Pain Management Resources to Support Clinical Decision Support Artifact Development:

An Environmental Scan

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Prepared by:

Janice Ballo, M.A., M.L.S.
Steve Boczenowski, B.S.
Rob McCready, M.S.
George Neyarapally, Pharm.D., J.D., M.P.H., R.Ph.
Joey Nichols, M.D., M.P.H.
Sharon Pacchiana, F.N.P., M.S.N., M.H.A., MMI
Sharon Sebastian, R.N.-B.C., M.S., CPHIMS
Jonathan Teich, M.D., Ph.D.
CMS Alliance to Modernize Healthcare, a federally funded research and development center operated by the MITRE Corporation

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1. Executive Summary

Chronic pain is among the most common, costly, and disabling chronic medical conditions in the U.S. [1-3, 66]. Approximately 100 million adults in the U.S. experience chronic pain [4-6], and approximately one in five patients with non-cancer pain or pain-related diagnoses is prescribed opioids in office-based settings [5]. Given these staggering statistics, the U.S. Department of Health and Human Services (HHS) released a National Pain Strategy in March 2016 to improve the prevention and management of pain, and increase awareness of treatment options and risks to facilitate informed decisions [7]. Most recently, the President declared a public health emergency to mobilize Federal efforts to address drug addiction and opioid use disorder [8]. The Agency for Healthcare Research and Quality (AHRQ) selected pain management as the clinical domain for the development of clinical decision support (CDS) artifacts via the CDS Connect contract to bolster the Federal response to the opioid crisis. This action will provide standards-based, shareable CDS resources that are free and publicly available to healthcare providers across the Nation to support decision making and high-quality care, and mitigate the risk of opioid misuse and related deaths.

During the first 6 weeks of the CDS Connect effort, the MITRE team conducted an environmental scan of the chronic, non-cancer pain management landscape to gain foundational awareness of the standards of care in this clinical domain and identify evidence-based recommendations and tools that could contribute to the development of new patient-centered CDS artifacts. The scan identified several findings that will inform CDS Connect efforts over the coming year. Some of the high-level findings include:

Limited availability of opioid CDS artifacts: Due (in part) to the shift of evidence-based recommendations in the past several years, which encourage self-management, non-pharmacologic, and non-opioid medications as the first line of treatment [9,10], presently CDS that supports the new standards of care is still evolving and is minimally shared. Reduced access to published CDS efforts and artifacts reduces the opportunity to leverage lessons learned regarding specification and implementation challenges.

Significant legal restrictions abound: The organizations responsible for many clinical practice guidelines, pain assessments, and opioid risk assessments hold copyrights that restrict their use. Obtaining legal approval to represent the copyrighted work in an electronic CDS format and disseminate publicly can be time- and labor-intensive. Intellectual property status is a prominent factor in the decision of what to develop, likely leading to strong consideration of government-authored resources for which permissions may be easier to attain.

Data characteristics and availability are critical: A 2014 study uncovered barriers to implementing electronic clinical quality measures (eCQMs) in the addiction domain due to a lack of standard terminologies to represent care concepts (e.g., psychosocial treatments) and the structured capture of these concepts [11]. The availability of structured data that accurately and

interoperably reflects clinical care across various vendor electronic health record (EHR) systems and clinical workflows is vital to effective eCQMs and CDS. Careful consideration of feasibility constraints related to the specification of a standard of care as CDS is imperative.

Minimal amount of published specifications: At present, there are no publicly available eCQMs and only one published opioid CDS specification [12]. In addition, there are only a handful of nonmalignant pain and opioid value sets available in the Value Set Authority Center (VSAC). This maybe due, in part, to the data characteristics discussed above. As a result, CDS development will likely be more labor intensive and require significant subject matter expert (SME) input to ensure proper translation of the evidence-based recommendations.

Prevention of inappropriate prescribing and opioid misuse: National efforts reflected in the most recent round of evidence-based recommendation statements advocate prevention of inappropriate prescribing and opioid misuse through patient education, provider training, risk evaluation, proper prescribing practices, and shared decision making between patients and providers based on the benefits and risks of potential treatments [9,10]. Well-positioned CDS artifacts in clinical workflow can contribute valuable support of patient and provider decisions, thus reinforcing the recommended standards of care.

Change management challenges: Recent shifts in pain management protocols and prescribing practices urge self-management and non-pharmacologic treatments as the first line of treatment [9,10]. When medications are indicated, providers are encouraged to prescribe non-opioid medications as opposed to opioids. In addition, under recent guidelines, the goal for pain management does not primarily focus on pain elimination but instead a reduction in pain to enable an individual to meet their functional goals [9,13]. This transformational change can be facilitated by CDS, but requires significant patient education, provider training, and organizational policy and process changes to realize maximum success.

External factors influencing treatment: Self-management techniques require patient buy in and adherence. Further, non-pharmacologic treatments can be costlier than opioids for patients due to gaps in insurance coverage of these treatments [14]. Furthermore, asking providers to consider a prescription of "alternative treatments" is impractical in the absence of supporting incentive structures [14]. As a result, first-line treatment approaches that are offered and encouraged via CDS may be refused by the patient or rejected by the provider, thus lessening the desired outcomes.

This document serves as a foundational resource for the CDS Connect team. MITRE researchers will continue investigation and outreach beyond the delivery of this paper to further inform project efforts.

2. Environmental Scan Context and Methodology

Information in this section provides a description of the CDS Connect project, the purpose of the environmental scan, and the methodology used by the CAMH CDS Connect team to conduct the search.

2.1   Background

The Centers for Medicare and Medicaid Services Alliance to Modernize Healthcare (CAMH) is a Federally Funded Research and Development Center (FFRDC) operated on behalf of all HHS agencies by The MITRE Corporation (a not-for-profit entity working in the public interest). In September 2016, AHRQ engaged CAMH to generate a systematic and replicable process of transforming patient-centered outcomes research (PCOR) findings into shareable, standards-based, publicly available CDS artifacts, along with developing prototype tools that would facilitate such a process of transformation. To this end, MITRE created a public-facing CDS Connect Repository to house available artifacts, along with an Authoring Tool to facilitate the creation of CDS artifacts. In addition, the MITRE team created and posted six CDS artifacts to demonstrate the Repository's capability to provide shareable, evidence-based cardiovascular health-related artifacts.

MITRE will continue to refine and expand the capabilities of the CDS Connect Repository and Authoring Tool in the second year of performance, which began in September 2017. The MITRE team will also create additional CDS artifacts, as directed by AHRQ sponsors, to support chronic pain management and proper opioid prescribing, thus contributing to the concerted effort outlined in the National Pain Strategy.

This environmental scan is one of the early project efforts to identify current pain management principles and relevant, existing PCOR findings, CDS artifacts, tools, and resources to inform project work throughout the period of performance.

2.2   Context and Approach

The MITRE team developed research questions and analyzed findings to inform project efforts, including artifact development and collaboration with individuals, researchers, organizations, and CDS developers in the pain management domain. Next, the team categorized findings based on objectives pertaining to the care of individuals with pain (e.g., patient-centered pain assessment, opioid avoidance) so resources in each category could be drawn upon during artifact development. Researchers focused on items with the greatest likelihood of directly informing or functionally contributing to CDS artifact development.

