# Variation in Preoperative and Postoperative Physical Therapist Management of Patients Opting for Elective Abdominal Surgery

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**Background.** Evidence about the role of physical therapy in perioperative care pathways to improve postoperative outcomes is growing. However, it is unclear whether research findings have been translated into daily practice.

**Objective.** The objectives of this study were to describe the current content and between-hospital variability of perioperative physical therapist management for patients undergoing colorectal, hepatic, or pancreatic resection in the Netherlands and to compare currently recommended state-of-the-art physical therapy with self-reported daily clinical physical therapist management.

**Design.** This was a cross-sectional survey study.

**Methods.** Hospital physical therapists were asked to complete an online survey about pre- and postoperative physical therapy at their hospital. To explore the variability of perioperative physical therapist management between hospitals, frequency variables were clustered to determine the level of uniformity. Latent class analysis was performed to identify clusters of hospitals with certain homogeneous characteristics on a 19-item dichotomous scale.

**Results.** Of 82 eligible Dutch hospitals, 65 filled out the survey (79.3%). Preoperative physical therapy was performed in 34 hospitals (54.0%; 2/65 responding hospitals were excluded from the data analysis). Postoperative physical therapy was performed in all responding hospitals, focusing mainly on regaining independent physical functioning. Latent class analysis identified a 3-class model. Hospitals in classes I and II were more likely to provide preoperative physical therapist interventions than hospitals in class III.

**Limitations.** The use of self-reported answers can lead to bias.

**Conclusions.** There was a wide degree of variability between hospitals regarding pre- and postoperative clinical physical therapist practice for patients opting for major abdominal surgery. Three different classes of daily practice were identified. Further translation of key research findings into clinical physical therapist practice is advised, especially for hospitals in which the physical therapist is not involved preoperatively. Moreover, improving uniformity by developing up-to-date clinical guidelines is recommended.

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According to the World Health Organization, the number of people aged 65 and older is expected to increase to 1.5 billion by 2050, representing 16.0% of the world's population.[1] With the aging population, the number of elderly people requiring surgical procedures is increasing. Elderly patients can experience difficulties when recovering from surgery because of diminished physiological reserves, frailty, and comorbidities.[2–4] In recent decades, improvements have therefore been made in perioperative care management. Developments in analgesic approaches and surgical techniques, as well as "enhanced recovery after surgery" and "fast-track" programs, have resulted in a reduced length of hospital stay and a reduction in overall complications.[5]

However, the stress response to surgery and hospitalization comprises metabolic and physiological changes and results in an increase in allostatic load.[6,7] A vulnerable patient with comorbid conditions and reduced physiological reserve opting for elective major surgery can have reduced capacity to adapt to the increased allostatic load, which can lead to an imbalance in autonomic, endocrine, metabolic, and immune function, resulting in additional clinical challenges leading to a delayed recovery of physical functioning,[8] or even a permanent loss of physical functioning.

Hence, a change in the continuum of care is advocated, with complementary prevention and care interventions to assist vulnerable patients in managing their perioperative course.[9–11] This implies a changing role for the physical therapist in acute care settings concerning patient care and professionalism, as already mentioned by Lopopolo in 1999.[12] Improvements in perioperative care should optimally include innovative physical therapist interventions to prevent a complicated peri- and postoperative course, as well as to enhance a rapid return to adequate performance of activities of daily living, which is essential to preserve independent physical functioning and perceived quality of life. Innovative pre- and postoperative physical therapist interventions should lead toward realization of predictive, preventive, personalized, and participatory (P4) perioperative physical therapy.[13] The latter means including preoperative risk stratification using performance-based tests, preoperative advice and recommendations about the importance of physical activity and physical fitness, preoperative exercise training (prehabilitation) for high-risk patients, and early mobilization and functional physical exercise training postoperatively, as recommended in several guidelines.[9,10,14–17] High-quality research demonstrates that preoperative physical therapist interventions for high-risk patients undergoing cardiac, abdominal, and major joint replacement surgery are feasible and effective.[18–22]

It remains unclear to what degree these research findings have already been translated and implemented in the real-life context of health care systems, especially in the routines of physical therapy services. Consequently, it is necessary to establish an understanding of current clinical practice in order to compare the differences between clinical research outcomes and clinical practice, and to anticipate what should change in clinical practice and education for physical therapist students according to the latest evidence. Nationwide surveys have been performed to explore clinical physical therapist management in different fields to examine practice variability with respect to known evidence and guidelines.[23–27] Benefits of such an approach were shown previously by Peter et al,[27] with improvements of guideline recommendations for postacute physical therapist practice after major joint replacement. To provide optimal physical therapist care for patients opting for major abdominal surgery this approach might be beneficial as well. Therefore, the aims of the present study were 2-fold: (1) to describe the overall reported content and between-hospital variability of perioperative physical therapist management for patients who opt for elective major abdominal surgery for colorectal, hepatic, or pancreatic cancer in the Netherlands; and (2) to compare the currently advised state-of-the-art physical therapy with the self-reported daily clinical physical therapist management. By "state-of-the-art physical therapist management," we refer to the current highest level of scientific evidence available in perioperative physical therapist management.

