

QUALITY IMPROVEMENT

Implementation of an Interdisciplinary Clinical Pathway to Treat Chemotherapy-Induced Peripheral Neuropathy

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Abstract

Background and Purpose: Chemotherapy-induced peripheral neuropathy (CIPN) affects up to 60% of cancer patients undergoing chemotherapy, yet current single-modality therapies yield limited efficacy. This project aimed to implement an evidence-based, interdisciplinary CIPN clinical pathway to increase advanced practice providers' (APPs') role understanding of the interdisciplinary team and referrals to the appropriate services. **Methods:** An interdisciplinary CIPN clinical pathway was implemented using a prospective pre-test and post-test quality improvement design over 12 weeks. The project included 53 outpatient APPs who care for adult patients with CIPN. Pre- and post-education surveys, as well as electronic health record data abstraction, assessed APPs' role understanding, referral behavior, and the feasibility of the intervention. **Results:** Post-intervention survey analysis yielded a statistically significant difference in APPs' role understanding median summary scores, from pre-test (19.00) to post-test (25.00) ($Z = -4.228, p < .001$). Electronic health record data revealed a clinically significant 43.48% increase in total patient referrals, with a statistically significant association between APP participation and the entry of one or more referrals to the appropriate services ($X^2(1, n = 31) = 7.86, p = .006$). Lastly, the post-test Feasibility of Intervention Measure (FIM) mean summary score was 17.13. **Conclusion:** Implementing an evidence-based, interdisciplinary CIPN clinical pathway improved APPs' role understanding and referral behavior within an ambulatory oncology setting. **Implications:** This intervention appears feasible and adaptable for similar clinical settings. Additional tailoring may be required based on organizational resources and workflows. Future work should evaluate patient-centered outcomes and long-term provider adherence.

Chemotherapy-induced peripheral neuropathy (CIPN) is a common and painful complication in approximately 30% to 60% of patients with cancer receiving treatment (Li et al., 2021; Yoon & Oh, 2018; Zhang, 2021). Symptoms of CIPN may be transient or permanent, affecting approximately 68%, 60%, and 30% of patients at 1, 3, and 6 months after chemotherapy, respectively (Seretny et al., 2014; Zajączkowska et al., 2019). Chemotherapy-induced peripheral neuropathy is often refractory to medication, presenting with chronic pain and sensory symptoms that can persist for years after chemotherapy cessation, affecting patients' quality of life, safety, and functioning (Zajączkowska et al., 2019; Zhang, 2021).

Due to its complex pathophysiology and the lack of benefit from existing single-modality treatments, CIPN poses a significant challenge for health-care providers to manage (Jordan et al., 2020; Loprinzi et al., 2020). A structured, collaborative, multimodal, interdisciplinary pain management (MIPM) approach can enhance care (Desforges et al., 2022; Jones et al., 2022; Klafke et al., 2023; Maindet et al., 2019; Mizrahi et al., 2022; Van Haren et al., 2024).

By addressing the multifaceted nature of pain, MIPM can improve pain relief and patient satisfaction while reducing costs and medication needs (Dowell et al., 2022; Preti et al., 2025; U.S. Department of Health and Human Services, 2019). The National Comprehensive Cancer Network (NCCN) and the American Society of Clinical Oncology (ASCO) recommend optimizing MIPM to treat cancer-related pain in patients with active disease and cancer survivors, respectively (Swarm et al., 2019; Paice et al., 2016; Preti et al., 2025). Additionally, ASCO has developed a clinical practice guideline specifically for CIPN, recommending pharmacologic management with duloxetine and collaboration with the medical oncology team to adjust the chemotherapy regimen (Loprinzi et al., 2020). The European Society for Medical Oncology (ESMO), the European Oncology Nursing Society (EONS), and the European Association of Neuro-Oncology (EANO) Clinical Practice Guidelines recommend using an MIPM approach that integrates pharmacologic and nonpharmacologic strategies to

treat CIPN, along with supportive measures to promote safety and function (Jordan et al., 2020).