2.2.1   Research Questions

MITRE researchers developed study questions to discern relevant principles, initiatives, recommendations, stakeholders, and tools in the realm of chronic, nonmalignant pain management.

Research questions aligned with the following themes:

- **The opioid epidemic and how pain management can impact the problem**
    - What is the opioid epidemic? How does chronic pain management intersect with the epidemic?
    - What is the current evidence-based approach to chronic, nonmalignant pain management?
    - How can CDS impact and improve the care of individuals in pain?
- **Organizations working in the pain management domain**

- o What government agencies and professional, non-profit, academic, and commercial organizations are contributing research, guidance, recommendations, and publicly available resources in the pain management space?
  - Are they developing, supporting, or using CDS to better manage pain? If so, are they willing to collaborate?
- **Available PCOR sources**
  - o **Clinical practice guidelines (CPGs) and CQMs**
    - What are the most recent and relevant CPGs and recommendation statements? Is information available on how guidance may differ and/or align across guidelines?
    - Are there CQMs and eCQMs that measure aspects of pain care? If so, how do they intersect with CPGs?
  - o **Tools and resources**
    - What are the prominent tools and applications in this clinical domain (e.g., morphine milligram equivalent (MME) calculators, risk assessments, checklists)? Can they be leveraged for our work? If so, do they have copyright restrictions?
  - o **Peer-reviewed journal articles**
    - What are the latest research findings in the chronic pain management domain? How can these findings inform project objectives?
- **Existing CDS efforts and artifacts in the pain management domain**
  - o Is existing work available? If so, how have prior CDS initiatives approached supporting evidence-based care in this realm?
    - Are configuration and implementation details available from their work, along with impact evaluations? What are their lessons learned?
    - Are they willing to collaborate or post the artifacts on the Repository?

2.2.2   Scope and Limitations

The MITRE team conducted this scan and compiled the findings during an early 6-week period in Option Year 1 of the AHRQ CDS Connect project. They evaluated each item at varying levels based on an initial impression of its impact on the project's objectives. The project team intends to continue research and a deeper dive into identified resources as work continues. The team also intends to utilize input from AHRQ sponsors, SMEs, and clinicians in the CDS Connect Work Group to identify additional areas of research and focus.

Scan and project efforts are primarily limited to chronic, non-cancer/non-palliative care/non-end-of-life pain management, with a focus on recent recommendations that outline how to best manage pain to lessen opioid use and the risk of opioid use disorder (i.e., prevention through reduction in exposure). Acute pain care is not a primary focus of the scan. In addition, intravenous medications, overdose treatment, and provider training and education are outside the scope of the scan. When identified, the research team compiled information regarding the treatment of opioid use disorder (OUD) since some pain management clinical practice guidelines address that concept of care; however, research attention was not centered on evidence-based OUD recommendation statements.

Information in this paper is not intended to inform policy or put forward new standards of care.

2.3   Research Methodology

CAMH conducted literature searches in biomedical databases PubMed, Scopus, and Engineering Vi for peer-reviewed and scholarly literature published between January 2007 and October 2017. The team used Google and Google Scholar search engines to retrieve both published and unpublished literature from government websites and other open web repositories. Subject headings and key terms incorporated in the search statements include: opioid(s); analgesics, narcotics; clinical decisions support; decision support system; electronic health record (EHR); pain management; substance (or drug) abuse (or addiction); behavior, addictive; population health; risk factors; patient-centered outcomes. Clinicians used the search words "pain" and "opioid" in AHRQ's National Guideline Clearinghouse and National Quality Measures Clearinghouse, the National Quality Forum's measure database, and the Centers for Medicare & Medicaid Services' eCQM Library and Measures Under Development spreadsheet to identify the broadest range of resources, then refined the search to "chronic pain." Research contributors vetted the literature search results and reviewed and analyzed select papers in depth. Bibliographic analysis of those papers identified additional relevant literature.

Researchers conducted searches within medical and technical databases and the Open Web for artifacts created by previous initiatives and examples of clinical resources used in CDS systems (e.g., dashboards, order sets, consults, care plans). They scanned resources posted on government and non-profit websites for work conducted in the CDS and pain management domains. In addition, Dr. Ric Ricciardi (director of the Division of Practice Improvement and Senior Nursing Advisor at AHRQ) provided a wealth of resources including papers, websites, Department of Veterans Affairs (VA)/ Department of Defense (DoD) training modules and a recent environmental scan (i.e., *Implementing Medication-Assisted Therapy for Opioid Use Disorder in Rural Primary Care: An Environmental Scan Volumes 1 and 2*) to kickstart the CDS Connect effort. Items catalogued in the medication-assisted treatment (MAT) scan were not re-cataloged in the CDS Connect scan. Instead, the team reviewed the findings and took note of relevant resources that would inform the CDS project.

As the team discovered potentially high-impact information regarding specific individuals and initiatives, they initiated contact with the individuals to learn more. Outreach efforts will continue throughout the project to socialize the project objectives and encourage collaboration with other stakeholders.

2.4   Timeline and Team

The environmental scan began in late September 2017, to be delivered to AHRQ on November 11, 2017. The MITRE team intends the scan effort to serve as the foundation for subsequent research, investigation, and outreach. Individuals who contributed to the scan are listed in Table 1.

Name	Research Role
Sharon Sebastian, RN-BC, CPHIMS	Lead Researcher
Jonathan Teich, MD, PhD	Research Contributor
Steve Boczenowski	Research Contributor
Sharon Pacchiana, FNP, MSN, MHA, MMI	Research Contributor
Janice Ballo, MA, MLS	Research Librarian Contributor
Rob McCready, MS	Advisor, Project Lead
George Neyarapally, PharmD, JD, MPH, RPh	Peer Reviewer
Joey Nichols, MD, MPH	Peer Reviewer

Table 1: Environment Scan Contributors

3. Introduction

About 90 lives are lost each day due to opioid overdoses [15]. Ninety more will die tomorrow. In 2015, two million people suffered from opioid use disorders; 33,000 of these died [15]. "That is the size of small city! [16]" The opioid epidemic is a serious national crisis that affects public health as well as social and economic welfare, resulting in an economic burden of $78.5 billion a year [17]. Urgent action is required at the Federal, State, community, organizational, and individual level to stem this overwhelming crisis.

The 2016 National Drug Control Strategy initiated a multi-agency response to the opioid crisis to confront the prescription drug misuse and heroin epidemic [18], since opioids (primarily prescription pain relievers and heroin) are the main drugs associated with overdose deaths [19]. In addition, the Comprehensive Addiction and Recovery Act (2016), 21st Century Cures Act, Mental Health Parity and Addiction Equity Act, and the Affordable Care Act have expanded prevention, treatment, and law enforcement efforts. Furthermore, HHS issued a National Pain Strategy, which outlines the Federal Government's first coordinated plan for reducing the burden of chronic pain that affects millions of Americans [7]. In part, the Strategy calls for the development of methods and metrics to monitor and improve the prevention and management of pain [7], driving awareness of non-pharmacologic therapies and prescription practices.

