each variable due to missing data.

**Percentage may exceed 100% because some items allowed more than one answer

598 **Table 2**. Perceived knowledge of terms (837 responded, 453 skipped).

	Understood and could explain No. (%)	**Understood somewhat No. (%)**	**Did not understand No. (%)**	**Unknown No. (%)**
Randomized-controlled trials	604 (72)	192 (23)	41 (5)	0 (0)
Meta-analysis	439 (52)	304 (37)	86 (10)	8 (1)
Relative risk	250 (30)	428 (51)	135 (16)	24 (3)
Statistical significance	543 (65)	246 (29)	41 (5)	7 (1)
Forest plot	144 (17)	197 (24)	147 (17)	349 (42)
Intention to treat	255 (30)	223 (27)	167 (20)	192 (23)
Confidence interval	316 (39)	271 (32)	176 (18)	104 (11)

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Table 3. Association between actual knowledge of EBP and selected variables. References categories are reported in legend.

	Characteristics			Odds ratio (95% CI)	Model P*
In your opinion, are patients' values and preferences a part of the EBP model?	**Age (yrs)**[a]	(n=818)	<29	1.57 (1.02 - 2.42)**	0.001
			29-38	1.03 (0.66 - 1.59)	
			39-49	0.68 (0.39 - 1.17)	
			>49	Reference	
	Sex[b]	(n=818)	Female	0.50 (0.38 – 0.67)**	0.000
			Male	Reference	
	Working time [c]	(n=814)	Patient care	0.99 (0.98 – 0.995)**	0.002
		(n=567)	Research	1.02 (1.01 – 1.03)**	0.001
		(n=609)	Teaching	1.01 (1.002 – 1.02)**	0.015
		(n=492)	Management	1.00 (0.98 – 1.02)	0.62
	Level of education[c]	(n=818)	Bachelor's degree	1.04 (0.75 – 1.45)	0.81
			Master of Science degree	2.06 (1.31 – 3.21)**	0.001
			1st level Specialist Master's degree	2.69 (1.98 – 3.64)**	0.000
			2nd level Specialist Master's degree	0.84 (0.14 – 5.07)	0.85
			Advanced continuing professional education	1.06 (0.80 – 1.42)	0.67
			Doctor of philosophy (PhD)	10.33 (1.28 – 83.00)**	0.005
			Distance and residential learning course	1.00 (0.75 – 1.34)	0.99
			Conferences/Meetings	1.40 (1.06 – 1.85)**	0.015
In your opinion, is clinical	**Age (yrs)** [a]	(n=818)	<29	1.43 (0.93 - 2.21)	0.11
			29-38	1.00 (0.65 - 1.55)	

expertise a part of the EBP model?			39-49	0.97 (0.57 - 1.64)	
			>49	Reference	
	Sex[b]	(n=818)	Female	0.65 (0.49 – 0.86)**	0.008
			Male	Reference	
	Working time [c]	(n=814)	Patient care	0.99 (0.98 – 0.99)**	0.032
		(n=567)	Research	1.01 (0.99 – 1.02)	0.24
		(n=609)	Teaching	1.01 (0.99 – 1.02)	0.14
		(n=492)	Management	0.98 (0.97 – 1.01)	0.32
	Level of education[c]	(n=818)	Bachelor's degree	1.25 (0.89 – 1.76)	0.19
			Master of Science degree	2.16 (1.31 – 3.58)**	0.002
			1st level Specialist Master's degree	1.99 (1.45 – 2.75)**	0.000
			2nd level Specialist Master's degree	0.97 (0.16 – 5.86)	0.98
			Advanced continuing professional education	0.90 (0.67 – 1.21)	0.49
			Doctor of philosophy (PhD)	0.26 (0.65 – 42.27)	0.06
			Distance and residential learning course	1.08 (0.80 – 1.45)	0.61
			Conferences/Meetings	1.20 (0.91 – 1.59)	0.20

Legend:

* Chi-square test

** Statistically significant (p <0.05)

[a] Odds ratio calculated using the variable >49 years as reference.

[b] Odds ratio calculated using the variable male as reference.

