Appropriate Use of Chronic Pain Medications: A Pre-post Intervention Comparison

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Abstract

Objective: To assess the effectiveness of a Chronic Pain Management Program (CPMP) on reducing inappropriate opioid use among patients.
Methods: We conducted a retrospective chart review of patients at one outpatient clinic who had a chronic pain syndrome diagnosis and were currently using opioids or seeking to restart a prescription. We assessed total morphine equivalent dose per day (MED) and type of prescription using pre-vs-post-implementation and cohort designs. We examined MED and percentage of patients on appropriate MED and/or appropriate type of prescription using Wilcoxon sign ranked test, Kruskal-Wallis, McNemar's test, and Chi Square. We examined the effect of CPMP involvement on MED and percentage of patients on appropriate MED using logistic regression.
Results: Two-hundred and forty CPMP patients [Co-management:112(46.7%); Consultation: 128(53.3%)], and 54 patients with no CPMP participation were included. The majority of patients was middle-aged, female, and used Medicare. Among CPMP patients, MEDs were significantly reduced (pre-CPMP median = 50mg/day; post-CPMP median 37.5mg/day; p = 0.0001). Opioid cessation was significantly related to level of CPMP involvement (Co-management = 8%; Consultation = 25.8%; p = 0.001). Patients involved in CPMP were significantly more likely to be on the appropriate type of prescription (Co-management = 92%; Consultation = 85.9%; No participation = 48.1%; p = 0.0001).
Conclusions: This CPMP was successful in helping patients reduce and/or cease opioid use.

Key Words: Chronic pain syndrome; Opioid use; Morphine equivalent dose per day (MED)

Introduction

Use and deadly misuse of opioids has skyrocketed and prescriptions for opioids have tripled over the last two decades.[1] Opioid misuse, abuse, and/or addiction occur in up to 54% of patient samples studied.[2] By 2009, overdose of prescription painkillers, primarily opioids, surpassed motor vehicle accidents as a leading cause of accidental death.[3]

The likelihood of accidental death from an overdose of opioids increases considerably as the total morphine equivalent dose (MED) per day increases. The risk increases most dramatically as the MED equals 100 mg/day and continues to increase as dosing approaches and exceeds 120 mg/day.[4-5] At the time of the project, the Centers for Disease Control and Prevention (CDC) guidelines recommend avoiding doses >120 mg/day MED. In March 2016, the CDC lowered this threshold to ≥ 90 mg/day MED.[6] While the majority of patients are prescribed appropriate MED, 20% of patients were prescribed opioids in excess of 100 mg/day MED. About half of these patients received excessive prescriptions from a single provider while the other half received prescriptions from multiple providers. Over 80% of the prescription opioid overdoses occur in this 20% of patients.[1]

In 2014, in North Carolina (NC), the rate of opioid related overdose deaths was 12.9 per 100,000 persons. This rate increased to 18.8 per 100,000 the next year resulting in North Carolina

being ranked 31st out of the 50 states and the District of Columbia.[7] However, NC was ranked the 13th leading prescriber of prescription pain killers, with 97 prescriptions written per 100 people.[3] Sales in western NC were among the highest in the state; of the 23 counties in NC with the highest rates of dispensing prescription opioid analgesics, nine were among the western 16 counties of our region. Five of the nine counties were among those in the state with the highest utilization of emergency departments due to medication overdoses. Two of the counties were among the top nine in the state with the highest rate of unintentional or undetermined prescription opioid overdose deaths.[3]

Given these regional problems, in 2012, Mountain Area Health Education Center (MAHEC) applied for and received a three year Centers for Medicare and Medicaid Innovations grant to implement professional education and standardized, chronic pain management in western NC. The first primary care clinic to implement the clinical intervention as part of this grant was the MAHEC Family Health Center at Biltmore.

Standardized Clinical Intervention

The clinical intervention consisted of operating a specific clinic for patients with a chronic pain syndrome diagnosis, staffed two half days a week by a nurse practitioner with special training in chronic pain management and a medical assistant. A board certified Family Medicine doctor provided clinical supervision.