## Methods

### Design

In this cross-sectional survey study, all heads of the departments of physical therapy who were registered with the Dutch Association for Physical Therapy in Hospitals and the Association of Intramural Physical Therapy Managers were contacted in November 2016 by email. They were informed about the purpose of the study and the content of the survey. Furthermore, they were asked to forward a participant information letter with the survey to the physical therapist at their department with the most expertise in working with patients undergoing elective major abdominal surgery for colorectal, hepatic, or pancreatic cancer. An email reminder was sent each month for 3 months to the heads of the departments of physical therapy from which no response had been obtained. Additionally, 2 short news items were published in the monthly newsletters of both the Dutch Association for Physical Therapy in Hospitals and the Association of Intramural Physical Therapy Managers that described the study and explained how to participate. One news item was published at the beginning of the study, and 1 was published after 3 months. Hospitals that had not filled out the survey after 3 months were contacted by phone.

The survey consisted of 41 mixed questions (6 open and 35 multiple choice) in the following 4 domains: demographic data (5 questions), preoperative diagnostics and treatment data (12 questions), postoperative

diagnostics and treatment data (17 questions), and discharge and readmission data (7 questions). The survey was mainly based on a survey study with a similar research aim.[26] The current survey was shaped with concepts of the framework of Hulzebos and van Meeteren[9,10] and a literature review to be able to inquire whether hospitals provide the currently advised state-of-the-art pre- and postoperative physical therapist management for patients scheduled for elective major abdominal surgery. Additionally, the survey included 6 questions concerning the context of the postoperative physical therapist treatment (2 items) and the availability and usefulness of a readmission protocol (4 items). The final version of the survey was peer-reviewed by 3 (hospital) physical therapists with experience and knowledge about the perioperative care pathway at the Maastricht University Medical Center. The survey was tested in a semistructured pilot process with written and verbal feedback of the assessors. The survey was evaluated on the number and type of questions, relevance of each question, wording, and whether the survey questions captured the total perioperative care pathway. The survey is available as a Supplementary Appendix (translated into English, not an official crosscultural adaptation; available at https://academic.oup.com/ptj). The survey was developed and administered using Qualtrics electronic survey software (www.qualtrics.com) provided by Maastricht University, Maastricht, the Netherlands. This study is reported according to the STROBE guideline for cross-sectional studies.

### Ethics

The participant information letter clearly stated that only coded survey data would be used for publication. Because of the voluntary nature of the survey without patient involvement, the study did not meet the criteria for the Dutch Medical Research Involving Human Subjects Act. Therefore, assessment by a medical ethical review committee was not necessary. None of the respondents objected, and a full response on the survey was interpreted as informed consent.

### Participants

Physical therapists employed in an acute-hospital care setting in the Netherlands were inquired by a survey about the preoperative and postoperative physical therapist management at their hospital for patients undergoing elective colorectal, hepatic, or pancreatic resection. Hospitals not performing these types of surgical procedures were excluded.

### Data Analysis

Two researchers (C.A.B. and A.F.H.) categorized the answers of the open questions. When differences between assessors were found, a third researcher (B.C.B.) was involved to obtain consensus. The Statistical Package for the Social Sciences for Windows (version 23.0; IBM SPSS Inc, Chicago, IL, USA) was used for the descriptive data analysis to describe the study population and responses to the survey. To explore the variability of perioperative physical therapist management between hospitals, frequency variables were clustered to determine the level of uniformity, presented as the percentage of respondents choosing the same answer. The categories of uniformity were classified as follows: no uniformity (< 60.0%), low uniformity (61.0%–70.0%), moderate uniformity (71.0%–80.0%), strong uniformity (81.0%–90.0%), and very strong uniformity (91.0%–100.0%).

To compare currently advised state-of-the-art physical therapy with self-reported daily clinical physical therapist practice, we extracted several items from each subdomain of the survey that were closely related to the described conceptual hypothesis in the literature for perioperative physical therapist management. These items were independently extracted from the survey by 3 individual assessors (C.A.B., A.F.H., and B.C.B.) and resulted in a 19-item dichotomous scale containing 7 items on preoperative diagnostics and treatment, 8 items addressing postoperative diagnostics and treatments, and 4 items concerning discharge and readmission (Tab. 1). On the basis of the reported clinical physical therapist management, each hospital was subsequently scored on the 19-item dichotomous scale.

Exploratory latent class analysis (LCA) was used to identify and classify clusters of hospitals with certain homogeneous characteristics on the 19-item dichotomous scale. Selection of the optimal number of classes was based on several goodness-of-fit parameters. The following statistical fit indexes were used in our study: the Akaike information criterion and the Bayesian information criterion. Lower Akaike information criterion and Bayesian information criterion values indicate a better fit. Furthermore, selection of the classes was based on their substantive meaningfulness (the classes should be distinct and meaningful for the clinical expert). LCA was performed with the open-source statistical package R (version 2.14.2; R Foundation for Statistical Computing, Vienna, Austria) using the package poLCA,[28] version 1.4. In addition, an index (frequency distribution) score was calculated on the basis of the given response by the hospitals on all items of the 19-item dichotomous scale. These scores represent the distance between the currently advised state-of-the-art physical therapy and the self-reported daily clinical physical therapist management. Respondents with scores greater than 75.0% were classified as "progressive," respondents with scores between 50.0% and 75.0% were classified as "moderately progressive," and respondents with scores less than 50.0% were classified as "conservative."

