Assessing Cranial Nerves in Physical Therapy Practice: Findings from a Cross-Sectional Survey and Implication for Clinical Practice

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Abstract: Background and objective: Serious pathologies of the neck can potentially result in cranial nerve palsy. Knowledge about cranial nerve examination (CNE) seems sparse, and its use is still unknown. We aim to investigate the knowledge, skills, and utilization of CNE of Italian physiotherapists. Materials and Methods: An online cross-sectional survey. Results: 396 completed the survey, reaching the required sample size. Although Italian physiotherapists consider CNE relevant (mean ± SD = 7.6/10 ± 2.0), over half of all responders (n = 229 (57.8%)) were not trained in the fundamentals and around a third did not use it in their daily practice (n = 138 (34.8%)). Additionally, participants were unconfident and insecure in conducting (n = 152 (38.4%) and n = 147 (37.1%)), interpreting (n = 140 (35.4%) and n = 164 (41.4%)), and managing the CNE (n = 141 (35.6%) and n = 154 (38.9%)). Possessing a musculoskeletal specialization was associated with an increased value attributed to clinical practice guidelines and reduced the lack of confidence in conducting, interpreting, and managing the CNE (respectively, n = 35 (25.5%)), p = 0.0001; n = 32 (23.4%) p = 0.0002; n = 32 (23.4%) p = 0.0002. Working in a direct access setting significantly increased the considered relevance of guidelines and the concerns about arterial (p = 0.004) and other serious pathologies (p = 0.021). Pain and visual disturbances were considered the main indicators to CNE, demonstrating limited knowledge of signs and symptoms’ indicating CNE. Participants considered specific training in CNE as relevant (mean ± SD = 7.6/10 = 2.1). Conclusions: a substantial proportion of Italian physiotherapists are not schooled in the fundamentals of cranial nerve examination. Given the number of physiotherapists who work in first contact roles, this is a professional concern.

Keywords: cranial nerve examination; physical therapy; differential diagnosis; neck pain; neurological examination
1. Introduction

Neck pain and associated disorders (NAD) are common complex biopsychosocial disorders with a high physical, psychosocial, and economic impact, leading to increased healthcare utilization [1–3]. The Neck Pain Task Force recommends a four-grade classification system of neck pain severity that is intended to help patients, researchers, clinicians, and policy makers in framing their questions and decisions [4].

Clinical practice guidelines recommend ruling out signs or symptoms of major structural pathologies (i.e., NAD IV)—such as congenital craniovertebral anomalies, cervical vascular pathologies, anatomical instabilities, and autonomic disorders—masquerading as neck pain before providing any evidence-based intervention [1,5,6]. The screening for the referral process in case of serious pathologies in physiotherapy—especially in a direct access setting—is a professional challenge. The incidence of delayed diagnosis of serious pathologies ranges from 5% to 20% in the cervical region [7], leading to a lack of recognition that may result in life-threatening consequences [8]. Red flags are signs and symptoms that should alert physiotherapists to consider carefully if the patient is within their scope of practice [1,9,10] and whether they need appropriate medical referral [1,11–13]. Commonly, patients with NAD IV present subtle transient antecedent neurological signs and symptoms or risk factors (i.e., acute onset of unusual headache or neck pain, recent trauma to the head or neck, and/or ischemic signs and symptoms, in younger people under 50 years) [14,15].

Clinicians should identify these during the subjective patient history and further verify during the neurological testing [8,16–19], especially by the use of cranial nerve examination (CNE) because serious pathologies of the neck can potentially result in cranial nerve (CN) palsy (especially CNs V, VI, VIII, IX, X, and XII) [11,20–22]. Physiotherapists therefore require skills in a wide range of neurological examination procedures required to screen all potential NAD IV clinical presentations [23].

Only 5% of clinicians routinely screen for red flags during initial assessment [6,8]. However, screening for serious pathology is a priority [1,5,6] and requires expertise in that field and a systematic approach [24]. In addition, information about physiotherapists’ knowledge of CNE is sparse and its use by physiotherapists is still unknown. Our survey aims to investigate the knowledge, skills, and utilization of CNE in a sample of Italian physiotherapists. This study aims to contribute to the knowledge base and discussion regarding potential future directions for the screening for referral process of NAD IV.

2. Methods

An online cross-sectional questionnaire survey was developed using the online platform Survey Monkey (SVMK Inc., San Mateo, USA) for Italian physiotherapists. The study is reported in line with the Checklist for Reporting Results of Internet Surveys (CHERRIES) [25] and the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines [26].

2.1. Survey Development

With the permission of the authors, to develop our version, we translated, modified the contents of, and culturally adapted into the Italian setting an unpublished recent survey conducted in the U.K. [27]. The survey was revised and adapted by two authors (native English and Italian specialized musculoskeletal physiotherapists with experience in education and research; FMo and AF). Then, the survey was piloted by six experienced Italian physiotherapists and physicians (AP, EG, FC, FMA, MG, and FP) for additional feedback on wording, response logic, and the fulfillment duration. The use of the original U.K. survey and the feedback provided by the pilot stage, respectively, strengthened the content and the face validity.

The survey was structured in three sections: the first section investigated demographic information, practice settings, and the education level; the second investigated the knowledge, skills, and clinical impact of CNE; the last section investigated education and personal opinions.
The survey consisted of 36 questions with a combination of close-ended (few of them with multiple selection) and Likert-scale questions. Only one question was an open-ended question (Supplement 1). All questions were presented at the same order and were mandatory to complete the survey.

2.2. Setting and Recruitment

A web-link to the survey was distributed via a mailing list of the Italian Physiotherapists Association on 23 March 2020. To take advantage of the forced period due to the COVID-19 pandemic and to maximize the response rate, invitations to participate were frequently re-published once per week via social media networks (Facebook, Twitter, LinkedIn, and Instagram). The survey was open for one month, and the closing date was 26 April 2020. For pragmatic purposes and in line with previous internationally published surveys, we adopted this methodological approach with the aim to collect the maximum number of answers within a specific period as most responses occur early after posting [28–35]. A priori, a sample size was calculated using the e-survey Dillman’s formula [36] with a 95% confidence level and a 5% of margin of error. At the time of the survey, the number of physiotherapists registered to the Italian Physiotherapists Association was 7398; therefore, the required sample size for this study was 366 [37]. The questionnaire could be completed on any electronic device with internet access; as Survey Monkey was used without collecting respondents’ IP addresses, the recruitment was anonymous and voluntary; in addition, the same IP was not allowed to access to the survey more than one time. Completion took approximately 10–15 min. No compensation or reimbursement were offered.

2.3. Data Processing and Analysis

Data from the survey platform were transferred to, and stored in, an encrypted computer for the purposes of data analysis, and access was allowed only to researchers involved in the data analysis. Incomplete surveys were not collected nor analyzed. We analyzed the open-ended questions by coding and categorizing the answers, adopting a bottom-up mixed approach [38].

Descriptive statistics was computed to describe the collected variables. A Chi-squared independent test was run to study any difference between responses provided by sample subgroups (i.e., Orthopedic Manipulative Physical Therapist (OMPT) specialization, physiotherapy access regimen, and experience years) to the categorical questions; in case the Chi-squared revealed significant differences ($p < 0.05$), adjusted standardized residuals [39] with their Bonferroni-corrected $p$-value were calculated for each cell to identify which cells of the contingency tables were accountable for the significant effect [40,41]. Moreover, to study any differences between responses provided by sample subgroups to the ordinal (i.e., Likert) questions, an independent t-test or an univariate ANOVA with Bonferroni-corrected post-hoc comparisons was run for answers to two categories (i.e., OMPT specialization and physical therapy access regimen) or to five categories (i.e., experience years).

All statistical analyses were performed with SPSS software (SPSS. Version 20 for Windows; SPSS Inc., Chicago, IL, USA, 2004), and the level was set at $p$-value < 0.05 for all comparisons.

2.4. Ethics

This study was approved by the Human Subjects Committee of the Department of Physical Therapy, Occupational Therapy, Rehabilitation and Physical Medicine, Universidad Rey Juan Carlos of Madrid, with approval letter URJC—DPTO 55—2019. The authors followed the principles outlined in the Declaration of Helsinki for this study [42].
3. Results

3.1. Responses

A total of 420 physiotherapists provided the consent and completed the survey. Of those, 24 were excluded as they did not work in Italy and were not included in the final analysis with the purpose to avoid any bias affecting our findings [43]. A final number of 396 physiotherapists was included. Although available for a very short period, our sample was in line with previous Italian surveys and reached the required sample size [44,45].

3.2. Respondent Characteristics

A total of 137 (34.6%; 95%CI 29.9–39.3) physiotherapists possessed an OMPT (i.e., musculoskeletal specialization) by completing a university master’s program, following the International Federation of Orthopaedic Manipulative Physical Therapists’ standards. The majority of respondents worked in a primary line care \( (n = 314, 79.3%; 95\%\text{CI} 75.3–83.3) \), and 41.4% \( (n = 164; 95\%\text{CI} 36.6–46.3) \) worked in a direct setting regimen. Almost half had practised for less than 10 years \( (n = 112, 28.3; 95\%\text{CI} 23.8–32.7) \); of those, 24.5% practiced less than 5 years \( (n = 97; 95\%\text{CI} 20.3–28.7) \). Further details are presented in Table 1.

