Knowledge of physiotherapists on the use of Muscle Energy Technique in the management of Non-Specific Low Back Pain

Usman Abba Ahmed (✉ uabba45@yahoo.com)
Rasheed Shekoni Teaching Hospital  https://orcid.org/0000-0001-8495-4431

SONILL Sooknunan Maharaj
University of KwaZulu-Natal College of Health Sciences

Nadasan Thaya
University of KwaZulu-Natal

Bashir Kaka
Bayero University College of Health Sciences

Ashiyat Kahinde Akodu
University of Lagos

Research article

Keywords: Non-specific low back pain, Muscle Energy Technique, Physiotherapists knowledge, Nigeria

DOI: https://doi.org/10.21203/rs.2.17864/v1

License: © This work is licensed under a Creative Commons Attribution 4.0 International License.  Read Full License
Abstract

Objective: The relevance and use of Muscle Energy Technique (MET) as a mode of treatment for Non-specific low back pain (NSLBP) over the last two decades has increased among physiotherapists and other health professionals. This supports the clinical relevance and efficacy of this technique. However, there are no studies to determine the level of MET knowledge among Nigerian physiotherapists. This study was designed to determine the MET knowledge among Nigerian physiotherapists.

Method: A total of one hundred and twenty physiotherapists were recruited from the database of the Nigerian Society of Physiotherapy and participated in the study. They completed a semi-structured questionnaire containing 46-items. This was divided into four sections which sourced information on sociodemographic characteristics, work-profile, treatment activities and the knowledge of MET for the management of NSLBP. Data were analyzed using descriptive statistics for mean, frequency and percentages. Inferential statistics of Chi-square, Pearson Correlation, independent t-test and ANOVA were used to determine the significant difference with significance set at \( p < 0.05 \).

Result: The study revealed that 16.7% of the participants had knowledge of the application of MET in the management for NSLBP. Age, educational level, practice setting, area of specialization such as musculoskeletal therapy, ergonomics and additional training of low back pain (LBP) were factors that influenced respondents’ MET knowledge \( (p < 0.05) \). However, gender, university of training, number of years of experience and the practice of managing of LBP in the physiotherapy department did not influence knowledge of MET for the management of NSLBP \( (p > 0.05) \).

Conclusion: This study showed that a small number of participants had knowledge of MET application in the management of NSLBP and certain factors influenced this knowledge. Keywords: Non-specific low back pain, Muscle Energy Technique, Physiotherapists knowledge, Nigeria

Background

Low back pain (LBP) is arguably the most prevalent musculoskeletal condition found among both developed and developing nations [1, 2, 3]. Broadly defined as pain or discomfort in the lumbar region of the spine, it is the leading cause of activity limitations, resulting in significant losses in productivity at work and incurs billions of dollars in medical expenditure annually [2, 3, 4].

A high prevalence of LBP has been associated with lower socioeconomic status and lower education levels [4, 5]. According to the Global Burden of Disease (GBD) 2010 study, LBP is currently the 6th highest burden on a list of 291 conditions and is the cause of more years lived with disability globally than any other disease [6]. LBP affects anyone, of any gender, race or socioeconomic background [5] and has a substantial impact on the overall and financial well-being of an individual and the society [4, 7].

Therefore, it was postulated that the burden of LBP would be greater in lower and middle-income countries like those situated in Africa [7, 8]. A recent systematic review and meta-analysis published in 2018 revealed that the lifetime, annual and point prevalence of LBP among African nations, was higher than the global LBP prevalence [9]. The majority of the studies included in this meta-analysis were conducted in Nigeria, which is a lower-middle-income country [9]. In Nigeria, the annual prevalence rate of LBP has been reported between 33% and 74%, mostly affecting workers [10]. The prognosis after an acute episode of LBP is less favourable than once thought, as 60–80% of the patients will experience recurrence or persistence of this disabling condition [11]. Despite the high incidence and prevalence of LBP little is known about the precise causes. As a clear patho-anatomic diagnosis cannot be identified in 85% of the patients [12], LBP in these patients is labelled as non-specific (NSLBP).

Despite extensive researches, the issue of spinal pain management still constitutes a challenge for physicians, physiotherapists, and researchers [13]. There are many therapies claimed to be useful for the treatment of NSLBP, but most of these treatments have not been well investigated or have been found to have modest effects in terms of pain relief and improving disability. Conservative treatment remains the best choice and usually involves physiotherapy [13, 14]. However, some physiotherapeutic techniques reported to be effective in the management of NSLBP are not very popular among physiotherapists, especially those techniques that were originally developed by other health professionals (e.g. Osteopaths, Chiropractors) who are also involved in the management of LBP. This could lead to lack of awareness and poor knowledge of the use of such techniques among physiotherapists, particularly the physiotherapists that practice in Nigeria and other African countries where there is near non-existence of functional rehabilitation team and professional teamwork.

A non-invasive, safe and inexpensive treatment technique used by physiotherapists, osteopaths, chiropractors and manual therapists in the treatment of NSLBP is Muscle Energy Technique (MET) [15]. It was developed 50 years ago by Fred Mitchell Sr and was then refined and partially modified by his son Fred Mitchell Jr [15, 16], the first manual for the technique was published in 1979 [17].

MET involves alternating periods of resisted muscle contractions and assisted stretching and it has been suggested that MET can be used to lengthen a shortened muscle, mobilize an articulation with restricted mobility, strengthen a physiologically weakened muscle and reduce localized oedema and passive congestion [15, 17]. It has been postulated that the physiological mechanisms underlying the therapeutic effects of MET involve altered proprioception, motor programming and control, but research is required to further confirm these hypotheses [15-18]. Authors of MET texts have described many techniques for treating lumbar spinal joint dysfunction and lumbar pelvic and lower extremity muscle dysfunction for the purpose of treating patients with NSLBP [16, 18].

The growth in popularity of Muscle Energy Technique (MET) over the last two decades among physiotherapists and other health professionals is a clear testimony of its clinical relevance and efficacy for the management of Non-specific low back pain. Therefore, this study is designed to determine factors influencing knowledge of MET use for the management of NSLBP among Nigerian physiotherapists. This study is the only identified survey that has investigated the factors influencing knowledge of physiotherapists on the use of MET or other manual therapy techniques for the management of NSLBP. The study will help improve awareness of the use of this effective manual intervention among physiotherapists and thus stimulate further research to validate its effectiveness among Nigerian population.
Aim
The main aim of the study is to determine the knowledge of Nigerian physiotherapists on the use of MET for the management of NSLBP and to identify factors that influence the knowledge of the physiotherapists on the use of MET. However, the following are the specific objectives of the study;

1. To test the validity of the questionnaire section that measures the knowledge of MET use among Nigerian Physiotherapists.
2. To determine if some selected sociodemographic characteristics of physiotherapists have any relation with the knowledge of MET use for the management of NSLBP (e.g. age, sex, educational level, university of graduation, year of induction into physiotherapy and location of practice).
3. To determine if physiotherapists work-related profile have any association with knowledge of MET use for the management of NSLBP.
4. To profile the treatment activities/strategies of Nigerian physiotherapists in the management of NSLBP.
5. To determine the proportion of Nigerian physiotherapists that use MET alone or in combination with other therapeutic technique in the management of NSLBP.
6. To determine if physiotherapists’ area of specialization has an association with choice of MET in the management of chronic NSLBP.

