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Research Article

Applications of complementary therapies during rehabilitation for individuals with traumatic Spinal Cord Injury: Findings from the SCIRehab Project

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Objective: Evaluate the use of complementary therapies during rehabilitation for patients with traumatic spinal cord injury (SCI).
Design: Secondary analyses were conducted to identify the use and associated outcomes of complementary therapies provided by occupational therapists (OTs) and physical therapists (PTs) during rehabilitation from a public dataset.
Setting: Inpatient rehabilitation.
Participants: A public dataset composed of 1376 patients with SCI that were enrolled in a five-year, multi-center investigation, the SCIRehab Project. Secondary analyses focused on a subset of 93 patients (47 who received complementary therapy during treatment and 46 case-matched controls who received no complementary therapy).
Interventions: OTs and PTs recorded use of complementary therapies during sessions, including yoga, Pilates, tai chi, aromatherapy, relaxation techniques, imagery and other.
Outcome Measures: Pain interference, pain severity, mobility, and social integration.
Results: Three percent of participants received any complementary therapies. Patients who received complementary therapies showed greater reductions in pain severity from 6 months to 12 months relative to matched controls. Furthermore, the amount of time that patients received complementary therapies during physical therapy sessions was associated with reduced pain interference at 6 months and with reduced pain severity at the 6-month and 12-month follow-ups. Complementary therapy use was not associated with mobility or social integration.
Conclusion: The current study provides preliminary evidence documenting the limited use of complementary therapies in rehabilitation settings and highlights the opportunity for further research, particularly regarding pain-related outcomes.

Keywords: Complementary Therapies, Spinal Cord Injuries, Rehabilitation, Physical Therapy, Occupational Therapy

Introduction

According to the National Spinal Cord Injury Database, approximately 17,500 new cases of spinal cord injury (SCI) are identified every year in the United States (US).[1] Many patients are referred for rehabilitation after obtaining a SCI to relearn mobility, activities of daily living and medical management from a new level of function. While the traditional structure of rehabilitation has maintained a typical medical-model focus for many years, a recent pilot survey

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suggests that people with SCI are also willing to use complementary therapies.[2]

Complementary and integrative medicine has become increasingly popular in the US.[3] In 2012, 33.2% of US adults had used some form of complementary therapies in the past 12 months.[3] Dietary supplements, deep breathing exercises, yoga, and chiropractic care were the most commonly used, while the use of yoga, tai chi, and qi gong increased linearly from 2002–2012.[3] Among individuals with SCI, reported rates of usage of complementary therapies range widely – from 14% to 73%, with higher rates found in studies that focus on people with both SCI and chronic pain.[4–6] However, most samples have been small, and prior studies have focused on use of complementary therapies to treat chronic sequelae of SCI. Little is known about use of complementary therapies during the first few weeks of inpatient rehabilitation for new patients with SCI and how they may correlate with physical or psychological outcomes.

Physical and psychological effectiveness of complementary therapies in SCI rehabilitation has been investigated. Physically, complementary therapies including acupuncture, seated tai chi, osteopathic therapy, healing touch, and yoga have been found to reduce neuropathic and nociceptive pain, improve bladder and bowel functioning, and promote static and dynamic balancing for patients with SCI.[7,8] Psychologically, complementary therapies have yielded inconsistent findings for depression, self-compassion, spiritual connection, and quality of life for patients with SCI.[7,9,10]

Despite the existing body of research on the effects of complementary therapies in SCI rehabilitation, many of the studies were small-scale pilot studies, case series reports, or intervention development studies.[7–10] As such, the current state of the literature on the effectiveness of complementary therapies in SCI rehabilitation in improving physical/psychological outcomes remains suggestive. Additional research is needed to establish the evidence for the use of complementary therapies in the treatment of patients with SCI.