| Variables | N  | %    | 95%CI          |
|-----------|----|------|----------------|
| What is your highest earned degree? | | | |
| BSc       | 203| 51.3 | 46.3–56.2      |
| MSc       | 193| 48.7 | 43.8–53.7      |
| Did you earn an IFOMPT OMPT specialization? | | | |
| Yes       | 137| 34.6 | 29.9–39.3      |
| No        | 259| 65.4 | 60.7–70.1      |
| How many years have you been practicing as a licensed physical therapist? | | | |
| 0–5       | 97 | 24.5 | 20.3–28.7      |
| 6–10      | 112| 28.3 | 23.8–32.7      |
| 11–15     | 71 | 17.9 | 14.2–21.7      |
| 16–20     | 42 | 10.6 | 7.6–13.6       |
| 20+       | 74 | 18.7 | 14.8–22.5      |
| What physical therapy setting(s) do you currently practice in? * | | | |
| Private practice (primary line care) | 314| 79.3 | 75.3–83.3      |
| Hospital (secondary care line) | 174| 43.9 | 39.1–48.8      |
| Education | 34 | 8.6 | 5.8–11.3       |
| Research  | 7  | 1.8  | 0.5–3.1        |
| What main physical therapy access regimen do you practice in? | | | |
| Direct access | 164| 41.4 | 36.6–46.3      |
| Secondary care referral pathway | 232| 58.6 | 53.7–63.4      |
| How frequently do you assess patients with headache? | | | |
| Never     | 18 | 4.5  | 2.5–6.6        |
| Rarely (1–5 patients yearly) | 114| 28.8 | 24.3–33.2      |
| Occasionally (1–5 patients monthly) | 175| 44.2 | 39.3–49.1      |
| Frequently (1–5 patients weekly) | 79 | 19.9 | 16–23.9        |
| Daily (>5 patients weekly) | 10 | 2.5 | 1–4.1 |
| How frequently do you assess patients with dizziness? | | | |
| Never     | 26 | 6.6  | 4.1–9          |
| Rarely (1–5 patients yearly) | 172| 43.4 | 38.6–48.3      |
| Occasionally (1–5 patients monthly) | 152| 38.4 | 33.6–43.2      |
| Frequently (1–5 patients weekly) | 41 | 10.4 | 7.4–13.4       |
| Daily (>5 patients weekly) | 5  | 1.3 | 0.2–2.4        |
| How frequently do you assess patients with cervical/head trauma? | | | |
| Never     | 21 | 5.3  | 3.1–7.5        |
| Rarely (1–5 patients yearly) | 175| 44.2 | 39.3–49.1      |
| Occasionally (1–5 patients monthly) | 143| 36.1 | 31.4–40.8      |
| Frequently (1–5 patients weekly) | 46 | 11.6 | 8.5–14.8       |
| Daily (>5 patients weekly) | 11 | 2.8 | 1.2–4.4        |
Table 1. Cont.

| Variables | N   | %   | 95%CI |
|-----------|-----|-----|-------|
| How frequently do you assess patients with WAD? |     |     |       |
| Never | 21 | 5.3 | 3.1–7.5 |
| Rarely (1–5 patients yearly) | 171 | 43.2 | 38.3–48.1 |
| Occasionally (1–5 patients monthly) | 152 | 38.4 | 33.6–43.2 |
| Frequently (1–5 patients weekly) | 42 | 10.6 | 7.6–13.6 |
| Daily (>5 patients weekly) | 10 | 2.5 | 1–4.1 |

Abbreviations: %: percentage; CI: confidence interval; N: number; WAD: Whiplash and associated disorders. * Multiple choice close-ended questions.

3.3. Knowledge and Education

Although Italian physiotherapists attribute a moderate importance to guidelines for assessing NAD (mean = 7.5/10 points; SD = 2.1), most of them were not familiar with the utilization (n = 256, 64.6%; 95%CI 59.9–69.4). A significant difference was found in possessing an OMPT specialization and working in a direct setting in attributing importance to guidelines (p = 0.003). Notably, a moderate percentage declares to manage 1 to 5 patients per month with potentially concerning clinical presentations such as headache (n = 175, 44.2%; 95%CI 39.3–49.1), dizziness (n = 152, 38.4%; 95%CI 33.6–43.2), neck or head trauma (n = 143, 36.1%; 95%CI 31.4–40.8), and whiplash (n = 152, 38.4%; 95%CI 33.6–43.2) (Table 2).

Table 2. Response to each survey questions, summarized for IFOMPT OMPT specialization.

| | Not Confident | Insecure | Quite Sure | Sure | p-Value * |
|-----------------|-------------|----------|------------|------|----------|
| Quantify your ability in conducting a cranial nerve examination | | | | | |
| IFOMPT OMPT specialization YES | 35 (25.5%) | 55 (40.1%) | 44 (32.1%) | 3 (2.2%) | <0.001 |
| IFOMPT OMPT specialization NO | 117 (45.2%) | 92 (35.5%) | 48 (18.5%) | 2 (0.8%) | 0.002 |
| Adjusted residual | −3.8 | −3.0 | 3.0 | 1.2 | 0.001 |
| p-value ** | 0.0001 | 0.0023 | 0.2294 | 0.2294 | 0.0001 |
| Quantify your confidence in interpreting the findings within your cranial nerve examination | | | | | |
| IFOMPT OMPT specialization YES | 32 (23.4%) | 63 (46.0%) | 40 (29.2%) | 2 (1.5%) | <0.001 |
| IFOMPT OMPT specialization NO | 108 (41.7%) | 101 (39.0%) | 50 (19.3%) | 0 (0.0%) | 0.002 |
| Adjusted residual | 3.6 | 2.2 | −1.2 | −2.2 | 0.0512 |
| p-value ** | 0.0002 | 0.0254 | 0.0254 | 0.0512 | 0.0002 |
| Quantify your confidence in managing the findings within your cranial nerve examination | | | | | |
| IFOMPT OMPT specialization YES | 32 (23.4%) | 59 (43.1%) | 43 (31.4%) | 3 (2.2%) | <0.001 |
| IFOMPT OMPT specialization NO | 109 (42.1%) | 95 (36.7%) | 55 (21.2%) | 0 (0.0%) | 0.002 |
| Adjusted residual | 3.7 | −2.2 | 2.2 | −2.2 | 0.0168 |
| p-value ** | 0.0002 | 0.0259 | 0.0259 | 0.0168 | 0.0002 |

If yes, how frequently do you use the cranial nerve examination?

| | Rarely (1–5 Patients Yearly) | Occasionally (1–5 Patients Monthly) | Frequently (1–5 Patients Weekly) | Daily (>5 Patients Weekly) | p-Value * |
|-----------------|-------------------------------|----------------------------------|-------------------------------|---------------------------|----------|
| IFOMPT OMPT specialization YES | 60 (58.8%) | 29 (28.4%) | 12 (11.8%) | 1 (1.0%) | 0.256 ** |
| IFOMPT OMPT specialization NO | 88 (56.4%) | 57 (36.5%) | 9 (5.8%) | 2 (1.3%) | 0.0591 |

Do concerns about potential cervical adverse events discourage you from using manual therapy in the management of patients with cervical disorders?

| | Yes | No | p-Value * |
|-----------------|-----|-----|----------|
| IFOMPT OMPT specialization YES | 84 (61.3%) | 53 (38.7%) | 0.0901 |
| IFOMPT OMPT specialization NO | 183 (70.7%) | 76 (29.3%) | 0.0901 |
Table 2. Cont.

| Question                                                                 | Not Confident | Insecure | Quite Sure | Sure | p-Value * |
|--------------------------------------------------------------------------|---------------|----------|------------|------|-----------|
| How valuable do you consider guidelines for the management of cervical disorders? | 8.01 ± 1.91   | 7.34 ± 2.22 | 7.49 ± 2.00 | 7.71 ± 2.30 | 7.41 ± 2.23 | 0.003 |
| How relevant is cranial nerve examination to your practice?              | 7.69 ± 2.06   | 7.59 ± 2.00 | 7.59 ± 2.00 | 7.62 ± 2.16 | 7.75 ± 2.22 | 0.655 |
| To what extent do you consider cranial nerve examination relevant to cervical arterial pathologies? | 6.73 ± 2.64   | 6.67 ± 2.49 | 6.67 ± 2.49 | 7.62 ± 2.48 | 7.60 ± 2.44 | 0.829 |
| To what extent are you concerned about cervical arterial pathologies when managing cervical disorders? | 7.63 ± 2.64   | 6.67 ± 2.49 | 6.67 ± 2.49 | 7.62 ± 2.48 | 7.60 ± 2.44 | 0.932 |
| To what extent do you consider cranial nerve examination relevant to pathologies of the cranio-cervical junction (e.g., ligament damage of the cranio-vertebral junction, cervical fracture, congenital anomalies, etc.)? | 6.73 ± 2.64   | 6.67 ± 2.49 | 6.67 ± 2.49 | 7.62 ± 2.48 | 7.60 ± 2.44 | 0.932 |
| How relevant do you consider training in cranial nerve examination?       | 7.69 ± 2.23   | 7.54 ± 2.14 | 7.54 ± 2.14 | 7.69 ± 2.23 | 7.54 ± 2.14 | 0.495 |

Abbreviations: IFOMPT: International Federation of Orthopedic Manipulative Physical Therapists; OMPT: Orthopedic Manipulative Physical Therapist. Notes: Data were reported as frequency and percentage, or mean ± standard deviation. * referred to Chi-squared independent test. ** referred to adjusted residual (Bonferroni-corrected p-value = 0.00625). *** referred to independent t-test.

Among the 396 respondents, only 167 (42.2%; 95%CI 37.3–47.0) reported having received information/training in the fundamentals of CNE mainly by personal reading (n = 83, 49.7%; 95%CI 44.8–54.6), continuing professional development courses (n = 77, 46.1%; 95%CI 38.5–53.7), and during a master’s program (n = 73, 43.7%; 95%CI 36.2–51.2). However, the majority of the respondents (n = 229, 57.8%; 95%CI 53.0–62.7) have not been sufficiently trained in CNE, primarily because of a lack of musculoskeletal focus during their undergraduate programs (n = 146, 63.8%; 95%CI 57.5–70.0). Interestingly, 71 (31.0%; 95%CI 25.0–37.0) did not feel the need to be educated in CNE because it was not considered relevant for their clinical practice (Table 3).