The Chronic Pain Management Program (CPMP) consisted of evidence-based, standardized care components:[1, 8-9]

1. Assessment of substance abuse behaviors and risks using a standardized interview[10-11] and periodic urine drug screening;
2. Regular review of the North Carolina controlled substance registry for opioid prescriptions;[12]
3. Opioid prescription guidelines for maximum MED (≤120 mg/day) and type of prescriptions (long acting, scheduled medications for maintenance and short acting medications as needed for breakthrough pain control),[1]
4. Ongoing assessment of well-being, including pain, functionality, coping and self-efficacy,[13] and behavioral health symptoms,[14]
5. Utilization of a controlled substance use contract that includes agreement to utilize one provider for opioid prescriptions;
6. Development of patient self-management goals;
7. Provision of patient education and counseling;
8. Participation at required individual medical visits minimally every 90 days, and more frequently as clinically indicated;
9. Encouraged participation at optional, monthly group medical visits;
10. Referral to clinical pharmacy consultation and individual appointments as needed; and
11. Referral to behavioral health consultation and individual appointments as needed.

Adult patients with a chronic pain syndrome diagnosis (ICD-9 338.4) who had been using opioids for ≥90 days were the target population of the program. Patients meeting these criteria as well as patients seeking to restart lapsed prescriptions for chronic pain management were referred by primary care providers for consultation and co-management.

Patients' adherence to their pain medication regimen was monitored regularly via pill counts, urine drug screening, and verification of prescriptions filled. Patients' self-reported pain levels, side effects and other concerns, self-efficacy with functioning and coping with chronic pain, and progress towards their goals were monitored at every visit. Patients on high MED were encouraged to wean to safe levels (<120mg/day). Clinical experience of the nurse practitioner suggested it may take up to six months to make significant changes in reduction of total MED of prescribed medications.

The objective of this project was to assess the effectiveness of this CPMP on reducing inappropriate opioid use among patients with a diagnosis of chronic pain syndrome.

Materials and Methods

Participants

We identified three distinct cohorts of patients over the course of this three year grant:

1. Patients referred for consultation and co-management with ongoing appointments with the nurse practitioner (Co-management);
2. Patients referred for consultation and co-management with the majority of appointments handled by the primary care providers (PCP; Consultation); and
3. Patients never referred for consultation or co-management (None or no participation).

We excluded all patients with current cancer diagnoses, and patients seen for less than 160 days as these patients had only one visit for chronic pain management with any provider.

Study Design

We conducted a retrospective chart review of all patients meeting the inclusion criteria in this project that was approved by the Mission Hospital Institutional Review Board. Healthcare utilization and outcomes, including changes in patients' pain and pain self-efficacy scores, were examined and reported elsewhere. This project focused on appropriate use of pain medication.

Using a pre- vs. post-implementation design, we examined change over time in MED, and in type of prescription (scheduled long acting or short acting; as needed long acting or short acting).

Using a cohort design, we compared MED and type of prescription at the end of the grant period across the three patient groups identified. We also compared opioid cessation rates.

Data Extraction and Coding

We extracted names and dosages of scheduled and as needed opioid medications reported at the intake outpatient visit to the CPMP (Co-management and Consultation cohorts) and those recorded as prescribed at the most recent appointment for chronic pain by any provider (all three cohorts). If we found contradictions between medication lists over visits and/or the documented clinical impressions and plans of visit notes, we looked back over the past two to three visit notes for consistency. If notes indicated opioid prescriptions were restarted or continued on every note, we recorded that as an active prescription.

Data points for patients not seen in the CPMP were included only from the most recent chronic pain appointment. We also extracted: the dates of the most recent chronic pain appointment; the dates of the initial and most recent appointment in the CPMP; the number of office visits in the CPMP; and if the patient was no longer an active patient in our panel, the reasons for discharge from the practice.

Program Participation Level. For patients seen for chronic pain for $\geq$160 days, we coded their participation in the CPMP as: 1. Co-management (seen $\geq$ 2 times in $\geq$ 3 months and seen by PCP for pain management); 2. Consultation (1-3 times in $<$3 months, then seen only by their PCP for pain management) or 3. None (no participation in the CPMP).