Despite consistent recommendations supporting the use of MIPM in the cancer pain population, barriers, such as lack of access, knowledge, and time, hinder adequate implementation (Dowell et al., 2022; Preti et al., 2025; U.S. Department of Health and Human Services, 2019). To address these barriers, proper education, treatment algorithms, and clinical pathways are recommended to increase knowledge, promote collaboration and communication, support evidence-based treatment decision-making, and streamline the referral process (Luckett et al., 2013; Manfrida et al., 2019; Mizrahi et al., 2022; Patel et al., 2016; Sayed, 2013; Swarm et al., 2019; Wachlin et al., 2024). A CIPN clinical pathway incorporating pain management, palliative care, rehabilitation medicine, neurology, and physical therapy was found to be easy to implement and associated with increased patient satisfaction (Wachlin et al., 2024). Similarly, Mizrahi and colleagues (2022) created a CIPN interdisciplinary clinical decision pathway based on best practices from the ASCO and ESMO-EONS-EANO Clinical Practice Guidelines. The pathway addresses appropriate assessment tools for initial assessment and reassessment, patient education needs, and interdisciplinary treatment plans based on patients' presentation of pain or functional impairment (Mizrahi et al., 2022).

The purpose of this quality improvement project was to implement an evidence-based, interdisciplinary clinical pathway for CIPN to enhance APPs' understanding of interdisciplinary CIPN management and facilitate referrals to appropriate services. This project aimed to improve APPs' knowledge of interdisciplinary CIPN management, increase patients' access to such management by identifying key disciplines and streamlining the referral process, and evaluate the feasibility of this intervention in this outpatient oncologic setting with this group of APPs.

METHODS

This project employed a prospective pre-test and post-test quality improvement design. The setting was a comprehensive cancer center in the greater New York area. The involved departments included Medical Oncology, Anesthesia

Pain Service, Rehabilitation Medicine, Integrative Medicine, Supportive Care, and Neurology. The sample consisted of outpatient APPs, including nurse practitioners and physician assistants, working in the cancer center's Medical Oncology, Anesthesia Pain Service, Supportive Care, Neurology, and Integrative Medicine departments, who care for adult patients with CIPN. Exclusion criteria included APPs who only care for pediatric patients and health-care professionals working in other departments.

In addition to ethical review approval by the academic site, the project site's Scholarly Project Review Committee reviewed the project and determined that institutional review board approval was not required. Staff participation in the project established implied consent. Participants were recruited via email and manager notification. An initial email was sent to the relevant lists of APPs to announce and introduce the project, and managers in the relevant departments were asked to notify their staff to promote awareness of and recruitment for the project.

During the project planning period, the clinical pathway was adapted with input from all major stakeholders to meet the project site's needs (Figure 1). Before implementation, all participants were asked to complete a pre-education survey. Once completed, participants received a brief educational presentation on the CIPN clinical pathway, which included evidence supporting its use, the role of each referral service, and instructions on accessing and utilizing the clinical pathway. Following the education session, participants were asked to complete a post-education survey. The project period lasted 12 weeks, during which participants had access to the CIPN clinical pathway via email, as well as the organization's internal site. An additional email was sent to all participants at the midway point to offer support, address any barriers that emerged, and reattach the clinical pathway for quick access.

Data collection consisted of two surveys: a pre-education and post-education survey, both of which utilized Research Electronic Data Capture (REDCap) tools hosted by the organization, as well as a chart review for patient referral data. The surveys gathered information on participants' demographics (Table 1), role understanding through

an adapted Challenge Team Member Survey with permission from the primary authors, and perceived feasibility using the Feasibility of Intervention Measure (FIM; Hudson et al., 2017; Weiner et al., 2017). The adapted Challenge Team Member Survey asked participants to rate their understanding of each health-care team role on a five-point Likert scale from 1 (very limited) to 5 (very strong), with scores ranging from 6 to 30, and with higher scores indicating a better understanding of each specialty's role (Hudson et al., 2017). The FIM evaluates how well the intervention can be implemented in a specific setting on a five-point scale, ranging from 1 (completely disagree) to 5 (completely agree), with scores from 4 to 20, and higher scores indicating greater feasibility (Weiner et al., 2017).

In addition to the surveys, data collection was obtained through Dataline, a chart retrieval system within the project site. Referral data included (1) the number of patients referred by the project's participants to the departments on the clinical pathway (Anesthesia Pain Service, Neurology, Rehabilitation Medicine, Physical Therapy, Occupational Therapy, Supportive Care Service, or Integrative Medicine) for patients with CIPN, and (2) the number of participants who entered at least one patient referral over the 12-week period for a patient with CIPN.