## Results

### Flow of Participants Through the Study

Of the 103 Dutch hospitals, 21 hospitals (20.4%) were excluded beforehand because they did not perform

**Table 1.**
Descriptive Statistics for Each Item on the 19-Item Dichotomous Scale and Class Response Probability[a]

| Predicted Class Membership (Posterior Probability) | No. (%) of Hospitals | Response Probability for: | | |
|---|---|---|---|---|
| | | Class I (0.25) | Class II (0.29) | Class III (0.46) |
| **Preoperative physical therapist management** | | | | |
| 1. Patients visit the physical therapist preoperatively | 34 (54.0) | 1.00 | 1.00 | 0.00 |
| 2. The physical therapist provides patient education | 30 (47.6) | 0.88 | 0.89 | 0.00 |
| 3. The physical therapist assesses the patient's physical fitness level | 20 (31.7) | 0.94 | 0.28 | 0.00 |
| 4. Questionnaires are used in the preoperative assessment | 16 (25.4) | 1.00 | 0.00 | 0.00 |
| 5. Physical performance tests are used in the preoperative assessment | 10 (15.9) | 0.63 | 0.00 | 0.00 |
| 6. The physical therapist provides exercise prehabilitation | 11 (17.5) | 0.50 | 0.17 | 0.00 |
| 7. The context of the prehabilitation is the patient's home | 8 (12.7) | 0.44 | 0.00 | 0.00 |
| **Postoperative physical therapist management** | | | | |
| 8. A multimodal perioperative care pathway (eg, ERAS, fast track) is implemented, and a postoperative protocol is followed | 43 (68.3) | 0.75 | 0.72 | 0.62 |
| 9. The physical therapist treatment is initiated by the physical therapist | 26 (41.3) | 0.50 | 0.44 | 0.34 |
| 10. The physical therapist treatment starts at the day of surgery | 10 (15.9) | 0.13 | 0.28 | 0.10 |
| 11. Physical therapy is structurally continued during the weekends | 11 (17.5) | 0.13 | 0.33 | 0.10 |
| 12. The physical therapist treatment is mainly performed in the living room of the surgical nurse ward[c] | 0 (0.0) | – | – | – |
| 13. If necessary, treatment frequency can be adapted to the patient's needs | 62 (98.4) | 1.00 | 1.00 | 0.97 |
| 14. To monitor postoperative outcome, questionnaires are used | 9 (14.3) | 0.13 | 0.06 | 0.21 |
| 15. To monitor postoperative outcome, physical performance tests are used | 16 (25.4) | 0.56 | 0.06 | 0.21 |
| **Discharge and readmission** | | | | |
| 16. Discharge is performed by shared decision-making | 26 (41.3) | 0.56 | 0.56 | 0.24 |
| 17. Discharge criteria are available | 42 (66.7) | 0.88 | 0.72 | 0.52 |
| 18. A readmission protocol is available[b] | 0 (0.0) | | | |
| 19. In case of a readmission, the physical therapist is consulted in a timely manner | 48 (76.2) | 0.75 | 0.67 | 0.82 |

[a]Probability of reporting "yes" on each item of each class. ERAS = enhanced recovery after surgery.
[b]This item contained only 1 outcome category ("no" response) and was removed from the analysis.

colorectal, hepatic, or pancreatic resection. The remaining 82 hospitals (82/103; 79.6%) were contacted for participation in the survey. After an inclusion period of 3 months, 65 of these 82 eligible hospitals responded to our survey, resulting in a response rate of 79.3%. Two responding hospitals (2/65; 3.1%) were excluded from data analysis because they did not meet the inclusion criteria for performing elective colorectal, hepatic, or pancreatic resection. Hence, a total of 63 surveys (63/82; 76.8%) were included in the data analysis. Figure 1 shows the flowchart of the study. Demographic and descriptive data concerning the reported pre- and postoperative clinical physical therapist management from the responding hospitals are provided in Tables 2 and 3.

## Content of and Variability in Reported Physical Therapist Management

Of 63 respondents, 34 (54.0%) reported that patients were seen preoperatively by a physical therapist, and most of these patients were seen once (31/34; 91.2%). The content of the preoperative intervention consisted of patient