Table 3. Knowledge, education, and confidence with regard to cranial nerve examination.

| Question                                                                 | Mean (SD) | N (%) | 95%CI |
|--------------------------------------------------------------------------|-----------|-------|-------|
| How valuable do you consider guidelines for the management of cervical disorders? | 7.5 (2.1) | 167 (42.2) | 37.3–47.0 |
| Which international guidelines are you familiar with *                   |           |       |       |
| IFOMPT cervical arterial dysfunction framework                            | 88 (22.2) | 18.1–26.3 |
| NICE headache assessment clinical knowledge summary                      | 62 (15.7) | 12.1–19.2 |
| Nottingham cervical arterial dysfunction classification model             | 27 (6.8)  | 4.3–9.3  |
| None                                                                     | 256 (64.6)| 59.9–69.4 |
| Have you received training in cranial nerve examination?                 |           |       |       |
| Yes                                                                      | 167 (42.2)| 37.3–47.0 |
| No                                                                       | 229 (57.8)| 53.0–62.7 |
| If yes, where did you learn cranial nerve examination? *                 |           |       |       |
| Workplace                                                                | 22 (13.2) | 8.0–18.3 |
| Continuing Professional Development courses                              | 77 (46.1) | 38.5–53.7 |
| During the Bachelor                                                      | 50 (29.9) | 23.0–36.9 |
| During the Master                                                        | 73 (43.7) | 36.2–51.2 |
| Interaction with other healthcare professionals                          | 44 (26.3) | 19.7–33.0 |
| Personal readings (scientific books or literature)                      | 83 (49.7) | 44.8–54.6 |
| Social media and podcast                                                | 15 (9.0)  | 4.6–13.3 |
| If no, why are you not interested in it?                                 |           |       |       |
| Not relevant for my practice                                            | 71 (31.0) | 25.0–37.0 |
| Outside the physical therapy’s scope                                     | 6 (2.6)   | 0.6–4.7 |
| Working in secondary care referral pathway                               | 6 (2.6)   | 0.6–4.7 |
| Lack of education                                                       | 146 (63.8)| 57.5–70.0 |

How relevant is cranial nerve examination to your practice?
Table 3. Cont.

| Question                                                                 | Mean (SD) | N (%)    | 95%CI       |
|--------------------------------------------------------------------------|-----------|----------|-------------|
| Likert scale (0–10)                                                      | 7.6 (2.0) |          |             |
| Do you use the cranial nerve examination in your practice?               |           |          |             |
| No                                                                       | 138 (34.8)| 30.2–39.5|             |
| Yes                                                                      | 258 (65.2)| 60.5–69.8|             |
| If no, why?                                                              |           |          |             |
| Outside the physical therapy scope of practice                          | 34 (24.6) | 17.4–31.8|             |
| Working in a secondary care referral pathway (patients previously evaluated by a physician) | 9 (6.5) | 2.4–10.6 |             |
| Not trained adequately                                                   | 94 (68.1) | 60.3–75.9|             |
| Requires too much time                                                   | 1 (0.7)   | 0.7–2.1  |             |
| If yes, how frequently do you use the cranial nerve examination?         |           |          |             |
| Rarely (1–5 patients yearly)                                            | 148 (57.4)| 51.3–63.4|             |
| Occasionally (1–5 patients monthly)                                     | 86 (33.3) | 27.6–39.1|             |
| Frequently (1–5 patients weekly)                                        | 21 (8.1)  | 4.8–11.5 |             |
| Daily (>5 patients weekly)                                              | 3 (1.2)   | 0.0–2.5  |             |
| What anamnestic items would prompt you to use the cranial nerve examination? ** |           |          |             |
| Neck/head trauma                                                         | 77 (29.8) | 24.2–35.4|             |
| Dizziness                                                                | 87 (33.7) | 27.9–39.4|             |
| Headache                                                                 | 78 (30.2) | 24.6–35.8|             |
| Drop attack                                                              | 7 (2.7)   | 0.7–4.6  |             |
| Visual disturbances                                                      | 101 (39.1)| 33.1–45.1|             |
| Nausea                                                                   | 40 (15.5) | 11.0–19.9|             |
| Cardiovascular symptoms                                                  | 23 (8.9)  | 5.4–12.3 |             |
| Nystagmus                                                                | 56 (21.7) | 16.6–26.7|             |
| 5D & 3N                                                                  | 10 (3.9)  | 1.5–6.2  |             |
| Tinnitus                                                                 | 41 (15.9) | 11.4–20.3|             |
| Pain                                                                     | 101 (39.1)| 33.1–45.1|             |
| Dysphagia                                                                | 33 (12.8) | 8.7–16.8 |             |
| Dysarthria                                                               | 13 (5.0)  | 2.3–7.7  |             |
| Diplopia                                                                 | 70 (27.1) | 21.7–32.5|             |
| Paresthesia                                                              | 82 (31.8) | 26.1–37.4|             |
| Sensitivity deficit                                                      | 88 (34.1) | 28.3–39.8|             |
| Balance deficit                                                          | 40 (15.5) | 11.0–19.9|             |
| Movement deficit                                                         | 61 (23.6) | 18.4–28.8|             |
| Cognitive alterations                                                     | 9 (3.5)   | 1.2–5.7  |             |
| Quantify your ability in conducting a cranial nerve examination          |           |          |             |
| Not confident                                                            | 152 (38.4)| 33.6–43.2|             |
| Insecure                                                                | 147 (37.1)| 32.4–41.9|             |
| Quite sure                                                               | 92 (23.2) | 19.1–27.4|             |
| Sure                                                                     | 5 (1.3)   | 0.2–2.4  |             |
| Quantify your confidence in interpreting the findings within your cranial nerve examination |           |          |             |
| Not confident                                                            | 140 (35.4)| 30.6–40.1|             |
| Insecure                                                                | 164 (41.4)| 36.6–46.3|             |
| Quite sure                                                               | 90 (22.7) | 18.6–26.9|             |
| Sure                                                                     | 2 (0.5)   | 0.0–1.2  |             |
| Quantify your confidence in managing the findings within your cranial nerve examination |           |          |             |
| Not confident                                                            | 141 (35.6)| 30.9–40.3|             |
| Insecure                                                                | 154 (38.9)| 34.1–43.7|             |
| Quite sure                                                               | 98 (24.7) | 20.5–29.0|             |
| Sure                                                                     | 3 (0.8)   | 0.0–1.6  |             |
| How do you manage abnormal findings during the cranial nerve examination? * |           |          |             |
| Monitoring patient’s symptoms                                            | 128 (32.3)| 27.7–36.9|             |
| Refer to general practitioner                                           | 184 (46.5)| 41.6–51.4|             |
| Referral to the Emergency Department                                     | 66 (16.7) | 13.0–20.3|             |
| Referral to a specialist                                                 | 268 (67.7)| 63.1–72.3|             |
| Request further examination                                              | 53 (13.4)| 10.0–16.7|             |
| Question                                                                 | Mean (SD) | N (%) | 95% CI       |
|--------------------------------------------------------------------------|-----------|-------|--------------|
| To what extent do you consider cranial nerve examination relevant to cervical arterial pathologies? | Likert scale (0–10) | 7.5 (2.2) |              |
| To what extent are you concerned about cervical arterial pathologies when managing cervical disorders? | Likert scale (0–10) | 7.7 (2.2) |              |
| To what extent do you consider the cranial nerve examination relevant to pathologies of the cranio-cervical junction (e.g., ligament damage of the cranio-vertebral junction, cervical fracture, congenital anomalies, etc.)? | Likert scale (0–10) | 6.7 (2.5) |              |
| To what extent are you concerned about serious cervical pathologies (e.g., ligament damage of the cranio-vertebral junction, cervical fracture, congenital anomalies, etc.) when managing cervical disorders? | Likert scale (0–10) | 7.6 (2.4) |              |
| Do concerns about potential cervical adverse events discourage you from using manual therapy in the management of patients with cervical disorders? | Yes | 267 (67.4) | 62.8–72.0 |
|                                                                       | No        | 129 (32.6) | 28.0–37.2 |
| To what extent do you agree with the following sentence? “Manual therapy to the cervical spine can cause adverse events” | Likert scale (0–10) | 4.0 (2.9) |              |
| What therapeutic interventions do you consider dangerous and capable of worsening or causing adverse events (e.g., cervical arterial dissection)? * | HVLA thrust manipulation | 270 (68.2) | 63.6–72.8 |
|                                                                      | Mobilization | 110 (27.8) | 23.4–32.2 |
|                                                                      | Soft tissue techniques (e.g., massage) | 36 (9.1) | 6.3–11.9 |
|                                                                      | Exercises | 21 (5.3) | 3.1–7.5 |
|                                                                      | Modalities | 62 (15.7) | 12.1–19.2 |
|                                                                       | None | 66 (16.7) | 13.0–20.3 |
| Do you use other screening procedures to screen (triage) serious cervical pathologies? * | Canadian Cervical Spine Rules | 32 (8.1) | 5.4–10.8 |
| Pre-Manipulative testing (e.g., Sharp Purser test, Alar lig. test, Anterior drawer test, etc.) | 176 (44.4) | 39.6–49.3 |
| History items (e.g., 5D & 3Ns) | 46 (11.6) | 8.5–14.8 |
| Imaging (Xray, CT scan, MRI) | 51 (12.9) | 9.6–16.2 |
|                                                                       | None | 91 (23.0) | 18.8–27.1 |
| How relevant do you consider training in cranial nerve examination? | Likert scale (0–10) | 7.6 (2.1) |              |
| How should training in conducting cranial nerve examination be provided? * | Within postgraduate programs (Masters) | 166 (41.9) | 37.1–46.8 |
|                                                                       | Within the undergraduate programs (Bachelor) | 281 (71.0) | 66.5–75.4 |
|                                                                       | Within Continuing Professional Development courses | 267 (67.4) | 62.8–72.0 |
|                                                                       | In the work place | 87 (22.0) | 17.9–26.0 |
| What should training of cranial nerve examination consist of? | Practical | 26 (6.6) | 4.1–9.0 |
|                                                                      | Theoretical | 7 (1.8) | 0.5–3.1 |
|                                                                      | Mixed | 363 (91.7) | 88.9–94.4 |
| What duration should training of cranial nerve examination have? | Half day | 23 (5.8) | 3.5–8.1 |
|                                                                       | 1 day | 81 (20.5) | 16.5–24.4 |
|                                                                       | 2 days | 202 (51.0) | 46.1–55.9 |
|                                                                       | 1 week | 69 (17.4) | 13.7–21.2 |
|                                                                       | >1 week | 21 (5.3) | 3.1–7.5 |