Data were managed and analyzed using the Statistical Package for the Social Sciences (SPSS). Demographic data were examined with descriptive statistics. For role understanding, pre-survey data were analyzed using descriptive statistics, and matched pre- and post-survey data were compared using the Wilcoxon signed-rank test to determine if the mean values of the two groups differed significantly. For patient referrals, a pre-test and post-test design evaluated the number of referrals and the number of APPs entering at least one referral. The number of referrals was counted as the total patients referred to the clinical pathway services (Anesthesia Pain Service, Neurology, Rehabilitation Medicine, Physical Therapy, Occupational Therapy, Supportive Care, and Integrative Medicine) by the participants. The number of APPs entering referrals was calculated based on how many of the 31 participants submitted at least one referral to these services. Referral and

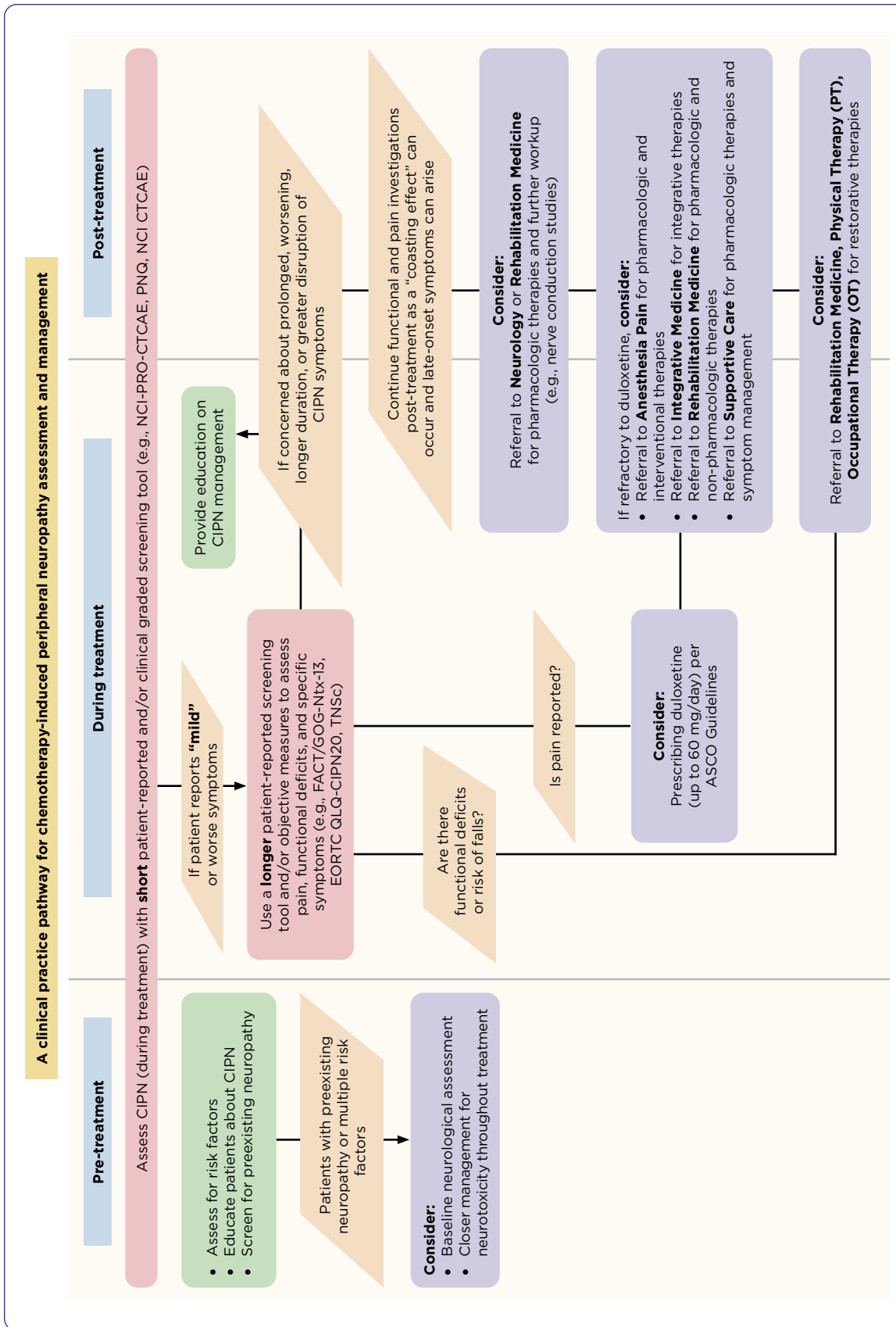


Figure 1. Chemotherapy-induced peripheral neuropathy interdisciplinary clinical decision pathway. ASCO = American Society of Clinical Oncology; CIPN = chemotherapy-induced peripheral neuropathy; EORTC QLQ-CIPN20 = European Organisation for Research and Treatment of Cancer Quality of Life Questionnaire-Chemotherapy-Induced Peripheral Neuropathy 20-item module; FACT/GOG-Ntx-13 = Functional Assessment of Cancer Therapy/Gynecologic Oncology Group-Neurotoxicity 13-item subscale; NCI CTCAE = National Cancer Institute Common Terminology Criteria for Adverse Events; NCI-PRO-CTCAE = National Cancer Institute Patient-Reported Outcomes version of CTCAE; OT = occupational therapy; PNQ = Patient Neurotoxicity Questionnaire; PT = physical therapy; TNSc = clinical version of the Total Neuropathy Score. Adapted with permission from Mizrahi et al. (2022).