The Patient-Centered Outcomes Research Institute (PCORI) and AHRQ are perfectly positioned to drive solutions that impact the delivery of evidence-based pain management across the Nation by facilitating patient-centered care. Concerted efforts are underway between the CDS Connect project team, the Patient-Centered Clinical Decision Support-Learning Network (PCCDS-LN), and Federal partners to accelerate the creation and dissemination of CDS artifacts that inform and empower patients and providers to make well-informed pain management decisions.

4. Chronic Nonmalignant Pain Management

In the wake of the opioid crisis, the treatment of chronic, nonmalignant pain has become much more controversial. It is well documented that the sales of prescription opioids have quadrupled since 1999 [20]. This was the result of physicians from across the country being subjected to a multi-million-dollar marketing campaign from the pharmaceutical industry over several years [21]. As an example, this campaign brought us the concept of "pain as a fifth vital sign" [22]. As fatal opioid overdose rates continued to climb, the medical community recognized that treating pain was a very complex issue [22]. In March 2016, the Centers for Disease Control and Prevention (CDC) published guidelines for prescribing opioids for chronic pain, which helped to bring some clarity to this topic [23].

CDC guidelines encourage prescribers to consider nonpharmacologic therapy and nonopioid pharmacologic therapy when treating chronic pain (i.e., pain lasting > 3 months or past the time of normal tissue healing), measure goals for pain *and* function [10], and encourage self-management. As Fitzcharles and Shir state: "Pain treatment should take into account symptoms that co-associate with pain, and proceed in parallel with the best management of the underlying rheumatologic process. Outcome for any treatment should not only be measured as pain relief, but also as an improvement in function" [24]. Additional approaches to chronic pain include:

- Identify and address co-existing mental health conditions (e.g., depression, anxiety).
- Use disease-specific treatments when available.
- Use first-line medication options preferentially.
- Consider interventional therapies (e.g., corticosteroid injections) when non-invasive therapies fail.
- Use multimodal approaches for select individuals [25].

Nonpharmacologic pain management methods, often the first line of treatment, can be divided into three categories: physical techniques (such as manipulation and exercise), psychological techniques (such as cognitive behavioral therapy, hypnosis, and relaxation/meditation), and social/environmental interventions (such as community support groups and work changes) [26].

- **Physical techniques:** These techniques include exercise and activities, manual therapies (e.g., manipulation, mobilization, and massage), and hyperstimulation analgesia (e.g., acupuncture, transcutaneous electrical nerve stimulation, and ice massage). The goal of physical techniques is to reduce the severity of the pain so that the patient can resume normal activities. Therefore, these techniques are more effective for acute pain states, and less achievable for persisting pain [26].
- **Psychological techniques:** All pain management treatment requires some level of psychological technique (e.g., active listening, providing advice, assurance, and encouragement, education/information provision). However, some patients can benefit from additional psychological techniques such as cognitive behavioral therapies, relaxation techniques, biofeedback, attentional techniques, meditation, hypnosis, and psychotherapy. Psychological techniques can be used as the primary treatment, but most commonly they are used as a facilitating technique. Careful assessment should be made to determine the most effective approach [26].

- **Social/Environmental techniques:** If environmental factors are a contributing factor in the persisting pain of the patient, then corresponding changes in the patient's environment may be in order (e.g., in the workplace) [26].

If nonpharmacologic and nonopioid therapies (e.g., ibuprofen, acetaminophen) fail to treat pain and improve function adequately, guidelines developed by the CDC, Department of Veterans Affairs/Department of Defense (VA/DoD), and other highly regarded institutions list a series of steps for providers to follow when considering long-term opioid therapy (e.g., assess baseline pain and function, patient goals and preferences, discuss benefits and risks, check prescription drug monitoring program (PDMP) and urine drug test (UDT) data to evaluate the risk of opioid misuse, reassess within 1- 4 weeks of opioid initiation, and prescribe short-acting opioids using the lowest dosage on product labeling [9,10]). Basing care decisions on these evidence-based recommendations, while ensuring patient-centered, patient-specific care will enhance the likelihood of a successful pain management regimen.

4.1　Patient-Centered Pain Management

Success in addressing the opioid crisis and evidence-based pain management requires a multifactorial, multidisciplinary, patient-centered approach to prevention and treatment. Additionally, it involves an actively engaged, willing patient. These two factors are intricately interwoven.

A patient-centered care (PCC) approach is identified by The Institute of Medicine (IOM), in Crossing the Quality Chasm: A New Health Care System for the 21st Century (2001) as one of the major aims for all health care organizations and is reflected in six dimensions (listed in Table 2 below).

Six Dimensions of Patient-Centered Care
1. Respect for patients' values, preferences, and expressed needs
2. Coordination and integration of care
3. Information, communication, and education
4. Physical comfort
5. Emotional support-relieving fear and anxiety
6. Involvement of family and friends

Table 2: Six Dimensions of Patient-Centered Care [27]

The report describes patient-centeredness as encompassing the qualities of compassion, empathy, and responsiveness to the needs, values, and expressed preferences of the individual patient. It is individualized care based on aspects such as a patient's capabilities, needs, goals, motivation, and preferences; applies a biopsychosocial perspective (including addressing social determinants of health) rather than a purely biomedical perspective; and forges a strong partnership between patient and clinician.

Effective PCC has demonstrated improved adherence, improved outcomes [28], satisfaction, self-management [29], and reduction of diagnostic tests and referrals [30]. Increased focus on PCC and its effectiveness in impacting cost, quality, access, and satisfaction is reflected in the recent Request for Information from the CMS Innovation Center's New Direction [31] for feedback on a new direction to promote patient-centered care and test market-driven reforms.

The focal areas and attributes of a patient-centered health care system (expanding the IOM six dimensions of PCC) are provided in Table 3 (below). Foundational in achieving these dimensions is a trusting relationship with the patient, family, and health care team, enabled by open and honest communication with active listening, information sharing, joint decision making with realistic goals, and joint accountabilities. Bottom line: The goal of patient-centeredness is to customize care to the specific needs and circumstances of the individual [27].

Key aspects to pain management include: understanding the patient's perception of pain through pain and biopsychosocial assessment tools, the impact of the pain on their well-being and quality of life, their perception of non-pharmacologic modalities of pain treatment, and their goals.