Abbreviations: %: percentage; CI: confidence interval; N: number; SD: Standard Deviation; IFOMPT: International Federation of Orthopedic Manipulative Physical Therapists; NICE, National Institute for Health and Care Excellence; 5D & 3N: dysphagia, diplopia, drop attack, dizziness and dysarthria & numbness, nystagmus and nasea; CT: computed tomography; MRI: Magnetic Resonance Imaging. * Multiple choice close-ended questions; N: number. ** Open-ended question.
3.4. Knowledge, Confidence, and Skills in Conducting Cranial Nerve Examination

Overall, physiotherapists attributed high importance to CNE (mean = 7.6/10 points; SD = 2.0). A relevant number \( (n = 138, 34.8\% ; \text{95\%CI } 30.2–39.5) \) reported that they did not use it in their clinical practice mainly because they were not trained adequately \( (n = 94, 68.1\% ; \text{95\%CI } 60.3–75.9) \). A total of 258 \( (65.2\% ; \text{95\%CI } 60.5–69.8) \) physiotherapists declared using CNE in their clinical practice; however, the majority included it in the patient’s physical examination rarely \( (n = 148, 57.4\% ; \text{95\%CI } 51.3–63.4) \) or occasionally \( (n = 86, 33.3\% ; \text{95\%CI } 27.6–39.1) \). A significant difference was found in those that rarely use the CNE and those with 0–5 years of practice \( (n = 44, 80\% ; \text{p } = 0.0001) \) (Table 4). The main items in the patient interview that prompt them to perform a CNE are visual disturbance \( (n = 101, 39.1\% ; \text{95\%CI } 33.1–45.1) \), pain \( (n = 101, 39.1\% ; \text{95\%CI } 33.1–45.1) \), sensibility changes \( (n = 88, 34.1\% ; \text{95\%CI } 28.3–39.8) \), and dizziness \( (n = 87, 33.7\% ; \text{95\%CI } 27.9–39.4) \). Importantly, the majority of all the participants felt unconfident \( (n = 152, 38.4\% ; \text{95\%CI } 33.6–43.2) \) or insecure \( (n = 147, 37.1\% ; \text{95\%CI } 32.4–41.9) \) in conducting a CNE; unconfident \( (n = 140, 35.4\% ; \text{95\%CI } 30.6–40.1) \) or insecure \( (n = 164, 41.4\% ; \text{95\%CI } 36.6–46.3) \) in interpreting the findings; and unconfident \( (n = 141, 35.6\% ; \text{95\%CI } 30.9–40.3) \) or insecure \( (n = 154, 38.9\% ; \text{95\%CI } 34.1–43.7) \) in managing the examination results.

A significant difference was found in the confidence in conducting CNE among participants \( (p < 0.001) \). Post hoc tests illustrated the differences between those with an OMPT qualification and the reduction of lack of confidence in the ability of conducting \( (n = 35, 25.5\% ; \text{p } = 0.0001) \), interpreting the findings \( (n = 32, 23.4\% ; \text{p } = 0.0002) \), and managing the abnormal findings \( (n = 32, 23.4\% ; \text{p } = 0.0002) \) (Table 2). Additionally, post hoc tests illustrated that those with 0–5 years of experience are significantly less sure in interpreting the findings \( (n = 11, 11.3\% ; \text{p } = 0.002) \) (Table 4). When abnormal findings were detected during the CNE, one-third \( (n = 128, 32.3\% ; \text{95\%CI } 27.7–36.9) \) of all respondents did not feel the need to refer to a physician in case of a positive finding during CNE, suggesting an underestimate of its clinical relevance.

3.5. Attitudes towards Instability and Cervical Arterial Pathologies

Respondents attributed moderate importance to CNE when assessing patients with potential cervical arterial pathologies \( (mean = 7.5/10 \text{ points}; \text{SD } = 2.2) \) but less importance for cervical instability (i.e., congenital craniovertebral anomalies, cervical fractures, craniovertebral junction ligaments damage, etc.) \( (mean = 6.7/10 \text{ points}; \text{SD } = 2.5) \). The most common used screening clinical tools for serious cervical conditions were the pre-manipulative tests (for both vertebro-basilar insufficiency and ligamentous instability) \( (n = 176, 44.4\% ; \text{95\%CI } 39.6–49.3) \). Notably, only 8.1% \( (n = 32; \text{95\%CI } 5.4–10.8) \) and 11.6% \( (n = 46; \text{95\%CI } 8.5–14.8) \) use, respectively, the Canadian Cervical Spine Rules and meaningful items from history taking.

Generally, manual therapy—especially spinal thrust manipulation—was not considered directly linked or the direct cause of cervical arterial dissection \( (mean = 4.0/10 \text{ points}; \text{SD } = 2.9) \). A significant difference was found in considering manual therapy to the neck causing adverse events in those with >20 years of experience \( (5.31 \pm 3.15; \text{p } = 0.001) \) and in those which not possess a OMPT specialization \( (4.41 \pm 2.96; \text{p } = 0.0003) \). However, more than half of the physiotherapists felt discouraged from using manual therapy to the neck region because of a perceived fear of causing adverse events \( (n = 267, 67.4\% ; \text{95\%CI } 62.8–72.0) \); that is, participants were highly concerned about vascular pathologies \( (mean = 7.7/10 \text{ points}; \text{SD } = 2.2) \) and instability of the cranio-cervical junction \( (mean = 7.6/10 \text{ points}; \text{SD } = 2.4) \). A significant difference was found in the perceived safety and working in a direct access setting for both vascular pathologies \( (7.97 \pm 2.09; \text{p } = 0.004) \) and cervical instability \( (7.84 \pm 2.33; \text{p } = 0.021) \) (Table 5). Although the majority of the respondents were aware of the lack of a causal link, they still had concerns mainly for spinal thrust manipulations \( (n = 270, 68.2\% ; \text{95\%CI } 63.6–72.8) \) or mobilizations \( (n = 110, 27.8\% ; \text{95\%CI } 23.4–32.2) \) compared to exercises \( (n = 21, 5.3\% ; \text{95\%CI } 3.1–7.5) \).
Table 4. Response to each survey question, summarized for years’ experience.

| Experience | Not Confident | Insecure | Quite Sure | Sure | p-Value * |
|------------|--------------|----------|------------|------|-----------|
|            |              |          |            |      |           |
|            | Quantify your ability in conducting a cranial nerve examination |          |            |      |           |
| 0–5 years of practice as a licensed PT | 45 (46.4%) | 41 (42.3%) | 11 (11.3%) | 0 (0.0%) | 0.1237   |
| 6–10 years of practice as a licensed PT | 38 (33.9%) | 45 (40.2%) | 27 (24.1%) | 2 (1.8%) | 0.5081   |
| 11–15 years of practice as a licensed PT | 24 (33.8%) | 25 (35.2%) | 20 (28.2%) | 2 (2.8%) | 0.0020   |
| 16–20 years of practice as a licensed PT | 15 (35.7%) | 13 (31.0%) | 13 (31.0%) | 1 (2.4%) | 0.2271   |
| 20+ years of practice as a licensed PT | 30 (40.5%) | 23 (31.1%) | 21 (28.4%) | 0 (0.0%) | 0.9248   |
|            | Quantify your confidence in interpreting the findings within your cranial nerve examination |          |            |      |           |
| 0–5 years of practice as a licensed PT | 37 (38.1%) | 49 (50.5%) | 11 (11.3%) | 0 (0.0%) | 0.0128   |
| 6–10 years of practice as a licensed PT | 40 (35.7%) | 48 (42.9%) | 24 (21.4%) | 0 (0.0%) | 0.0264   |
| 11–15 years of practice as a licensed PT | 17 (23.9%) | 33 (46.5%) | 20 (28.2%) | 1 (1.4%) | 0.0958   |
| 16–20 years of practice as a licensed PT | 15 (35.7%) | 12 (28.6%) | 14 (33.3%) | 1 (2.4%) | 0.1919   |
| 20+ years of practice as a licensed PT | 31 (41.9%) | 22 (29.7%) | 21 (28.4%) | 0 (0.0%) | 0.1674   |
|            | Quantify your confidence in managing the findings within your cranial nerve examination |          |            |      |           |
| 0–5 years of practice as a licensed PT | 39 (40.2%) | 43 (44.3%) | 15 (15.5%) | 0 (0.0%) | 0.1237   |
| 6–10 years of practice as a licensed PT | 39 (34.8%) | 44 (39.3%) | 29 (25.9%) | 0 (0.0%) | 0.0020   |
| 11–15 years of practice as a licensed PT | 17 (23.9%) | 32 (45.1%) | 21 (29.6%) | 1 (1.4%) | 0.2271   |
| 16–20 years of practice as a licensed PT | 15 (35.7%) | 13 (31.0%) | 13 (31.0%) | 1 (2.4%) | 0.9248   |
| 20+ years of practice as a licensed PT | 31 (41.9%) | 22 (29.7%) | 20 (27.0%) | 1 (1.4%) | 0.0236   |
Table 4. Cont.