The present study and the SCIRehab dataset

The present study sought to describe the use and potential benefits of complementary therapies during rehabilitation for patients with SCI. Secondary data analyses were conducted on public data from the SCIRehab Project, a five-year, multi-center, observational, practice-based evidence (PBE) research methodology, cohort study involving 1376 patients with traumatic SCI. PBE methodology applies an observational approach that utilizes a naturalistic view of examining what occurs in the care process. It does not alter the treatment regimen.[11] The overall aims and methodology of the SCIRehab Project were to "open the black box" of SCI rehabilitation during the acute phase and provide information on all the treatments that were delivered by the disciplines involved in the rehabilitation process and correlate these to create guidelines for clinical decision making.[11] Briefly, the goals of the SCIRehab Project were to gain a better understanding of the treatment interventions for patients with SCI during rehabilitation and to develop a comprehensive, multidisciplinary taxonomy for describing the details of the SCI rehabilitation process for many disciplines involved in the care of patients. Data were gathered from all clinical disciplines (i.e. physical therapy, occupational therapy, speech therapy, recreational therapy, psychology, nursing, and medicine) providing care for patients with SCI at six rehabilitation centers across the US. The details of the SCIRehab Project have been described in greater detail elsewhere.[11–15]

In the SCIRehab Project, occupational therapists (OTs) and physical therapists (PTs) collected treatment data on the use of complementary therapies such as yoga, Pilates, relaxation techniques, and imagery during their treatment sessions. Prior research from the outpatient setting shows that complementary therapies may be acceptable to people with SCI and may improve their physical and psychosocial outcomes.[2,4–10] However, this has not been examined in acute SCI rehabilitation. The current research therefore conducted secondary data analyses of the publicly available SCIRehab dataset to examine how frequently OTs and PTs provided complementary therapies to patients with SCI, the specific types of complementary therapies used, and whether the use of complementary therapies was associated with pain, functional mobility and social integration outcomes.

Methods

Participants

Between 2008 and 2011, individuals with new traumatic SCI were recruited from the following six rehabilitation centers: 1) Craig Hospital, Englewood, CO; 2) Carolinas Rehabilitation, Charlotte, NC; 3) Mt. Sinai Medical Center, New York, NY; 4) National Rehabilitation Hospital, Washington, DC; 5) Rehabilitation Institute of Chicago, Chicago, IL; and 6) Shepherd Center, Atlanta, GA. A total of 1376 individuals consented to provide data for the SCIRehab Project. Rates of receipt of complementary therapies during SCI

rehabilitation were calculated using the full sample (N = 1376). Analyses to examine associations among the use of complementary therapies and pain, mobility, and social integration outcomes were conducted in a subset of 93 patients: 47 patients who received any complementary therapies during their treatment and a case-control matched comparison group of 46 patients who did not receive any complementary therapies.

Procedure

During the course of each participant's rehabilitation stay, clinical care providers including PTs and OTs entered data utilizing a handheld-style personal digital assistant that was programmed by MobileDataforce in Boise, Idaho, US.[12] Over the course of 2.5 years, data were entered daily for care provided by the aforementioned clinical disciplines providing rehabilitation for traumatic SCI. In addition, patients completed follow-up surveys at six and twelve months post-discharge from rehabilitation. Data were de-identified and made available in a public use dataset for future researchers.[11–15] The original data collection and the secondary data analysis reported herein were conducted in accordance with ethical research guidelines and approved by Institutional Review Boards at participating institutions.

Complementary therapies used during SCI rehabilitation

OTs and PTs documented the treatments used during their sessions, including details of whether they used complementary therapies. OTs documented the number of times the patient practiced yoga or Pilates for strengthening/endurance during their session. From this, the total number of occupational therapy sessions in which participants received either yoga or Pilates was calculated. Time spent on yoga or Pilates was not recorded during occupational therapy sessions.

In physical therapy sessions, PTs documented the following: 1) the total number of minutes they spent on complementary therapies during the session, 2) the number of different types of complementary therapies used during the session, and 3) the number of times the PT used each of the following approaches during the session: yoga, relaxation techniques, imagery, and other (not otherwise specified). From this, calculations were completed for: 1) the total number of physical therapy sessions in which participants received any complementary therapies, 2) the total amount of time that patients received complementary therapies during their physical therapy sessions, and 3) the total number of times that the patient received each specific approach (yoga, relaxation techniques, imagery, and other (not otherwise specified)).

