Nursing Knowledge, Practice Patterns, and Learning Preferences Regarding Chemotherapy-Induced Peripheral Neuropathy

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Purpose/Objectives: To explore nurses' practice patterns, knowledge, and barriers related to chemotherapy-induced peripheral neuropathy (CIPN).

Design: Descriptive, cross-sectional.

Setting: The United States.

Sample: 408 oncology nurses.

Methods: A team of eight experts met and developed the CIPN nurse knowledge and preferences survey, which was electronically sent to randomly selected nurses.

Main Research Variables: The survey assessed nurses' knowledge and practice patterns regarding assessment strategies and barriers, evidence-based interventions, preferences for education, and perceived gaps in scientific knowledge.

Findings: Nurses in the survey lacked knowledge regarding neurotoxicity of specific agents and evidence-based treatments. CIPN-focused physical examinations and standardized measurement tools were infrequently used during assessment. The most frequently reported barriers to CIPN assessment included lack of access to measurement tools, lack of specialized skills needed for assessment, lack of confidence, and lack of time. Recommendations for future research included CIPN prevention research, exploration of CIPN-related effects on quality of life, and alternative treatments of CIPN. The majority of participants preferred online educational opportunities.

Conclusions: Nurses do not consistently integrate evaluation and management of CIPN in their practices.

Implications for Nursing: Educational offerings should incorporate web-based CIPN assessment and management content.

Key Words: chemotherapy-induced peripheral neuropathy; nurse knowledge; preferences; assessment; evidence-based practice

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Worldwide, the number of cancer survivors has increased significantly to more than 28 million individuals (Boyle, 2008), many of whom experience persistent treatment-related toxicities (Park et al., 2013) such as chemotherapy-induced peripheral neuropathy (CIPN). CIPN occurs in 40%–100% of patients receiving taxanes, platinums, vinca alkaloids, thalidomide, lenolidomide, and bortezomib (Argyriou, Bruna, Marmiroli, & Cavaletti, 2012; Gutierrez-Gutierrez, Sereno, Miralles, Casado-Saenz, & Gutierrez-Rivas, 2010; Hausheer, Schilsky, Bain, Berghorn, & Lieberman, 2006; Kautio, Haanpaa, Kautiainen, Kalso, & Saarto, 2011; Windebank & Grisold, 2008). Symptom onset varies by chemotherapy agent and may begin soon after receiving the first treatment (Hausheer et al., 2006; Loprinzi et al., 2011; Visovsky & Daly, 2004). In addition, CIPN symptoms can persist for months to years after chemotherapy completion and may become permanent (Bakitas, 2007; Smith et al., 2011; Tofthagen, 2010).

CIPN is associated with a variety of sensory, motor, and autonomic nerve impairments. Sensory manifestations can include decreased vibratory and cutaneous sensation; diminished proprioception; numbness, tingling, and burning; and neuropathic pain. Motor neuron damage may cause muscle atrophy and weakness. Urinary retention, constipation, blood pressure alterations, and sexual dysfunction may occur because of autonomic nerve injury. Difficulties with activities of daily living (ADL), such as walking, buttoning clothing, and writing, are frequently reported and, along with symptoms, can significantly impair quality of life (QOL) (Bakitas, 2007; Dodd, Cho, Cooper, & Miaskowski, 2010; Gutierrez-Gutierrez et al., 2010; Shimozuma et al., 2012; Smith et al., 2013).

Nurse Knowledge and Confidence Regarding Chemotherapy-Induced Peripheral Neuropathy

Oncology nurses play a pivotal role in assessing patient-reported symptoms and clinical manifestations of CIPN. Tofthagen, Visovsky, and Hopgood (2013) provided an algorithm that guides nurses through the steps involved with CIPN assessment and management. However, evidence-based tools and methods for evaluating oncology nurses' knowledge and confidence with CIPN assessment and management are lacking. One study conducted in several outpatient chemotherapy clinics evaluated oncology nurses' (N = 39) CIPN assessment practices and general knowledge and found that, although nurses recognized the importance of assessing CIPN, they lacked adequate preparation in CIPN assessment and reported low self-confidence in neurologic examination (Binner, Ross, & Browner, 2011).

A second study suggested that targeted education regarding CIPN assessment can improve nurses' confidence and assessment skills. Visovsky et al. (2012) evaluated the effectiveness of a nurse-targeted CIPN educational program in which RNs (N = 24) used a standardized approach to assess vibration, deep tendon reflexes, and touch before neurotoxic chemotherapy and provided data regarding their attitudes, knowledge, confidence, and skills. Although no changes in knowledge or attitudes were identified, assessment confidence and skill increased significantly ($p = 0.0037$) by the end of the study. Nurse participants identified lack of time as a significant barrier to conducting comprehensive CIPN examinations (Visovsky et al., 2012).