Methods
Research Design
The research design for this study was a cross-sectional survey.

Questionnaire design
This questionnaire titled ‘Knowledge of physiotherapists on Muscle Energy Technique use for the management of NSLBP’ was adopted from the previous study that is related to the present study (19). A five-man focus group that consisted of expert researchers and clinicians use the adopted questionnaire as a working document to develop the version of the present structured questionnaire for this study. The final version was subjected to a validity test for reliability and acceptability. The questionnaire consisted of 46 items divided into four sections. Section A (item 1–6) which sought information on sociodemographic data of the participants, section B (item 7–15) collected information on profile of work experience, section C (item 16–31) collected information on physiotherapists treatment activities/strategies for the management of NSLBP, while section D (item 32–46) collected information on physiotherapists knowledge of the use of MET in the management of NSLBP.

Administration of Questionnaire
Ethical approval was sought and obtained prior to the administration of the questionnaire from the Biomedical Research Ethics Committee (BREC) of the University of KwaZulu-Natal, Durban, South Africa. Copies of the questionnaire were then distributed online to practising physiotherapists across the 36 states of Nigeria. Participants for this study were selected from the database of Nigerian Society of Physiotherapy based on their current financial standing with the association and registration with physiotherapy practice regulatory agency i.e. Medical Rehabilitation Therapists Board of Nigeria (MRTB). The aims and objectives of the study were clearly explained in a cover note attached to each copy of the questionnaire, in order to seek their consent. The copies of the questionnaire were distributed to a total of 200 participants aged 20 years and above recruited for this study.

Data Analysis
Data collected were analyzed using SPSS version 24.0. The statistical analyses used for this study were descriptive and inferential statistics. The descriptive statistics focused mainly on frequency, percentages, mean and standard deviation while the inferential statistics focused on Chi-square/Fisher exact test, Pearson correlation, independent t-test and ANOVA (one-way analysis of variance) to determine significant difference at p < 0.05. However, to test the internal consistency for section D of the questionnaire, Cronbach's alpha was determined.

Result
Normality test
The normality distribution of age score and MET knowledge score were assessed using a Kolmogorov-Smirnov test of normality, and the p-values were greater than 0.05(Table 3). Therefore, one-way Anova was used to evaluate the mean difference of age between MET knowledge category (i.e. excellent, very good, good, poor, very poor), and independent t-test was used to evaluate the mean difference of MET knowledge score between the choice of MET category (i.e. yes and no) (Table 7).

Sociodemographic characteristics
The sociodemographic data of the respondents are shown in table 1. Two-hundred questionnaires were distributed and 140 questionnaires were returned, but only 120 were valid for analysis giving a response of 60.0%. The mean age of the respondents was 36.04 ± 7.51 with range of 33–67 years, 93 (77.5%) are males while the females were 27 (22.5%), the highest, 57 (47.5%) educational attainment for most of the respondents was Master’s degree, followed by first degree 40 (33.3%). Most of the respondents to this study graduated from Bayero University Kano 76(64.4%), and with regards to respondents year of graduation,
graduates from 2001 to 2010 have the highest percentage (45.0%) and those from 1970 to 1980 have the least (0.8%). Most of the respondents to this study practice at teaching hospital (29.2%), also (44.2%) of the respondents are musculoskeletal specialists with (43.3%) presently practising at the musculoskeletal unit of their respective hospitals (table 1).
| Variable                            | mean(SD), range    | N  | %    |
|------------------------------------|--------------------|----|------|
| Age                                | 36.04 ± 7.51*, 33–67** |    |      |
| Gender                             |                    |    |      |
| Male                               | 93                 |    | 77.5 |
| Female                             | 27                 |    | 22.5 |
| Education level                    |                    |    |      |
| Degree                             | 40                 |    | 33.3 |
| Masters                            | 57                 |    | 47.5 |
| PhD                                | 18                 |    | 15.0 |
| Others (DPT)                       | 5                  |    | 4.2  |
| University of graduation           |                    |    |      |
| Bayero University Kano             | 76                 |    | 64.4 |
| Nnamdi Azikiwe University          | 4                  |    | 3.4  |
| Obafemi Awolowo University         | 7                  |    | 5.9  |
| University of Nigeria, Nsukka      | 9                  |    | 7.6  |
| University of Ibadan               | 12                 |    | 10.2 |
| University of Lagos                | 5                  |    | 4.2  |
| University of Maiduguri            | 5                  |    | 4.2  |
| Year of graduation from University |                    |    |      |
| 1970–1980                          | 1                  |    | 0.8  |
| 1981–1990                          | 3                  |    | 2.5  |
| 1991–2000                          | 18                 |    | 15.0 |
| 2001–2010                          | 54                 |    | 45%  |
| 2011–2019                          | 44                 |    | 36.7 |
| Setting of practice                |                    |    |      |
| Teaching hospital                  | 35                 |    | 29.2 |
| General Hospital                   | 30                 |    | 25.0 |
| Private practice                   | 6                  |    | 5.0  |
| Domiciliary                        | 2                  |    | 1.7  |
| Military                           | 2                  |    | 1.7  |
| Academics                          | 12                 |    | 10.0 |
| Federal Medical Centre             | 13                 |    | 0.8  |
| Specialist Hospital                | 15                 |    | 12.5 |
| Others                             | 5                  |    | 4.2  |
| Area of Specialization             |                    |    |      |
| Neurology                          | 24                 |    | 20.0 |
| Musculoskeletal                    | 53                 |    | 44.2 |
| Cardiopulmonary                    | 9                  |    | 7.5  |
| Paediatrics                        | 8                  |    | 6.7  |
| Women Health                       | 3                  |    | 2.5  |
| Geriatrics                         | 1                  |    | 0.8  |
### Table 1: Sociodemographic characteristics of the respondents

| Category          | N | Mean (SD) |
|-------------------|---|-----------|
| Ergonomics        | 4 | 3.3       |
| Sports            | 4 | 3.3       |
| Others            | 14| 11.7      |

**Present unit of practice**

- Neurology: 33 (28.2)
- Paediatrics: 10 (8.5)
- Musculoskeletal: 52 (43.3)
- Women health: 5 (4.3)
- Others: 17 (14.5)

N = frequency, *mean(SD), **range, DPT = Doctor of Physical Therapy

### Reliability

Reliability test was carried out to test the internal consistency of section D of the questionnaire which evaluates the level of therapists' knowledge in the use of MET for the management of NSLBP. The internal consistency Cronbach's $\alpha$ of the 15 items section of the questionnaire was found to be 0.89, which implies a good score. Additionally, all the items of the section have demonstrated good correlation between each other (Table 2).