Pain

At admission and at discharge, participants reported their highest and lowest pain scores using an 11-point scale, from 10 being "pain so severe you cannot stand it" and 0 being "no pain." At the 6-month and 12-month post-discharge follow-up interviews, participants indicated their pain severity and pain interference. Pain severity was assessed with the following question, "Using a 0–10 scale with 10 being pain so severe you could not stand it and 0 being no pain, what has been your usual level of pain over the past 4 weeks?" Pain interference was assessed by asking, "During the past 4 weeks, how much did pain interfere with your normal work including both work outside the home and housework?" using a 5-point scale ranging from 0 (not at all) to 4 (extreme).

Mobility

Mobility was assessed by clinicians at admission to rehabilitation and at discharge, and it was self-reported by patients at 12 months post-discharge using the Functional Independence Measure (FIM).[16] The FIM is a tool used to rate the burden of care or level of assistance required to complete functional tasks.

Social integration

Social integration was assessed at 12 months post-discharge using the Craig Handicap Assessment and Reporting Technique (CHART)- Social Integration Score.[17] The CHART was developed to assess the World Health Organization's six dimensions of handicap, which include orientation, physical independence, mobility, occupation, social integration, and economic self-sufficiency.[17] The social integration dimension measures an individual's ability to participate in and maintain customary social relationships. Questions assess household composition; romantic involvement; the number of relatives, business associates, and friends with whom regular written or oral contact is maintained; and the frequency of initiating conversations with strangers.

Sociodemographic and medical characteristics

The following sociodemographic and medical characteristics were extracted from patients' medical records: age, sex, race, education, injury level, and insurance status. To be consistent with previous publications on the SCIRehab Project, participants were grouped based upon their neurological level of injury and degree of completeness of injury following the International

Standards of Neurological Classification of SCI (ISNCSI) and the American Spinal Injury Association Impairment Scale (AIS).[18] Injury categories included: 1) high tetraplegia cervical (C) 1-4 AIS A, B, C; 2) low tetraplegia including C5-8 AIS A, B, C; 3) paraplegia AIS A, B, C; and 4) AIS D.[13]

Statistical analysis

Statistical analysis was performed using the SPSS statistical software (SPSS version 22). Case-control matching was used to select a subset of participants who did not receive complementary therapies. 46 out of 47 participants were able to be matched on the following sociodemographic and medical characteristics: age, sex, injury level, and insurance status. Paired *t*-tests were completed comparing participants who received any complementary therapies (n = 46) with their matched control (n = 46) who did not receive complementary therapies. Correlations were completed using the Pearson's correlation test.

Results

Frequency of complementary therapy use

Forty-seven participants (3%) received any complementary therapies during their treatment: 33 participants (2%) received complementary therapies during physical therapy sessions, and 14 participants (1%) received complementary therapies during occupational therapy sessions (Table 1). No participants received complementary therapies in both their physical therapy and occupational therapy sessions. Participants who received any complementary therapies received complementary therapies from their OTs in an average of 1.43 +/− 0.75 sessions (range 1 to 3) and from their PTs in an average of 1.39 +/− 0.93 sessions (range 1 to 5). The complementary approaches used included: yoga (28%), relaxation techniques (21%), Pilates (11%), and other complementary therapies (not otherwise specified) (38%). Imagery (2%) was used least frequently (Figure 1). PTs spent approximately 30 minutes (26.85 +/− 34.63, range: 5 to 210) using complementary therapies and typically used 1 type (1.03 +/− 0.18, range: 1 to 2) of complementary therapy per session.

Comparison of participants who received complementary therapies with a matched comparison group who did not receive complementary therapies

Patients who received any complementary therapies showed greater decreases in pain severity from the 6 month to 12 month follow-up assessments relative to the matched comparison group, though the effect was only marginal in statistical significance. There were no significant differences between participants who received complementary therapies and the matched comparison group on any other outcomes (Table 2).

Associations among complementary therapy use and pain, mobility and social integration outcomes

The amount of time that participants received complementary therapies during physical therapy was associated with lower levels of pain severity at the 6-month ($r = -0.40$, $P < 0.05$) and 12-month follow-up interviews ($r = -0.33$, $P < 0.05$), and less pain interference at the 6 month follow-up ($r = -0.38$, $P = 0.048$), but not the 12 month follow-up ($r = -0.26$, $P = 0.17$) (Table 3).