Nurses tend to serve as patients' primary contact points within the healthcare system and are ideally suited to educate patients and caregivers about CIPN and to assess CIPN-related impairments and functional deficits. However, results from Binner et al. (2011) and Visovsky et al. (2012) suggest that nurses lack the necessary knowledge and confidence to serve effectively in this capacity.

Prior to developing effective strategies for improving nurse knowledge regarding CIPN management, additional research is needed to identify nurses' knowledge deficits and barriers to implementing evidence-based practices. The current study describes the development and implementation of an online survey designed to explore oncology nurses' practice patterns, knowledge, and reported barriers related to evidence-based CIPN assessment and treatment recommendations.

Methods

The Oncology Nursing Society (ONS) convened a diverse team of eight nationally recognized clinical and research CIPN experts to develop an electronic CIPN nurse knowledge and preferences survey. The survey was used in this cross-sectional, descriptive, quantitative study to determine the current state of ONS nurses' knowledge, practice patterns, and learning preferences regarding CIPN. Study results will guide ONS's development of CIPN-related educational programs and research priorities. Study-specific aims were to describe (a) nurse knowledge and practice patterns regarding CIPN assessment strategies and barriers, (b) nurse knowledge and practice patterns regarding effective evidence-based CIPN prevention and treatment interventions, (c) nurse opinions regarding clinically important gaps in CIPN-related science that should be addressed via future research, and (d) nurse preferences for educational approaches to expand their knowledge about CIPN assessment and treatment.

Eligible study participants were ONS members currently working in the United States at least 20 hours per week in a clinical setting (e.g., clinical nurse specialist, clinical trials nurse, nurse practitioner, patient educator, staff nurse). The study was reviewed by the University of Michigan's Institutional Review Board, which deemed the study exempt from review because of the anonymous nature of the acquired data. Participant informed consent was implied by survey completion.

Procedure

The ONS membership roster was used to create the sampling frame and to retrieve valid email addresses for electronic survey distribution (Alreck & Settle, 2004). The study sample was obtained using stratified random sampling of 5,000 nurses with master's degrees and above (MS, MSN, DNP, PhD, or DNSc) and 5,000 with bachelor's degree and below (BSN, diploma, or ADN). The first email invitation was sent to 5,000 nurses (2,500 with graduate degrees, 2,500 with less than a graduate degree), and follow-up invitations were sent 7, 14, and 42 days following the initial email (Dillman, 2007). One month later, another 5,000 clinically-based nurses were randomly sampled, followed by two reminders. Of the 10,000 nurses sampled, 408 completed the survey.

To encourage participation, the email invitation also explained that study participants could enter a drawing for a tablet computer. Upon completing the survey, participants exited the anonymous survey link and had the option to open an iPad drawing registration link.

Nurse Knowledge and Preference Survey

Development: The ONS survey project team met over a two-day period to discuss relevant literature, develop the survey, and design the survey methods. When developing survey questions, the team carefully considered question order, wording, and level of

specificity in determining the individual items that would apply to clinical nurses and nurses in advanced practice roles (Converse & Presser, 1986). The end-product was a new 20-item survey that would quantify nurse knowledge of the most recent evidence-based assessment and treatment recommendations (Argyriou et al., 2012; Cavaletti et al., 2010; Griffith, Merkies, Hill, & Cornblath, 2010; Hershman et al., 2014; Pachman, Barton, Watson, & Loprinzi, 2011; Stubblefield et al., 2009; Visovsky, Collins, Abbott, Aschenbrenner, & Hart, 2007). In addition, the survey included five demographic items related to age, practice setting, and educational preparation (25 items total). Eight items focused on CIPN assessment. Nurses were asked to describe how frequently they assessed the following: (a) CIPN at various points along the cancer survivorship trajectory; (b) comorbid risk factors; (c) signs and symptoms; (d) effects on work, recreation, sexual function, and QOL; and (e) functional limitations. Two items assessed the frequency of nurse assessment using various measurement tools (e.g., grading scales, patient-reported outcome questionnaires, pain scales). Response options for items assessing frequency ranged from 0 (never) to 4 (always). One item asked respondents to describe barriers to CIPN assessment. Six items assessed nurse knowledge and/or practice patterns related to CIPN causes, treatment, and prevention. Treatment- and prevention-related questions were designed to gauge knowledge about effective evidence-based interventions. One open-ended question asked participants to identify clinically important areas for future CIPN-related research. One item asked nurses to identify their preferences for future educational venues to enhance their CIPN-related knowledge.