### Table 2: Internal consistency of the 15 items MET knowledge assessment section of the questionnaire

| Item          | N  | Mean score(SD) | Item correlation | Item Cronbach's $\alpha$ | Cronbach's $\alpha$ |
|---------------|----|----------------|------------------|--------------------------|---------------------|
| Question 32   | 120| 4.48(4.98)     | 0.79             | 0.88                     | 0.88                |
| Question 33   | 120| 3.35(4.00)     | 0.90             | 0.87                     |                     |
| Question 34   | 120| 2.94(4.00)     | 0.87             | 0.87                     |                     |
| Question 35   | 120| 1.60(3.66)     | 0.76             | 0.88                     |                     |
| Question 36   | 120| 1.24(3.08)     | 0.75             | 0.88                     |                     |
| Question 37   | 120| 3.01(3.33)     | 0.35             | 0.89                     |                     |
| Question 38   | 120| 5.56(2.28)     | 0.63             | 0.89                     |                     |
| Question 39   | 120| 7.33(2.71)     | 0.77             | 0.88                     |                     |
| Question 40   | 120| 5.08(3.91)     | 0.34             | 0.89                     |                     |
| Question 41   | 120| 2.62(2.81)     | 0.50             | 0.88                     |                     |
| Question 42   | 120| 0.48(2.07)     | 0.33             | 0.89                     |                     |
| Question 43   | 120| 4.01(2.88)     | 0.76             | 0.87                     |                     |
| Question 44   | 120| 1.48(3.25)     | 0.52             | 0.88                     |                     |
| Question 45   | 120| 2.38(3.49)     | 0.62             | 0.88                     |                     |
| Question 46   | 120| 3.67(2.73)     | 0.50             | 0.88                     |                     |

N = Sample size, SD = Standard deviation

The chi-square analysis showed that there was a significant relationship between therapists MET knowledge level and respondents educational level ($p < 0.001$), but there was no significant relationship between therapists MET knowledge level with gender and university of graduation (Table 3). Pearson correlation demonstrated a significant correlation between the age of the participants and MET level of knowledge ($r = 0.45$, $p<0.001$), furthermore, ANOVA method showed a significant difference ($p<0.01$) in age between the level of knowledge score among the participants; those with excellent score have a mean age of 43.0 ± 12.9 while those with poor score had 31.6 ± 2.5 (table 3).
Table 3: Relationship between MET level of knowledge with Gender, Educational level, University of graduation and Age

| Variable          | Excellent | Very good | Good | Poor | Very poor | $X^2$ | $P$ value |
|-------------------|-----------|-----------|------|------|-----------|-------|-----------|
|                   | n         | %         | n    | %    | n         |       |           |
| Gender            |           |           |      |      |           |       |           |
| Male              | 4         | 4.3       | 19   | 20.4 | 28        | 30.1  | 32        | 34.4    | 10       | 10.8    | 2.03   | 0.70   |
| Female            | 2         | 7.4       | 6    | 22.2 | 10        | 37.0  | 8         | 29.6    | 1        | 3.7     |        |        |
| Educational level|           |           |      |      |           | 42.86 | 0.00      |
| Degree            | 0         | 0         | 3    | 7.5  | 12        | 30.0  | 19        | 47.5    | 6        | 15.0    |        |        |
| Masters           | 2         | 3.5       | 11   | 19.3 | 22        | 38.6  | 19        | 33.3    | 3        | 5.3     |        |        |
| PhD               | 2         | 11.1      | 10   | 55.6 | 2         | 11.1  | 2         | 11.1    | 2        | 11.1    | 2      |        |
| DPT               | 2         | 40.0      | 1    | 20.0 | 2         | 40.0  | 0         | 0       | 0        | 0       |        |        |
| University of Graduation |           |           |      |      |           | 24.4  | 0.44      |
| BUK               | 4         | 5.3       | 13   | 17.1 | 24        | 31.6  | 30        | 39.5    | 5        | 6.6     |        |        |
| UNIZIK            | 0         | 0.0       | 1    | 25.0 | 0         | 0.0   | 2         | 50.0    | 1        | 25.0    |        |        |
| OAU               | 0         | 0.0       | 3    | 42.9 | 1         | 14.3  | 3         | 42.9    | 0        | 0.0     |        |        |
| UNEG              | 0         | 0.0       | 3    | 33.3 | 3         | 33.3  | 1         | 11.1    | 2        | 22.2    | 2      |        |
| UI                | 2         | 16.7      | 3    | 25.0 | 6         | 50.0  | 1         | 8.3     | 0        | 0.0     | 6.5    | 0.01   |
| UNILAG            | 0         | 0.0       | 1    | 20.0 | 3         | 60.0  | 1         | 20.0    | 0        | 0.0     | 12.9   | 0.022  |
| UNIMED            | 0         | 0         | 1    | 20.0 | 1         | 20.0  | 2         | 40.0    | 1        | 20.0    | 12.9   | 0.001  |
| Age               | 6         | 43.8±12.9 | 25   | 40.0±6.5 | 38 | 37.3±7.8 | 40 | 32.4±2.5 | 11 | 31.6±2.5 | 8.7* | 0.001 |

*F ratio, p<0.05, Mean ± Standard deviation

Findings from this study also revealed a significant correlation between knowledge of MET use with years of work experience and years of practice in the musculoskeletal unit of physiotherapy departments (r = 0.29 and 0.34 respectively, P<0.05). However, chi-square analysis demonstrated significant association between knowledge of MET use with other work-related variables that have categorical scales (e.g. setting of practice, area of specialization, cadre of practice and additional training), but it showed no significant association between knowledge of MET use with present unit of practice, certified OMT therapists and whether you have worked in musculoskeletal unit (Table 4).
Table 4: Relationship between MET use knowledge with work-related variables (Setting of practice, Area of Specialization, Present unit of practice, Certified OMT, Worked in MSK, Cadre of practice and additional training in LBP management)