Discussion

The current investigation used data from the SCIRehab Project to examine the use of complementary therapies provided by occupational and physical therapists during rehabilitation for traumatic SCI. In this analysis, complementary therapies were used minimally across all centers. The most frequently used complementary therapies were yoga, relaxation techniques, and other complementary therapies (not otherwise specified). Initial evidence identified an association suggesting that participants who received any complementary therapies during their physical therapy or occupational therapy sessions showed greater decreases in pain severity from the 6-month interview to the 12-month interview, relative to a matched comparison group of participants who did not receive any complementary therapies, although this effect was only marginal in statistical significance. Furthermore, initial evidence suggested that the amount of time spent on complementary therapies during participants' physical therapy sessions was associated with reduced pain severity over time. There was no evidence found suggesting that use of complementary therapies was associated with pain at admission or discharge, or patient mobility or social integration outcomes. Taken together, the current investigation documents the limited use of complementary therapies in SCI rehabilitation and provides initial support for the use of complementary therapies to improve pain-related outcomes among patients with SCI.

The current investigation builds upon a previous analysis using a portion of the SCIRehab dataset that documented how often complementary therapies were

Table 1 Descriptive characteristics of SCIRehab project participants, stratified by receipt of complementary therapies.

Variable	Total Sample (*N* = 1376)	Received Complementary Therapies During Rehabilitation: Yes (*n* = 47)	Received Complementary Therapies During Rehabilitation: No (*n* = 1329)	P value
Age, mean +/− standard deviation	38.08 +/− 16.87	35.80 +/− 15.46	38.16 +/− 16.92	0.35
Sex, n (%)				0.25
Female	265 (19.3%)	6 (12.8%)	259 (19.5%)	
Male	1111 (80.7%)	41 (87.2%)	1070 (80.5%)	
Race/Ethnicity, n (%)				0.81
Caucasian	980 (71.2%)	31 (66%)	949 (71.4%)	
African American	291 (21.1%)	10 (21.3%)	281 (21.1%)	
American Indian/Eskimo	9 (0.7%)	0 (0%)	9 (0.7%)	
Asian/Pacific Islander	30 (2.2%)	2 (4.3%)	28 (2.1%)	
Other	45 (3.3%)	2 (4.3%)	43 (3.2%)	
Education Level, n (%)				0.41
< High School	18 (1.3%)	2 (4.3%)	16 (1.2%)	
Some High School	141 (10.2%)	3 (6.4%)	138 (10.4%)	
High School Graduate or GED	586 (42.6%)	23 (48.9%)	563 (42.4%)	
Associate Degree	97 (7.0%)	1 (2.1%)	96 (7.2%)	
Bachelor's Degree	184 (13.4%)	7 (14.9%)	177 (13.3%)	
Master's Degree	51 (3.7%)	2 (4.3%)	49 (3.7%)	
Doctorate	26 (1.9%)	0 (0%)	26 (2.0%)	
Other	66 (4.8%)	2 (4.3%)	64 (4.8%)	
ASIA Impairment Scale, n (%)				0.34
C1-4ABC	393 (28.6%)	13 (27.7%)	380 (28.6%)	
C5-8 ABC	270 (19.6%)	14 (29.8%)	256 (19.3%)	
Para ABC	499 (36.3%)	14 (29.8%)	485 (36.5%)	
All D's	214 (15.6%)	6 (12.8%)	208 (15.7%)	
Insurance, n (%)				0.77
Medicare	109 (7.90%)	2 (4.3%)	107 (8.1%)	
Medicaid	248 (18.0%)	10 (21.3%)	238 (17.9%)	
Private Insurance/Payer	880 (64.0%)	30 (63.8%)	850 (64.0%)	
Worker's Compensation	139 (10.1%)	5 (10.6%)	134 (10.1%)	

Note: P values are based on independent samples *t*-tests for continuous outcomes and Chi-square tests for categorical outcomes.

provided during the first year of data collection, on a total of 600 patients.[11] The current analysis includes the full data set of 1376 patients. This allows for a more comprehensive study of the use of complementary therapies during SCI rehabilitation.

Although initial evidence suggesting that the use of complementary therapies during treatment may be associated with reduced pain severity over time, there were no associations found between the use of complementary therapies during treatment and patient mobility outcomes.