Appropriate Type of Medications. A list of long and short acting opioids was provided to the data extraction team by the clinical pharmacists. Patients prescribed long acting opioids or no opioids as their scheduled medication were coded as "appropriate type of prescription". Those prescribed short acting opioids as the scheduled medication were coded as "inappropriate type of prescription." Patients prescribed short or long acting opioids as needed with MED $>$100mg/day were coded as "inappropriate type of prescription."

Morphine Equivalent Dose (MED). We used a clinical pharmacy calculator to determine the total MED of various prescribed opioid medications and doses.[15-16] For as needed prescriptions, we used the maximum allowed dose. We coded the MED as "appropriate MED" if the total prescribed dose of both scheduled and as needed medications was MED $<$100 mg/day. We calculated the change in MED from intake to final reporting.

Data Analyses

Pre- vs. Post-CPMP Comparisons. We compared the total MED of prescribed medications reported at the intake visits to the Chronic Pain Management Clinic (pre-CPMP) to that recorded at the most recent appointment for chronic pain management (post-CPMP) using Wilcoxon sign ranked test. We compared the percentage of patients on appropriate MED and appropriate type of prescription pre- to post-CPMP using McNemar's test. We compared the rate of opioid cessation using Chi square analysis.

We used logistic regression to examine the effect of level of program participation, duration of involvement in the CPMP [intake appointment (pre-CPMP) to most recent pain management appointment (post-CPMP)] on MED (stepwise) and percentage of patients on appropriate MED (binary – enter) at post-CPMP.

Cohort Analysis of Program Participation. We examined the effect of level of program participation (Co-management vs. Consultation vs. None) on the change in MED over time using Kruskal-Wallis, and the change in percentage of patients on appropriate MED and using the appropriate type of prescriptions using Chi square analysis.

Results

We identified 274 CPMP patients eligible for this study. When we examined the reason for discharge from our practice, we identified 34 (12.4%) patients we stopped prescribing medications due to behaviors associated with substance dependency (n = 27) or whom we referred to pain specialists due to their acuity (n = 7). These CPMP patients were excluded from further analyses. We also identified 54 patients never seen in CPMP meeting inclusion criteria. Characteristics of the included patients are shown in Table 1 by level of CPMP participation.

There were no significant differences in age, sex or insurance status of the participants.

Table 1. Patient Characteristics by Cohort of Program Participation Level

		Co-management N = 112	Consultation N = 128	No Participation N = 54	p*
Age	Mean (SD)	56.4 (13.5)	56.41 (16.4)	59.8 (15.5)	0.339
	Median (min-max)	58.3 (19-83)	56.1 (25-91)	61.0 (28-90)	
		n (%)	n (%)	n (%)	p**
Age Category					
	18-25	1 (0.9)	1 (0.8)	0 (0.0)	
	26-64	83 (74.1)	81 (63.3)	32 (59.3)	0.417
	65-74	18 (16.1)	27 (21.1)	12 (22.2)	
	75+	10 (8.9)	19 (14.8)	10 (18.5)	
Sex	Male	35 (31.3)	39 (30.5)	11 (20.4)	0.306
	Female	77 (68.8)	89 (69.5)	43 (79.6)	
Insurance					
	Private	21 (18.8)	33 (25.8)	9 (16.7)	0.070
	Medicaid	29 (25.9)	25 (19.5)	8 (14.8)	
	Medicare	59 (52.7)	66 (51.6)	33 (61.1)	
	None	3 (2.7)	4 (3.1)	4 (7.4)	