[c] Odds ratio calculated as the ratio between the odds in the presence of characteristics variable against the odds in the absence of the variable. (i.e., characteristic: working time; variable: patient care. The odds ratio is the ratio between the odds of working in patient care against the odds of not working in patient care).

First level master's degree: equivalent to postgraduate diploma: program for which a bachelor's degree is a prerequisite.
Second level master degree: postgraduate level for which a master of science degree is a prerequisite.
Advanced continuing professional education: postgraduate certification

Table 4. Barriers to applying EBP in order of importance (%).

Type of barrier	Order of importance from the most to the least (%)									
	1st	2nd	3nd	4th	5th	6th	7th	8th	9th	10
Lack of interest	10.7	8.3	5.6	6.9	6.2	7.0	10.2	10.7	10.7	23.7
Applicability of EBP findings to clinical practice	11.1	12.8	9.7	8.4	13.5	9.8	9.5	8.8	7.6	8.8
Lack of time	23.0	13.2	15.1	10.0	9.0	9.0	5.8	5.5	5.8	3.7
Difficulty in searching literature in databases	9.5	11.8	14.4	15.1	13.7	14.6	10.5	7.6	0.0	0.9
Difficulty in critically appraising literature and statistical analysis	9.7	17.8	16.5	16.7	16.9	9.3	6.0	4.0	2.1	1.1
Difficulty applying literature findings to individual patients	9.5	11.4	12.7	14.1	12.7	16.9	11.3	5.6	5.5	0.5
Lack of financial and organizational support (computer, access to databases)	8.4	7.4	8.6	8.8	8.8	10.5	20.6	12.8	7.4	6.7
Workplace does not use EBP	12.0	11.3	9.7	9.8	9.8	9.5	10.0	17.8	6.0	4.2
Language of scientific publications	4.8	3.0	5.1	6.3	7.4	8.6	10.0	15.6	30.8	8.4
Unfamiliarity with using the computer/technology	1.4	3.2	2.6	3.9	2.1	4.8	6.2	11.6	22.3	42.0

Figure Legend

Figure 1. Flow diagram of the study.

Figure 2. Perceived knowledge of the basic principles EBP: patients' values, clinical expertise, and scientific literature.

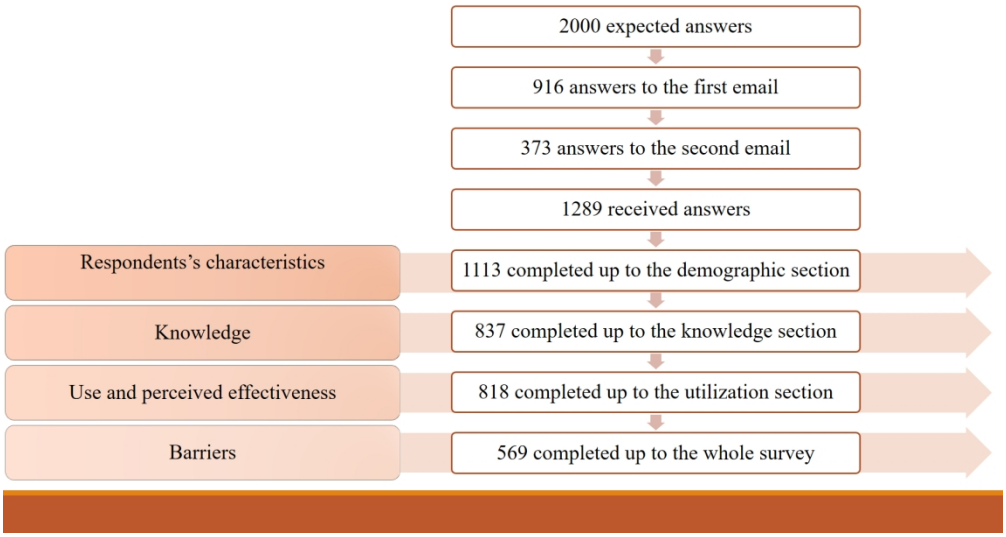

Figure 1.