Interpersonal (Relationship)	Clinical (Provision of Care)	Structural (System Features)
Communication -Begins with listening -Creates a fabric of trust -Promotes clear, empathic communication, tailored to patients' needs and abilities -Welcomes participation of family, friends, and caregivers	**Clinical Decision Support** -Ensures shared decision making based on best-available evidence coupled with patient preferences -Supports self-management	**Build Environment** -Provides calm, welcoming space -Accommodates patient, clinician, and family needs -Emphasizes easy "way-finding" and navigation through the system
Knowing the Patient -Uses knowledge of the patient as a whole and unique person for effective interactions -Finds common ground based on patient preferences -Facilitates healing relationships	**Coordination and Continuity** -Manages care transitions and seamless flow of information, whether for a broken arm or life-altering illness -Coordinates with community resources	**Access to Care** -Eases appointment-keeping process -Minimizes clinic wait times -Payment system accommodates patients' circumstances -Coordinated, consistent, efficient
Importance of Teams -Ensures responsiveness by entire care team to patient and family needs -Recognizes that actions of both clinicians and staff can influence perceptions of care	**Types of Encounters** -Accommodates virtual visits (phone, email) as well as in-office visits -Reimbursement structure supports range of encounters that meet patients' varied needs	**Information Technology** -Supports patient and clinician before, during, and after encounters -Tracks patients' preferences, values, and needs dynamically -Provides self-management tools and information

Table 3: Dimensions and Attributes of a Patient-centered Health Care System [32]

The EHR, patient portals, and CDS resources (such as automated pain assessment tools like PainCAS [33]) are fundamental in facilitating PCC. Several patient-centered research efforts are underway to facilitate pain management and opioid prescribing via CDS, including the use of alerts to survey patients about the outcome of their pain treatment [35], provide prescribing guidance, identify high-risk patients for opioid-related harms, and provide patient education and activation tools via a patient portal [36].

4.2   Pain Management Clinical Resources

Professional organizations, government agencies, non-profit organizations, prominent scientists, academic institutions, and others have developed a vast and varied amount of clinical resources to inform and guide clinicians as they deliver patient care. Resources include (but are not limited to) clinical practice guidelines, clinical quality measures, assessments, calculators, care plans, and flow sheets. Consequently, CDS developers utilize these resources to inspire and support the CDS specifications.

4.2.1   Clinical Practice Guidelines

The National Guideline Clearinghouse, managed by AHRQ, houses a wealth of guidelines that focus on chronic pain management and opioid prescriptions (i.e., a search of "chronic pain" returned 72 guidelines, and "opioid" returned 152). The MITRE team reduced the queried sample further by eliminating topics outside the scope of the project (e.g., cancer pain, acute pain, radiology guidance), leading to a deeper dive of approximately 12 CPGs. The team noted significant overlap of guidance regarding treatment principles in the most recent releases of many of the guidelines.

Prior to publishing the *CDC Guideline for Prescribing Opioids for Chronic Pain* in 2016, the CDC's National Center for Injury Prevention and Control, National Institute on Drug Abuse (NIDA), Substance Abuse and Mental Health Services Administration (SAMHSA), and the Office of the National Coordinator for Health Information Technology (ONC) conducted a systematic review of eight evidence-based guidelines. The joint effort identified the following commonalities across guidelines:

- Conduct a physical exam, pain history, past medical history, and family/social history.
- Conduct urine drug testing, when appropriate.
- Consider all treatment options, weighing benefits and risks of opioid therapy, and using opioids when alternative treatments are ineffective.
- Start patients on the lowest effective dose.
- Implement pain treatment agreements.
- Monitor pain and treatment progress with documentation, using greater vigilance at high doses.
- Use safe and effective methods for discontinuing opioids (e.g., tapering, making appropriate referrals to medication-assisted treatment, substance use specialists, or other services) [37].

Though not listed in the commonalities, the reviewers also felt that the use of data from PDMPs to identify past and present opioid prescriptions at initial assessment and during the monitoring phase would become an integral part of opioid prescribing as States enhanced their monitoring technology [37]. As of 2016, at least 26 States and Guam required prescribers to use the PDMP before writing opioid prescriptions [86]. As MITRE researchers delve further in to determining which evidence-based recommendation(s) to specify as CDS, guidance that aligns with 1) the above themes, and 2) IOM-outlined criteria for trustworthy guidelines (e.g., generated after a systematic review, include ratings for the strength of evidence and recommendations) [38] will be favorably considered.

Evidence-based guidelines identified as high-value "source" content from which a CDS artifact might be derived, were published within the past 5 years and provide guidance on pain management [40,41], opioid prescribing [9,10,42-44], and opioid use disorder treatment [45,46]. With AHRQ sponsor and CDS Connect Work Group input, the MITRE team will identify recommendation statements within one or more of the CPGs to serve as the foundation for CDS artifacts. Given lessons learned during the initial period of performance of the CDS Connect project, gaining intellectual property approval from government entities that have authored CPGs may be more feasible and timely than seeking permissions from professional organizations.

4.2.2 Clinical Quality Measures

Clinical quality measures evaluate the degree of compliance with the clinical practice guideline (or standard of care) that a CQM is based upon. CQMs, and in particular eCQMs, serve as excellent starting points for CDS because the logic, data elements, exclusions, exceptions, and value sets representing each data concept are specified. As a result, there is little room for misinterpretation. Furthermore, National Quality Forum (NQF)-endorsed eCQMs have demonstrated the accuracy, feasibility, reliability, and validity of measure logic and data elements utilized in the measure. Basing a CDS artifact on endorsed e-specifications provides reasonable assurance that the data evaluated by CDS logic will be accurate and routinely available in a structured format.

Unfortunately, United States Health Information Knowledgebase (USHIK) and the National Quality Measures Clearinghouse (NQMC) house only one eCQM related to nonmalignant pain: *CMS 166v6 Use of Imaging Studies for Low Back Pain*, which is outside the scope of project efforts. A search in VSAC identified three organizations that may be working toward e-specification of pain or opioid-related resources: SAMHSA, ECRI Institute, and American Academy of Neurology (AAN). The value sets created by these organizations are not tied to specific eCQMs at present, although AAN is the author of a Physician Quality Reporting System (PQRS) measure (i.e., PQRS 414: Evaluation or Interview for Risk of Opioid Misuse), which does include some terminology specifications (e.g., a list of Current Procedural Terminology [CPT] codes for encounters).

The research team identified numerous organizations that have authored text-based CQMs in our area of interest; several published entire suites of CQMs in the pain management [68-70] and opioid [71,72] domains. However, most of these measures lack distinct details that would readily support e-specification, rendering them less informative to project efforts. The CMS Measure Under Development list includes an AHRQ measure titled, "Pain Assessment for Chronic Pain," which bears additional investigation.

The team did pinpoint four new measures that appear instructive, due to the level of detail that is provided in the published manuscripts. Although the measures are not e-specified, they do list some standardized codes for certain concepts.

- **Use of Opioids from Multiple Providers (UOP)** – a 2018 Healthcare Effectiveness Data and Information Set (HEDIS) measure based on administrative data [73]
- **Use of Opioids at High Dosage (UOD)** – a 2018 HEDIS measure based on administrative data [73]

- **PQRS 0420: Pain Assessment and Follow Up** – a CMS measure that will be used in the 2018 Merit-based Incentive Payment System (MIPS) [47]
- **PQRS 414: Evaluation or Interview for Risk of Opioid Misuse** – a 2017 and 2018 MIPS measure [47]

In 2014, a panel within American Society of Addiction Medicine's (ASAM) Practice Improvement and Performance Measurement Action Group identified the following barriers to implementation of CQMs and eCQMs in the addiction domain:

- Identifying the presence of a treatment plan in the EHR in a standard, structured way
- Assessing treatment duration
- Tracking referrals
- Determining attendance or utilization frequency of psychosocial interventions (since they often occur off-site and are not documented in the EHR)
- Reconciling data systems between medical and behavioral health systems
- Lack of specificity for psychosocial treatments for addiction codes (e.g., CPT codes)
- Lack of CPT-specific codes for certain types of addiction (e.g., outpatient withdrawal management for OUD, buprenorphine induction and medication transitions like methadone to naltrexone or methadone to buprenorphine) [48]

Given the panel's findings, the absence of eCQMs in the addiction domain at this time is not surprising. The MITRE team plans to exercise caution as CDS artifacts are considered for development, given these identified constraints.