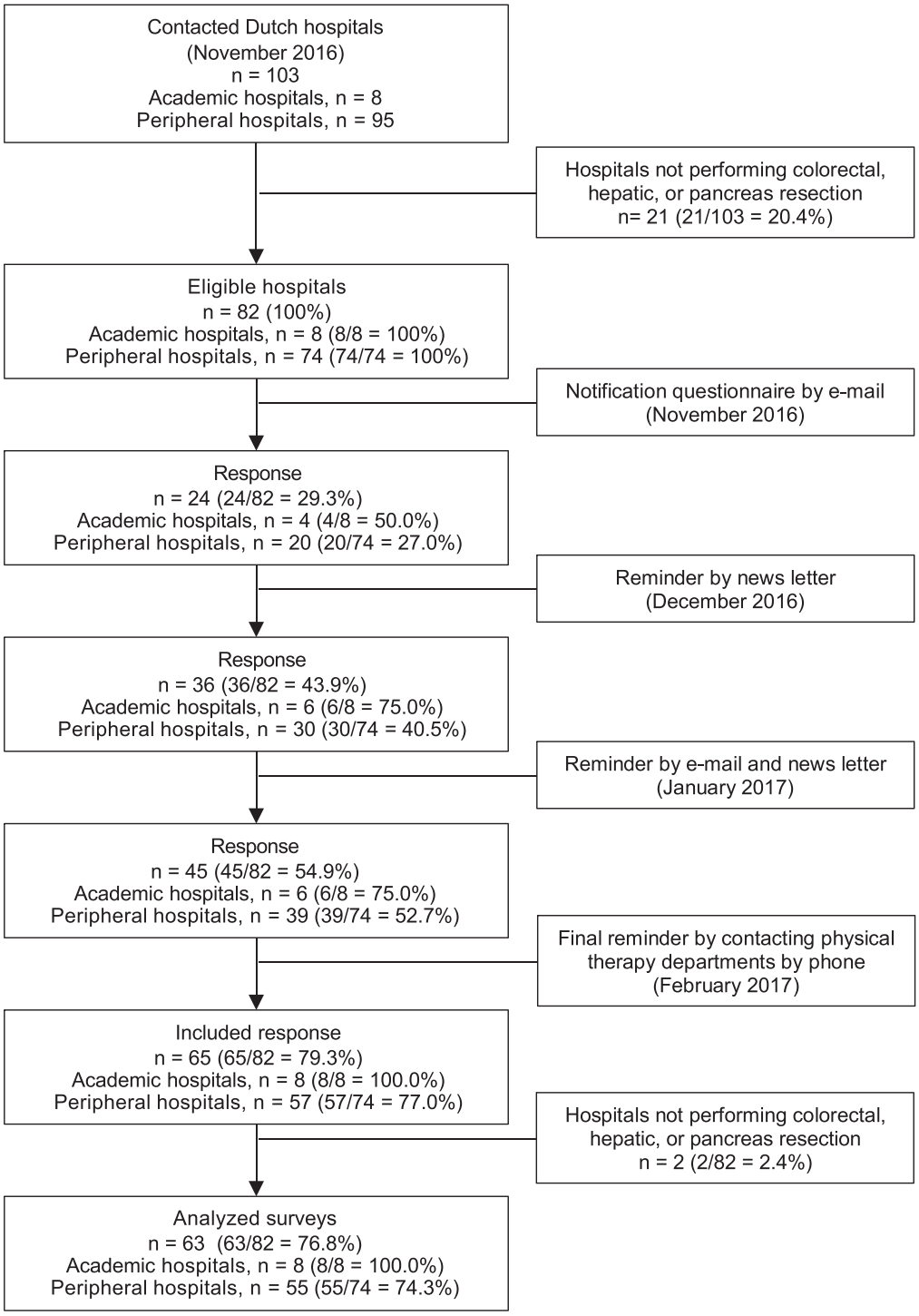


**Figure 1.**
Flowchart of the study.

**Table 2.**
Demographic Data for the 63 Responding Hospitals[a]

| Demographic | No. (%) of Hospitals | Mean [SD] % of Therapists |
|---|---|---|
| Type of hospital | | |
| Academic | 8 (12.7) | NA |
| General | 52 (82.5) | NA |
| Other | 3 (4.8) | NA |
| Education level of hospital physical therapist | | |
| Bachelor of Applied Science degree | NA | 76.3 [7.4] |
| Clinical specialization in physical therapy | NA | 16.2 [3.3] |
| Master of Science degree | NA | 6.6 [2.1] |
| Doctor of Philosophy degree | NA | 1.0 [0.0] |
| Standardized care pathway for major abdominal surgery | | |
| Yes | 43 (68.3) | NA |
| Physical therapist involved in development | 31 (72.1) | NA |
| No | 20 (31.7) | NA |
| Type of standardized care pathway (n = 43)[b] | | |
| Enhanced recovery after surgery | 27 (62.8) | NA |
| Fast-track | 10 (23.3) | NA |
| Other | 8 (18.6) | NA |
| Protocol-guided physical therapy | | |
| Yes | 49 (77.8) | NA |
| No | 14 (22.2) | NA |

[a]NA = not applicable.
[b]Multiple answers were possible.

education (30/34; 88.2%), assessment of physical fitness (20/34; 58.8%), and/or prehabilitation (11/34; 32.4%). There was a strong uniformity between hospitals (30/34; 88.2%) reporting about the elements of education for patients (Fig. 2, graph IA). A total of 20 respondents (20/34; 58.8%) reported that they measured the patient's preoperative physical fitness level prior to the surgical procedure. Strong uniformity concerning the importance of the assessment of daily physical activity level (18/20; 90.0%) and functional mobility (17/20; 85.0%) was observed. There was no uniformity concerning other domains of the preoperative physical fitness assessment (Fig. 2, graph IB). No uniformity was seen for the type of preoperative physical performance tests and the type of preoperative questionnaires (Fig. 2, graph IC). Regarding the type of exercise prehabilitation, moderate to low uniformity was observed for inspiratory muscle strength

**Table 3.**
Pre- and Postoperative Clinical Physical Therapist Management[a] for Patients Who Underwent Elective Colorectal, Hepatic, or Pancreatic Resection

| Physical Therapist Management | No. (%) of Hospitals |
|---|---|
| **Preoperative** | |
| Preoperative physical therapist intervention (eg, patient education, assessment of physical fitness, and prehabilitation)[b] | |
| Yes | 34 (54.0) |
| No | 29 (46.0) |
| Preoperative physical therapist intervention[c] | |
| Usual care | 15 (44.1) |
| Only after referral (specialist physician, case manager, nurse practitioner) | 19 (55.9) |
| Content of preoperative physical therapist intervention (n = 34)[d] | |
| Patient education | 30 (88.2) |
| Assessment of physical fitness level | 20 (58.8) |
| Physical training (prehabilitation) | 11 (32.4) |
| **Postoperative** | |
| Postoperative physical therapy as part of usual care | |
| Yes | 43 (68.3) |
| No | 20 (31.7) |
| Person referring patient for postoperative physical therapy[d] | |
| Ward physician | 46 (73.0) |
| Surgeon | 42 (66.7) |
| Nurse | 35 (55.6) |
| Physical therapist | 26 (41.3) |
| Nurse practitioner | 21 (33.3) |
| Other | 4 (6.3) |
| Postoperative physical therapist treatment frequency | |
| Once/d | 47 (74.6) |
| Once or twice/d | 9 (14.3) |
| Twice/d | 5 (7.9) |
| Other (depends on individual patient) | 2 (3.2) |
| Postoperative physical therapist treatment session duration (min) | |
| 10 | 9 (14.3) |
| 15 | 23 (36.5) |
| 20 | 30 (47.6) |
| 30 | 1 (1.6) |
| Postoperative physical therapist treatment session during weekends | |
| Yes | 60 (95.2) |
| No | 3 (4.8) |

