

Models of Care for Chronic Non-Cancer Pain: A Summary of the Research on Stepped Care and Hub-and-Spoke Models

Key Take-Away Messages for Decision-Makers

Based on 2 CADTH reports, we are unable to draw any formal conclusions on specific stepped care or hub-and-spoke models of care for chronic non-cancer pain. The models reviewed differed from one another and were commonly adapted to meet the needs of a specific population. This observation aligns with the findings of the CADTH 2021 Environmental Scan on models of care for chronic pain. Our conclusion in the Environmental Scan was that decision-makers should consider the needs of their patients and the specific needs of their jurisdictions when designing, adopting, or adapting a model of care for chronic pain.

Why Did CADTH Look for Research Studies on Models of Care for Chronic Pain?

In 2021, CADTH conducted an [Environmental Scan](#) to look at the models of care for chronic pain that were being used in Canada and in other countries. Two of the models of interest in that report were stepped care and hub-and-spoke. The scan summarized the main categories of patient-related outcomes associated with models of care for chronic non-cancer pain; however, we did not describe the clinical or cost-effectiveness of using these models. For other medical conditions, some models of care have demonstrated benefits and cost-savings. CADTH completed 2 reports to learn more about the potential benefits, harms, and cost implications of [stepped care](#) and [hub-and-spoke](#) models of care for chronic pain. This information may be helpful to decision-makers who are considering implementing a model of care for chronic pain.

What Are Stepped Care and Hub-and-Spoke Models of Care?

The stepped care model involves interventions organized into a series of steps. These steps are commonly placed on a continuum from the least to most intensive based on a variety of factors. There are many different types of stepped care models. Some models focus on the facility's level of care (e.g., primary, secondary, tertiary), while other stepped care models may focus on type of care, treatment needs, patient effort, level of health care provider contact, and cost. Patients start at the most appropriate step for them based on several factors (e.g., symptom and treatment history); they can then be stepped up or down until treatment goals are met.

The hub-and-spoke model normally consists of 1 centralized “hub” that offers specialized services or more intensive therapies. The hub is complemented by secondary clinics, the “spokes.” The spokes provide basic services or routine follow-up, and they are spread across different locations.

How Did We Review the Literature on Models of Care for Chronic Pain?

CADTH completed 2 narrative syntheses to identify and describe the literature on the potential benefits, harms, and cost implications of the stepped care and hub-and-spoke models of care for chronic pain. At CADTH, we do not complete formal program evaluations; therefore, no conclusions or recommendations about specific models of care were formed. The literature described in these reports was not critically appraised.

What Did We Find?

CADTH identified 11 publications that described the clinical benefits or cost implications of models of care for chronic non-cancer pain. All the publications reviewed described some positive results for their outcomes of interest. There was minimal information on potential harms for these models. For additional information on the specific publication outcomes and limitations, refer to Appendix 1 and Appendix 2.

Stepped Care

Clinical Benefits

We found 6 publications that described the clinical benefits of 5 different stepped models of care for chronic non-cancer pain.

- Two publications reported on the same stepped care model, which included 3 steps, with each step based on a different level of care (i.e., primary, secondary, and tertiary). The study populations were:
 - primary care providers who implemented the stepped model for their patients with chronic pain
 - veterans with moderate to severe pain.
- Two publications reported on other 3-step models:
 - 1 study included people with non-cardiac chest pain for whom the first step involved a biopsychosocial assessment, the second step used low-intensity cognitive behavioural therapy (CBT), and the third step used high-intensity CBT
 - 1 study included people with hip or knee osteoarthritis for whom the different steps involved different therapies and assessments, and the final step involved multidisciplinary care.

- Two publications reported on models that consisted of 2 steps:
 - 1 study included people with excess body weight and knee osteoarthritis for whom the first step involved diet and exercise and the second step included 4 different treatment options that were dependent on the patient's results from step 1
 - 1 study included veterans with chronic and disabling musculoskeletal pain of the spine or extremities for whom the first step involved analgesic therapy optimization and pain self-management strategies and the second step incorporated CBT.

Cost Implications

We found 1 publication on the cost implications for stepped care for chronic non-cancer pain, specifically chronic sciatica pain.

- The economic evaluation examined the cost-effectiveness of 3 pathways for sciatica pain treatment. One pathway was a 3-step model. The other comparison pathways were treatments in primary care only and immediate referral for surgery following initial treatments.

Hub-and-Spoke

Clinical Benefits

We found 4 publications on the clinical benefit of 4 hub-and spoke models of care for the management of people with chronic non-cancer pain.