4.2.2.1 PROMIS® Measures

Patient-Reported Outcomes Measurement Information System (PROMIS) is a set of person-centered measures developed with National Institutes of Health (NIH) funding to evaluate and monitor physical, mental, and social health in adults and children to support research assessment and clinical care [89]. The measures are relevant across all conditions to assess symptoms and functions, including pain intensity and interference [89].

In October 2016, NIH awarded Northwestern and a consortium of nine universities a $6.3 million grant to accelerate the use of patient-reported outcomes by integrating the PROMIS measures into EHR systems [90]. Efforts are underway to integrate the measures in Cerner and Epic, two of the largest vendors [90]. Use of the measures to inform clinical care will likely increase once the questions and responses are integrated in the EHR.

Based on information gleaned during MITRE research, CPGs appear to mention the use of multidimensional assessments (e.g., Pain, Enjoyment, and General Activity [PEG]) to inform pain management, as opposed to PROMIS assessments. Additional investigation is required to determine if and how select PROMIS questions intersect with questions included in the multidimensional assessments mentioned in CPGs and other literature.

4.2.3 Clinical Tools

Dozens of tools are available to clinicians, social workers, counselors, and patients to manage care provided to a patient experiencing pain. These resources include recommendation statements, educational materials (for patients and providers), pain assessment questionnaires, opioid misuse risk assessments, care plans, flowsheets, protocols, and checklists, to name a few.

Tools identified during the scan that might contribute to a CDS artifact in the pain management domain are outlined in Section 5 below.

5. Identified Pain Management Resources

The environmental scan led to the identification of a very large number of clinical resources to inform and facilitate chronic, nonmalignant pain management. The research team considered two approaches to categorizing the items that were most likely to contribute to a CDS artifact:

1. By what segment of care the item supported (i.e., patient-centered pain assessment, opioid avoidance, identification of at-risk individuals, opioid reduction, opioid dose reduction, and the treatment of opioid use disorder)
2. By what type of CDS artifact the item would facilitate (e.g., an order set, checklist, alert), since the CDS Connect team aims to develop diverse types of CDS to support pain care

The team opted to categorize and present scan findings based on the former (the care process that items support), since this approach provides the most contextual understanding of the resource. The "type of CDS" that a resource might lend itself to will be one of several factors considered during discussions on what content to develop.

The sections below include a representative sample of resources that might inform, augment, or facilitate patient-centered CDS artifacts to support pain care and the proper prescription of opioids. Resources discussed in this section are intended to highlight how the identified item might contribute to a patient-centered artifact. The *Pain Management Environmental Scan Catalog* includes a broader list of resources identified during the scan. Although not listed specifically, the MITRE team is aware that pain treatment, resources, and recommendations can vary slightly based on the underlying etiology of the pain (e.g., rheumatoid arthritis, migraines). Addressing each unique etiology will likely be outside the scope of CDS Connect artifact development efforts.

5.1 Patient-Centered Pain Assessment

Pain as a symptom is multifaceted and influenced by a range of physical, psychosocial, and behavioral factors [3]. As a result, measuring pain intensity alone offers little insight into the quality or character of an individual's pain experience [49]. A comprehensive pain assessment includes a biopsychosocial interview and focused physical exam [9]. Elements of the biopsychosocial pain interview include a pain-related history; assessment of pertinent medical and psychiatric comorbidities, including personal and family history of SUD, functional status, and functional goals; coping strategies; and a variety of psychosocial factors, such as the patient's beliefs and expectations about chronic pain and its treatment [50].

Dozens of clinical resources are available to support pain assessment and diagnosis. They include, but are not limited to:

- **Pain Intensity Ratings:** Numeric Rating Scale (NRS), Verbal Rating Scale (VRS), Facial Iowa Pain Thermometer
- **Multidimensional Assessments:** Pain, Enjoyment, and General Activity (PEG), Brief Pain Inventory (BPI), Defense Veteran Pain Rating Scale (DVPRS)

- **Anxiety and Depression Assessments:** Patient Health Questionnaire (PHQ)-4, PHQ-9, General Anxiety Disorder (GAD)-7
- **Functional and Other Assessments:** Health Status Questionnaire (SF)-36, Quality of Life (QoL) Survey

Many of these surveys and questionnaires can be self-administered, provided they are scored and interpreted by a health care professional. Tools that assist in shifting focus beyond pain intensity alone are valuable resources to evaluate treatment response, functional status, patient well-being and quality of life [51]. Assessment responses can be used to inform diagnosis, the plan of care, and the effectiveness of the care during subsequent patient visits.

Clinical practice guidelines from organizations such as the VA/DoD and the Institute for Clinical Systems Improvement encourage the use of multidimensional assessments to evaluate and diagnose pain. These assessments are prime candidates for patient-centered CDS artifacts since they engage patients, encourage the expression of their pain experience, and become a foundation for shared decision making as a plan of care is established.

5.2   Opioid Avoidance

Education is vital for patients with chronic pain. The goal of chronic pain management is to safely and effectively reduce pain and improve function and quality of life [13]. Complete eradication of chronic pain is an unrealistic expectation and should not be a goal for the patient or the medical provider [9]. Many providers and patients are still coming to terms with this shift in paradigm. Resources are available to both patients (e.g., PainACTION, Which Treatment is Right for You?) [52,53] and providers via continuing education, training modules, and internet resources (e.g. PainEDU, Nonopioid Treatments for Chronic Pain) [54,55] to assist with buy in and adherence with this approach,.

CDC and VA/DoD CPGs recommend against initiation of long-term opioid therapy for chronic nonmalignant pain [9,10] and state that non-pharmacologic therapy and non-opioid pharmacologic therapy are the preferred methods of treatment [9,10]. Examples of non-pharmacologic therapies include:

- Self-management skills, which may address stretching and exercise, the use of spa, relaxation skills, pacing, record-keeping (diary), weight loss, medication management, yoga, tai-chi, or bibliotherapy.
- Cognitive Behavioral Therapy (CBT) and Behavioral Activation and Acceptance and Commitment Therapy (ACT) are therapies that also show promise. Psychological treatments may be delivered in individual or group formats.
- Relaxation techniques.
- Physical therapy (which also includes coaching and development of exercise/activity programs).
- Identification and treatment of comorbid conditions, in particular depression, substance use disorder, and insomnia [56].

No matter what form of treatment is initiated, patient education is integral. If and when medications are indicated, providers are encouraged to first consider non-opioid analgesics such

as acetaminophen, nonsteroidal anti-inflammatory drugs (including COX-2 inhibitors), ibuprofen, and aspirin [3]. "Adjuvant analgesic drugs" often used for other conditions can also be considered (e.g., anticonvulsants or psychotropic classes) [3].