Notes. * One-way ANOVA; **Chi square

Pre- vs. Post-CPMP Comparisons

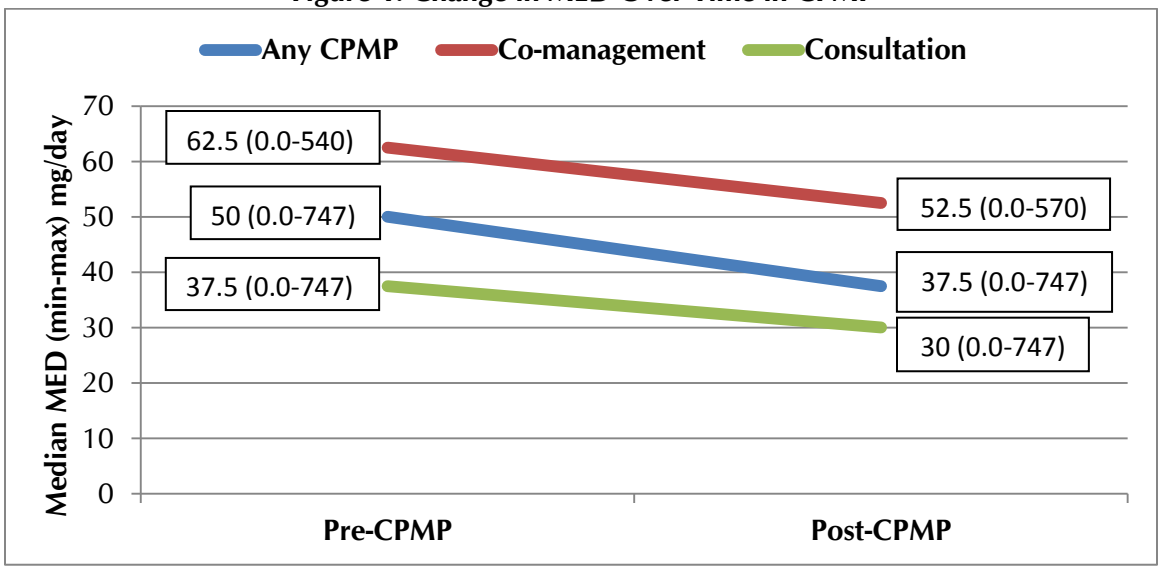
Of the 240 CPMP patients for whom we continued to see for chronic pain management, 128 (53.3%) were seen in the CPMP for consultation and returned to their PCP for management, and 112 (46.7%) were seen in the CPMP for ongoing co-management with their PCP. Overall, for the 240 patients with any level of involvement in the CPMP, there was a significant reduction in MEDs: pre-CPMP median = 50 mg/day (0-747.5) vs. post-CPMP median = 37.5 mg/day (0-747.5), p = 0.0001 (see Figure 1, blue line).

There was no significant difference, however, in MED improvement between patients seen more frequently in the CPMP for Co-management vs. patients seen only for Consultation (p = 0.506; see Figure 1, red and green lines, respectively). The best predictor of MED at the post-CPMP visit was the MED at pre-CPMP appointment (adj R^2 = .655, p = 0.0001).

The percentage of patients on an appropriate type of prescription increased from 79.6% (n = 191) at pre-CPMP to 84.2% (n = 202) at post-CPMP. Overall, 175 were on an appropriate type of prescription at both points in time, 27 patients were switched to an appropriate type of prescription, 22 patients were on an inappropriate type of prescription at both pre and post-CPMP, and 16 were switched to an inappropriate type of prescription. This change was not significant (p = 0.127).

The percentage of patients on an appropriate MED increased from 74.2% (n = 178) at pre-CPMP to 77.5% (n = 195) at post-CPMP. Overall, 168 were on an appropriate MED at both points in time, 18 patients reduced their MED to an appropriate level, 44 patients remained on excessive MEDs, and 10 increased to an excessive MED. This change was not significant (p = 0.186).

Figure 1. Change in MED Over Time in CPMP



The percent of patients that stopped use of opioid medication by the end of the program was significantly related to level of program participation: Co-management = 9 (8%) vs. Consultation = 33 (25.8%); (p = 0.001).

After adjusting for the MED at intake, duration of time in the CPMP (from the pre-CPMP to the post-CPMP) was the only significant predictor of MED at post-CPMP (adj R^2 = 0.07, p = 0.001). The longer a patient is seen, the greater the MED at the last appointment for chronic pain (Pearson correlation r = 0.253, p = 0.0001). Duration of time from pre-CPMP to post-CPMP was the significant predictor of being on an appropriate MED at post-CPMP (Nagelkerke R^2 = 0.058, p = 0.046).

Cohort Analysis by Level of Program Participation

At the most recent pain management appointment, the level of program involvement was not related to the median MED, nor to the percentage of patients on an appropriate MED < 100 mg/day. Program involvement was significantly related to the percentage of patients using the appropriate type of prescription. CPMP involvement resulted in significantly more patients prescribed the appropriate type of prescription compared to patients with no CPMP involvement ($p = 0.001$; see Figure 2).