- Three publications were about studies that assessed the use of Extension for Community Healthcare Outcomes (ECHO) programs, which uses videoconferencing to connect pain specialists or expert interprofessional pain teams (the hub) with primary care providers in more remote locations (the spokes):
 - 1 included primary care providers who care for active-duty military personnel, dependents of active-duty personnel, members of the National Guard or Reserve, and military retirees
 - 1 included primary care providers who care for people with chronic pain
 - 1 included primary care providers who care for people who were medically underserved.
- One publication was about a program for adults with persistent chronic pain who lived in remote or rural communities. Education sessions were held by different specialists at the hub site using videoconferencing. Patients attended the session at their nearest health facility (spokes).

Cost Implications

We did not find any literature on the cost implications for hub-and-spoke models of care for chronic non-cancer pain.

Appendix 1: Stepped Models of Care for Chronic Pain Study Summaries

Improving Pain Care Through Implementation of the Stepped Care Model at a Multisite Community Health Centre

- An **uncontrolled before-and-after study** assessed the implementation of the Stepped Care Model for Pain Management (SCM-PM) by primary care providers. Medical records of adults living with chronic non-cancer pain were reviewed 1 year before and 1 year after the implementation of the model.
- The stepped care intervention comprised **3 steps**. The first step involved primary care activities such as screening, pain assessments, documentation, and management of common pain conditions. Treatment plans were based on self-management and primary care interventions. The second step involved secondary consultations, which included additional resources and more active collaborative treatments (e.g., behavioural health, physical therapy, chiropractic, virtual pain specialty referral). The third step incorporated tertiary interdisciplinary care in which there was increased involvement from the pain management team and referrals to community partners.
- The implementation of SCM-PM was associated with improvements in providers' pain care documentation, treatment, and follow-up; an increase in referrals to behavioural health providers and chiropractic professionals; a decrease in referrals to neurologic and orthopedic surgery; and no decline in opioid prescribing.
- The authors highlighted the following limitations: the focus of the study was process measures, interventions used were implemented agency-wide and could not be limited to selected practices, randomization was not possible, and there was health care provider turnover.

Project STEP: Implementing the Veterans Health Administration's Stepped Care Model of Pain Management

- A **retrospective cohort study** reported on the Veterans Health Administration SCM-PM. Veteran patients with a documented pain intensity rating of moderate to severe were treated according to the stepped model. These results were compared with those from veterans with no indication of pain or only mild pain intensity who were treated in the integrated veteran's health system.
- The stepped care intervention comprised **3 steps**. The first step involved primary care activities such as screening, pain assessments, documentation, and management of common pain conditions. Treatment plans were based on self-management and primary care interventions. The second step involved secondary consultations, which included additional resources and more active collaborative treatments (e.g., behavioural health, physical therapy, chiropractic, virtual pain specialty referral). The third step incorporated tertiary interdisciplinary care in which there was increased involvement from the pain management team and referrals to community partners.

- For the pain cohort, the authors reported that long-term opioid treatment decreased, non-opioid prescriptions increased, referrals by primary care providers for any consultation increased (largest increases to physiotherapy and occupational therapy), and patient visits for any reason increased.
- The authors highlighted the following limitations: the pain definition did not distinguish between type (acute or chronic) and cause of pain, some speciality pain care services provided extended beyond pain, diagnoses were not specified for prescriptions, it was not possible to determine if patients were receiving appropriate services, and changes were implemented at various system levels during the life cycle of the study.

A Multidisciplinary, Biopsychosocial Treatment for Non-Cardiac Chest Pain

- An **uncontrolled before-and-after study** was conducted that included people with non-cardiac chest pain. It evaluated a biopsychosocial stepped care approach.
- The stepped care intervention comprised **3 steps**. The first step involved a biopsychosocial assessment, the second step used low-intensity CBT, and the third step used high-intensity CBT.
- Stepped care reduced the frequency of pain, depression and anxiety scores, and the use of health care resources. The stepped care intervention also improved chest pain interference and severity scores and negative beliefs and/or convictions that chest pain is attributable to a cardiac cause.
- The authors highlighted the following limitations: there was no comparison group, the length of the intervention was not standardized, some participants continued to receive treatment after 3 months, longer-term follow-up was not offered, and there was no formal economic analysis.