| If yes, how frequently do you use the cranial nerve examination? | Not Confident | Insecure | Quite Sure | Sure | p-Value * |
|---------------------------------------------------------------|--------------|---------|-----------|------|-----------|
| 0–5 years of practice as a licensed PT                        | 44 (80.0%)   | 11 (20.0%) | 0 (0.0%) | 0 (0.0%) | 0.0453 |
| Adjusted residual                                             | 3.8          | 2.4      | 2.5       | 0.9   |           |
| p-value **                                                     | 0.0001       | 0.0180   | 0.0128    | 0.3644 |           |
| 6–10 years of practice as a licensed PT                        | 41 (56.2%)   | 25 (34.2%) | 6 (8.2%) | 1 (1.4%) | 0.8454 |
| Adjusted residual                                             | 0.8          | 0.2      | 0.02      | 0.2   |           |
| p-value **                                                     | 0.8065       | 0.8450   | 0.9765    | 0.5835 |           |
| 11–15 years of practice as a licensed PT                       | 26 (52.0%)   | 19 (38.0%) | 4 (8.0%) | 1 (2.0%) | 0.0453 |
| Adjusted residual                                             | 0.9          | 0.8      | 0.04      | 0.6   |           |
| p-value **                                                     | 0.3929       | 0.4356   | 0.9679    | 0.5385 |           |
| 16–20 years of practice as a licensed PT                       | 16 (51.6%)   | 10 (32.3%) | 5 (16.1%) | 0 (0.0%) | 0.5196 |
| Adjusted residual                                             | 0.7          | 0.1      | 1.7       | −0.6  |           |
| p-value **                                                     | 0.4899       | 0.8922   | 0.0828    | 0.1023 |           |
| 20+ years of practice as a licensed PT                         | 21 (42.9%)   | 21 (42.9%) | 6 (12.2%) | 1 (2.0%) | 0.5241 |
| Adjusted residual                                             | 2.3          | 1.6      | 1.2       | 0.6   |           |
| p-value **                                                     | 0.0225       | 0.1161   | 0.2429    | 0.5241 |           |

Do concerns about potential cervical adverse events discourage you from using manual therapy in the management of patients with cervical disorders?

| Yes | No | p-Value *** |
|-----|----|-------------|
| 0–5 years of practice as a licensed PT | 68 (70.1%) | 29 (29.9%) |
| 6–10 years of practice as a licensed PT | 65 (58.0%) | 47 (42.0%) |
| 11–15 years of practice as a licensed PT | 54 (76.1%) | 17 (23.9%) |
| 16–20 years of practice as a licensed PT | 26 (61.9%) | 16 (38.1%) |
| 20+ years of practice as a licensed PT | 54 (73.0%) | 20 (27.0%) |

How valuable do you consider guidelines for the management of cervical disorders?

| 0-5 Years of Practice as a Licensed PT | 6-10 Years of Practice as a Licensed PT | 11-15 Years of Practice as a Licensed PT | 16-20 Years of Practice as a Licensed PT | 20+ Years of Practice as a Licensed PT | p-Value *** |
|---------------------------------------|----------------------------------------|----------------------------------------|----------------------------------------|----------------------------------------|-------------|
| 7.85 ± 1.86                           | 7.66 ± 2.04                            | 7.48 ± 2.09                            | 7.57 ± 2.17                            | 7.16 ± 2.63                            | 0.332       |

How relevant is cranial nerve examination to your practice?

| 0-5 Years of Practice as a Licensed PT | 6-10 Years of Practice as a Licensed PT | 11-15 Years of Practice as a Licensed PT | 16-20 Years of Practice as a Licensed PT | 20+ Years of Practice as a Licensed PT | p-Value *** |
|---------------------------------------|----------------------------------------|----------------------------------------|----------------------------------------|----------------------------------------|-------------|
| 7.46 ± 2.09                           | 7.89 ± 1.79                            | 7.42 ± 2.16                            | 7.48 ± 2.13                            | 7.70 ± 2.08                            | 0.461       |

To what extent do you consider cranial nerves examination relevant to cervical arterial pathologies?

| 0-5 Years of Practice as a Licensed PT | 6-10 Years of Practice as a Licensed PT | 11-15 Years of Practice as a Licensed PT | 16-20 Years of Practice as a Licensed PT | 20+ Years of Practice as a Licensed PT | p-Value *** |
|---------------------------------------|----------------------------------------|----------------------------------------|----------------------------------------|----------------------------------------|-------------|
| 7.42 ± 2.22                           | 7.59 ± 2.25                            | 7.34 ± 2.25                            | 7.36 ± 2.36                            | 7.76 ± 2.30                            | 0.780       |
Table 4. Cont.

|                                                                 | Not Confident | Insecure | Quite Sure | Sure     | p-Value * |
|-----------------------------------------------------------------|---------------|----------|------------|----------|-----------|
| To what extent are you concerned about cervical arterial pathologies when managing cervical disorders? | 7.64 ± 1.96   | 7.65 ± 2.34 | 7.73 ± 2.22 | 7.24 ± 2.46 | 8.11 ± 2.06 | 0.337 |
| To what extent do you consider the cranial nerves examination relevant to pathologies of the cranio-cervical junction (e.g., ligament damage of the cranio-vertebral junction, cervical fracture, congenital anomalies, etc.)? | 6.45 ± 2.28   | 6.64 ± 2.55 | 6.87 ± 2.60 | 6.31 ± 2.82 | 7.12 ± 2.62 | 0.365 |
| To what extent are you concerned about serious cervical pathologies (e.g., ligament damage of the cranio-vertebral junction, cervical fracture, congenital anomalies, etc.) when managing cervical disorders? | 7.36 ± 2.53   | 7.63 ± 2.16 | 7.83 ± 2.41 | 7.02 ± 2.84 | 8.01 ± 2.51 | 0.199 |
| To what extent do you agree with the following sentence? “Manual therapy to the cervical spine can cause adverse events” | 3.64 ± 2.54   | 3.66 ± 2.97 | 4.17 ± 2.91 | 3.50 ± 2.58 | 5.31 ± 3.15 | 0.001 |

Abbreviations: PT: physiotherapist. Notes: significant p-values are reported in bold. * referred to Chi-squared independent test. ** referred to adjusted residual (Bonferroni-corrected p-value = 0.00625). *** referred to univariate ANOVA.

Table 5. Response to each survey questions, summarized for physiotherapy access regimen.

|                                                                 | Not Confident | Insecure | Quite Sure | Sure     | p-Value * |
|-----------------------------------------------------------------|---------------|----------|------------|----------|-----------|
| Quantify your ability in conducting a cranial nerve examination |               |          |            |          |           |
| Direct access                                                   | 90 (38.8%)    | 81 (34.9%) | 56 (24.1%) | 5 (2.2%) | 0.2130    |
| Secondary care referral pathway                                 | 62 (37.8%)    | 66 (40.2%) | 36 (22.0%) | 0 (0.0%) |           |
| Quantify your confidence in interpreting the findings within your cranial nerve examination |               |          |            |          |           |
| Direct access                                                   | 85 (36.6%)    | 87 (37.5%) | 58 (25.0%) | 2 (0.9%) | 0.1702    |
| Secondary care referral pathway                                 | 55 (33.5%)    | 77 (47.0%) | 32 (19.5%) | 0 (0.0%) |           |
| Quantify your confidence in managing the findings within your cranial nerve examination |               |          |            |          |           |
| Direct access                                                   | 82 (35.3%)    | 81 (34.9%) | 67 (28.9%) | 2 (0.9%) | 0.1008    |
| Secondary care referral pathway                                 | 59 (36.0%)    | 73 (44.5%) | 31 (18.9%) | 1 (0.6%) |           |
Table 5. Cont.

| Not Confident | Insecure | Quite Sure | Sure | p-Value * |
|---------------|----------|------------|------|-----------|
| Rarely (1–5 Patients Yearly) | Occasionally (1–5 Patients Monthly) | Frequently (1–5 Patients Weekly) | Daily (>5 Patients Weekly) | p-Value * |
| If yes, how frequently do you use the cranial nerve examination? | | | | |
| Direct access | 82 (55.4%) | 50 (33.8%) | 15 (10.1%) | 1 (0.7%) | 0.4470 |
| Secondary care referral pathway | 66 (60.0%) | 36 (32.7%) | 6 (5.5%) | 2 (1.8%) | |
| Do concerns about potential cervical adverse events discourage you from using manual therapy in the management of patients with cervical disorders? | | | | |
| Direct access | 158 (68.1%) | 74 (31.9%) | | | 0.7315 |
| Secondary care referral pathway | | 109 (66.5%) | 55 (33.5%) | | |
| How valuable do you consider guidelines for the management of cervical disorders? | | | | |
| How relevant is cranial nerve examination to your practice? | 7.77 ± 2.09 | 7.29 ± 2.19 | | 0.030 |
| To what extent do you consider cranial nerves examination relevant to cervical arterial pathologies? | 7.75 ± 2.05 | 7.45 ± 1.97 | | 0.154 |
| To what extent are you concerned about cervical arterial pathologies when managing cervical disorders? | 7.63 ± 2.33 | 7.34 ± 2.15 | | 0.212 |
| To what extent do you consider the cranial nerve examination relevant in pathologies of the cranio-cervical junction (e.g., ligament damage of the cranio-vertebral junction, cervical fracture, congenital anomalies, etc.)? | 7.97 ± 2.09 | 7.33 ± 2.29 | | 0.004 |
| To what extent do you consider serious cervical pathologies (e.g., ligament damage of the cranio-vertebral junction, cervical fracture, congenital anomalies, etc.) when managing cervical disorders? | 6.63 ± 2.64 | 6.78 ± 2.40 | | 0.560 |
| To what extent do you agree with the following sentence? “Manual therapy to the cervical spine can cause adverse events” | 7.84 ± 2.33 | 7.27 ± 2.58 | | 0.021 |
| How relevant do you consider training in cranial nerve examination? | 4.00 ± 2.91 | 4.09 ± 2.92 | | 0.785 |

Notes: * referred to Chi-squared independent test. ** referred to univariate ANOVA.
3.6. Training in Cranial Nerve Examination and Future Implications

Respondents considered having a specific training in CNE relevant (mean = 7.6/10 points; SD = 2.1); most of them considered that training in CNE should be provided during continuing professional development courses (n = 267, 67.4%; 95%CI 62.8–72.0) or within master’s programs (n = 166, 41.9%; 95%CI 37.1–46.8) with mixed theoretical and practical sessions (n = 363, 91.7%; 95%CI 88.9–94.4) for at least two days duration (n = 202, 51%; 95%CI 46.1–55.9).