81x45mm (600 x 600 DPI)

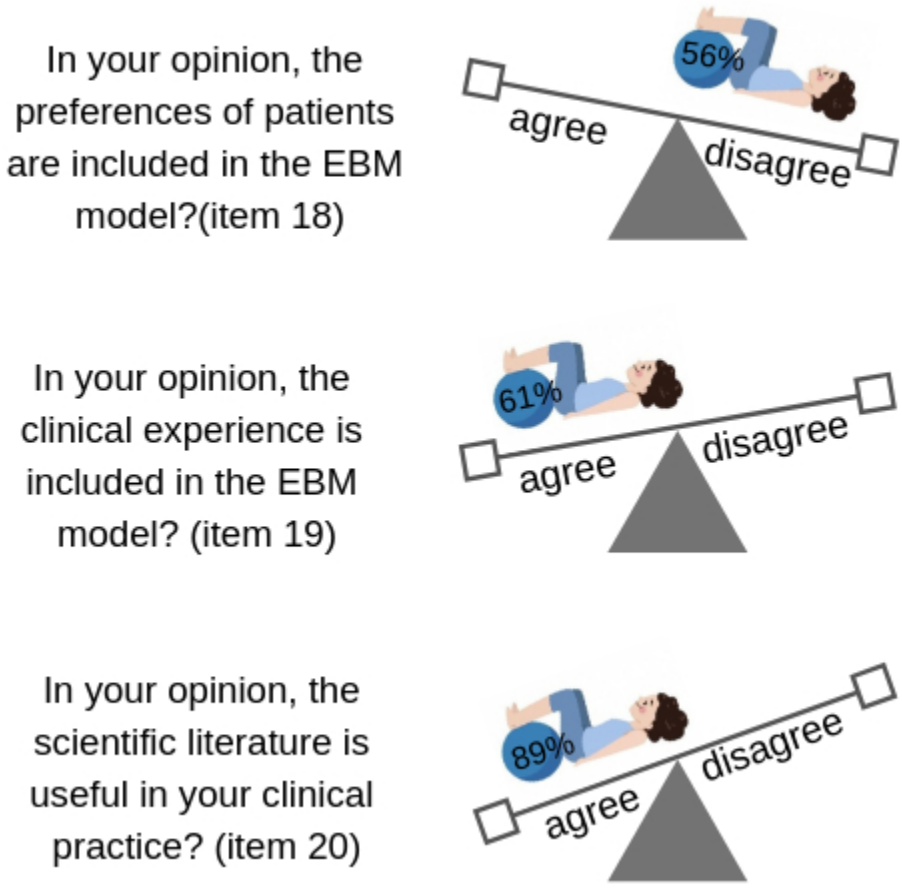
In your opinion, the preferences of patients are included in the EBM model?(item 18)
56%
agree
disagree
In your opinion, the clinical experience is included in the EBM model? (item 19)
61%
agree
disagree
In your opinion, the scientific literature is useful in your clinical practice? (item 20)
89%
agree
disagree

Figure 2.

Evidence-Based Practice (EBP) Questionnaire[a]

SECTION 1. General information

For the following items, place a mark x *in the appropriate box next that indicates your response.*

1.What is your sex?

□ Male □ Female

2. What is your age? ____

3. Where did you acquire the license to practice as Physiotherapist (PT)?

□ Italy □ Abroad

4. In which Italian region did you acquire your physiotherapist's degree (degree or equivalent title)?

_____

5. In which University (eg., Università degli Studi di Genova) o other (e.g.,. Scuola Dirette ai Fini Speciali/Scuole Regionali) did you acquire your PT title?