When prescribed, opioid medications should never be the sole therapy [13]. Multi-modal treatment therapies addressing the biopsychosocial-spiritual needs of the patient (as above) should be employed as safe best practices [13]. Detailed opioid prescribing guidance is provided in numerous CPGs [9,10,42-44].

5.3   Identification of At-Risk Individuals

Prior to initiating opioid therapy, it is imperative to closely scrutinize an individual's risk of misusing the medication (i.e., using the opioid in a way that is not medically sanctioned, such as dose escalation, bingeing on opioids, or crushing controlled-release tablets) [57]. Clinical practice guidelines urge providers to perform a baseline risk assessment to evaluate the feasibility of prescribing an opioid, and periodic assessments while a patient is receiving opioid therapy [9,10].

Providers can assess the risk of opioid misuse in numerous ways:
- **Determining risk by predisposition:** identifying patients with chronic pain International Classification of Diseases (ICD) codes, existing sedative or narcotic prescriptions (while also evaluating the total MME exposure and how long the patient has been receiving opioids), a history of substance abuse, depression, anxiety, and even arthritis [58].
- **Determining risk by demographics:** 18-25 years of age, rural setting, education level, low socioeconomic status, employment status, disability status, history of criminal behavior [59].
- **Determining risk by clinical features:** withdrawal symptoms, escalating reports of pain despite stable chronic condition.
- **Utilizing patient-facing tools:** opioid risk assessments such as Screener and Opioid Assessment for Patients with Pain (SOAPP-R), Opioid Risk Tool (ORT), and Current Opioid Misuse Measure (COMM), and many more.
- **Utilizing provider-facing tools:** PDMP, UDT, and Automation of Reports and Consolidated Orders System (ARCOS).
- **Utilizing predictive analytics:** The High-Risk Dashboard [60] and proprietary products like the Venebio Opioid Advisor which calculates risk based on demographic and clinical variables [61].

VA/DoD clinical practice guidelines suggest mitigating risk via periodic UDT and PDMP checks, face-to-face follow up encounters (with frequency determined by risk), overdose education, informed consent, providing alternative therapies, and naloxone distribution [3]. CDS artifacts that facilitate these risk mitigation techniques will provide a valuable means to maintain patient safety.

5.4 Opioid Dose Reduction

Many resources are directed at reducing opioid exposure in prescriptions: reducing the prescription of opioids and benzodiazepines, reducing the daily dose, reducing total amount dispensed, reducing opioid dose at refill time, or eliminating refills altogether. This has been a natural focus for CDS as well as guidelines, since it is squarely part of the prescribing workflow, where CDS has long had an accepted role. Tools and resources, as well as CDS, are dedicated toward ensuring that prescribers understand the MME of different drugs, helping them stay under guideline-driven limits, and providing recommendations for ongoing monitoring to reduce dosage as soon as possible. CDC has produced a mobile app with dosing guidance and MME calculators [62]. Other resources range from checklists [63] to information pages describing opioid effects to patient agreements that reinforce the seriousness of opioid prescribing. More interactive tools are described in Section 6.

The *VA/DoD Clinical Practice Guideline for Opioid Therapy for Chronic Pain* contains four bundled modules and algorithms for determining if opioid therapy (OT) is appropriate, and how to implement, monitor and taper OT [9]. Each module includes a detailed flowchart. The CPG also provides a documentation form that allows a provider to record the condition, social factors, treatment, results, and effects, which can be very valuable in determining the minimum dose that is effective for pain control [9].

A newer addition has been the inclusion of genomics in opioid prescribing, particularly targeting variations in the CYP2D6 gene, which dictates the effectiveness and toxicity of codeine-family drugs. Identifying very high or very low metabolizers can prevent toxic events and excessive dosing [44]. Additionally, there have been a small number of patient-facing dose reduction tools, such as PainCAS (mentioned previously), which provides prescribing guidance based on assessed opioid risk [33].

It is worth noting that, until recently, there was a significant push to prioritize sufficient pain control and to avoid inadequate dosing of analgesics (e.g., the "Pain is the 5th Vital Sign" campaign [64] and others); this likely had the effect of increasing such processes as routine post-procedure opioid prescriptions. With the more recent intense focus on the opioid epidemic, guidance and CDS have had to reverse some of the stronger statements of the previous campaign and misinformation directed at physicians [87].

5.5 Opioid Use Disorder Treatment

There has been considerable evolution and discussion about access to treatment and treatment methods for patients who are actively using opioids in an addictive pattern. Whether active OUD began with prescription drugs or illicit drugs, evidence increasingly shows that active users with OUD need prompt and sustained treatment to return to sustained non-use [65]. OUD treatment must commence promptly after significant events such as overdoses or a change in social environment (e.g., release from incarceration), and the duration of treatment should be tailored to each individual patient [65]. While both abstinence therapy and medication-assisted therapy (MAT) have advocates, there is increasing support for MAT as a mainstay of treatment, along with behavioral support [66].

OUD treatment resources focus on several areas:

- Provider selection of and management of MAT therapy, using the various drugs available

- Education for patients and family caregivers about MAT drugs and their effects;
- Monitoring templates for following both side effects and response to therapy (both MAT and psychosocial)

Both ASAM and VA/DoD authored 2015 practice guidelines that can educate professionals about the selection of MAT as well as its use with psychosocial addiction therapies [45,46]. AHRQ recently commissioned an environmental scan focused on MAT for OUD in rural primary care [67], which contains a variety of guidelines and educational resources.

6. Identified Pain Management CDS Efforts

As noted in previous sections, many steps in the pain management patient journey have best practices that lend themselves to CDS, directed to providers, patients, family, social entities and quality leaders. This is a relatively new area for CDS, however, compared to well-established targets such as adverse drug events and health maintenance. As a result, the number of developed and implemented CDS artifacts is relatively small. Also, current CDS generally follows patterns that applied to these earlier targets, such as dose alerts and information advisories. Here we review identified CDS efforts, categorized by the care objective that each effort supports.

6.1 Patient-Centered Pain Assessment

Pain assessment lends itself to patient use, either alone or in collaboration with a clinician. Smart entry forms with pain score calculations built in, interactive reference for patients, and care plans or order sets for clinicians can all be useful in both collecting data and making data-driven decisions. The Veteran Health Administration's (VHAs) Clinical Pain Reminders include a wide range of smart documentation forms geared towards nurses and providers related to pain assessment and reevaluation, in a wide range of situations including chronic pain and post-procedure pain.

PainCAS [33], a for-profit, patient-facing tool created through initial funding from NIH, provides patient reminders to complete opioid-risk assessments, either at home via a patient portal or in a clinician's waiting room on a tablet. The CDS evaluates the answers and scores the assessment, giving the provider concise information to support decision-making.

Despite being created to facilitate pain care for cancer patients in hospice care, the CDS tools created by the PAINRelieveIt study funded by PCORI may provide valuable resources to promote patient-centered assessment of nonmalignant pain care. The study implemented CDS logic delivered via a tablet-based assessment tool that generated a report and analgesic recommendations to hospice nurses, along with multimedia education tailored to patients and their lay caregivers [74].