4. Discussion

4.1. Key Findings

This is the first published study to investigate physiotherapists’ knowledge, understanding, and skills in the use of CNE, providing indications on future physiotherapy education, research, and practice. Our results highlight that CNE is considered relevant to be implemented in the screening of cervicocranial presentations and as part of the triage process. However, Italian physiotherapists reported not being sufficiently trained for an appropriate utilization in clinical practice. Interestingly, 57.8% of respondents stated that they had not received a specific training in CNE and linked this to omissions from the university’s core undergraduate curriculum programs (63.8%). A total of 31.0% of the not-trained did not consider CNE a relevant skill for their clinical practice. The most recent guidelines for the management of NAD recommend priority screening to rule out major pathologies mimicking musculoskeletal conditions [1,6,18,46]. Furthermore, it is the physiotherapists’ responsibility to screen if the patient’s presenting symptoms are within their scope of practice and appropriate for physiotherapy management. However, our findings show that although a large proportion of respondents worked in a direct (41.4%) access setting, most of them (64.6%) were not aware of guidelines when assessing patients with NAD with potential serious pathologies [1,5,21,47,48].

Clinicians should raise their index of suspicion of serious pathologies (i.e., congenital craniovertebral anomalies, cervical arterial pathologies, anatomical instabilities, autonomic disorders, etc.) during the subjective patient history taking. The identification of any red flags should be explored in detail with specific questioning as patients often did not think to mention them spontaneously [18]. It has been suggested that advanced clinical reasoning incorporating detailed knowledge of potential pathologies, combined with appropriate clinical testing (e.g., neurological signs or function examination), may be required to make the best informed judgement [23]. As clinicians cannot rely on valid and reliable screening tests that may help in identifying NAD IV patients [11], the neurological examination (i.e., cranial nerves, peripheral nerves, and upper motor neuron examination) is a key part of the triage process and may assist in evaluating the potential for serious conditions.

Although Italian physiotherapists occasionally encounter patients with potential concerning clinical presentations, such as headache, whiplash, neck or head trauma, dizziness, or visual disturbances, a relevant number (34.8%) of respondents did not routinely include CNE in their assessment, even when potentially required based on the patient’s history. Moreover, the majority suggested that they were not confident or secure (respectively, 38.4% and 37.1%) in conducting CN assessment, identifying pathognomonic signs and symptoms (respectively, 35.4% and 41.4%), or interpreting and managing the findings of the examination (respectively, 35.6% and 38.9%). Interestingly, those that had less clinical experience (<5 years) use the CNE significantly rarely and showed lesser confidence in interpreting the assessment finding. On the other hand, those possessing an OMPT specialization showed more confidence in conducting a CNE, interpreting the findings, and managing the examination results. This observation may be related to a significantly better understanding of the relevance of guidelines for the participants possessing an OMPT specialization. Although an increasing number of primary studies suggest the importance of CNE when examining the neck region to inform pattern recognition of sinister clinical conditions [13,47,49–63], our findings may reflect the lack of high-quality evidence for CN involvement in NAD IV. To the best of the authors’ knowledge, no specific data are
available to support the diagnostic accuracy of a complete CNE. However, although peripheral neurological examination (e.g., sensory, motor, and reflex testing) has been shown to possess low sensitivity, moderate specificity, and limited diagnostic accuracy [49], the examination of isolated CN injury for focal impairment shows poor sensitivity (0.22) but high specificity (0.95) and is predictable for advanced diagnostic imaging [50], and raising the index of suspicion of serious pathologies. Therefore, it is suggested to contextualize the physical examination, including the neurological examination, with the clinical presentation and subjective patient history and to combine more tests in order to strengthen their clinical relevance [51].

Subtle transient neurological signs and symptoms, such as headache (81%), neck pain (57–80%), dizziness (32%), visual disturbance (34%), paresthesia (19–34%) [18], CN palsies [12,13,52–58], Horner’s syndrome, and tinnitus [54], are common predictors of potential serious pathologies (e.g., vascular pathologies) [18]. The cause of these conditions can be disabling or even lethal; therefore, understanding how to recognize, diagnose, and appropriately evaluate them is of great importance to all clinicians. CNE may assist in the identification of serious pathology when subtle transient neurological signs and symptoms are identified in neck pain patients [18].

Our study highlights the need for further education and research for an appropriate clinical utilization and diagnosis [51].

4.2. Recommendations for Clinical Practice

The results of our study show that Italian physiotherapists do not conduct an adequate screening for referral and systems review procedures. The lack of expertise and updated education in that field may explain the reported increased fear of manual therapy delivery to the neck because of perceived potential risk of adverse events (n = 267, 67.4%). That is, those without an OMPT specialization (p = 0.0003) and with more than 20 years of clinical experience (p = 0.001) showed a significant increase in belief that manual therapy to the neck can cause adverse events. It is important to note that the first IFOMPT Master’s program was started in 2004 (i.e., <20 years) [59], and physiotherapists that typically attend postgraduate programs are younger and have less experience than 20 years [60]. This observation may reflect the suspicion that many colleagues still based their clinical practice on continually propagated dogmatic knowledge instead of scientific clinical studies [61–63]. Therefore, we strongly encourage institutions and policymakers to use the findings of our study as a starting point to introduce appropriate screening for referral competencies into the Italian physiotherapy core curriculum and invite other research group to collaborate for further generalize our result in other countries.

Although there is no convincing evidence to support a causal link between spinal thrust manipulation and cervical artery dissection or anatomical instability [64], in addition to the notion that mobilization and manipulation have been shown to possess the same adverse events’ risk [65], the majority of Italian physiotherapists are more discouraged from using spinal thrust manipulation (68.2%) compared to mobilizations (27.8%) in patients with NAD. These anecdotal beliefs strongly influence physiotherapists’ clinical practice [65–68]. Therefore, we advise updating the knowledge of physiotherapists concerning adverse events. Furthermore, although cervical arterial dissection has been documented related to a wide variety exercises [18,69–71], physiotherapists are not accustomed to evaluating cardiovascular parameters [72–74], and only 5.3% of the respondents are concerned about the exercises’ related risk: considering that 62% of physiotherapists’ patients potentially have a history or suffer of cardiac disease, the risk of acute myocardial infarction during exercise is seven times higher than that of sudden cardiac death [75–78]. Therefore, we advise physiotherapists to consider risk factors and more specific cardiovascular parameters, in their clinical reasoning. To guide physiotherapists in their daily practice, we created an infographic decision tool for early identification of potential vascular/neurological pathologies of the neck for public use (Supplement 2). Moreover, an extensive description of the CNE is available elsewhere [79].
4.3. Strengths and Limitations

A key strength is the high response rate, which permitted a required sample size calculation, confirming the willingness of physiotherapists to participate in this study. Moreover, authors have adopted a previous local online survey to understand the opinion of the target population. The methodological choice was previously used in surveys representing a valid tool aimed to capture the perspective of a large sample of healthcare providers [80]. That is, although we do not send personal invitations, the publication of several reminders helped to recruit a number of Italian physiotherapists in line with previous surveys [44,45]. However, the number of responders could have been influenced by the detailed and specific questions that were employed. Additionally, there is also high potential for responder bias, as those with stronger positive or negative interest in the topic may be more likely to respond or to give more detail to the survey. The recruitment methodology may potentially lead to a selection bias.

5. Conclusions

Our study exposed a concerning number of Italian physiotherapists who work as first-line practitioners who had not been trained in the fundamentals of CNE. Many of those who had been trained reported a lack of knowledge or confidence about exactly when and how to implement CN screening. In addition, the physiotherapists surveyed in this study did not report confidence in identifying pathognomonic signs and symptoms of NAD IV, with a lack of clarity regarding exactly when to assess CNs. All the above may impact appropriate clinical reasoning and triage in such cases, having the potential to adversely impact on the patient and practitioner. We strongly encourage institutions and policymakers to use the findings of our study as a starting point to introduce appropriate screening for referral competencies into the Italian physiotherapy core curriculum.

Highlights

- Triage of serious pathologies masquerading as neck pain before providing any evidence-based intervention is recommendation number one in clinical practice guidelines and a professional responsibility.
- Cranial nerve examination may potentially impact on appropriate clinical reasoning and the screening process for referral.
- It is concerning that a considerable number of Italian physical therapists who work as first line practitioners are not schooled in the fundamentals of cranial nerve examination.
- Improvement of the physiotherapy core curriculum concerning screening for referral competencies and cranial nerve examination is important.
- To guide physiotherapists in their daily practice, we created an infographic for public use.

Supplementary Materials: The following are available online at https://www.mdpi.com/article/10.3390/healthcare9101262/s1, Supplement 1: Survey Questions, Supplement 2: Infographic Decision Tool for early identification of potential vascular/neurological pathologies of the neck.

Author Contributions: F.M. (Firas Mourad) conceived the study and was responsible for the project administration. F.M. (Firas Mourad), F.M. (Filippo Maselli), F.C. and G.L. designed the study. F.M. (Firas Mourad), F.M. (Filippo Maselli), F.C. and G.L. developed the survey tool. L.P., F.M. (Firas Mourad) and G.L. analyzed the data. All authors overviewed data analysis and interpretation. F.C. and G.L. wrote the first draft of the paper. F.M. (Firas Mourad) and G.L. were major contributors in writing (original draft). N.H., A.T., R.K., H.K., F.M. (Filippo Maselli) and M.S. contributed to the investigation and to the writing (review and editing). L.P. contributed to data curation and formal analysis. F.M. (Firas Mourad) is the guarantor. All authors have read and agreed to the published version of the manuscript.

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**Informed Consent Statement:** Informed consent was obtained from all subjects involved in the study.