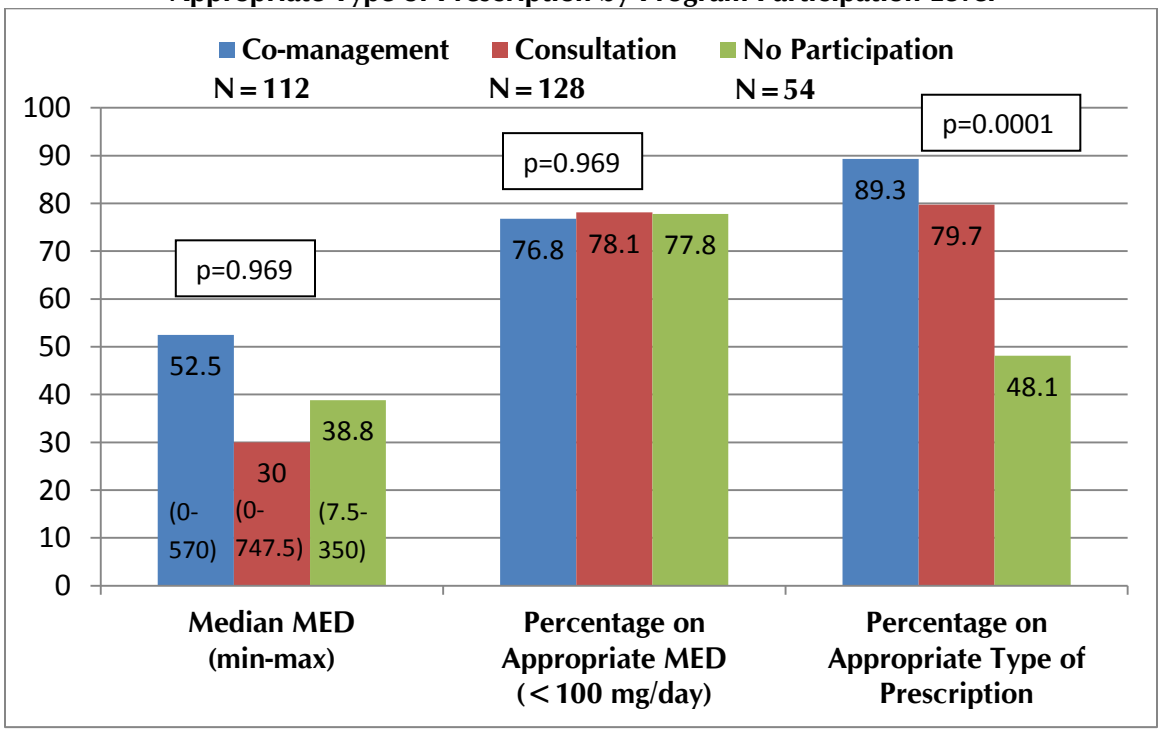
Discussion

Involvement in the CPMP, including consultation with the nurse practitioner specially trained in chronic pain management, and either with co-management with a PCP or management primarily by the PCP, resulted in a significant reduction in the overall MEDs utilized by program patients. There was no statistically significant change in the percentage of patients on appropriate MED.

The overall duration of care was positively related to MED and significantly predicted the likelihood of having an appropriate MED prescription. This suggests chronic pain management in primary care must be viewed as a longitudinal care management strategy. Additionally, patients on higher doses may need a longer time period for weaning to a safe MED.[17]

While cessation is not necessary for chronic pain patients to improve their coping and functionality,[18] ending reliance on chronic opioid use is nevertheless an ideal goal of effective of interdisciplinary pain programs. A significantly greater proportion of patients seen for Consultation in the CPMP discontinued use as compared to patients seen for Co-management. This is indicative of the more acute patients being seen for Co-management in the CPMP – an appropriate utilization of this resource.

Figure 2. Comparison of MED, Appropriate MED and Appropriate Type of Prescription by Program Participation Level



Patients never seen in the CPMP were significantly less likely to be on the preferred and safer schedule of prescriptions: long-acting for ongoing, regular, scheduled use and short-acting for

breakthrough pain control only. Half of the patients with no involvement in the CPMP were being prescribed short-acting medication for ongoing, regular control of pain.