Effect of Stepped Care on Health Outcomes in Patients With Osteoarthritis: An Observational Study in Dutch General Practice

- A **prospective cohort study** was conducted that included people with chronic pain caused by hip or knee osteoarthritis. The intervention was stepped care strategy–consistent care which was compared to stepped care strategy–inconsistent care.
- The stepped care intervention comprised **3 steps**. The first step included medical history and physical evaluation, education, goal setting, and medications such as acetaminophen. The second step involved further assessment and adjustment of goals, exercise, dietary therapy, and medications such as topical nonsteroidal anti-inflammatory drugs. The third step involved multidisciplinary care and more advanced modalities, such as transcutaneous electrical nerve stimulation and intra-articular injections.
- Stepped care strategy–consistent care showed improvements in pain and physical function compared to baseline, although there were no changes in levels of self-efficacy or active pain coping. For stepped care strategy–consistent care, there were no differences compared to stepped care strategy–inconsistent care in scores for pain, physical function, self-efficacy, or active coping.

- The authors highlighted the following limitations: there were differences in cohort groups regarding age, other medical conditions, and health care insurance; the time frame of the study may have been too short; and the study had an observational study design.

Effectiveness of Stepped Care Intervention in Overweight and Obese Patients With Medial Tibiofemoral Osteoarthritis: A Randomized Controlled Trial

- A **randomized controlled trial** was conducted that included people older than 50 years with excess body weight and knee osteoarthritis. It compared stepped care to educational materials.
- The stepped care intervention comprised **2 steps**. The first step was a diet and exercise regimen. It consisted of 3 phases; each phase was 6 weeks long. At the end of the first step, there was an evaluation to determine what intervention the participant should receive as part of the second step. There were 4 possible treatment options for the second step: diet and exercise maintenance, online CBT, knee brace, and muscle strengthening exercises.
- There was a 13% difference in disease remission in favour of stepped care; however, this is lower than 25% which was the estimated worthwhile difference. The authors also reported improvements in function for the stepped care group and no differences between the groups for changes from baseline in pain intensity or depression.
- The authors highlighted the following limitations: there was a high dropout rate (comparison group); step 2 sample sizes were not powered to detect differences between groups; the maintenance group were not provided with guidance; the disease remission rate sample size calculation was overestimated; there was no cost-effectiveness analysis; and adherence, compliance, and fidelity were not assessed.

Evaluation of Stepped Care for Chronic Pain (ESCAPE) in Veterans of the Iraq and Afghanistan Conflicts: A Randomized Clinical Trial

- A **randomized controlled trial** was conducted that included US veterans with chronic and disabling musculoskeletal pain of the spine or extremities. It compared stepped care to usual care.
- The stepped care intervention comprised **2 steps**. The first step involved analgesic therapy optimization according to an algorithm and pain self-management strategies. The second step incorporated CBT.
- Stepped care led to improvements in pain interference, pain severity, and pain-related disability. The stepped care group were more likely to demonstrate a 30% improvement in Roland Morris Disability Scale score by 9 months and were prescribed more analgesics (oral or topical) at the end of step 1. The usual care group were more likely to be prescribed tricyclic antidepressants. There was no difference between groups for opioid use.
- The authors highlighted the following limitations: participants were recent US veterans so findings may not be generalizable to other groups, the study was conducted at a single medical centre, they assessed a multimodal intervention and bundled approach to delivery, and study participants were unblinded.

Cost-Effectiveness of Different Strategies to Manage Patients With Sciatica

- An **economic evaluation** was conducted to examine the cost-effectiveness of 3 pathways for sciatica pain treatment. One pathway was a **3-step** model, the other comparison pathways were treatments in primary care only and immediate referral for surgery following initial treatments.
- The authors concluded that none of the strategies were 100% successful; however, the most successful regimen in the stepped approach pathway was non-opioids, followed by biologic drugs, epidural and/or nerve block, and disk surgery. In the primary care pathway, the most successful regimen was non-opioids. The pathway of immediate surgery was not cost-effective. The authors stated that the sensitivity analyses using the highest cost estimates resulted in comparable results.
- The authors highlighted the following limitations: the time perspective of the study was limited to 12 months, they did not include disease relapse and recurrence in the model, a number of issues were not considered in the analysis (e.g., issues relating to work, additional costs associated with surgery), there were a number of contentious assumptions, there was statistical heterogeneity and potential inconsistency, and the nature of the economic model was simplistic and did not fully account for various uncertainties and distributions.