**Data Availability Statement:** Raw data are available upon request.

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**References**

1. Côté, P.; Wong, J.J.; Sutton, D.; Shearer, H.M.; Mior, S.; Randhawa, K.; Ameis, A.; Carroll, L.J.; Nordin, M.; Yu, H.; et al. Management of neck pain and associated disorders: A clinical practice guideline from the Ontario Protocol for Traffic Injury Management (OPTIMa) Collaboration. *Eur. Spine J.* 2016, 25, 2000–2022. [CrossRef]  
2. Hoy, D.G.; Protani, M.; De, R.; Buchbinder, R. The epidemiology of neck pain. *Best Pract. Res. Clin. Rheumatol.* 2010, 24, 783–792. [CrossRef]  
3. Bovim, G.; Schrader, H.; Sand, T. Neck pain in the general population. *Spine* 1994, 19, 1307–1309. [CrossRef]  
4. Haldeman, S.; Carroll, L.; Cassidy, J.D.; Schubert, J.; Nygren, A. The bone and joint decade 2000–2010 task force on neck pain and its associated disorders. *Eur. Spine J.* 2008, 17, 5–7. [CrossRef]  
5. Blanpied, P.R.; Gross, A.R.; Elliott, J.M.; Devaney, L.L.; Clewley, D.; Walton, D.M.; Sparks, C.; Robertson, E.K. Neck pain: Revision 2017: 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.* 2017, 47, A1–A83. [CrossRef] [PubMed]  
6. Bussieres, A.E.; Stewart, G.; Al-Zoubi, F.; Decina, P.; Désartheaux, M.; Hayden, J.; Hendrickson, B.; Hincapie, C.; Page, I.; Passmore, S.; et al. The treatment of neck pain–associated disorders and whiplash-associated disorders: A clinical practice guideline. *J. Manip. Physiol. Ther.* 2016, 39, 523–564. [CrossRef]  
7. Platzer, P.; Hauswirth, N.; Jaidl, M.; Chatwani, S.; Gaebler, C. Delayed or missed diagnosis of cervical spine injuries. *J. Trauma Acute Care Surg.* 2006, 61, 150–155. [CrossRef]  
8. Sizer, P.S., Jr.; Brisme, J.-M.; Cook, C. Medical screening for red flags in the diagnosis and management of musculoskeletal spine pain. *Pain Pract.* 2007, 7, 53–71. [CrossRef] [PubMed]  
9. Boissonnault, W.G. *Examination in Physical Therapy Practice: Screening for Medical Disease*, 2nd ed.; Churchill Livingstone: New York, NY, USA, 1995.  
10. Downie, A.; Williams, C.M.; Henschke, N.; Hancock, M.J.; Ostelo, R.W.; De Vet, H.C.; Macaskill, P.; Irwig, L.; Van Tulder, M.W.; Koes, B.W.; et al. Red flags to screen for malignancy and fracture in patients with low back pain: Systematic review. *BMJ* 2013, 347, f7095. [CrossRef] [PubMed]  
11. Redekop, G.J. Extracranial carotid and vertebral artery dissection: A review. *Can. J. Neurol. Sci.* 2008, 35, 146–152. [CrossRef] [PubMed]  
12. Ursekar, M.A.; Singhal, B.S.; Konin, B.L. Hypoglossal Nerve Palsy Due to Spontaneous Dissection of the Internal Carotid Artery: A Case Report. *Clin. Radiol.* 2000, 55, 978–979. [CrossRef] [PubMed]  
13. Peltz, E.; Köhrmann, M. Internal-carotid-artery dissection and cranial-nerve palsies. *N. Engl. J. Med.* 2011, 365, e43. [CrossRef] [PubMed]  
14. Debette, S.; Grond-Ginsbach, C.; Bodenmann, M.; Kloss, M.; Engelter, S.; Metso, T.; Pezzini, A.; Brandt, T.; Caso, V.; Touze, E.; et al. Differential features of carotid and vertebral artery dissections: The CADISP study. *Neurology* 2011, 77, 1174–1181. [CrossRef]  
15. Thomas, L.C. Cervical arterial dissection: An overview and implications for manipulative therapy practice. *Musculoskelet. Sci. Pract.* 2016, 21, 2–9. [CrossRef] [PubMed]  
16. Hutting, N.; Kerry, R.; Coppieters, M.W.; Scholten-Peeters, G.G. Considerations to improve the safety of cervical spine manual therapy. *Musculoskelet. Sci. Pract.* 2018, 33, 41–45. [CrossRef]  
17. Hutting, N.; Antonius, H.; Kerry, R. Yes, we should abandon pre-treatment positional testing of the cervical spine. *Musculoskelet. Sci. Pract.* 2020, 49, 102181. [CrossRef]  
18. Thomas, L.C.; Rivett, D.A.; Attia, J.R.; Levi, C. Risk factors and clinical presentation of cervical arterial dissection: Preliminary results of a prospective case-control study. *J. Orthop. Sports Phys. Ther.* 2015, 45, 503–511. [CrossRef]  
19. Thomas, L.; Treleaven, J. Should we abandon positional testing for vertebralbasilar insufficiency? *Musculoskelet. Sci. Pract.* 2020, 46, 102095. [CrossRef]  
20. Patel, R.R.; Adam, R.; Maldjian, C.; Lincoln, C.M.; Yuen, A.; Arneja, A. Cervical carotid artery dissection: Current review of diagnosis and treatment. *Cardiol. Rev.* 2012, 20, 145–152. [CrossRef]  
21. Kerry, R.; Taylor, A.J. Cervical arterial dysfunction: Knowledge and reasoning for manual physical therapists. *J. Orthop. Sports Phys. Ther.* 2009, 39, 378–387. [CrossRef]
22. Paik, S.W.; Yang, H.J.; Seo, Y.J. Sixth Cranial Nerve Palsy and Vertigo Caused by Vertebrobasilar Insufficiency. *J. Audiol. Otol.* 2020, 24, 157. [CrossRef]

23. Finucane, L.M.; Downie, A.; Mercer, C.; Greenhalgh, S.M.; Boissonnault, W.G.; Pool-Goudzwaard, A.L.; Beneciuk, J.M.; Leech, R.L.; Selby, J. International Framework for Red Flags for Potential Serious Spinal Pathologies. *J. Orthop. Sports Phys. Ther.* 2020, 50, 350–372. [CrossRef]

24. Cook, C.E.; Décar, S. Higher order thinking about differential diagnosis. *Braz. J. Phys. Ther.* 2020, 24, 1–7. [CrossRef]

25. Eysenbach, G. Improving the quality of Web surveys: The Checklist for Reporting Results of Internet E-Surveys (CHERRIES). *J. Med. Internet Res.* 2004, 6, e34. [CrossRef] [PubMed]

26. Von Elm, E.; Altman, D.G.; Egger, M.; Pocock, S.J.; Gotzsche, P.C.; Vandenbroucke, J.P. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement: Guidelines for reporting observational studies. *Ann. Intern. Med.* 2007, 147, 573–577. [CrossRef] [PubMed]

27. Cranial Nerve Examination. Available online: https://coventry.onlinesurveys.ac.uk/cranialnerveexamination (accessed on 5 September 2019).

28. Littlewood, C.; Lowe, A.; Moore, J. Rotator cuff disorders: A survey of current UK physiotherapy practice. *Shoulder Elb.* 2012, 4, 64–71. [CrossRef]

29. Littlewood, C.; Mauzquin, B.; Moffatt, M.; Bateman, M. Rehabilitation following rotator cuff repair: A survey of current practice (2020). *Musculoskel. Care* 2020, 19, 165–171. [CrossRef] [PubMed]

30. Littlewood, C.; Bateman, M. Rehabilitation following rotator cuff repair: A survey of current UK practice. *Shoulder Elb.* 2015, 7, 193–204. [CrossRef] [PubMed]

31. Pieters, L.; Voogt, L.; Bury, J.; Littlewood, C.; Feijen, S.; Cavaggion, C.; Struyf, F. Rotator CUFF disorders: A survey of current physiotherapy practice in Belgium and the Netherlands. *Musculoskel. Sci. Pract.* 2019, 43, 45–51. [CrossRef]

32. Smythe, A.; White, J.; Littlewood, C.; Bury, J.; Haines, T.; Malliaras, P. Physiotherapists deliver management broadly consistent with recommended practice in rotator cuff tendinopathy: An observational study. *Musculoskel. Sci. Pract.* 2020, 47, 102132. [CrossRef]

33. Brindisino, F.; Matteuzzi, I.; Bury, J.; McCreech, K.; Littlewood, C. Rotator cuff disorders: A survey of current (2018) Italian physiotherapy practice. *Physiother. Pract. Res. 2020*, 41, 11–22. [CrossRef]

34. Kane, L.T.; Lazarus, M.D.; Namdari, S.; Seitz, A.L.; Abboud, J.A. Comparing expert opinion within the care team regarding postoperative rehabilitation protocol following rotator cuff repair. *J. Shoulder Elb. Surg.* 2020, 29, e330–e337. [CrossRef]

35. Pribicevic, M.; Pollard, H.; Bonello, R. An epidemiologic survey of shoulder pain in chiropractic practice in Australia. *J. Manip. Physiol. Ther.* 2009, 32, 107–117. [CrossRef]

36. Dillman, D.A. Mail and Internet Surveys: The Tailored Design Method, 2nd ed.; Wiley: Hoboken, NJ, USA, 2007.

37. AIFI. Associazione Italiana di Fisioterapia. Available online: https://aifi.net/ (accessed on 5 September 2019).

38. Delle Fave, A.; Brdar, I.; Freire, T.; Vella-Brodrick, D.; Wissing, M.P. The eudaimonic and hedonic components of happiness: Qualitative and quantitative findings. *Soc. Indic. Res.* 2011, 100, 185–207. [CrossRef]

39. Haberman, S.J. The analysis of residuals in cross-classified tables. *Biometrics* 1973, 29, 205–220. [CrossRef]

40. Beasley, T.M.; Schumacker, R.E. Multiple regression approach to analyzing contingency tables: Post hoc and planned comparison procedures. *J. Exp. Educ.* 1995, 64, 79–93. [CrossRef]

41. Garcia-Perez, M.A.; Nunez-Anton, V. Cellwise residual analysis in two-way contingency tables. *Educ. Psychol. Meas.* 2003, 63, 825–839. [CrossRef]

42. World Medical Association. World Medical Association Declaration of Helsinki: Ethical principles for medical research involving human subjects. *J. Am. Coll. Dent.* 2014, 81, 14.