Pilot testing: The survey was pilot tested and assessed for reliability and validity. Content validity of survey questions was first assessed by six CIPN experts (clinicians and scientists). Using established methods (Lynn, 1986), content experts rated the relevance of each survey item using a scale ranging from 1 (not relevant and requires revision) to 4 (very relevant). For all but three items, the content validity index was 1.0 (excellent) (Lynn, 1986). The mean relevance scores for all items ranged from 2.83–3.83 (SD range = 0.41–1.47). The project team leader obtained additional feedback about item validity using cognitive interviewing techniques during a face-to-face interview with an experienced oncology nurse practitioner. One item with a low mean relevance score (2.83) was eliminated. Two other lower-scoring items (less than 3.5) were revised based on the qualitative feedback. The Cronbach alpha coefficient for 27 continuous level sub-items was 0.92.

Before administering the survey to ONS members, the final electronic survey was pilot tested by oncology nurses employed at each survey team member's clinical site. Nurse pilot-testers reported that the survey took 10–15 minutes to complete. Additional feedback from these nurses was used to improve survey language clarity, overall formatting, white space, font, and survey structure.

Table 1. Sample Characteristics

Characteristic	Population[a] (N = 25,710) n	%	Sample (N = 400) n	%	p
Primary position					< 0.0001
Clinical nurse specialist	1,092	4	34	9	
Clinical trials nurse	1,121	4	26	7	
Nurse practitioner	2,385	9	134	34	
Patient educator	256	1	3	1	
Staff educator	565	2	3	1	
Staff nurse	20,291	79	200	50	
Nursing degree[b]					< 0.0001
Diploma	2,621	8	14	4	
Associate	8,340	25	56	14	
Bachelor's	15,695	47	102	26	
Master's	6,404	19	216	54	
DNP	144	–	6	2	
PhD/DNSc	448	1	3	1	
Non-nursing degree[b]					< 0.0001
Associate	1,565	19	42	24	
Bachelor's	4,706	58	72	40	
Master's	1,643	20	60	34	
Doctorate	185	2	4	2	

[a] Oncology Nursing Society roster used to generate sample
[b] Participants could have multiple nursing and non-nursing degrees.
Note. Because of rounding, not all percentages total 100.

Statistical Analysis

Power analysis: Analyses of statistical power and precision were conducted with PASS, version 13, software to select a sample size that would provide high precision for describing the data and 80% power for detecting medium-sized differences among subgroups of nurses (Cohen, 1988). The sample size of 400 nurses was selected to provide 95% confidence intervals with an SD of no more than 5% in estimates of any percentage. Power for detecting differences in means and percentages between subgroups of nurses was also ample. For comparison of two equal-sized subgroups, power would be 99% to detect medium-sized differences between means or proportions and 93% to detect medium-small differences.

Analytic approach: Frequency distributions were determined for all variables. The Cronbach alpha coefficient was calculated for 27 continuous-level scale sub-items (alpha = 0.92). Frequencies by nurse education qualifications (bachelor's degree or lower versus

Table 2. Chemotherapy-Induced Peripheral Neuropathy (CIPN) Assessment Practices

	All RNs (N = 397)											Less Than BSN (n = 172)				More Than BSN (n = 225)				
	Never		Seldom		Frequently		Always													
Question	n	%	n	%	n	%	n	%	N	$\bar{X}$	SD	n	%	$\bar{X}$	SD	n	%	$\bar{X}$	SD	p
How frequently do you assess CIPN?																				
• Each time you see the patient who is receiving neurotoxic chemotherapy?	–	–	9	2	73	18	315	79	397	2.8	0.5	170	44	2.7	0.5	219	56	2.8	0.4	0.31
• When the patient verbalizes they are experiencing pain, numbness, or tingling?	1	–	2	1	21	5	364	94	388	2.9	0.3	162	43	2.9	0.3	218	57	2.9	0.3	0.63
• During survivorship care after the end of treatment?	7	2	60	16	130	34	186	49	383	2.3	0.8	158	42	2.2	0.9	217	58	2.4	0.8	0.21
How frequently do you assess for preexisting/comorbid neuropathy risk factors?																				
–	4	1	30	8	110	29	239	62	383	2.5	0.7	165	44	2.5	0.7	210	56	2.6	0.6	0.49
How frequently do you collect the following patient-reported information?																				
• Motor neuropathy symptoms (e.g., weakness, clumsiness)	4	1	17	4	94	24	281	71	396	2.6	0.3	170	44	2.6	0.7	218	56	2.7	0.6	0.28
• Sensory neuropathy symptoms (e.g., tingling, numbness, burning)	2	1	3	1	52	13	338	86	395	2.8	0.4	170	44	2.8	0.5	217	56	2.9	0.4	0.16
• Autonomic neuropathy symptoms (e.g., postural hypotension, urinary hesitancy, constipation)	6	2	84	21	133	34	170	43	393	2.2	0.8	168	44	2.2	0.8	217	56	2.1	0.8	0.23
• Co-occurring symptoms (i.e., depression/anxiety, sleep disturbance, fatigue, or changes in cognition)	8	3	45	12	144	37	196	50	393	2.3	0.8	168	44	2.3	0.8	217	56	2.4	0.7	0.53
• Neuropathic pain caused by CIPN	2	1	15	4	96	24	283	72	396	2.7	0.6	170	44	2.6	0.6	218	56	2.7	0.5	0.53
When assessing ongoing CIPN, how frequently do you assess the following?																				
• Sensation (i.e., pinprick)	47	12	109	28	130	33	109	28	395	1.8	1	169	44	1.8	1	218	56	1.7	1	0.89
• Vibration sensation	74	19	173	44	96	25	49	13	392	1.3	0.9	169	44	1.3	0.9	215	56	1.3	0.9	0.78