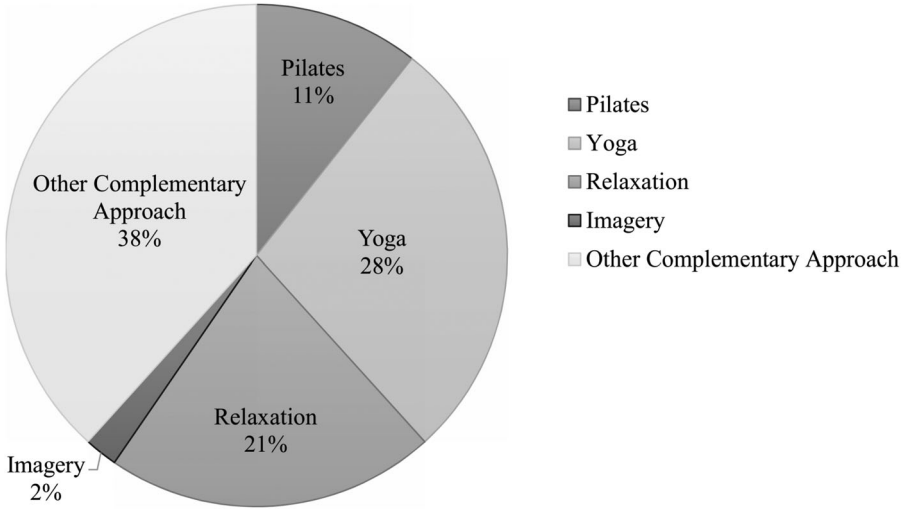

Figure 1 Types of complementary therapies used in SCI rehabilitation.

Table 2 Comparison of participants who received complementary therapies with a matched comparison group who did not receive complementary therapies.

	Received Complementary Therapies During Rehabilitation		
	Yes (n = 46)	No, Matched Comparison Group (n = 46)	P value
Highest Pain Score at Admission	6.74 +/– 2.33	6.71 +/– 2.04	0.96
Lowest Pain Score at Admission	1.88 +/– 2.31	1.67 +/– 2.71	0.69
Change in Highest Pain Score from Admission to Discharge	–0.83 +/– 2.49	–0.93 +/– (1.77	0.85
Change in Lowest Pain Score from Admission to Discharge	–0.81 +/– 2.45	–0.40 +/– (2.42	0.39
Change in Pain Severity from 6 to 12 Months	–0.86 +/– 2.05	0.04 +/– 2.21	0.07
Change in Pain Interference from 6 to 12 Months	–0.67 +/– 1.22	0.01 +/– 0.87	0.20
Change in Patient Mobility from Admission to Discharge	3.54 +/– 2.03	3.50 +/– 1.76	0.91
Change in Patient Mobility from Admission to One Year Annual Exam	3.67 +/– 2.37	3.88 +/– 1.87	0.67
Social Integration at One Year Annual Exam	86.68 +/– 24.08	90.89 +/– 18.21	0.44

Note: All data were expressed as mean +/- standard deviation. P values are reported for paired sample *t*-tests to compare outcomes of interest among participants who received complementary therapies with a matched comparison group of participants who did not receive complementary therapies; matching was based on sociodemographic and medical characteristics.

One explanation for the lack of change on patient mobility outcomes may be the use of FIM for measuring patient mobility. Because the FIM focuses on the burden of care, it has limited ability to demonstrate a change in function for many patients with SCI. For example, patients who may be dependent for their care due to their particular level of SCI would not demonstrate any improvement on this scale even if they are able to direct their care independently with a caregiver. As a result, it was not anticipated that the FIM would reflect a significant change among SCIRehab participants.

One strength of the current work is the use of practice-based evidence methodology, which allows for the investigation of complex multifaceted interventions in natural settings.[11] Moreover, the collection of treatment data from various clinical disciplines and across multiple rehabilitation centers allows researchers to compare the impact of different therapies, including complementary therapies, on patient-reported and clinical outcomes. The findings from the present study suggest that there is the opportunity to incorporate greater usage of complementary therapies in SCI rehabilitation. Future recommendations include increasing the working knowledge of complementary therapies for PTs, OTs, and other rehabilitation professionals.

Table 3 Correlations among the use of complementary medicine during occupational therapy and physical therapy treatment and pain, patient mobility, and social integration outcomes.