The majority of previous studies of multidisciplinary pain treatment programs do not include medication use as a primary outcome. Those that do, report mixed results ranging from non-significant differences to reductions of 50% or more when compared to standard medical care, wait lists, or insurance denials for program participation.[19-20] Further, there is no evidence for duration or specific program components as predictors of effectiveness.[20]

We found among patients with chronic pain syndrome who were referred to our CPMP, overall reductions in MED and an overall rate of 17.5% cessation. Involvement in the CPMP resulted, most importantly, in significantly greater numbers of patients with appropriate types of opioid prescriptions as compared to patients with no CPMP involvement at all.

Generalization of the results of this project is limited due to the retrospective nature of the project that was conducted at one site. Further, we did not control for comorbid diagnoses among patients that affect pain medication utilization, nor did we assess effects of reductions, cessation, or differences in opioid medications and dosing on pain levels, coping, or functionality. The relative cost-effectiveness of chronic opioid use is debated,[2,19] and we did not address it here.

Given the high rate of problematic use among patients on opioid medications[2] and that about one fifth of all patients are prescribed dangerously high doses of opioids,[1] interventions designed to reduce harm and risky behaviors are vital to the national efforts to deal with this epidemic. Most importantly, reduction, stabilization of MED at effective *and* safe levels, or cessation of chronic opioid use among patients with chronic pain syndrome were among the CPMP goals. For many of our patients, these goals were met regardless of the level of involvement in the CPMP. Finding a way to increase patient involvement in the CPMP, with higher acuity in Co-management and lower acuity in Consultation, should help patients reduce risky use of opioids.

References

1. Centers for Disease Control and Prevention (CDC). CDC grand rounds: prescription drug overdoses - a U.S. epidemic. MMWR Morb Mortal Wkly Rep. 2012 Jan 13;61(1):10-3. PubMed PMID: 22237030.
2. Vowles KE, McEntee ML, Julnes PS, Frohe T, Ney JP, van der Goes DN. Rates of opioid misuse, abuse, and addiction in chronic pain: a systematic review and data synthesis. Pain. 2015 Apr;156(4):569-76. doi: 10.1097/01.j.pain.0000460357.01998.f1. Review. PubMed PMID: 25785523.
3. Proescholdbell, S. (North Carolina Injury and Prevention Branch, North Carolina Public Health) [Medication and Drug Overdoses North Carolina]. 2014. Available at http://injuryfreenc.web.unc.edu/files/2014/07/Data-Overview-071414.pdf.
4. Bohnert AS, Valenstein M, Bair MJ, Ganoczy D, McCarthy JF, Ilgen MA, Blow FC. Association between opioid prescribing patterns and opioid overdose-related deaths. JAMA. 2011 Apr 6;305(13):1315-21. doi: 10.1001/jama.2011.370. PubMed PMID: 21467284.
5. Dunn KM, Saunders KW, Rutter CM, Banta-Green CJ, Merrill JO, Sullivan MD, Weisner CM, Silverberg MJ, Campbell CI, Psaty BM, Von Korff M. Opioid prescriptions for chronic pain and overdose: a cohort study. Ann Intern Med. 2010 Jan 19;152(2):85-92. doi: 10.7326/0003-4819-152-2-201001190-00006. PubMed PMID: 20083827; PubMed Central PMCID: PMC3000551.
6. Dowell D, Haegerich TM, Chou R. CDC Guideline for Prescribing Opioids for Chronic Pain - United States, 2016. MMWR Recomm Rep. 2016 Mar 18;65(1):1-49. doi: 10.15585/mmwr.rr6501e1. PubMed PMID: 26987082.
7. Rudd RA, Aleshire N, Zibbell JE, Gladden RM. Increases in Drug and Opioid Overdose Deaths--United States, 2000-2014. MMWR Morb Mortal Wkly Rep. 2016 Jan 1;64(50-51):1378-82. doi: 10.15585/mmwr.mm6450a3. PubMed PMID: 26720857.