(Continued on the next page)

Table 2. Chemotherapy-Induced Peripheral Neuropathy (CIPN) Assessment Practices *(Continued)*

	All RNs (N = 397)											Less Than BSN (n = 172)				More Than BSN (n = 225)				
	Never		Seldom		Frequently		Always													
Question	n	%	n	%	n	%	n	%	N	$\bar{X}$	SD	n	%	$\bar{X}$	SD	n	%	$\bar{X}$	SD	p
When assessing ongoing CIPN, how frequently do you assess the following? *(Continued)*																				
• Temperature sensation	54	14	114	29	129	33	96	24	393	1.7	1	169	44	1.8	1	216	56	1.6	1	0.02
• Deep tendon reflexes	60	16	143	37	123	32	60	16	386	1.5	0.9	164	43	1.4	1	214	57	1.5	0.9	0.16
• Muscle strength	25	6	50	13	166	43	150	38	391	2.1	0.9	167	44	2	0.9	217	57	2.2	0.8	0.02
• Gait or balance testing	22	6	45	12	167	43	159	41	393	2.2	0.8	168	44	2.1	0.9	217	57	2.2	0.8	0.07
• Toxicity grading scales	89	22	69	17	127	32	115	29	400	1.7	1.1	168	43	1.5	1.2	223	57	1.8	1	< 0.001
• Patient-reported outcome measures	153	37	93	24	93	24	57	14	396	1.1	1	166	43	1.3	1.1	221	57	1	1	0.01
• Pain assessment scales	19	5	19	5	77	19	283	57	398	2.6	0.8	170	44	2.7	0.7	219	56	2.5	0.9	0.15
• A scale or instrument that quantifies several neurologic tests	206	52	109	27	51	13	32	8	398	0.8	1	166	43	0.9	1	223	57	0.7	0.9	0.09
• Social or recreational activities	15	4	62	16	182	46	141	35	400	2.1	0.8	170	43	2	0.9	222	57	2.2	0.7	0.08
• Sexual functioning	66	17	193	48	91	23	49	12	399	1.3	0.9	169	43	1.2	0.9	223	57	1.4	0.9	0.05
• Usual work or employment	17	4	37	9	172	43	176	44	402	2.3	0.8	171	43	2.1	0.9	223	57	2.4	0.7	0.02
• Quality of life	7	2	13	3	147	37	231	58	398	2.5	0.6	169	43	2.4	0.7	221	57	2.6	0.6	0.22
• Home safety (risk of falls, risk of thermal injury)	7	2	21	5	139	35	236	59	403	2.5	0.7	170	43	2.5	0.7	224	57	2.5	0.6	0.48
• Gait and balance	1	–	17	4	126	31	259	64	403	2.6	0.5	170	43	2.5	0.6	224	57	2.6	0.6	0.26
• Fine motor skills (writing, buttoning, or holding a cup)	3	1	27	7	139	35	234	58	403	2.5	0.7	170	43	2.3	0.7	224	57	2.6	0.6	< 0.001
• Functional muscle strength (ability to rise from a chair, climbing stairs, or turning on faucet)	10	3	29	7	155	39	207	52	401	2.4	0.7	170	43	2.3	0.8	222	57	2.5	0.7	0.28

master's degree or higher) were compared using chi-square tests or Fisher's exact test when the expected sample size in a cell was less than five. Chi-square tests for comparison of the sample to the population of ONS members were also conducted. To minimize the risk of type 1 error because of multiple testing, statistically significant differences by nurse educational background were studied only for CIPN assessment and preferred educational venue items.