_____

6. When did you acquire your title to practice as physiotherapist (e.g., 2005)

_____

7. Where did you mostly practice your profession?

□ Private practice

□ Research Hospital

□ Clinical Hospital

□ Residential and nursing home

□ Unemployed (e.g. student)

□ Others _____

8. Please indicate the percentage of your total work time that you spend in each type of activity during an average month.

a) Patient care □ %

b) Research □ %

c) Teaching □ %

d) Management (as Director) □ %

SECTION 2. Knowledge of EBP principles

9. Do you know the Evidence Base Practice (EBP) model?

□ Yes □ No

10. Where did you learn the foundations of EBP

- Bachelor's degree
- Master of Science degree
- 1st level Specialist Masters degree
- 2nd level Specialist Masters degree

- Advanced continuing professional education
- Doctor of philosophy (PhD)
- Distance and residential learning course
- Conferences/Meetings

11. When you did not know how to manage a clinical issue, how did you behave?

- I rely on my experience
- I discuss with colleagues
- I consult the scientific literature
- It has never happened

12. I'm able to launch search strategies for finding research relevant to my practice (e.g., Pubmed)

□ Strongly Disagree □ Disagree □ Neutral □ Agree □ Strongly Agree

13. I am confident in my ability to critically review the literature (quality assessment, statistical and clinical significance).

□ Strongly Disagree □ Disagree □ Neutral □ Agree □ Strongly Agree

For the following item, place a mark v *in one box in the row for each term.*

14. My understanding of the following terms is:

Term	**Understand Completely**	**Understand Somewhat**	**Do Not Understand**
a) Randomized controlled trial	□	□	□
b) Meta-analysis	□	□	□
c) Relative risk	□	□	□
d) statistical significance	□	□	□
e) Forest plot	□	□	□
d) Intention to treat	□	□	□
f) Confidence interval	□	□	□

15. In your experience, which is the best study design to assess the efficacy of a rehabilitative intervention?

- Case report/case series
- Cohort observational study
- Case – control observational study
- Controlled clinical study
- Randomized controlled clinical study
- I don't know

16. A systematic review, comparing exercise versus manual therapy in acute low back pain for reducing disability at 3 months of follow-up, reports the following result (please, see the figure below). What is your interpretation?

- I don't know
- Esercise is more efficacious than manual therapy
- Exercise is less efficacious than manual therapy

- Both have the same efficacy

Review: Motor control exercise for chronic non-specific low-back pain

Comparison: 2 Motor control exercise versus manual therapy

Outcome: 2 Disability

Study or subgroup	Motor control exercise N	Mean(SD)	Manual therapy N	Mean(SD)	Mean Difference IV,Random,95% CI	Weight	Mean Difference IV,Random,95% CI
1 Short-term (< 3 months from randomisation)							
Ferreira 2007	80	32.92 (23.75)	80	32.92 (25)		25.4 %	0.0 [-7.56, 7.56]
Rabin 2014	32	16.1 (11.2)	49	20.2 (16)		41.3 %	-4.10 [-10.03, 1.83]
Rasmussen-Barr 2003	22	10.7 (7.6)	19	14 (12.9)		33.2 %	-3.30 [-9.91, 3.31]
Subtotal (95% CI)	**134**		**148**			**100.0 %**	**-2.79 [-6.60, 1.02]**

Heterogeneity: $Tau^2 = 0.0$; $Chi^2 = 0.73$, df = 2 (P = 0.69); $I^2 = 0.0\%$

Test for overall effect: Z = 1.44 (P = 0.15)

SECTION 3: Personal attitudes toward, use of, and perceived benefits and limitations of EBP.

For the following items, place a mark x *in the appropriate box that indicates your response.*

17. Application of EBP is necessary in the practice of physiotherapy.

□ Strongly disagree □ Disagree □ Neutral □ Agree □ Strongly Agree

18. EBP takes into account the patient's preferences and values.

□ Strongly disagree □ Disagree □ Neutral □ Agree □ Strongly Agree

19. EBP takes into account the clinical experience.

□ Strongly disagree □ Disagree □ Neutral □ Agree □ Strongly Agree

20. Literature and research findings are useful in EBP in my daily practice.

□ Strongly disagree □ Disagree □ Neutral □ Agree □ Strongly Agree

21. Read/review research/literature related to my clinical practice (a typical month).

□Never □ 1–5 articles □ 6–10 articles □ 11–15 articles □ 16 articles

22. Use literature and research findings in the process of clinical decision making (a typical month).

□Never □ few times □ the majority of times □ always

23. I need to increase the use of EBP in my daily practice.

□ Strongly Disagree □ Disagree □ Neutral □ Agree □ Strongly Agree

24. My career will benefit from a more uptake of EBP into my clinical practice.

□ Strongly Disagree □ Disagree □ Neutral □ Agree □ Strongly Agree

SECTION 4: Barriers of EBP.