*(Continued)*

**Table 3.**
Continued

| Physical Therapist Management | No. (%) of Hospitals |
|---|---|
| Decision for hospital discharge | |
| Shared decision-making | 26 (41.3) |
| Surgeon | 22 (34.9) |
| Ward physician | 15 (23.8) |
| Specific hospital discharge criteria available | |
| Yes | 42 (66.7) |
| No | 21 (33.3) |
| Specific readmission protocol available | |
| Yes | 0 (0.0) |
| No | 24 (38.1) |
| Unknown | 39 (61.9) |
| Opinion concerning usefulness of readmission protocol | |
| Useful | 3 (4.8) |
| Neutral | 29 (46.0) |
| Not useful | 31 (49.2) |

[a]Reported by physical therapists.
[b]Number of hospitals in which a preoperative physical therapist intervention was part of the routine perioperative care pathway (n = 34; eg, for "Yes" answer, 34/63 = 54.0%).
[c]Distribution of "yes" and "no" answers about a preoperative referral to the physical therapy department in the 34 hospitals in which a preoperative physical therapist intervention was part of the care pathway.
[d]Multiple answers were possible.

training (8/11; 72.7%), peripheral muscle strength training (7/11; 63.6%), and cardiorespiratory exercise training (7/11; 63.6%). For functional exercise training (4/11; 36.4%) and breathing exercises (2/11; 18.2%), no uniformity was observed (Fig. 2, graph ID). The majority of the respondents (10/11; 90.9%) reported that not all patients were eligible for exercise prehabilitation, in which case the decision for preoperative physical exercise training was based on the risk profile of the patient (5/10; 50.0%), the request of the surgeon (2/10; 20.0%), or other reasons, such as the age of the patients, number of comorbidities, or need for inspiratory muscle training (3/10; 30.0%).

Postoperative physical therapist practice of which (very) strong uniformity was observed between the respondents (n = 63) were breathing exercises (62/63; 98.4%), practicing transfers (62/63; 98.4%), patient education (61/63; 96.8%), stair climbing (56/63; 88.8%), and walking exercises (55/63; 87.3%) (Fig. 2, graph IIA). Low or no uniformity was observed for postoperative physical performance tests to monitor and evaluate a patient's recovery of physical functioning (Fig. 2, graph IIB).

### Comparison of Reported Physical Therapist Management and Advised State-of-the-Art Physical Therapy

LCA identified a 3-class model based on the Akaike information criterion (988.52), Bayesian information criterion (1102.10), and substantive relevance. The fit indexes from the LCA are reported in the Supplementary Table (available at https://academic.oup.com/ptj). LCA assigned each hospital to 1 of the 3 classes (posterior probability) and calculated the conditional probabilities (values between 0 and 1) of each item for each class (Tab. 1). For the items addressing preoperative physical therapy, respondents in classes I and II were more likely to respond that they provide preoperative physical therapy for patients than respondents in class III. There was a 94.0% chance that a hospital in latent class I provided a preoperative assessment of physical fitness, and there was a 50.0% chance that this respondent provided prehabilitation; however, these probabilities for respondents in class II were 28.0% (providing a preoperative assessment) and 17.0% (providing prehabilitation). For postoperative physical therapist management, no major differences were seen in the conditional probabilities between the 3 classes. Calculating the index scores for each hospital, meaning the distance between the reported physical therapist practice and advised state-of-the-art physical therapy, the same patterns as the LCA classes were observed in the pre- and postoperative physical therapy. Figure 3 shows the index scores for each hospital. Average response profiles for each group on the 19-item dichotomous scale are graphically presented in Figure 3.

## Discussion

This study provides an overview of the current clinical physical therapist management (response rate = 65/82, or 79.3%) for patients who opt for abdominal surgery for colorectal, hepatic, or pancreatic cancer in the Netherlands. The reported content and between-hospital variability is described, and moderate to strong uniformity among physical therapists was reported regarding preoperative education and postoperative physical therapist treatment goals. For pre- and postoperative performance measures, no uniformity was found. In addition, 3 different classes of clinical physical therapist practice were identified by comparing the currently advised state-of-the-art physical therapy and the self-reported physical therapist management.