Results

Table 1 summarizes the sample's (N = 400) demographic characteristics. The authors intentionally sampled an equal percentage of non-APN and APNs. Therefore, when compared to the larger ONS membership, clinical nurse specialists, clinical trials nurses, and nurse practitioners were over-represented, and nurse educators and staff nurses or nurse clinicians were under-represented in the survey sample ($p < 0.001$). Nurses with graduate degrees (mainly master's degrees) also were over-represented ($p < 0.0001$). No statistically significant differences existed between the ONS membership and the study sample based on nurse age or practice setting (adult versus pediatric).

Table 3. Barriers to Chemotherapy-Induced Peripheral Neuropathy Assessment

	All RNs (N = 397)		Less Than BSN (n = 172)		More Than BSN (n = 225)	
Barrier	**n**	**%**	**n**	**%**	**n**	**%**
No barriers stop me.	177	44	72	42	100	44
I do not have access to questionnaires.	92	23	38	22	52	23
I do not know how to perform a neuropathy-focused physical examination.	58	14	35	20	21	9
The charting system does not allow.	57	14	27	16	28	12
I can do the assessment, but I am not very good at it.	53	13	21	12	32	14
I do not have time.	50	12	17	10	33	15
Someone else does so I do not have to.	50	12	28	16	22	10
I do not know how to interpret the assessment.	28	7	18	11	10	4
It does not make a difference in decisions.	22	5	9	5	12	5
I do not know how to evaluate.	19	5	10	6	9	4
My colleagues do not support it.	19	5	7	4	12	5
It is not a priority.	14	3	5	3	9	4
I do not know which drugs are neurotoxic.	11	3	8	5	3	1
No effective treatments exist.	10	3	3	2	7	3
It does not make a difference in patient outcomes.	4	1	1	1	3	1
Patients do not want to talk about it, and I do not ask.	2	1	1	1	1	–
I do not think it is a big problem.	1	–	–	–	1	–
Other responses	29	7	12	7	17	8

Assessment and Barriers

Table 2 illustrates study findings regarding assessment practices. A high percentage of nurses reported always assessing neuropathy at each encounter with patients receiving neurotoxic chemotherapy (79%) and whenever the patient reported CIPN symptoms (94%). About 62% always assessed for comorbid risk factors (previous neurotoxic chemotherapy, preexisting neuropathy, diabetes, and vitamin B_{12} deficiency). Fewer nurses reported that they always assessed CIPN after completion of all recommended chemotherapy treatments (49%).

Most nurses reported always collecting patient-reported information regarding weakness/clumsiness (71%), sensory symptoms (86%), and CIPN-related neuropathic pain (72%). Fewer nurses reported always assessing for the presence of autonomic symptoms (43%), or other co-occurring symptoms such as anxiety, depression, fatigue, sleep disturbance, and impaired cognition (50%).

Nurses reported that CIPN-focused physical examinations were performed infrequently. Gait and balance assessment accomplished by watching patients walk or via Romberg testing were always performed by 41% of nurse respondents, and were, therefore, the most frequently performed physical examination approaches.

Vibration sensibility and deep tendon reflexes were assessed least often (13% and 16%, respectively).

Nurses reported infrequent use of standardized measurement tools or surveys to assess CIPN-related pain, function, or QOL. Validated instruments for assessing pain were the most frequently used formal assessment tools, followed by grading scales, such as the National Cancer Institute's Common Terminology Criteria for Adverse Events (CTCAE), self-report tools specifically for CIPN, and then measures of physical examination findings, such as the Total Neuropathy Score. Effects on social functioning, employment, QOL, safety, and functional ability (gait and balance, fine motor skills, rising from a chair, climbing stairs) were reported to be frequently or always assessed by the majority of respondents. CIPN effects on sexual function were not commonly assessed (always assessed by only 12%).

Nurse-reported assessment rates differed by nurse education level. Nurses with a BSN or lower degree (non-APN) reported assessing temperature sensation more often than advanced-practice nurses (APNs) ($p = 0.02$). Nurses without graduate degrees also reported using a standardized patient-reported outcome measure to assess function and QOL ($p = 0.01$) more often than APNs. However, APNs were more likely to use the CTCAE when assessing CIPN ($p < 0.001$). Lastly, APNs reported assessing muscle strength ($p = 0.02$), sexual function ($p = 0.05$), employment status ($p = 0.02$), and fine motor skills ($p < 0.001$) more frequently than non-APNs. Barriers to assessment were reported by most respondents (see Table 3).