| Variable                        | Excellent | Very good | Good | Poor | Very poor | X²  | P_value |
|---------------------------------|-----------|-----------|------|------|-----------|-----|---------|
|                                  | n         | %         | n    | %    | n         |     |         |
| **Setting of practice**          |           |           |      |      |           | 56.77 | 0.001*  |
| Teaching Hospital                | 2         | 5.7       | 4    | 11.4 | 9         | 25.7 |        |
| General Hospital                 | 1         | 3.3       | 4    | 13.3 | 10        | 33.3 |        |
| Private Practice                 | 3         | 50.0      | 2    | 33.3 | 1         | 16.7 |        |
| Domiciliary                     | 0         | 0         | 0    | 0    | 1         | 50   |        |
| Military                         | 0         | 0         | 0    | 0    | 2         | 100  |        |
| Academics                        | 0         | 0         | 6    | 50   | 3         | 25   |        |
| Federal Medical Center          | 0         | 0         | 7    | 5    | 3         | 23.1 |        |
| Specialist Hospital             | 0         | 0         | 8    | 12.5 | 7         | 46.7 |        |
| Others                           | 0         | 0         | 1    | 20.0 | 2         | 40.0 |        |
| **Area of specialization**       |           |           |      |      |           | 57.90 | 0.001*  |
| Neurology                        | 2         | 8.3       | 2    | 8.3  | 7         | 34.5 |        |
| MSK                              | 4         | 7.5       | 19   | 35.8 | 18        | 34.0 |        |
| Cardiology                       | 0         | 0         | 0    | 0    | 1         | 11.1 |        |
| Pediatrics                       | 0         | 0         | 1    | 20.0 | 3         | 37.4 |        |
| Women Health                     | 0         | 0         | 0    | 0    | 2         | 66.7 |        |
| Geriatrics                       | 0         | 0         | 0    | 0    | 1         | 100  |        |
| Ergonomics                       | 0         | 0         | 1    | 25.0 | 1         | 25.0 |        |
| Sports                           | 0         | 0         | 0    | 0    | 0         | 2    |        |
| Others                           | 0         | 0         | 2    | 14.3 | 5         | 35.7 |        |
| **Present unit of practice**     |           |           |      |      |           | 25.4 | 0.063  |
| Neurology                        | 2         | 6.1       | 2    | 6.1  | 8         | 24.2 |        |
| Pediatrics                       | 0         | 0         | 2    | 20.0 | 3         | 30.0 |        |
| Surgery/MSK                      | 4         | 7.7       | 19   | 36.5 | 15        | 28.8 |        |
| Women Health                     | 0         | 0         | 1    | 20.0 | 3         | 60.0 |        |
| Others                           | 0         | 0         | 1    | 5.0  | 7         | 41.2 |        |
Table 4: Relationship between MET use knowledge with work-related variables (Setting of practice, Area of Specialization, Present unit of practice, Certified OMT, Worked in MSK, Cadre of practice and additional training in LBP management)

|                          | Yes | 11.1 | 4 | 44.4 | 4 | 44.4 | 0 | 0 | 0 | 0 |
|--------------------------|-----|------|---|------|---|------|---|---|---|---|
| Certified OMT            |     |      |   |       |   |      |   |   |   |   |
| Yes                      | 1   | 11.1 | 4 | 44.4 | 4 | 44.4 | 0 | 0 | 0 | 0 |
| No                       | 5   | 4.6  | 20| 18.5 | 32| 29.6 | 40| 37.0| 11| 10.2|
| Worked in MSK unit       |     |      |   |       |   |      |   |   |   |   |
| Yes                      | 6   | 5.4  | 25| 22.5 | 36| 32.4 | 35| 31.5| 9 | 8.1 |
| No                       | 0   | 0    | 0 | 0    | 1 | 20.0 | 4 | 80.0| 0 | 0 |
| Maybe                    | 0   | 0    | 0 | 0    | 1 | 25.0 | 1 | 25.0| 2 | 50.0|
| Cadre of Practice        |     |      |   |       |   |      |   |   |   |   |
| Director                 | 0   | 0    | 2 | 50.0 | 1 | 25.0 | 1 | 25.0| 0 | 0 |
| Assistant Director       | 3   | 15.8 | 6 | 31.6 | 10| 52.6 | 0 | 0  | 0 | 0  |
| Chief                    | 0   | 0    | 9 | 39.1 | 5 | 21.7 | 7 | 30.4| 2 | 8.7 |
| Principal                | 1   | 4.8  | 2 | 9.5  | 5 | 23.8 | 11| 52.4| 2 | 9.5 |
| Senior                   | 1   | 4.2  | 6 | 25.0 | 9 | 37.5 | 6 | 25.0| 2 | 8.3 |
| Physiotherapist          | 1   | 3.7  | 0 | 0    | 7 | 25.9 | 15| 55.6| 4 | 14.8|
| Additional training on LBP management |     |      |   |       |   |      |   |   |   |   |
| Yes                      | 6   | 7.1  | 23| 27.4 | 31| 36.9 | 20| 23.8| 4 | 4.8 |
| No                       | 0   | 0    | 2 | 5.6  | 7 | 19.4 | 20| 55.6| 7 | 19.4|

*p ≤ 0.005

Regarding treatment activities of Nigerian physiotherapists in the management of NSLBP, this study showed that 90% (108) of physiotherapists who responded to this research treat NSLBP with an average of 5.88 ± 6.49 patients a week, chronic NSLBP is the most frequent class of the condition attended 73 (60.8%) (Figs. 1 & 2). However, on the list of the treatment modalities frequently used for the management of NSLBP, TENS, therapeutic ultrasound, McKenzie exercises, Massage, Spine stabilization exercises, patient education and counseling are the most frequent modalities used by the respondents for the management of NSLBP (Table 5). However, only 20 (16.7%) participants reported to include MET in the management of the condition, and 90 (75.0%) respondents reported that availability of the modalities is the major reasons for the choice of the treatment modalities (Table 5). On average, therapists spend about 20–30 minutes for the management of NSLBP for both initial and follow-up visits (Fig. 3), additionally, 10 to 12 treatment sessions are the most frequent sessions spent 97(80.8%) followed by 7 to 9 sessions 85(70.8%) (Fig. 4), however, the study showed that the respondents spend more time and sessions for the management of chronic NSLBP patients. The major determinant for the choice of the treatment sessions is prognosis followed by a diagnosis of the condition (Fig. 5).

Seventy-three (60.8%) of the study respondents re-evaluate their NSLBP patients over a period of time (Fig. 6), especially after about four to six sessions of treatment (Fig. 7). This study showed that more than 50% of the respondents used one to several outcome measures for the assessment of the NSLBP; however, most common outcome measures reported in the study are stated in Table 6, this includes visual analogue scale (VAS), Oswestry Disability Index (ODI), Quality of Life (SF-36), Inclinometer and Pain Numeric Rating Scale (PNRS), others are Roland Morris disability questionnaire, Pain disability questionnaire, Starter Back disability index, Tampa scale kinesiophobia etc. The outcome of the re-evaluation on patient prognosis determines the therapist’s decision on discharge105 (87.5%), and thus, 88 (73.3%) reported to discharge their patients after a satisfactory recovery as indicated by the outcome of the re-evaluation (Table 6).
Table 5: Physiotherapy treatment strategies for the management of NSLBP, as reported by respondents

| Modalities                             | N  | %   |
|----------------------------------------|----|-----|
| Electrotherapy                         |    |     |
| TENS                                   | 98 | 81.7|
| Pulse Short Wave Diathermy             | 49 | 40.8|
| Interferential therapy                 | 54 | 45.0|
| Ultrasound therapy                     | 74 | 61.7|
| Cold packs                             | 68 | 56.7|
| Iontophoresis                          | 12 | 10.0|
| Hot packs                              | 43 | 35.8|
| Mechanical traction                    | 36 | 30.0|
| Laser therapy                          | 17 | 14.2|
| Manual therapy                         |    |     |
| Manual traction                        | 56 | 46.7|
| Spinal mobilization                    | 57 | 47.5|
| Spinal manipulation                    | 45 | 37.5|
| McKenzie exercises                     | 76 | 63.3|
| Mulligan approach                      | 11 | 9.2 |
| Muscles Energy Technique               | 20 | 16.7|
| Neurodynamics                          | 19 | 15.8|
| Massage                                | 90 | 75.0|
| Myo-facial trigger point therapy       | 22 | 18.3|
| Exercise therapy                       |    |     |
| Flexibility exercises                  | 61 | 50.8|
| Spinal stabilization exercises         | 51 | 42.5|
| Abdominal strengthening                | 47 | 39.2|
| Spinal extensor strengthening          | 51 | 42.5|
| Hip muscles strengthening              | 41 | 34.2|
| Advice/Education                       |    |     |
| Postural reeducation                   | 74 | 61.7|
| Ergonomic advice                       | 83 | 69.2|
| Usage of corsets                       | 53 | 44.2|
| Return to work                         | 38 | 31.7|
| Activity limitation                    | 26 | 21.7|
| Bed rest                               | 32 | 26.7|
| Counselling                            | 69 | 57.5|
| Others                                 |    |     |
| Acupuncture                            | 7  | 5.8 |
| Dry needling                           | 3  | 2.5 |
| Tai chi                                | Nil|    |