43. Bisconti, M.; Brindisino, F.; Maselli, F. Gender Medicine and Physiotherapy: A Need for Education. Findings from an Italian National Survey. *Healthcare* 2020, 8, 516. [CrossRef]

44. Brindisino, F.; Ristori, D.; Lorusso, M.; Miele, S.; Pellicciari, L.; Rossettini, G.; Bonetti, F.; Heick, J.D.; Testa, M. Subacromial impingement syndrome: A survey of Italian physiotherapists and orthopaedists on diagnostic strategies and management modalities. *Arch. Physiother.* 2020, 10, 1–17. [CrossRef] [PubMed]

45. Rossettini, G.; Palae, A.; Geri, T.; Fiorio, M.; Colloca, L.; Testa, M. Physical therapists’ perspectives on using contextual factors in clinical practice: Findings from an Italian national survey. *PLoS ONE* 2018, 13, e0208159. [CrossRef] [PubMed]

46. Strudwick, K.; McPhee, M.; Bell, A.; Martin-Khan, M.; Russell, T. Best practice management of neck pain in the emergency department (part 6 of the musculoskeletal injuries rapid review series). *Emerg. Med. Australas.* 2018, 30, 754–772. [CrossRef] [PubMed]

47. Rushton, A.; Rivett, D.; Carlesso, L.; Flynn, T.; Hing, W.; Kerry, R. International framework for examination of the cervical region for potential of cervical arterial dysfunction prior to orthopaedic manual therapy intervention. *Man. Ther.* 2014, 19, 222–228. [CrossRef]

48. Olesen, J. International classification of headache disorders. *Lancet Neurol.* 2018, 17, 396–397. [CrossRef]

49. Al Nezari, N.H.; Schneiders, A.G.; Hendrick, P.A. Neurological examination of the peripheral nervous system to diagnose lumbar spinal disc herniation with suspected radiculopathy: A systematic review and meta-analysis. *Spine J.* 2013, 13, 657–674. [CrossRef]

50. Matuszak, J.M.; McVige, J.; McPherson, J.; Willer, B.; Ledy, J. A practical concussion physical examination toolbox: Evidence-based physical examination for concussion. *Sports Health* 2016, 8, 260–269. [CrossRef]
51. Downs, M.B.; Laporte, C. Conflicting dermatome maps: Educational and clinical implications. J. Orthop. Sports Phys. Ther. 2011, 41, 427–434. [CrossRef]
52. Debette, S.; Leys, D. Cervical-artery dissections: Predisposing factors, diagnosis, and outcome. Lancet Neurol. 2009, 8, 668–678. [CrossRef]
53. Waespe, W.; Nieser, J.; Imhof, H.-G.; Valavanis, A. Lower cranial nerve palsies due to internal carotid dissection. Stroke 1988, 19, 1561–1564. [CrossRef]
54. Marin, L.F.; Bichuetti, D.B.; Felício, A.C.; Santos, W.A.; Oliveira, F.F.; Morita, M.E.; Avelar, W.M.; Braga-Neto, P.; Lima, E.C.; Martins, R.J. Hypoglossal nerve palsy as the sole manifestation of spontaneous internal carotid artery dissection. Arq. Neuropsiquiatr. 2009, 67, 107–108. [CrossRef][PubMed]
55. English, S.W.; Passe, T.J.; Lindell, E.P.; Klaas, J.P. Multiple cranial neuropathies as a presentation of spontaneous internal carotid artery dissection: A case report and literature review. J. Clin. Neurosci. 2018, 50, 129–131. [CrossRef][PubMed]
56. Lindsay, F.W.; Mullin, D.; Keefe, M.A. Subacute hypoglossal nerve paresis with internal carotid artery dissection. Laryngoscope 2003, 113, 1530–1533. [CrossRef]
57. Bezerra, M.L.E.; Pedroso, J.L.; Pieri, A. Spontaneous carotid dissection with hypoglossal nerve palsy as residual deficit: The importance of magnetic resonance evaluation. Arq. Neuropsiquiatr. 2009, 67, 1109–1110. [CrossRef]
58. Fuji, H.; Ohtsuki, T.; Takeda, I.; Hosomi, N.; Matsumoto, M. Isolated unilateral hypoglossal nerve paralysis caused by internal carotid artery dissection. J. Stroke Cereb. Dis. 2014, 23, e405–e406. [CrossRef]
59. OMT. Master-UNIGE. Available online: http://www.masteromt.unige.it/index.php/master/presentazione (accessed on 5 September 2019).
60. Rossettini, G.; Geri, T.; Palese, A.; Marzano, C.; Miranda, M.; Colloca, L.; Fiorio, M.; Turolla, A.; Manoni, M.; Testa, M. What Physiotherapists Specialized in Orthopedic Manual Therapy Know About Nocebo-Related Effects and Contextual Factors: Findings from a National Survey. Front. Psychol. 2020, 11, 2820. [CrossRef]
61. Peace, S.; Fryer, G. Methods used by members of the Australian osteopathic profession to assess the sacroiliac joint. J. Osteopath. Med. 2004, 7, 25–32. [CrossRef]
62. Magarey, M.E.; Rebbeck, T.; Coughlan, B.; Grimmer, K.; Rivett, D.A.; Refshauge, K. Pre-manipulative testing of the cervical spine review, revision and new clinical guidelines. Man. Ther. 2004, 9, 95–108. [CrossRef]
63. Grant, R. Dizziness testing and manipulation of the cervical spine. Clinics in Physical Therapy. In Grant, R., Ed.; Churchill Livingstone: New York, NY, USA, 1988; Volume 17, pp. 111–124.
64. Church, E.W.; Sieg, E.P.; Zalatimo, O.; Hussain, N.S.; Glantz, M.; Harbaugh, R.E. Systematic review and meta-analysis of chiropractic care and cervical artery dissection: No evidence for causation. Curr. Neurol. 2016, 8, e498. [CrossRef]
65. Carlesso, L.C.; Macdermid, J.C.; Santaguida, P.L.; Thabane, L.; Giulekas, K.; Millard, J.; Williams, C.; Miller, J.; Chespworth, B.M. Beliefs and practice patterns in spinal manipulation and spinal motion palpation reported by Canadian manipulative physiotherapists. Physiother. Can. 2013, 65, 167–175. [CrossRef]
66. Rozmovits, L.; Mior, S.; Boon, H. Exploring approaches to patient safety: The case of spinal manipulation therapy. BMC Complementary Altern. Med. 2016, 16, 1–9. [CrossRef][PubMed]
67. Adams, G.; Sim, J. A survey of UK manual therapists’ practice of and attitudes towards manipulation and its complications. Physiother. Res. Int. 1998, 3, 206–227. [CrossRef]
68. Puentedura, E.J.; Slaughter, R.; Reilly, S.; Ventura, E.; Young, D. Thrust joint manipulation utilization by US physical therapists. J. Man. Manip. Ther. 2017, 25, 74–82. [CrossRef][PubMed]
69. Saw, A.E.; McIntosh, A.S.; Kountouris, A. Vertebral artery dissection in sport: Expert opinion of mechanisms and risk-reduction strategies. J. Clin. Neurosci. 2019, 68, 28–32. [CrossRef][PubMed]
70. Saw, A.E.; McIntosh, A.S.; Kountouris, A.; Newman, P.; Gaida, J.E. Vertebral Artery Dissection in Sport: A Systematic Review. Sports Med. 2019, 49, 553–564. [CrossRef]
71. Schlemm, L.; Nolte, C.H.; Engelter, S.T.; Endres, M.; Ebinger, M. Cervical artery dissection after sports—An analytical evaluation of 190 published cases. Eur. Stroke J. 2017, 2, 335–345. [CrossRef][PubMed]
72. Frese, E.M.; Richter, R.R.; Burris, T.V. Self-reported measurement of heart rate and blood pressure in patients by physical therapy clinical instructors. Phys. Ther. 2002, 82, 1192–1200. [CrossRef][PubMed]
73. Severin, R.; Wang, E.; Wielechowski, A.; Phillips, S.A. Outpatient Physical Therapist Attitudes Toward and Behaviors in Cardiovascular Disease Screening: A National Survey. Phys. Ther. 2019, 99, 833–848. [CrossRef]
74. Albarrati, A. Outpatient physical therapy cardiovascular assessment: Physical therapist perspective and experience. Physiother. Theory Pract. 2019, 35, 843–850. [CrossRef]
75. Savonen, K.P.; Lakka, T.A.; Laukkanen, J.A.; Halonen, P.M.; Rauramaa, T.H.; Salonen, J.T.; Rauramaa, R. Heart rate response during exercise test and middle-aged men. Eur. Heart J. 2006, 27, 582–588. [CrossRef]
76. Risgaard, B.; Winkel, B.G.; Jabbari, R.; Glinge, C.; Ingemann-Hansen, O.; Thomesen, J.L.; Ottesen, G.L.; Haunso, S.; Holst, A.G.; Tfelt-Hansen, J. Sports-related sudden cardiac death in a competitive and a noncompetitive athlete population aged 12 to 49 years: Data from an unselected nationwide study in Denmark. Heart Rhythm. 2014, 11, 1673–1681. [CrossRef]
77. Ghali, J.K.; Kadakia, S.; Cooper, R.S.; Liao, Y. Impact of left ventricular hypertrophy on ventricular arrhythmias in the absence of coronary artery disease. J. Am. Coll. Cardiol. 1991, 17, 1277–1282. [CrossRef]
78. Jouven, X.; Desnos, M.; Guerot, C.; Ducimetière, P. Predicting sudden death in the population: The Paris Prospective Study I. *Circulation* **1999**, *99*, 1978–1983. [CrossRef] [PubMed]

79. Taylor, A.; Mourad, F.; Kerry, R.; Hutting, N. A guide to cranial nerve testing for musculoskeletal clinicians. *J. Man. Manip. Ther.* **2021**, *29*, 1–14. [CrossRef] [PubMed]

80. Maselli, F.; Rossettini, G.; Storari, L.; Barbari, V.; Viceconti, A.; Geri, T.; Testa, M. Knowledge and management of low back pain as running-related injuries among Italian physical therapists: Findings from a national survey. *Phys. Sportsmed.* **2021**, *49*, 278–288. [CrossRef] [PubMed]