Table 1. Baseline Characteristics of APP Participants

	Pre-Survey (<i>n</i> = 53)	Post-Survey (<i>n</i> = 31)
Role, <i>n</i> (%)		
Nurse practitioner	47 (88.7)	29 (93.5)
Physician assistant	6 (11.3)	2 (6.5)
Years of experience, <i>n</i> (%)		
< 1 year	1 (1.9)	1 (3.2)
1–5 years	4 (7.5)	3 (9.7)
6–10 years	24 (45.3)	14 (45.2)
11–15 years	13 (24.5)	8 (25.8)
16+ years	11 (20.8)	5 (16.1)
Service, <i>n</i> (%)		
Oncology	39 (73.6)	21 (67.7)
Anesthesia Pain Service	4 (7.5)	4 (12.9)
Supportive Care Service	6 (11.3)	4 (12.9)
Neurology	3 (5.7)	2 (6.5)
Integrative Medicine	1 (1.9)	0

APP participation rates during the 12-week project period were compared with those of the 12 weeks preceding it. Any increase in referrals was considered clinically significant, as it indicates improved patient access to interdisciplinary care. The total number of patient referrals was analyzed with descriptive statistics, while the number of APPs making referrals was compared using a Chi-square test. Finally, for feasibility, a post-test design assessed participants' perceptions of the intervention's feasibility, and their responses were analyzed with descriptive statistics.

RESULTS

One hundred and thirty-three APPs were invited to participate. A total of 53 APPs enrolled in this project, with 88.7% being nurse practitioners, 73.6% working in primary oncology services, and 90.6% having 6 or more years in their role (Table 1). A total of 31 APPs (58.5%) completed both the pre-education and post-education surveys, with 93.5% being nurse practitioners, 67.7% working in primary oncology services, and 87.1% having 6 or more years in their role.

This intervention resulted in a statistically significant improvement in APPs' role understanding of the interdisciplinary team. The mean summary score (*n* = 53) for the pre-survey assessing

role clarity was 22.09 (standard deviation [SD] 5.29), with a median of 22.00 (interquartile range [IQR] 6.00). Following the online educational program, the mean summary score (*n* = 31) for the post-survey was 24.26 (SD 4.04), with a median of 25.00 (IQR 4.00). Based on these exploratory analyses, the assumption of a normal distribution has not been met for the difference in summary scores (Shapiro-Wilk 0.909, *p* = .012; Kolmogorov-Smirnov 0.207, *p* = .002); thus, a Wilcoxon signed-rank test was conducted to compare the pre-education and post-education summary scores. Of the 31 APPs who completed both surveys, the results indicated a statistically significant difference in role understanding summary scores pre-intervention vs. post-intervention, *Z* = −4.228, *p* < .001. The median role understanding summary score for the 31 participants increased from 19.00 (IQR 5) to 25.00 (IQR 4). There was a clinically significant increase in the total number of patient referrals from pre-intervention to post-intervention, with the number of referrals increasing by 43.48% from the 12-week timeframe before implementation (*n* = 23) to the 12-week timeframe during implementation (*n* = 33). A Pearson Chi-square test was conducted to assess the number of APPs entering one or more referrals to the appropriate services within the clinical pathway. Comparing the

12-week timeframe before implementation ($n = 10$) to the 12-week timeframe during implementation ($n = 11$), the association was statistically significant, $X^2(1, n = 31) = 7.86, p = .006$. Lastly, the mean summary score for FIM ($n = 31$) was 17.13 (SD 2.60), with a median of 16.00 (IQR 4.00).