Possible reasons for the choice(s) of modalities

| Reason                  | N  | %   |
|-------------------------|----|-----|
| Availability            | 90 | 75.0|
| Power supply            | 20 | 16.7|
Table 5: Physiotherapy treatment strategies for the management of NSLBP, as reported by respondents

| Skills            | 72 | 60.0 |
|-------------------|----|------|
| Personal preference | 35 | 29.2 |
| Treatment time    | 15 | 12.5 |
| Number of patients| 13 | 10.8 |
| Prognosis         | 60 | 50   |
| Diagnosis         | 60 | 50   |

The categorization of treatment modalities was adopted from the study of Hendrick et al., (2013)[20]

Table 6: Outcome measures used for the assessment of NSLBP, as reported by the respondents

| Outcome Measure                                      | N   | %    |
|------------------------------------------------------|-----|------|
| Quality of life (SF-36)                              | 20  | 16.7 |
| Oswestry Disability Index                            | 35  | 29.2 |
| Roland Morris Disability Index                       | 10  | 8.2  |
| Quebec Back Pain Disability Scale                    | 2   | 1.7  |
| Pain Disability Index                                | 1   | 0.8  |
| Visual Analogue Scale                                | 57  | 47.5 |
| Pain Numeric Rating Scale                            | 26  | 21.7 |
| Inclinometer (Trunk ROM)                             | 5   | 4.2  |
| STarT Back Screening Tool                            | 5   | 4.2  |
| Katz Index of Independence in ADL                    | 2   | 1.7  |
| Hospital Anxiety and Depression scale                | 2   | 1.7  |
| McGill Pain Questionnaire                            | 1   | 0.8  |
| Tampa Scale of Kinesiophobia                         | 2   | 1.7  |
| Global rating of change scale                        | 1   | 0.88 |
| Schober test (lumbar ROM during flexion)             | 2   | 1.7  |
| Fear-Avoidance Beliefs Questionnaire                  | 4   | 3.3  |
| McKenzie Disability Scale                            | 1   | 0.8  |
| Discharge of patients with NSLBP                     |     |      |
| Yes                                                   | 88  | 73.3 |
| No                                                    | 13  | 10.9 |
| Maybe                                                 | 18  | 15.1 |
| Factor influencing the decision of patient discharge  |     |      |
| Prognosis                                             | 93  | 77.5 |
| Patient request                                       | 19  | 15.8 |
| Physician request                                     | 7   | 5.8  |
| Rehab team consensus                                  | 1   | 0.8  |
Chi-square analysis revealed that there was a statistically significant association ($\chi^2 = 16.37, P = 0.04$) between respondents area of specialization and the choice of MET intervention in the management of NSLBP (Table 6). Additionally, independent t-test analysis further showed that there was a significant mean difference in knowledge score between therapists that use MET (mean = 5.15 ± 2.68) and those who do not use MET (mean = 2.86 ± 1.84) in the management of NSLBP, $p$-value = 0.001, $t(df)= -3.65(22.7)$.

Table 7: Relationship between respondents area of specialization and choice of MET intervention in the management of NSLBP

| Area of specialization | MET | % | Yes | % | $\chi^2$ | $P_{\text{value}}$ |
|-----------------------|-----|---|-----|---|----------|----------------|
| Neurology             | 21  | 87.5 | 3 | 12.5 | 16.4 | 0.040 |
| MSK                   | 38  | 71.7 | 15 | 28.3 |       |      |
| Cardiopulmonary       | 9   | 100.0 | 0 | 0   |       |      |
| Pediatrics            | 7   | 87.5 | 1 | 12.5 |       |      |
| Women Health          | 3   | 100.0 | 0 | 0   |       |      |
| Geriatrics            | 1   | 100.0 | 0 | 0   |       |      |
| Ergonomics            | 3   | 75.0 | 1 | 25.5 |       |      |
| Sports                | 4   | 100  | 0 | 0   |       |      |
| Others                | 14  | 100  | 0 | 0   |       |      |
| MET knowledge score   | 100 | 2.86 ± 1.84* | 20 | 5.15 ± 2.68 | -3.65(22.7)** | 0.001 |

MSK = musculoskeletal, MET = Muscles Energy Technique, **$t(df)$ value, *mean ± SD, $p<0.05$

Discussion

The main aim of the study is to determine the knowledge of Nigerian physiotherapists on the use of MET for the management of NSLBP and to identify factors that influence the knowledge of physiotherapists on the use of MET for the management of NSLBP. The finding of section D of the questionnaire which evaluates the physiotherapists’ knowledge on MET use for the management of NSLBP was a valid tool with good internal consistency, this implies that the data collected was valid and it reflects the accurate level of respondents’ knowledge.

An important finding from this study is that NSLBP is one of the most common musculoskeletal conditions seen by many physiotherapists in Nigeria, 90% of the respondents reported that they currently manage patients with LBP. This support the current literature estimates that about 50% of patients treated by physiotherapists suffer from LBP [149, 152, 21, 22, 23].

This survey also intended to determine if some selected sociodemographic characteristics of the respondents (age, gender, educational level and university of graduation) would have any influence on the knowledge level of MET use in the management of patients with NSLBP. The findings from this study revealed that age and educational level have a significant influence on respondents’ knowledge of MET, while gender and university of graduation do not influence the knowledge of the use MET. This implies that the knowledge of the respondents is dependent on his/her years of experience which is directly linked to opportunity for educational advancement in form of postgraduate or in-service training by the respondents in the course of their practice. Additionally, the study showed that majority of the respondents possesses postgraduate qualifications (i.e. masters, PhD or DPT). This finding is in agreement with the report of Swinkels et al[24] and Odebiyi et al[24], who in their studies on low back pain management, reported that older physiotherapists have more knowledge and skills than their younger counterparts, and this could be attributed to experience acquired over the years and more so the acquisition of additional qualifications. Additional post-qualification training by physiotherapists has been found by this study to have a significant relationship with the knowledge of MET use in the management of NSLBP. Therefore, this finding goes in line with the findings of the above mentioned studies.