Research efforts presented at the 2017 American Medical Informatics Association (AMIA) conference provide additional insight as to how CDS can facilitate patient-centered assessments. Purdue Pharma found alerts successful in improving the administration of multidimensional assessments and documentation of the results to better manage pain care [91], and a NIDA-sponsored study found that EHR modifications were required to achieve adequate usability of

CDS to deliver optimally-timed alerts to providers with assessment scores and risk stratifications [92]. The NIDA research also provides insight to identifying at-risk patients.

6.2　Opioid Avoidance

Opioid avoidance CDS could include order sets for pain syndromes (back pain is especially common) to steer a provider to alternative therapies, including complementary medicine and non-opioid analgesics. This could also be realized as alerts that trigger when an opioid prescription is entered.

The Choosing Wisely [75] program contains several opioid-avoidance artifacts. The American Society of Anesthesiologists Choosing Wisely recommends avoiding the prescription of long-term opioids for non-cancer pain unless risks are considered and discussed with the patient. While this is a guideline and not CDS, companies such as Stanson have taken large parts of the Choosing Wisely set and implemented them in a form permitting easy upload into Epic and other EHRs. Thus, reusable CDS is being applied to opioid avoidance with some success.

Another interesting effort from Cedars-Sinai, Patient Voices in Chronic Pain [76], provides alerts and reminders upon each new prescription of refill of long-acting opioids, recommending avoidance when possible; provides alerts for concomitant prescribing of opioids and benzodiazepines, which can cause magnified sedative effects; and also runs analyses to identify patients at risk of opioid-related harms. The Cedars-Sinai work also provided patient education and activation tools (PEATs) via the patient portal prior to office visits to facilitate shared decision making during the visit [76]. PEATs, whether triggered by the presence of opioids on the medication list (which qualifies as CDS) or manually invoked, are valuable resources that can reinforce effective alternatives to opioids, including self-management, complementary therapies, and nonopioid medications.

Overall, there are a few efforts in this area, primarily alerts that are triggered by an opioid prescription and try to show both elevated risk profiles and alternative options. Further efforts could be devoted toward more proactive CDS, such as order sets, which can be targeted to a given problem (back pain, sickle cell pain, etc.) and which are better accepted than alerts. Regardless of CDS type, there appears to be more room for increased awareness and facilitation of complementary therapy ordering.

6.3　Identifying At-Risk Individuals

This category includes displays, particularly PDMP displays, but also monitoring other determinants of health to ideally calculate and show at a glance whether a patient is at low, medium, or high risk of excessive opioid use and addiction. The category also could include monitoring algorithms that check a patient's ongoing use of prescribed opioids, and intervene to recommend dose reduction after a period of time.

Several interesting efforts look for determinants within the EHR. The University of Florida Collaborative Health Outcomes Information Registry (CHOIR) project identifies patients with more than a few chronic pain codes in their EHR. With this information it can decide, when a new patient arrives for a visit, to alert administrators to offer high-risk patients a CHOIR

(registry) survey. This prompt can bring more patients into treatment, compared to more passive means.

The VHA [77] has developed risk score calculators assessing the risk of overdose or serious opioid-induced respiratory depression (RIOSORD) based on 15 variables including drugs used, mental health disorders, pulmonary disorders, and recent hospitalization. This was prototyped by VHA and has been used, tested, and commercialized by Venebio [61]. The commercial software can administer surveys to patients as they wait in the waiting room of the practice; then, by combining the patient's responses with EHR data, the software can provide an overall risk assessment and make the information available to the clinician.

Alert or dashboard formats make sense for identifying patients at risk. Future work could further refine the algorithms, which now heavily depend on PDMPs, to incorporate social determinants of health.

6.4   Dose Reduction

Much of the existing opioid-related CDS is directed toward prescribing, including dose-reduction order sets and alerts that assess total MME dosing. As noted above, these are fairly easy to create and easy for users to understand and accept, since they are familiar with similar CDS encountered during their regular drug prescribing.

The range of demonstrated dose-reduction CDS includes simple MME displays and smarter calculators based on a patient's complete medication list; alerts for excessive daily MMEs or total prescription amounts; order sets targeted to a particular problem (such as lower back pain) that guide dosing while also promoting non-opioid therapies; and surveillance analytics that can run periodically to find patients with worrisome prescription fill and usage patterns. Order sets have also been used to both reduce morphine dosing and direct prescribers toward non-opioid medications, such as ketorolac for renal colic [78].

In keeping with CDS principles that call for multifaceted CDS at different parts of the workflow, some organizations have tried combination CDS, including order sets to reduce ordering and pain management information displays [79]. Multi-panel smart data displays (dashboards), another form of CDS, can give comprehensive information about a patient's current opioid prescription load, display guidance specific to the patient's pain syndrome, and present a checklist for opioid management actions [80]. A current research effort at MITRE combines a PDMP display and past-prescription history to determine patients who are at or over the top of recommended prescribing maxima [81].

Kaiser Permanente of Southern California completed a 5-year multi-pronged set of interventions including CDS to alert for large daily doses, large total prescribed amounts, and combined prescribing of opioids with benzodiazepines [88]. Outcomes from the organization-wide effort demonstrated the overwhelming impact that policy, provider training, and CDS can have on prescribing practices: 30% reduction in prescribing opioids at high doses; a 98% reduction in the number of prescriptions with quantities greater than 200 pills; a 90% decrease in the combination of an opioid prescription with benzodiazepines and carisoprodol; a 72% reduction in the

prescribing of Long Acting/Extended Release opioids; and a 95% reduction in prescriptions of brand name opioid-acetaminophen products [88].

A welcome technological advance is the use of more interoperable CDS technologies. Implementations of selected CDS from the CDC guideline set have been realized in Clinical Quality Language (CQL), using Fast Healthcare Interoperability Resources (FHIR) profiles [12] and CDS Hooks [82]. The use of these technologies facilitates sharing the CDS across multiple sites with different EHR technologies and data dictionaries, consistent with the philosophy underlying the CDS Connect repository.

Genomic opioid prescribing decision support is also appearing. As noted previously, the Mayo Clinic has CDS to detect the CYP2D6 drug-gene interaction [83]. The next step would be to use this information to drive different dosing levels for the same problem in different patients, just as dosing reduction software has been implemented for renal failure patients.

6.5   Opioid Use Disorder Treatment

There is not much published at this time about live CDS that facilitates OUD treatment. This is a significant gap area, as CDS could be valuable for identifying patients in need of prompt treatment, monitoring response to outpatient treatment that is tailored to each patient, and facilitating the access to and prescribing of buprenorphine and other MAT drugs. These could be presented as order sets, flowcharts following treatment with alerts, and alerts from payer-contracted monitoring programs, such as those which periodically contact patients with chronic obstructive pulmonary disease (COPD) or atrial fibrillation.

Elfvengren [84] has developed a set of tools to facilitate the various processes of chronic, nonmalignant pain management. These are mainly presented as static forms that are available at appropriate points. However, these certainly do qualify as CDS, as they are data-driven, only appear for appropriate patients, and bring information reminders at strategic points in care.