	Occupational Therapy (# of Sessions with Yoga or Pilates)	Physical Therapy (# Sessions used Complementary)	Physical Therapy (Minutes Used Complementary)
Occupational Therapy (# of Sessions with Yoga or Pilates)	—	—	—
Physical Therapy (# of Sessions Used Complementary)	–0.54***	—	—
Physical Therapy (Minutes Used Complementary)	–0.30*	0.36*	—
Maximum Pain at Discharge	–0.11	0.27†	–0.12
Minimum Pain at Discharge	–0.29*	0.03	0.06
Pain Severity at 6 Months	0.35*	–0.36*	–0.40*
Pain Severity at 12 Months	0.24	–0.27†	–0.33*
Pain Interference at 6 Months	0.39*	–0.40*	–0.38*
Pain Interference at 12 Months	0.13	–0.10	–0.26
Patient Mobility at Discharge	0.18	–0.01	0.11
Patient Mobility at 1 Year Annual Exam	0.21	–0.15	–0.03
Social Integration at 1 Year Annual Exam	–0.07	0.02	0.14

Note: †P < 0.10; *P < 0 .05; **P < 0.01; ***P <0 .001. Occupational therapy minutes were not collected.

Study limitations

There are a number of limitations of the current investigation. First, the terminology used in the physical therapy and occupational therapy data collection were not consistent with one another. Whereas the approaches documented in physical therapy included yoga, relaxation techniques, imagery, and other, the approaches documented in occupational therapy only consisted of yoga and Pilates. Moreover, PTs assessed the amount of time spent on complementary therapies during each session, whereas OTs did not. In order to have a true comparison of complementary therapies within the rehabilitation environment, it is necessary to assess its use consistently across disciplines. Additionally, patients' post-discharge usage of complementary therapies was not assessed. In future studies, measuring complementary therapies in a similar manner across disciplines and assessments will facilitate a more comprehensive understanding of the effects of complementary therapies among people with SCI.

A second limitation is that the most frequent classification of complementary therapies fell into the "other" category. It is unknown what the actual therapeutic interventions that clinicians at the point of care were classifying as complementary therapies. Clinicians may have been utilizing deep breathing with a variety of patients with tetraplegia and classifying it as "other." Future research should provide a greater number of options in classifying complementary therapies or provide clinicians with the opportunity to specify the complementary therapies they used.

A third limitation is that pain severity and interference were not measured consistently upon admission and discharge compared with the 6 and 12-month interviews. At admission and discharge, participants' highest and lowest pain scores were recorded, whereas at the 6 and 12-month interviews, participants reported their usual level of pain severity over the past 4 weeks and their overall pain interference over the past 4 weeks. As a result, participants' levels of pain severity and interference from admission and discharge could not be compared with their pain severity and interference at the 6-month and 12-month interviews. Future research should use consistent measures of pain severity and interference from baseline through follow-up interviews to test whether receiving complementary therapies may have affected the trajectories of change in pain severity and interference from admission to discharge, and the 6 and 12-month follow-up interviews.

A final limitation is that the complementary therapies that were assessed in the current study were varied (yoga, Pilates, aromatherapy, relaxation techniques, imagery and other). In addition, the conditions in which the different complementary therapies were implemented were not assessed. Given that multiple different complementary treatments were implemented under differing conditions, the variability in this methodology makes it difficult to draw precise conclusions regarding how the use of complementary therapies may be associated with pain-related outcomes. Future research should employ experimental methodologies (e.g. randomized controlled trials) to more directly examine how specific complementary therapies (i.e. yoga, Pilates, relaxation techniques) may impact pain-related outcomes in patients with SCI.

Conclusion

The findings from the present investigation increase our understanding of the clinical usage of complementary therapies in the field of physical medicine and rehabilitation by: 1) identifying the proportion of patients who received complementary therapies during inpatient rehabilitation from a large, multicenter dataset, and 2) associations among usage of complementary therapies and pain, mobility and social integration outcomes. The current research provides some preliminary evidence documenting the limited use of complementary therapies in rehabilitation settings and highlights the opportunity for the use of complementary therapies in rehabilitation. Moreover, this analysis provides suggestions for further research, particularly regarding the association between use of complementary therapies during SCI rehabilitation and pain-related outcomes.

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Disclaimer statements

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