The findings from this study on the relationship between knowledge of MET use and some work-related variables (i.e. setting of practice, area of specialization, the present unit of practice, certified orthopaedic manual therapist, worked in musculoskeletal unit, the cadre of practice and additional training in LBP management) shows that there was a significant relationship between the setting of practice and level of knowledge of MET use for the management of NSLBP; this implies that setting of practice could have a tremendous influence on physiotherapists’ MET knowledge. Further analysis of the respondents setting of practice shows that majority of the respondents’ practice in teaching hospitals and most of them specialized in musculoskeletal therapy. Teaching hospitals in Nigeria like in most countries are linked to universities for the purpose of research and advanced care to patients, therefore, the institutions provide opportunity to physiotherapists practising at the facility for postgraduate and post-qualification training, therefore, those in musculoskeletal unit will have the advantage to acquire more qualifications in their speciality and also to regularly attend post-qualification training and workshops on LBP management. This
could be the reason why they are more knowledgeable than their counterparts in other practice settings. The finding is in line with the report from the study by Akodu et al [19] that reported a significant association between the setting of practice and knowledge of clinical practice among Nigerian physiotherapists.

The finding that there was a significant association between respondents MET use knowledge level and area of specialization suggests that the area of specialization of respondents contributed to their MET knowledge. The study further reveals that those who specialized in musculoskeletal therapy are more knowledgeable about MET application in the management of NSLBP than their counterparts in other specialization of physiotherapy. This finding conforms with the findings of Akodu et al [19], who reported that physiotherapists who specialize in Orthopedic/musculoskeletal physiotherapy are more knowledgeable about techniques used in the management of LBP as recommended in clinical practice guidelines. However, on the contrary, it was observed from the result of this study that there was no significant relationship between MET use knowledge and whether the respondent has ever worked in musculoskeletal unit of his/her department as it would have been presumed that those who have worked in musculoskeletal unit would have a much broader knowledge on LBP management techniques. This implies that only physiotherapists who acquired additional training or qualifications particularly in the management of LBP are knowledgeable about MET application. However, it was observed that there are very few Nigerian physiotherapists, who are certified OMT specialists. Although generally, they have a good MET knowledge level score, when compared to other respondents who are not OMT specialists, it was found that presently in Nigeria certification in OMT does not have any significant influence on knowledge of MET use among physiotherapists. This might be as a result of the fact that the OMT is relatively a new sub-speciality of physiotherapy in the country with relatively few experts. The program is not yet integrated into the already established postgraduate program and post-qualification training of musculoskeletal physiotherapy and also, there might be a possibility that MET is not well captured in the current OMT curriculum offered in Nigeria as compared to musculoskeletal postgraduate program or post-qualification training on LBP management.

The respondents’ professional cadre of practice was observed to have a significant relationship with the MET use knowledge, and the result showed there is a relatively high level of MET knowledge among respondents on the senior cadre of practice than their junior colleagues. This also could be attributed to more skills and additional knowledge acquired as one advance on the professional cadre.

It is evident from this study that majority of Nigerian physiotherapists manage patients with NSLBP, and that chronic NSLBP is the most common type of the ailment attended to followed by recurrent NSLBP while acute on chronic is the least type of NSLBP managed by the respondents. However, the pattern of patient referral is a challenge as many physiotherapists reported the first contact with NSLBP patients when the condition was at the chronic stage. This is contrary to the recommendation of the principle of evidence-based practice and the majority of clinical practice guidelines for NSLBP management [26, 27, 28, 29].

This study reveals that there was a significant relationship between the respondents’ area of specialization and choice of MET intervention in the management of NSLBP and also there was a significant difference in the knowledge of MET use between respondents that used MET and those who do not use MET for the management of NSLBP. This showed that those who specialized in musculoskeletal therapy and ergonomics are more knowledgeable than their counterparts in other specialities of physiotherapy, and thus they have demonstrated a better preference to employ MET approach for the treatment of NSLBP.

It is obvious from the findings of this study that physiotherapists use a variety of treatment modalities for the management of NSLBP. The respondents of this study generally involve the use of exercise therapy approach for the treatment of NSLBP, the most common preferred exercises involved included McKenzie, spinal stabilization, abdominal strengthening, spinal extensor strengthening, hip muscles strengthening and flexibility exercises. Although, majority of the respondents believe exercise therapy in combination with other forms of therapeutic intervention is the best approach for the management of NSLBP, this belief could be attributed to the fact that previous study reported Nigerian physiotherapists to believe spinal disc diseases and muscle strain were the reason for the greatest proportion of back pain symptoms[23]. Thus, exercises therapy alone may not resolve the symptoms as desired, but its combination with other therapeutic modalities particularly manual therapy techniques will restore spinal stability, trunk flexibility and consequently relieve pain and improve lost functions. TENS is the most common electrotherapy modality involved followed by therapeutic ultrasound and cold packs for the management of NSLBP. The study also showed that postural re-education, ergonomic advice and counselling regarding proper body mechanics in daily activity are highly involved in the management of NSLBP. The selection and combination of therapeutic modalities are in agreement with the report from the work of [19, 21, 23, 30]. Some physiotherapists also favour a combination of MET with other forms of intervention particularly stabilization exercises and perceive it as an appropriate intervention approach for the management of NSLBP especially chronic type of the condition. However, physiotherapists involved in this study were less inclined to the involvement of some treatment approaches like iontophoresis, laser therapy, mulligan approach, Myo-facial trigger point therapy, acupuncture, dry needling and Tai Chi.

This study tried to identify the reasons for the respondents’ choice of treatment modalities for the management of NSLBP; the findings reveal that availability of modalities is the major reason that influences the choice of the modalities followed by respondents’ skills, patients’ prognosis and diagnosis. This is in line with the finding from the study of Akodu et al [19] that also reported skills, diagnosis and availability of treatment modalities to be the most common factors that influenced Nigerian physiotherapists’ choice of treatment modalities. However, the respondents reported that power supply, personal preference, treatment time and the number of patients are the least factors that influence their choice of modalities for the management of NSLBP.

On treatment duration, this study reveals that the majority of physiotherapists participating in this study spend about 20 to 30 minutes on the treatment of NSLBP for both initial and follow-up visits, although on the initial visit there is a substantial number of respondents who spend 30 to 40 minutes on the treatment of patients with NSLBP. Additionally, this survey showed that majority of the respondents prefer 9–11 treatment sessions for the management of patients with NSLBP but the study also reveals that a good number of respondents employ 7–9 treatment sessions, however, it is obvious from the result that physiotherapists that are more experienced in practice with additional qualifications, especially in the management of LBP prefer fewer number of sessions than their younger counterparts. This finding is in agreement with the trend in the literature, Wheeler[30] reported 11 treatment sessions(visits) for the
management of patients with NSLBP, Swinkels et al [24] reported 9.9 sessions as a mean number of treatment sessions for NSLBP. Odebiyi et al [25] suggested that most of the Nigerian physiotherapists employ 10 treatment sessions for NSLBP patients. Thus, it is observed that the patient's prognosis is the major factor that influences the respondents' choice of treatment sessions; this is followed by the availability of modalities and then the patient's diagnosis. This implies that patients characteristics are the major factor that determines the number of treatment sessions for the management of NSLBP; this is in line with finding from the study of Swinkels et al [24] that reported the number of physical therapy treatment sessions in patients with LBP mainly depends on patient-level (characteristics) instead of practice level.