25. Do you think there are limitations in using EBP in clinical practice?

□ Yes □ No □ Do Not Know

For the following items, rank from 1 to 10 by placing numbers in the appropriate boxes (1most important).

26. Rank from 1 (most important) to 10 (least important) the barriers to the use of EBP in your clinical practice.

□ The adoption of EBP is inapplicable in physiotherapy

□ Insufficient time

□ Lack of instrumental resources in my facility (PCs, free scientific databases)

□ Poor ability to use the computers/techonology

□ Poor ability to systematically search the literature

□ Poor ability to critically appraise the literature

□ Lack of generalizability of the literature findings to my patient population

□ Lack of understanding English language

□ Lack of collective support among my colleagues in my facility, lack of a stimulating environment

□ Lack of interest

[a] The questionnaire published by Jette et al. 2003 was adapted by the authors and contains elements as reported by McColl et al.

Supplementary file 2. Reponses to question regarding the contribution of education to learning the principles of EBP (837 answered, 453 did not).

	A lot **No. (%)**	**A little** **No. (%)**	**Not at all** **No. (%)**	**Omitted** **No. (%)**
Bachelor's degree	194 (23)	409 (49)	201 (24)	33 (4)
Master's of Science degree	93 (11)	61 (7)	18 (2)	665 (79)
1st level Specialist Master's degree	256 (31)	60 (7)	18 (2)	503 (60)
2nd level Specialist Master's degree	(1)5	8 (1)	11 (1)	813 (97)
Advanced continuing professional education	293 (35)	187 (22)	31 (4)	326 (39)
Doctor of philosophy (PhD)	9 (1)	8 (1)	14 (2)	806 (96)
Distance and residential learning course	292 (35)	272 (32.5)	39 (4.7)	234 (28)
Conferences/Meetings	404 (48)	354 (42)	30 (4)	49 (6)

Checklist items for reporting survey research.

	Section & Topic	Reported on page #
	Background	
1	Justification of research method	5-6
2	Background literature review	5-6
3	Explicit research question	5-6
4	Clear study objectives	5-6
	Methods	
5	Description of methods used for data analysis	9
6	Method of questionnaire administration	7-8
7	Location of data collection	6-7
8	Dates of data collection	6-7
9	Number and types of contact	6-7
10	Methods sufficiently described for replication	6-8
11	Evidence of reliability	7
12	Evidence of validity	7
13	Methods for verifying data entry	na
14	Use of a codebook	na
15	Sample selection	7
16	Sample size calculation	7
17	Representativeness	7
	Method of sample selection	
18	Description of population and sample frame	7
19	Research tool	7-8
20	Description of the research tool	7-8
21	Description - development of research tool	7-8
22	Instrument pretesting	Na
23	Instrument reliability and validity	Na
24	Scoring methods	7-8
	Results	
25	Results of research presented	10-14
26	Results address objectives	10-14
27	Clear description - results based on part sample	10-14
28	Generalisability	10-14
	Response rates	
29	Response rate stated	10
30	How response rate was calculated	10
31	Discussion of nonresponse bias	17
32	All respondents accounted for	
	Interpretation and discussion	
33	Interpret and discuss findings	14-17
34	Conclusions and recommendations	14-17
35	Limitations	17
	Ethics and disclosure	
36	Consent	6
37	Sponsorship	20
38	Research ethics approval	20
39	Evidence of ethical treatment of human subjects	Na

PLoS Med. 2010 Aug;8(8):e1001069. doi: 10.1371/journal.pmed.1001069. Epub 2011 Aug 2. Reporting guidelines for survey research: an analysis of published guidance and reporting practices. Bennett C1, Khangura S, Brehaut JC, Graham ID, Moher D, Potter BK, Grimshaw JM.