Appendix 2: Hub-and-Spoke Models of Care for Chronic Pain Study Summaries

Army and Navy ECHO Pain Telementoring Improves Clinician Opioid Prescribing for Military Patients: An Observational Cohort Study

- A **retrospective cohort study** was completed to evaluate the hub-and-spoke model. Patients were active-duty US military personnel, dependents of active-duty personnel, members of the National Guard or Reserve, and military retirees. The intervention was compared with treatment at clinics where the primary care physicians did not participate.
- The hub used secure, audiovisual networks to connect pain medicine specialists with remote primary care providers (spokes). Expert teams at the hub used multi-point videoconferencing to conduct virtual learning sessions. Sessions ran for 2 hours weekly. This hub-and-spoke program was called ECHO Pain.
- Both the ECHO Pain group and comparison group had declines in opioid prescribing; however, patients in the ECHO Pain group had steeper declines. The authors concluded that these observations indicate a more judicious use of opioid pharmacotherapy and more engaged management of patients following participation in the ECHO program as a model for care.
- The authors highlighted the following limitations: they did not randomize the assignment of clinicians and patients into matched groups, health care providers volunteered to participate and had highly complex pain patients, data on pharmacotherapy use could not be analyzed at the individual clinician or patient level, and they were unable to specify the reasons opioids were used in each patient.

ECHO Ontario Annual Report 2017–2018

- The evaluation of the hub-and-spoke model was completed using an **uncontrolled before-and-after study**. Medical charts were reviewed for patients with chronic pain. Data about pharmacotherapy use and health care practice were collected from 1 year before the clinician attended their first ECHO session and 1 year after they attended their first ECHO session.
- The ECHO project linked an expert interprofessional team (the hub) with primary care providers across Ontario (the spokes) via weekly videoconferencing sessions.
- The authors reported there was a 25% reduction in dangerous polypharmacy, a 25% increase in discussion about pain interference with patients' functional status, a 25% increase in recommendations to stay active, a 21% reduction in number of visits to health care providers, and that 33% of patients tapered their opioids. Based on surveys, the mean Brief Pain Inventory scores for patients in ECHO were 6.4 at time 1 and 6.2 at time 2. The mean depression severity scores for patients in ECHO were 14.5 at time 1 and 13.5 at time 2.
- The ECHO project evaluation was part of an annual report publication; the authors did not fully describe their methodology or limitations.

Improving Pain Care With Project ECHO in Community Health Centers

- The evaluation of the hub-and-spoke model was completed using a **before-and-after study** with a comparison group. A medical record review was undertaken for all patients with chronic pain who received care from primary care providers who participated in ECHO and the control group of matched care providers that did not participate in ECHO. The record review was for the 1-year period before starting ECHO and for the 1-year period following the intervention.
- The Integrative Pain Centre of Arizona (the hub) used videoconference case-based learning to hold weekly learning sessions for 2 large, multisite federated community health care centres (the spokes). The spokes provided care for patients who were medically underserved. The sessions were led by a multidisciplinary pain specialist team from the hub; attendees from the spokes were primary care medical providers.
- The authors reported that participation in ECHO resulted in increased referrals to behavioural health and physical therapists as well as a reduction in opioid prescribing. There were some outcomes, such as referrals to other specialities and number of health care visits, that showed no significant differences between groups.
- The authors highlighted the following limitations: there were no data on the dosages of the opioids prescribed by providers in the intervention group, providers were not randomly assigned to intervention groups, there was a significant commitment from the participating agencies to support consistent attendance of their providers in the intervention group, and there were no cost data.

Evaluation of a Multisite Telehealth Group Model for Persistent Pain Management for Rural/Remote Participants

- The evaluation of the hub-and-spoke model was completed using an **uncontrolled before-and-after study**. The study included adults with persistent chronic pain (longer than 6 months) who lived in remote or rural communities. Patients completed self-administered questionnaires before and after completion of the program.
- The intervention included weekly 2-hour education sessions over 4 weeks. The sessions were led by specialists from different disciplines at the hub site using videoconferencing. Patients attended the session at their nearest health facility.
- For the Chronic Pain Acceptance Questionnaire 20, 12 of 21 participants showed some improvement. No participants had reliable deterioration. There were no significant changes in Brief Pain Inventory scores at the group level but there were some changes at the individual level. Scores from the Pain Self-Efficacy Questionnaire, the Depression Anxiety Stress Scale 21, and the Patient-Reported Outcomes Measurement Information System short form showed no significant changes.
- The authors highlighted the following limitations: there were fewer than 25 patients in their study, limited demographic information was collected, there was no long-term follow-up, there was no validation of the program in a face-to-face format, there was a lack of an explicit implementation framework for the program, some continuous outcomes were dichotomized, and outcomes related to patient and service costs were lacking.



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