8. Chou R, Fanciullo GJ, Fine PG, Adler JA, Ballantyne JC, Davies P, Donovan MI, Fishbain DA, Foley KM, Fudin J, Gilson AM, Kelter A, Mauskop A, O'Connor PG, Passik SD, Pasternak GW, Portenoy RK, Rich BA, Roberts RG, Todd KH, Miaskowski C; American Pain Society-American Academy of Pain Medicine Opioids Guidelines Panel. Clinical guidelines for the use of chronic opioid therapy in chronic noncancer pain. J Pain. 2009 Feb;10(2):113-30. doi: 10.1016/j.jpain.2008.10.008. PubMed PMID: 19187889; PubMed Central PMCID: PMC4043401.
9. Franklin GM; American Academy of Neurology. Opioids for chronic noncancer pain: a position paper of the American Academy of Neurology. Neurology. 2014 Sep 30;83(14):1277-84. doi: 10.1212/WNL.0000000000000839. Review. PubMed PMID: 25267983.
10. Butler SF, Fernandez K, Benoit C, Budman SH, Jamison RN. Validation of the revised Screener and Opioid Assessment for Patients with Pain (SOAPP-R). J Pain. 2008 Apr;9(4):360-72. doi: 10.1016/j.jpain.2007.11.014. Epub 2008 Jan 22. PubMed PMID: 18203666; PubMed Central PMCID: PMC2359825.
11. Belgrade MJ, Schamber CD, Lindgren BR. The DIRE score: predicting outcomes of opioid prescribing for chronic pain. J Pain [Internet]. 2006; [cited 2013 Sept 12]; 7:[671-81]. Available from: http://www.ncbi.nlm.nih.gov/pubmed/16942953.
12. North Carolina Controlled Substance Reporting System [Internet]. Raleigh: North Carolina Controlled Substance Reporting System Division of Mental Health, Developmental Disabilities, and Substance Abuse Services; c2013. Available from https://nccsrsph.hidinc.com/nclogappl/bdncpdmqlog/pmqhome.html.
13. Nicholas MK. The pain self-efficacy questionnaire: Taking pain into account. Eur J Pain. 2007 Feb;11(2):153-63. Epub 2006 Jan 30. PubMed PMID: 16446108.
14. Maurer DM. Screening for depression. Am Fam Physician. 2012 Jan 15;85(2):139-44. Review. Erratum in: Am Fam Physician. 2013 Apr 1;87(7):464. PubMed PMID: 22335214.
15. Opioid Medication Dose Conversion [Internet]. Drug Facts and Comparisons; c.2016. Available from http://online.factsandcomparisons.com/login.aspx?url=/MedCalc/Calculators.aspx&qs=calculator$Opioid.htm@type$General%20Pharmacotherapy.
16. McPherson ML. Demystifying opioid conversion calculations. Bethesda: American Society of Health-System Pharmacists, Inc. 2010.
17. Berna C, Kulich RJ, Rathmell JP. Tapering Long-term Opioid Therapy in Chronic Noncancer Pain: Evidence and Recommendations for Everyday Practice. Mayo Clin Proc. 2015 Jun;90(6):828-42. doi: 10.1016/j.mayocp.2015.04.003. Review. PubMed PMID: 26046416.
18. Murphy JL, Clark ME, Banou E. Opioid cessation and multidimensional outcomes after interdisciplinary chronic pain treatment. Clin J Pain. 2013 Feb;29(2):109-17. doi: 10.1097/AJP.0b013e3182579935. PubMed PMID: 22751033.
19. Gatchel RJ, Okifuji A. Evidence-based scientific data documenting the treatment and cost-effectiveness of comprehensive pain programs for chronic nonmalignant pain. J Pain. 2006 Nov;7(11):779-93. Review. PubMed PMID: 17074616.
20. Scascighini L, Toma V, Dober-Spielmann S, Sprott H. Multidisciplinary treatment for chronic pain: a systematic review of interventions and outcomes. Rheumatology (Oxford). 2008 May;47(5):670-8. doi: 10.1093/rheumatology/ken021. Epub 2008 Mar 27. Review. PubMed PMID: 18375406.

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Courtenay Gilmore Wilson, Pharm D: Clinical provider, methodology, and critical review of the manuscript
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