The first aim of this study was to describe the current content and variability in pre- and postoperative physical therapist management in major abdominal surgery. A response rate greater than 75% is considered excellent, which makes the participant responses to our survey fairly representative for current Dutch clinical practice. Besides, comparable studies have reported similar response rates

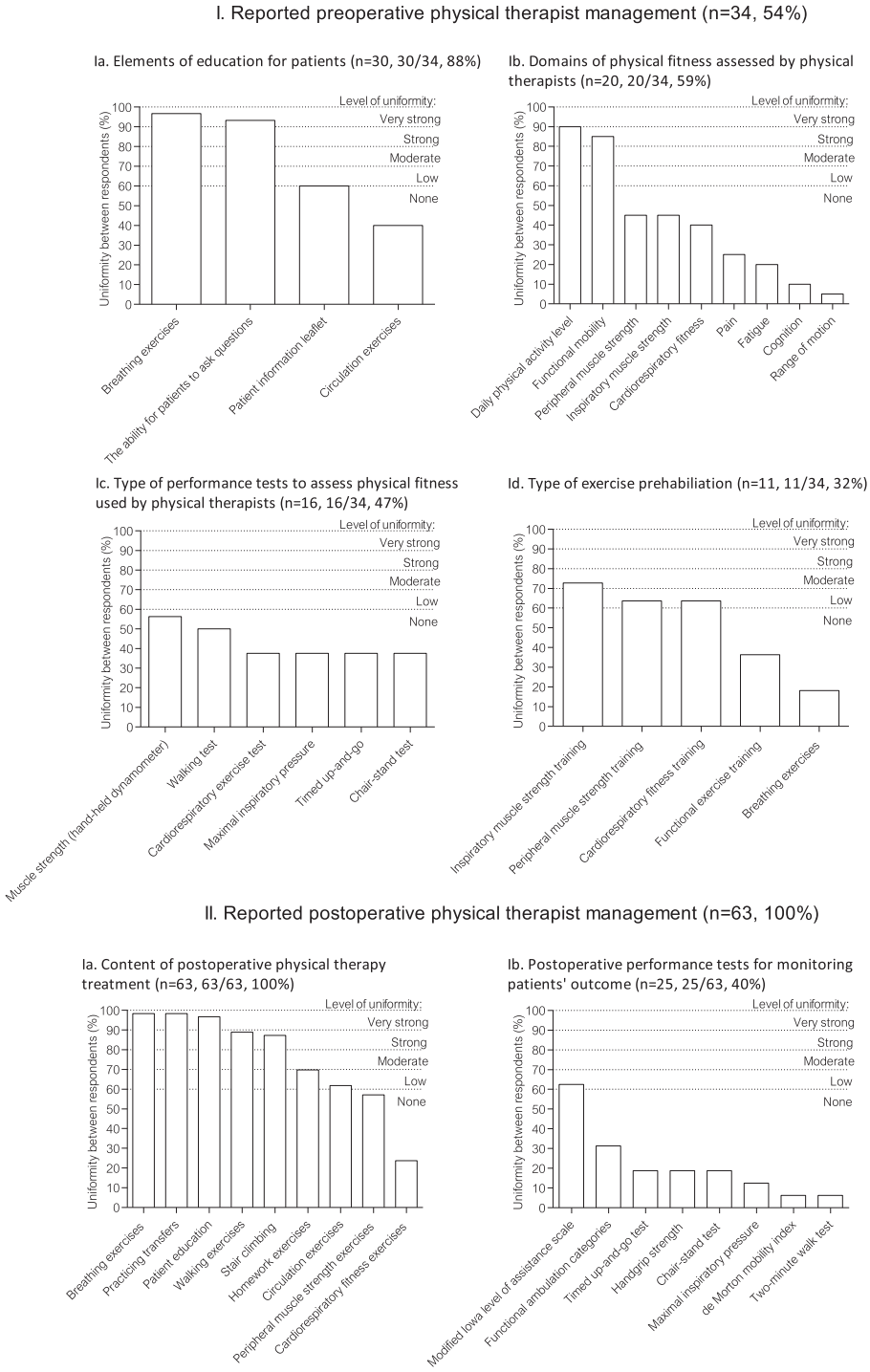


**Figure 2.**
Reported physical therapist interventions performed by physical therapists for patients after elective colorectal, hepatic, or pancreatic resection. Preoperative physical therapist interventions (n = 34) included: elements of education (IA, n = 30), domains of physical fitness assessment used by physical therapists (IB, n = 20), types of performance tests used by physical therapists to assess physical fitness (IC, n = 16), and components of exercise prehabilitation (ID, n = 11). Postoperative physical therapist interventions (n = 63) included: content of postoperative physical therapist treatment (IIA, n = 63), and postoperative performance tests for monitoring patients' outcomes (IIB, n = 25).