Nurse Knowledge and Practice Patterns Regarding Treatment and Prevention

Many nurses lacked knowledge regarding which chemotherapeutic agents are neurotoxic. Although most nurses indicated that taxanes (88%), platinums (87%), and vinca alkaloids (78%) are neurotoxic, lower percentages of nurses understood that thalidomide/lenolidomide (46%), bortezomib (43%), interferon/interleukin (23%), and ixabepilone (22%) are also neurotoxic. Nurses in both educational strata incorrectly indicated that doxorubicin (28%) and growth factors (4%) are neurotoxic. Survey findings regarding nurse-reported

Table 4. Nurse-Reported Chemotherapy-Induced Peripheral Neuropathy (CIPN) Management Practices

	All RNs (N = 397)		Less Than BSN (n = 172)		More Than BSN (n = 225)	
Question	**n**	**%**	**n**	**%**	**n**	**%**
Which of the following are effective treatments that are recommended to TREAT painful CIPN?						
• Amitriptyline	208	51	67	39	137	16
• Duloxetine	108	27	26	15	79	35
• Gabapentin	377	93	158	92	210	93
• Opioids	156	38	60	35	94	42
• Nonsteroidal anti-inflammatory drugs	98	24	44	26	52	23
• Capsaicin	103	25	24	14	76	34
• Alternative treatments	254	63	110	64	139	62
• None of the above	6	2	2	1	4	2
• I don't know.	12	3	6	4	6	3
• Other treatments	26	6	7	4	18	8
Which of the following are effective treatments that are recommended to PREVENT CIPN?						
• Calcium and magnesium infusions	127	31	60	35	62	28
• Vitamin E	74	18	33	19	40	18
• Gabapentin	64	16	29	17	34	15
• Amitriptyline	27	7	13	8	13	6
• Glutamine	92	23	29	17	59	26
• Alternative treatment	100	25	46	27	50	22
• None of the above	75	19	20	12	55	24
• I don't know.	91	22	47	27	42	19
• Other	21	5	9	5	12	5
Which of the following are effective treatments that are recommended for patients at risk for falling due to their CIPN?						
• Acupuncture	62	15	23	14	37	16
• Massage	74	18	31	18	39	17
• Transcutaneous electrical nerve stimulation unit	52	13	17	10	31	14
• Physical therapy	337	83	141	83	188	84
• None of the above	14	4	6	4	8	4
• I don't know.	40	10	21	12	19	8

Note. For each question, respondents could select more than one answer.

Table 5. Nurse Preferences for Educational Venue to Improve Chemotherapy-Induced Peripheral Neuropathy Knowledge

	All RNs (N = 397)											BSN or Less (n = 172)				More Than BSN (n = 225)				
	Not at All Preferred		Somewhat Preferred		Preferred		Highly Preferred		Total											
Venue	n	%	n	%	n	%	n	%	n	$\bar{X}$	SD	n	%	$\bar{X}$	SD	n	%	$\bar{X}$	SD	p
Traditional classroom-style lectures	72	18	142	36	107	27	72	18	393	1.5	1	167	44	1.4	1	217	57	1.5	1	0.78
Traditional lectures with small group skills practice	72	18	105	27	123	32	91	23	391	1.6	1	165	43	1.6	1	217	57	1.6	1	0.95
Online independent study courses using PowerPoint® slides and quizzes	23	6	97	25	153	39	116	30	389	1.9	0.9	164	43	1.9	0.9	216	57	2	0.8	0.19
Online interactive courses using videos, games, simulations	60	15	103	27	119	31	107	28	389	1.7	1	165	43	1.8	1	215	57	1.6	1	0.08
Independent study combined with opportunities for web-based discussion of material	64	16	107	27	123	32	97	25	391	1.6	1	168	44	1.5	1	214	56	1.7	1	0.11
An ONS chapter meeting	92	24	96	25	110	28	91	23	389	1.5	1.1	165	43	1.4	1.1	215	57	1.6	1	0.05
A hands-on workshop	63	16	87	22	119	31	121	31	390	1.8	1	165	43	1.8	1	217	57	1.7	1.1	0.09

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treatment and prevention practices are reported in Table 4.