It is observed that the majority of respondents in this study always re-evaluate patients with NSLBP before, during and after treatment sessions, and they usually re-evaluate the patients after four to six treatment sessions. The finding that all the respondents employ the use of one to several outcome measures for the assessment of patients with NSLBP is consistent with the above finding, and it implies that it is a common practice in Nigeria. The most common outcome measures employed by the respondents are those for the assessment of pain, functional disability, body functions and quality of life. This may be for the reason that pain, functional disability and limitation in body functions are usually the main reason for hospital visit by the patients. The assessment of these variables is possibly used as the basis for objectively determining the patient's improvement before and after sessions of treatment. This practice is widely practised in developed nations [31, 25] and is in line with recommendations of clinical practice guidelines linked to the international classification of functioning, disability and health for the management of LBP [32].

The finding that the majority of the respondents discharge their patients after successful patient recovery is a positive development in the management of patients with NSLBP. This implies that the physiotherapists in Nigeria have good skills for the management of NSLBP and that they try to minimize the rate of transition from acute/subacute to the chronic stage of the condition. The study further reveals that prognosis is the major factor that influences the respondents to this study to discharge their patients with NSLBP.

**Conclusion**

Based on the finding of this study, it can be concluded that the outcome tool (section D of the questionnaire) for the assessment of physiotherapists MET knowledge level is valid and reliable. The study reveals despite the decades' existence of postgraduate and post-qualification training in Nigeria, the knowledge of MET use for the management of NSLBP among Nigerian physiotherapists is still low. Although, the study showed that many physiotherapists believed MET in combination with other therapeutic intervention will be an appropriate management procedure for patients with NSLBP.

It is however revealed that physiotherapists' knowledge for MET use in the management of NSLBP was influenced by age, educational level, the setting of practice, area of specialization, the professional cadre of practice and additional training in LBP management.

Although, this study did not intend to assess the knowledge of Nigerian physiotherapists on the use of clinical practice guidelines for the management of LBP; however, the study profiled the treatment strategies of the Nigerian physiotherapists for the management of NSLBP. This demonstrated that to a large extent Nigerian physiotherapists complied with the recommendation of many clinical practice guidelines for the management of LBP; thus, they take the importance of patients evaluation/re-evaluation using standard outcome measures, the treatment time and number of treatment sessions are adequate, the treatment modalities are selected based on patients characteristics (patient-centred-approach) and discharge of patients is based on informed decision from evaluation of patient's prognosis. However, the pattern of patient referral is quite worrisome as many physiotherapists reported the first contact with NSLBP patients when the condition was at the chronic stage; this is quite contrary to the recommendation of the principle of evidence-based practice and majority of clinical practice guidelines for NSLBP. The problem may be attributed to the fact that physiotherapists in Nigeria do not have first contact access to patients, but with the recent upgrade of physiotherapy curriculum and institutionalization of postgraduate/post-qualification training, it is hoped that the trend will change for better patient care.

Therefore, from the findings of this study, it can be recommended that there is a need for the Nigerian physiotherapists to develop a clinical practice guideline for effective and efficient management of LBP. Thus, further research on the effectiveness of MET for the management of LBP among Nigerian population is highly recommended for possible inclusion of the technique as management protocol in the clinical practice guideline. Furthermore, effective manual therapy techniques like MET need to be integrated into the present curriculum of the postgraduate program and post-qualification training of musculoskeletal speciality. This will help improve the knowledge and expertise of Nigerian physiotherapists in the use of this effective treatment modality for the management of LBP.

**Declarations**

**Ethical Considerations and consent to participate**

This study has been approved by the Biomedical Research Ethics Committee of the University of KwaZulu Natal (South Africa) (Ethics Number: BFC198/18). Please, it is of importance to note that this study is part of the objectives of the main study I am presently carrying out for my PhD; therefore the title of the main study is the one on the ethical approval letter.

A written and signed informed consent was obtained from all recruited participants for the study by attaching the consent form to the copy of the questionnaire distributed. The consent form is designed by the Biomedical Research Ethics Committee of University of KwaZulu-Natal (BREC) according to the WMA Helsinki declaration. The aims and objectives of the study were clearly explained in the form attached.

**Competing interests**

The authors declare that they have no competing interests.
Authors' contributions

UAA conceptualized the study, participated in the design of the methodology and drafted the manuscript. BK and TN were involved in data acquisition, analysis and data interpretation. SSM participated in the design of the study’s methodology, conducted the analysis, interpretation of data and prepared the manuscript for final publication. AAK gave permission for the use of her tool to develop the questionnaire for this study, also participated in developing the study’s methodology and reviewed the manuscript for important intellectual content. All authors read and approved the final manuscript.

Acknowledgement

The authors acknowledge the contribution of the Nigerian Society of Physiotherapy particularly its current executives that provided the register and directory of physiotherapists in the country. Our profound appreciation goes to Dr Abdulwali Sabo Abdulrahman for his assistance with statistical analysis of the study data and Mr Anas Musa for his editorial assistance and Professional advice.

Funding

The study is funded by the College of Health Science of the University of KwaZulu-Natal post-graduate student bursary (internal funding). The institution has no interest or role in the design of the study, writing the manuscript, collection and analysis of data. No external funding is received from any source for the study.

Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author (Ahmed UA) on reasonable request. However, the findings from the study would be made available to participating researchers as required by law.