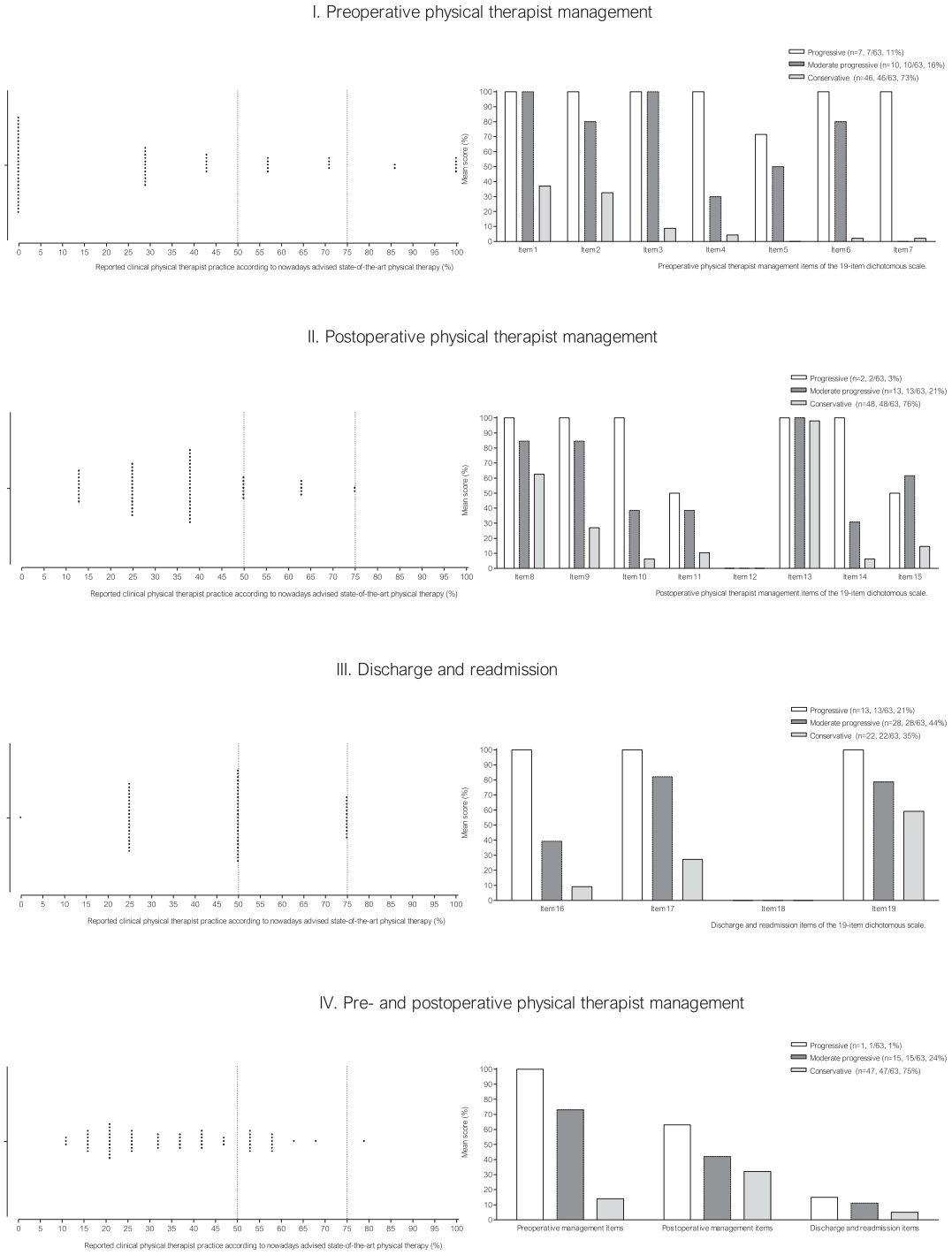


**Figure 3.**
Index scores (frequency distributions) for each hospital and average response profiles for each group on the 19-item dichotomous scale. The graph is divided in three themes (preoperative, postoperative, and discharge and readmission physical therapist management) and one theme combining these. Left graphs depict individual hospital scores within each theme, based on the overall score on the theme items as part of the 19-item dichotomous scale for pre- and postoperative physical therapist management. These scores represent the distance between the currently advised state-of-the-art physical therapy and the self-reported daily clinical physical therapist management. Respondents with scores greater than 75.0% were classified as "progressive," respondents with scores between 50.0% and 75.0% were classified as "moderately progressive," and respondents with scores less than 50.0% were classified as "conservative." The right graphs represent the mean score of each group (eg, progressive, moderately progressive, conservative) on each item relevant in a certain theme.

of 80.7% (46/57)[29] and 82.4% (28/34).[26] We consulted physical therapists working on a daily basis with patients opting for elective major abdominal surgery and who therefore have extensive knowledge concerning the current practice in their respective hospitals. Consequently, this study provides accurate information about the current pre- and postoperative physical therapist management in their respective hospitals.

Variability between the respondents was assessed by evaluating the level of uniformity in physical therapist management. Fifty-four percent (34/63) of the respondents reported that patients were seen preoperatively by a physical therapist; uniformity existed in the provided elements of education for patients, but not concerning the different domains of physical fitness assessed. Additional descriptive analysis did not demonstrate clear differences between academic and general hospitals. Screening of patients prior to major abdominal surgery by physical therapists is not yet routine physical therapist practice in the Netherlands.[9,10] Similar results have been reported in surveys in other surgical populations.[23,25,30–31] Previously reported potential barriers for preoperative physical therapy were lack of time, insufficient evidence, or that relevant information was already provided by other health care professionals.[23] Concerning postoperative physical therapy, our study indicated strong uniformity between respondents concerning airway-clearing exercises, patient education (stimulating self-management), early mobilization, and practicing functional tasks (eg, transfers, walking exercises, and stair climbing). Airway-clearing exercises were performed in most hospitals (62/63; 98.4%); however, the literature remains inconclusive about the type of breathing exercises and the additional effects of breathing exercises compared with mobilization alone in major (upper) abdominal surgery.[32,33] Of the respondents, 38.1% reported that there is no readmission protocol available at their hospital. However, 61.9% of the respondents were unaware about the availability of such a protocol in their hospital. Nevertheless, 76.2% (48/63) of the respondents reported that they were consulted in time when a readmission occurred. It is important to react adequately when a readmission occurs, because a readmission is associated with additional short-term morbidity and mortality in major abdominal surgery.[34]

The second aim of the study was to compare the currently advised state-of-the-art physical therapy with the self-reported daily clinical physical therapist practice. Using LCA on the reported data about pre- and postoperative physical therapy, 3 classes of practice were identified, in which hospitals in class I and class II were more likely to provide preoperative risk assessment; however, prehabilitation was most likely to be offered in class I. Therefore, class I is most closely related to the currently advised state-of-the-art physical therapy and such hospitals are classified as "progressive." Respondents who reported merely providing preoperative risk assessment are more likely to belong to class II ("moderately progressive"). Respondents that do not provide preoperative physical therapy (risk assessment and prehabilitation) are most likely to belong to class III ("conservative"). These respondents can learn from the experiences of classes I and II when aiming to implement state-of-the-art evidence- and practice-based preoperative interventions.