When respondents were asked what advice they give to patients about nonanalgesic over-the-counter (OTC) remedies for CIPN (e.g., vitamins, herbals, nutritional supplements), 27% tell their patients that these agents are safe despite recent evidence suggesting that some may make CIPN worse (Hershman et al., 2013), whereas 52% state that OTC agents may compromise chemotherapy efficacy. Nurses also indicated via write-in responses that they refer patients back to their clinical provider (n = 23) or to a pharmacist, dietitian, other specialist (e.g., integrative medicine) (n = 12) for guidance regarding OTC agents. Eleven respondents stated that they would not recommend OTC products because no data supports their use and/or they are not FDA approved to treat CIPN. Conversely, others would directly recommend treatment with OTC products (n = 7). Finally, a few nurses stated that their answer would depend on the agent the patient intended to take (n = 9).

Nurses reported that a myriad of drugs/treatments are effective to prevent CIPN, despite a lack of evidence to support efficacy of these interventions (Argyriou et al., 2012; Hershman et al., 2014; Pachman et al., 2011; Stubblefield et al., 2009). More APNs (24%) than non-APNs (12%) responded that none of the intervention choices were effective to prevent CIPN. Similarly, for preventing falls, nurses indicated that many interventions were effective. Most (83%) indicated that physical therapy was an effective approach, even though no definitive CIPN-specific experimental trials have been conducted. Numerous small studies do support the use of physical therapy and strength and balance training exercises for fall prevention in people with diabetic neuropathy (Allet et al., 2010; Kruse, Lemaster, & Madsen, 2010), and older adults at high risk of fall (Hartmann, Murer, de Bie, & de Bruin, 2009; Miller, Magel, & Hayes, 2010; Wonders, 2010). In addition to physical therapy, a few nurses indicated that occupational therapy/assistive devices (n = 7), and enhancing safety via appropriate footwear, hand rails, and removing throw rugs and clutter (n = 5) were also effective treatments.

Nurses reported that they frequently referred patients to subspecialty services for

assistance with CIPN-related symptoms and functional limitations, specifically physical therapists (78%), pain specialists (70%), neurologists (63%), occupational therapists (39%), massage therapists (20%), and social workers (19%). A few nurses stated that they also refer patients to palliative care, integrative medicine, healing touch, Reiki specialists, pharmacists, and endocrinologists. Reported referral practices were similar for APNs and non-APNs.

Nurse Recommendations for Future Research

Survey respondents provided several recommendations for future CIPN research. The most commonly mentioned need (21%) was for more research on CIPN prevention. Thirty-five nurses recommended exploration of CIPN-related effects on QOL, and nine cited the need for further research regarding alternative treatments of CIPN.

A few responses elucidated the importance of future research focused on addressing clinical practice shortfalls and healthcare policy. Nurses want more education regarding available treatments and assessment options (n = 30), better access to CIPN assessment scales (n = 18), and better insurance reimbursement for the time needed to complete a neuropathy assessment (n = 1). Respondents indicated that greater emphasis should be placed on encouraging patients to report CIPN symptoms to a clinician (n = 6), and on long-term follow-up of patients off chemotherapy who are still experiencing CIPN (n = 7). The responses suggest a need for implementation- and cost-effectiveness–focused research informing future strategies for moving the best assessment and treatment approaches into clinical practice.

Preferences for Educational Venue

Most nurses (74%) indicated a preference for using a work-based computer to access educational information about CIPN. Table 5 illustrates nurse-reported preferences for future educational approaches to expand oncology nurse knowledge about CIPN assessment and treatment. Online independent study courses using PowerPoint® slides and quizzes were the preferred approach for expanding nurses' knowledge. The traditional in-class lecture format was least preferred. APNs preferred use of local ONS chapter meetings as an educational venue more often than non-APNs ($p = 0.05$). Additional preferred educational approaches and tools noted in the open-ended item included in-person didactic education such as classes, lectures, in-services, and meetings (n = 5), as well as hard copy materials like handouts and print journal articles (n = 9).

Discussion

CIPN can be a life-altering consequence of chemotherapy. To minimize the negative effects on function and QOL, nurses must take on a major role in assessment, teaching, and management of patients with CIPN. However, little is known regarding whether nurses are adequately prepared to meet this challenge. This research was designed to expand current knowledge regarding oncology nurses' CIPN assessment, reported barriers, knowledge, practice patterns, and evidence-based CIPN assessment and treatment recommendations. The study findings will guide future efforts to translate evidence-based knowledge into clinical practice.

Study findings provide evidence that nurses lack knowledge regarding which drugs are neurotoxic. One reason for knowledge deficits in this area may be that many oncology nurses work in subspecialty areas caring for very specific patient populations (e.g., breast, lung, multiple myeloma) and are not as familiar with chemotherapy treatments used to treat all malignancy types. In addition, many of these agents are given in the outpatient setting. Nurses who practice solely in the inpatient setting may have little experience caring for patients receiving these types of treatments.