References

1. Hoy D, Bain C, Williams G, March L, Brooks P, Blyth F, et al. A systematic review of the global prevalence of low back pain. *Arthritis Rheum*. 2012;64(6):2028–37.
2. Froud R, Patterson S, Eldridge S, Seale C, Pincus T, Rajendran D, et al. A systematic review and meta-synthesis of the impact of low back pain on people’s lives. *BMC Musculoskelet Disord*. 2014;15(1). DOI: 10.1186/1471-2474-15-50
3. Manchikanti L, Singh V, Falco FJE, Benyamin RM, Hirsch JA. Epidemiology of Low Back Pain in Adults. *Neuromodulation Technol Neural Interface*. 2014;17(2):3–10. DOI:10.1111/ner.12018
4. Hoy D, Brooks P, Blyth F, Buchbinder R. The epidemiology of low back pain. *Best Pract Res Clin Rheumatol*. 2010;24(6):769–81. DOI:10.1016/j.berh.2010.10.002
5. Majid K, Truumees E. Epidemiology and Natural History of Low Back Pain. *Semin Spine Surg.* 2008;20(2):87–92.
6. Vos T, Allen C, Arora M, Barber RM, Brown A, Carter A, et al. Global, regional, and national incidence, prevalence, and years lived with disability for 310 diseases and injuries, 1990–2015: a systematic analysis for the Global Burden of Disease Study 2015. *Lancet*. 2016;388:1211-1259
7. Wooff AD, Erwin J, March L: The need to address the burden of musculoskeletal conditions. Best Practice and Research: Clinical Rheumatology. 2012: 26: 183-224. DOI: 10.1016/j.berh.2012.03.005.
8. Morris LD, Daniels KJ, Ganguli B, Louw QA. An update on the prevalence of low back pain in Africa: a systematic review and meta-analyses. *BMC Musculoskeletal Disorder*. 2018;19(1). DOI:10.1186/s12891-018-2075-x.
9. Bello B, Bello Adebayo H. A Systematic Review on the Prevalence of Low Back Pain in Nigeria. Middle East J Rehabil Heal. 2017;4(2):1-5 DOI: 10.5812/mejrh.45262.
10. Von Korff M. Studying the natural history of back pain. *Spine*. 1994;19:2041S-2046S. DOI:10.1097/00007632-199409151-00005.
11. Airaksinen O, Brox JI, Cedraschi C, Hildebrandt J, Klaber-Moffett J, Kovacs F, et al. Chapter 4: European guidelines for the management of chronic nonspecific low back pain. *Eur Spine J*. 2006;15:192–300.
12. Desomer A, Wambeke van P, Jonckheer P KCE Report: Klinische richtlijn rond lage rugpijn en radiculaire pijn(Clinical guideline on low back pain and radicular pain). *Evidence-based medicine*. 2017; 73(19):1182-1195. DOI: 10.2143/TVG.73.19.2002426
13. Hides JA, Jull GA, Richardson CA. Long-Term Effects of Specific Stabilizing Exercises for First-Episode Low Back Pain. *Spine*. 2001;26(11):243–8.
14. Franke H, Fryer G, Ostelo RW, Kamper SJ. Muscle energy technique for non-specific low-back pain. *Cochrane Database of Systematic Reviews*. 2015. Issue 2. Art. No.: CD009852. DOI: 10.1002/14651858.CD009852.pub2
15. Mitchell FL, Mitchell PK. The Muscle Energy Manual, vol. 3: Evaluation Treatment of the Pelvis and Sacrum. East Lansing: MET Press. 1999. Pg 94. Available from: http://www.shortdwarf.com/main/mitchell_muscle_energy_manual.PDF
16. Fryer G. Muscle Energy Concepts - A Need for Change. *J Osteopath Med*. 2000;3(2):54–9.
17. Fryer G. MUSCLE ENERGY CONCEPTS: A NEED FOR CHANGE Fryer G. Muscle energy concepts a need for change. Vol. 3, Journal of Osteopathic Medicine. 2000.
18. Chaitow L. Muscle energy techniques. Churchill Livingstone/Elsevier. 2006. Pg 346. Available from: https://books.google.co.za/books?hl=en&lr=&id=GZd046gACgIC&oi=fnd&pg=PP7&dq=(MET)+is+classified+as+an+active+technique+in+which+the+patient+voluntarily+uses+his+muscles+from+a+precisely+controlled+position+in+a+specified position&sig=XlclBAppnNGxensj7Nm0KiseqNQ&redir_esc=y#v=onepage&q&f=false

19. Akodu A, Kareem R, Faniyi O. Management of low back pain: knowledge and adherence to clinical practice guidelines amongst physiotherapists in selected hospitals in Lagos state. Res J Heal Sci. 2016;4(3):203-20.

20. Hendrick P, Mani R, Bishop A, Milosavljevic S, Schneiders AG. Therapist knowledge, adherence and use of low back pain guidelines to inform clinical decisions - A national survey of manipulative and sports physiotherapists in New Zealand. Man Ther. 2013;18(2):136–42. DOI: 10.1016/j.math.2012.09.002

21. Cherkov DC, Deyo RA, Battie M, Street J, Barlow W. A comparison of physical therapy, chiropractic manipulation, and provision of an educational booklet for the treatment of patients with low back pain. N Engl J Med. 1998; 339(15):1021–9.

22. Deyo RA, Battie M, Beurksens AJ, Bombardier C, Croft P, Koes B, et al. Outcome measures for low back pain research. A proposal for standardized use. Spine. 1998; 23(18):2003–13.

23. Cherkin DC, Deyo RA, Battié M, Street J, Barlow W. A comparison of physical therapy, chiropractic manipulation, and provision of an educational booklet for the treatment of patients with low back pain. N Engl J Med. 1998; 339(15):1021–9.

24. Swinkels ICS, Wimmers RH, Groenewegen PP, Bosch WJH Van Den, Dekker J, Ende CHM Van Den: What factors explain the number of physical therapy treatment sessions in patients referred with low back pain; a multilevel analysis. BMC Health Serv Res. 2005:5:1–10. DOI: 10.1186/1472-6963-5-74

25. Odebiyi DO, Aweto HA, Igbari TO, Tella BA, Odebiyi DO, Surulere I. Factors Influencing Number of Physiotherapy Treatment Sessions for Patients with Low Back. AJPARS. 2012:4:23–8. DOI: 10.4314/ajprs.v4i1-2.4

26. Airaksinen O, Brox JI, Cedraschi C, Hildebrandt J, Klaber-Moffett J, Kovacs F, et al: Chapter 4 European guidelines for the management of chronic nonspecific low back pain. Eur Spine J. 2006:15:192–300. DOI: 10.1007/s00586-006-1072-1.

27. Chou R, Huffman L: Guideline for the evaluation and management of low back pain: Evidence review. Am Pain Soc. 2007:1–482. Available from: http://scholar.google.com/scholar?hl=en&btnG=Search&q=intitle:Evaluation+and+Management+of+Low+Back+Pain+Evidence+Review#0

28. Chou R, Qaseem A, Snow V, Casey D, Cross TJ, Shekelle P, et al.: Diagnosis and treatment of low back pain: A joint clinical practice guideline from the American College of Physicians and the American Pain Society. Ann Intern Med. 2007: 147(7):478–91. DOI:10.7326/0003-4819-147-7-200710020-00006

29. Ladeira CE: Evidence-based practice guidelines for the management of low back pain: physical therapy implications. Brazilian J Phys Ther. 2011;15(3):190–9.

30. Michele Crites Battié, Daniel C Cherkin, Roxanne Dunn, Marcia A Ciol, Kimberly J Wheeler: Managing Low Back Pain: Attitudes and Treatment Preferences of Physical Therapists. Physical Therapy.1994;74(3):219–226. DOI:10.1093/ptj/74.3.219

31. Janet M Copeland, William J Taylor, Sarah G Dean: Factors Influencing the Use of Outcome Measures for Patients With Low Back Pain: A Survey of New Zealand Physical Therapists. Physical Therapy.2008; 88(12):1492–1505. DOI:10.2522/ptj.20080083

32. Delitto A, George SZ, Van Dillen LR, Whitman JM, Sowa G, Shekelle R et al: Low back pain. Clinical Practice Guidelines Linked to the International Classification of Functioning, Disability, and Health from the Orthopaedic Section of the American Physical Therapy Association. J Orthop Sports Phys Ther. 2012;42(4): A1-57. DOI:10.2519/jospt.2012.42.4.A1