The importance of a preoperative assessment of physical fitness in predicting postoperative outcomes is well documented nowadays.[35] Cardiopulmonary exercise testing is the gold standard for assessing cardiorespiratory fitness and has been found to have a consistent relation with postoperative outcomes (eg, morbidity, length of stay, mortality) in major abdominal surgery.[36,37] Clear cutoff values for cardiorespiratory fitness to preoperatively identify patients with a higher risk for postoperative morbidity have been published.[38] However, performing cardiopulmonary exercise testing is not always feasible as usual care in the Netherlands. More practical performance-based tests to estimate cardiorespiratory fitness can be used (eg, incremental shuttle walk test, Timed "Up & Go" Test)[39,40]; however, they still need further validation.[38] The latter might explain the lack of uniformity between the respondents using these types of tests in their preoperative physical fitness assessment. Moreover, besides measuring cardiorespiratory fitness, it is important to preoperatively assess muscle strength and functional mobility, because these components of physical fitness are a prerequisite for (early) mobilization and being physically active postoperatively.[41]

It is encouraging that 17.5% of the respondents (11/63) provide exercise prehabilitation prior to major abdominal surgery. Recent studies in major abdominal surgery demonstrated that prehabilitation (in high-risk patients) improves the preoperative physical fitness level and can reduce the risk of postoperative complications and length of stay.[42–44] Despite these reported beneficial effects, most studies evaluating the effectiveness of prehabilitation are hampered by a lack of adequate preoperative risk assessment that might lead to selection bias (inclusion of mainly low-risk patients).[45] Moreover, the studies are too heterogeneous concerning the context (home-, community-, or hospital-based) and content (frequency, intensity, time, and type) of the preoperative exercise training program, making further research necessary.[45]

Concerning postoperative physical therapist management, no major differences were seen in the conditional probabilities between the 3 classes. No probability could be calculated from items 12 and 18, because there was no variability within the item response. Postoperatively, early mobilization and practicing functional tasks are part of the "enhanced recovery after surgery" care pathway, as implemented by 63.0% of the respondents. Implementation of "enhanced recovery after surgery"

programs resulted in major improvements in clinical outcomes and costs in colorectal, hepatic, and pancreatic surgery.[46–48] Although the importance of early mobilization and the physiological and functional consequences of bed rest are known,[49] it was reported that patients spent about 83% of their time in bed, often without a medical reason.[50] The use of the "enhanced recovery after surgery" care pathway with a multidisciplinary patient-centered approach in combination with a physical activity culture and infrastructure has been advocated to improve and accelerate the recovery of physical functioning postoperatively.[9,10] The low probabilities for the use of performance-based tests to monitor patients' recovery of physical functioning and the availability of clear (clinometric) discharge criteria in hospitals are remarkable. Literature describes that frequent monitoring of the recovery of physical functioning, ideally using performance-based tests, during the treatment course is very important for guiding the care process and discharge planning.[51]

Implementation of state-of-the-art pre- and postoperative physical therapist management is a complex intervention. A pragmatic strategy in which implementation consists of an interaction between the implementation process, context, and outcomes might be valuable.[52] First, the physical therapist should be aware of the available evidence and the related recommendations for clinical practice. Then, in an iterative process, small changes can be made in daily clinical practice with real-time monitoring of relevant outcomes on the basis of qualitative and quantitative data. These real-time feedback-driven adaptations are necessary to make changes in daily clinical practice sustainable.[52,53] An example for such an approach is published by van der Sluis et al.[22]

A limitation of this study is uncertainty concerning the generalizability of the used literature to describe the state-of-the-art physical therapist management. Patient characteristics of the participating hospitals were unknown, preventing evaluation of how well the patient population described in the literature fits the patient population of the participating hospitals. The survey was not evaluated on reliability and validity and there was no structured assessment of the interpretation of the questions. Finally, the use of self-reported answers might lead to bias toward real-life practice.

There is wide variability between hospitals regarding pre-and postoperative clinical physical therapist practice for patients opting for major abdominal surgery. Three classes of clinical physical therapist practices were identified, differing in adherence to the evidence provided in the literature. It is encouraging to see current developments (eg, preoperative risk assessment and prehabilitation) in daily clinical practice related to evidence- and practice-based conceptual models as described in the literature to further improve perioperative (physical therapist) care for these patients. Further translation of key research findings into clinical physical therapist practice is advised, especially for hospitals in which the physical therapist is not involved preoperatively. Moreover, improving uniformity by developing up-to-date clinical guidelines is recommended.

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## Ethics Approval

The participant information letter clearly stated that only coded survey data would be used for publication. Because of the voluntary nature of the survey without patient involvement, the Dutch Medical Research Involving Human Subjects Act was not applicable. Assessment by a medical ethical review committee, therefore,

was not necessary. None of the respondents objected, and a full response on the survey was interpreted as informed consent.

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## Disclosures

The authors completed the ICMJE Form for Disclosure of Potential Conflicts of Interest and reported no conflicts of interest.

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