The authors discovered that most nurses perform some type of CIPN assessment, although knowledge deficits exist related to what type of assessment to perform, how to interpret assessment findings, and how to gain access to the best CIPN measures. In addition, a nurse's ability to assess patients for CIPN can be thwarted for several reasons, including lack of access to measurement tools, lack of specialized skills needed for assessment, lack of confidence, and lack of time. The current findings differ from other published reports suggesting that lack of time is the biggest barrier to CIPN assessment (Binner et al., 2011; Visovsky et al., 2012). In the current study, lack of time was more of an issue among APNs. Non-APN reports of lack of assessment skills was more than double that of APNs.

Not surprisingly, the survey results reveal frequent usage of ineffective or unproven interventions to treat or prevent CIPN. Nurses and other healthcare professionals may lack knowledge regarding evidence-based CIPN assessment and management strategies. However, use of unproven interventions may be related to more than knowledge deficits. Despite published Phase III studies showing lack of efficacy, high usage of some interventions such as gabapentin and amitriptyline continues (Hershman et al., 2014), likely because these drugs are recommended to treat neuropathic pain from other causes (Dworkin et al., 2007). When faced with a suffering patient and no known effective interventions, providers will use treatments with demonstrated efficacy for other similar conditions.

In addition, reported use of alternative and complementary treatments was high. These treatments were recommended by 27% of the nurses in the survey despite lack of evidence supporting efficacy, possibly without

Knowledge Translation

Nurses lack knowledge regarding which drugs are neurotoxic, how to access chemotherapy-induced peripheral neuropathy (CIPN), and how to gain access to the best CIPN measurement tools.

Nurses frequently recommend ineffective or unproven interventions to treat or prevent CIPN, some of which may be harmful.

Study findings emphasize the need to develop and implement new approaches to educate and support nurses who are caring for patients with CIPN.

regard to possible chemotherapy drug interactions, and despite evidence that some agents can actually worsen CIPN. Another concern is that one efficacious intervention, duloxetine, is not being used more often. Clearly, even when research results are widely disseminated in high-impact journals, clinical guideline publications, and systematic reviews (Hershman et al., 2014; Smith et al., 2013; Stubblefield et al., 2009; Visovsky et al., 2007), the findings are not reaching practicing clinicians. Fortunately, ongoing research may uncover effective mechanism-targeted treatment and preventive interventions. In the meantime, study findings emphasize the need to develop and implement new approaches to educate and support nurses who are caring for patients with CIPN. Innovative approaches are needed to bring the research evidence to the practicing nurse. Role-targeted educational approaches may address barriers more effectively.

Limitations

A few study limitations warrant discussion. Although the authors used stratified random sampling to obtain a representative sample of ONS nurses, only 408 out of 10,000 nurses sampled completed the survey. This small percentage of the accessible population may reflect response bias. Also, nurses may have inaccurately reported assessment and treatment practices based on their beliefs regarding what should be done, and not based on their actual practice behaviors. Lastly, non-APN survey responses regarding CIPN interventions being used in today's practice settings may more accurately reflect practice patterns of prescribers (physicians, midlevel providers) as opposed to nurse practice patterns.

Conclusions and Implications for Nursing Practice

Findings from the current study underscore the need for basic and ongoing education concerning the neurotoxic profile of chemotherapeutic agents, therapies for the prevention and treatment of CIPN, and the incorporation of complementary and alternative therapies for CIPN in practice settings. As new agents are approved for use and new drug combinations are investigated, knowledge regarding the neurotoxic profiles of chemotherapy will be needed. Chemotherapy educational offerings need to cross clinical practice boundaries so as not to be disease or practice specific. Evidence-based educational programs covering prevention and treatment of CIPN and the use of complementary and alternative therapies need to be incorporated into oncology nurse orientation and updated as new evidence becomes available.

Basic and ongoing performance proficiency using standardized, feasible neurologic assessments for CIPN needs to be instituted for all nurses caring for patients receiving neurotoxic chemotherapy. Appropriate CIPN measurement tools need to be made more widely available because one of the main responsibilities of APNs is the assessment of treatment-related toxicities. Since cancer treatment decisions can be impacted by CIPN assessment, APNs need to recognize and advocate for the time necessary to perform comprehensive and accurate assessment of CIPN. Ultimately, oncology nurses and APNs are at the forefront of symptom management, and, therefore, must endeavor to close their knowledge gaps surrounding CIPN assessment and advocate for evidence-based treatments for patients burdened by CIPN.

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