DISCUSSION

Despite the evidence supporting the use of MIPM to treat cancer pain, specifically CIPN, its optimization has been limited mainly by providers' lack of knowledge, time, and perceived access (Didwaniya et al., 2015; Dowell et al., 2022; Luckett et al., 2013; Manfrida et al., 2019; Patel et al., 2016; Preti et al., 2025; Ren et al., 2022; Sayed, 2013; Swarm et al., 2019; U.S. Department of Health and Human Services, 2019). This quality improvement project, which implemented an evidence-based, interdisciplinary clinical pathway to assess and treat CIPN, primarily aimed to increase APPs' understanding of the interdisciplinary management of CIPN, improve patients' access to this management, and evaluate the feasibility of implementing this intervention in an ambulatory oncologic setting with this population of APPs. By identifying relevant disciplines, providing evidence-based assessment and treatment strategies, and simplifying the referral process, this project ultimately aimed to enhance provider knowledge, streamline workflows, and increase clinical efficiency.

The intervention led to a statistically significant enhancement in APPs' role understanding of the interdisciplinary team. This improvement underscores the existing knowledge gap among providers regarding the interdisciplinary management of CIPN, as highlighted in previous research (Didwaniya et al., 2015; Luckett et al., 2013; Manfrida et al., 2019; Patel et al., 2016; Ren et al., 2022; Sayed, 2013; Swarm et al., 2019).

Regarding patient access, there was a clinically significant increase in the total number of patient referrals from pre-intervention to post-intervention, and a statistically significant association was found among APPs who entered one or more referrals to the appropriate services within the clinical pathway. These results not only align with the organizational strategic goal to increase interdisciplinary collaboration but also build on previous studies, which recommend clinical pathways,

treatment algorithms, and education to improve care coordination and collaboration (Luckett et al., 2013; Manfrida et al., 2019; Mizrahi et al., 2022; Patel et al., 2016; Sayed, 2013; Swarm et al., 2019; Wachlin et al., 2024). These findings highlight the impact of this clinical pathway on changing provider behavior. Whereas this project yielded an increase in APPs' referral behavior, Knoerl and colleagues (2021) found that their CIPN clinical pathway did not significantly improve providers' assessment or management behaviors. Knoerl and colleagues (2021) attribute their outcomes to a failure to consider clinicians' perspectives of acceptability and satisfaction with the intervention before implementation. In contrast, this project conducted a thorough review and approval process by APP and physician stakeholders within each relevant service before implementation.

Lastly, this project achieved a mean FIM summary score of 17.13 out of 20. This finding aligns with feedback from another recent study, where participants reported that a CIPN clinical pathway was easy to implement (Wachlin et al., 2024). This project builds on the work of Mizrahi and colleagues (2022), who created the original CIPN clinical pathway, which was used and adapted with permission for this project. The successful implementation and high feasibility score support Mizrahi and colleagues' (2022) suggestion that clinical pathways are most likely to succeed when tailored to meet the specific needs of a setting. This intervention may be feasible in similar clinical environments treating adult cancer patients with CIPN, although additional adaptations might be necessary based on organizational resources and needs.

Several limitations were associated with this quality improvement project. The project included a small sample size, with 53 participants completing the pre-education survey and a 41.5% attrition rate, with 22 participants failing to complete the post-education survey. Of the 31 APPs who completed the project, 93.5% were nurse practitioners, which may limit generalizability to physician assistants and other health-care professionals. Although this project included APPs from diverse specialties, including Oncology, Pain Management, Supportive Care, Neurology, and Integrative Medicine, it was conducted at a single

institution, which could further limit its generalizability at other organizations with different staff, patient populations, resources, and work cultures. Using this clinical pathway may be limited in settings that either lack complete access to or are unable to provide timely access to the referral services in the pathway. This project also compared data over two 12-week time frames; thus, the project's long-term impact is unknown, specifically regarding ongoing APP adherence to the clinical pathway. Lastly, confounding variables during the two data collection periods, such as patient volumes, operational and staffing changes, seasonal changes, and competing priorities, could have affected the results. Future studies are needed to assess the impact of various CIPN-related MIPM approaches and clinical pathways on patient-related outcomes, including pain, function, quality of life, and satisfaction, as well as provider-related outcomes, such as adherence to the intervention and satisfaction.

CONCLUSION

Up to 60% of cancer patients undergoing chemotherapy suffer from CIPN, with symptoms often persisting for years due to the complex nature of CIPN and the limited efficacy of current single-modality treatment options. An interdisciplinary and multimodal approach to assessing and treating CIPN can enhance care and improve the quality of life for patients. This project highlights how implementing an evidence-based clinical pathway that promotes interdisciplinary management of CIPN can improve APPs' knowledge and referral behavior. By adapting the evidence-based clinical pathway to meet organizational needs and involving relevant stakeholders in its development, the intervention was successfully implemented among this population of APPs caring for adult oncology patients with CIPN. ●

Disclosure

The authors have no conflicts of interest to disclose.

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