Another early NIH-supported project at the University of Minnesota [85] is evaluating CDS targeted at OUD treatment, including guidance and facilitation of buprenorphine prescribing.

As with many of these newer efforts, it will be important to see the impact of this CDS on care processes and outcomes.

7.   Recommendations for CDS Connect

As the above discussion illustrates, there is early work on a fair range of CDS artifacts, segmented by: parts of the pain management and treatment journey, provider or patient focus, types of CDS presentation, integration with the EHR, and actionability of the result.

The AHRQ CDS Connect project has a 2017-18 task to identify, develop, and publish CDS artifacts in the pain management and prevention of opioid misuse arena. In identifying preferred CDS artifacts to produce, the following attributes are favorable to straightforward and effective completion of this task:

- The CPG, CQM, or clinical practice that the CDS will facilitate should be based on high-quality evidence and should have been developed by a well-respected governmental, provider, academic, or commercial source body without bias.
- The source content and/or clinical resources should be free of intellectual-property issues that could hamper or block open publication of the CDS artifact. Most guidance that is sourced from a U.S. government agency should be free of major IP issues; guidance from other sources needs review to ensure this will not be a problem.
- It is useful to extend the example space that CDS Connect handles by choosing artifacts that together represent more than one of the standard CDS presentation types (reactive alerts, reminders, order sets, tailored reference information, intelligent data displays, calculators, multi-patient displays, algorithms). The ability of CDS Connect to handle at least the first four or five of these options will be an important factor in its growth and acceptance within the community of CDS producers.
- At the same time, the amount of new effort needed to specify and develop these first new artifacts should be reasonable, so that the implementation can be successful in the contract time provided. More complex types such as longitudinal algorithms may be deferred to the next phase of CDS Connect development.
- If possible, the artifacts should be actionable and focused – giving specific recommendations that translate to actions or orders rather than simply providing an informational handout.
- The CDS artifacts chosen should cover varied parts of the problem space (e.g., one about dose reduction and one about treatment access).
- In keeping with the PCOR focus of CDS Connect, all artifacts should be patient-centered and one might potentially have patient-facing components. That said, patient-facing CDS is at a much earlier state of advancement than clinician-facing CDS in general, and the connection may not be directly to an EHR; thus, such an artifact specification also must include the description of the right vehicle that the patient can use to interact with it.
- If possible, the artifacts selected for development should not duplicate other efforts underway (particularly a known effort by CDC and ONC to convert opioid-related CDS to structured form). The use of CDC and other guidelines is still very reasonable.
- The artifacts should be chosen such that, in a pilot environment, they are likely to be invoked relatively frequently, and the data to support the logic should be readily available.

Based on the criteria outlined above, the MITRE team assembled a list of CDS artifacts for considered development. Deeper investigation into the technical feasibility of numerous options is indicated before a fully informed decision can be made. Potential development options are listed in Table 4, along with some of the benefits and constraints of each possibility.

Table 4: Potential CDS Artifact Development Options. (Higher numbers indicate greater degree of feasibility or impact.)

Type of CDS	Description and Trigger	Resource and/ or Data Dependency	Feasibility	Impact	Rationale
Alert	Check PDMP to determine total MME prior to signing an opioid order **Trigger:** Opioid order	PDMP, MME, Med List	TBD	5	**Benefit:** If presented in an informative, user-friendly format this would facilitate workflow. **Constraint:** States have distinct PDMP resources; therefore, code would need to be re-written to access another State's PDMP system. In addition, the best approach to supporting PDMP data in CQL would be to use an "external" function definition, which means that the details of accessing the PDMP aren't defined in the CQL but are left for individual implementation. This is a new feature in CQL 1.2 and is not yet implemented in the CDS Connect execution framework.
Reminder	Check PDMP every 3 months if receiving opioids. **Trigger:** Follow up visit that evaluates time past and opioid order	PDMP, MME, Med List	3	4	**Benefit:** If presented in an informative, user-friendly format, this would facilitate workflow and prompt the reassessment of risk. **Constraint:** To correctly evaluate "every 3 months," the system would also need to record the last date the PDMP was checked (which is not captured in a structured way), or the date a medication was last ordered (which could prove challenging). If the reminder went on to link to the PDMP and display results, constraints listed above would be introduced.
Reminder/ Order	Consider naloxone **Trigger:** If on OT and >50 MME/day, concurrent use of benzodiazepines, or history of SUD	MME Calculator, Med List, Problem List	3	5	**Benefit:** Targets a preventive action **Constraint:** May be deemed controversial by some provider or organizations. To support a trigger based on MME calculation, the CDS would also need to calculate MME (which is complex). Order sets provide additional constraints: FHIR Clinical Reasoning supports Order Sets, but not many vendors support FHIR Clinical Reasoning yet. This leads to subsequent considerations and the likelihood that an order set implementation would be proprietary to the pilot site.

Type of CDS	Description and Trigger	Resource and/ or Data Dependency	Feasibility	Impact	Rationale
Alert/ Order	Provide or recommend MAT for OUD **Trigger:** New OUD diagnosis, a visit for an opioid-related crisis	Problem List, Encounter diagnosis, CPT	5	4	**Benefit:** Facilitates evidence-based treatment **Constraint:** May be deemed controversial by some providers or organizations. May depend upon knowledge of local resources if patients need to be referred elsewhere to initiate MAT treatment. If presented as an order, the constraints listed above apply.
Order set	Opioid tapering guidance **Trigger:** MME over a designated threshold	MME, Med List	1	5	**Benefit:** Would lessen opioid risk and reduce the need for providers to do the tapering calculation **Constraints:** Very complicated to develop. Would require access to the MME result and the patient's medication list, generating tapering guidance for a wide range of opioid dosages (and RxNorm codes). Technical constraints involving the specification of Order Sets apply.
Alert/ Documentation Template	Pain assessment and follow up (PQRS 420) Trigger: Every encounter	Assessment, Care plan	4	4	**Benefit:** This is a PQRS measure, so IP approval should be reasonable. Numeric Rating Scale (NRS) alone would qualify. The measure will be part of MIPS, so valuable to providers. **Constraint:** Will need to ensure the NRS isn't copyrighted, ideally a functional status assessment is included also (which would need IP clearance). This does not address opioid prevention. FHIR's standard CarePlan resource is not well supported by vendors. In addition, assessment/collection would likely happen via a Documentation Template (FHIR Questionnaire), which may not be supported by vendors. With standards potentially being out in front of implementation capabilities, a standard might be used to represent the concept, but the pilot implementation would be proprietary.

Type of CDS	Description and Trigger	Resource and/ or Data Dependency	Feasibility	Impact	Rationale
Flowsheet	Visualizes pain and functional assessment scores, medication start and stop date, dosage, total MME, and additional therapies **Trigger:** Encounter when pain "diagnosis" and active pain medication are present	MME, Med List/Order, Problem List	2	4	**Benefit:** Enables provider and patient to establish appropriate prescription of buprenorphine for opioid use disorder (OUD) [34], and treatment effectiveness and correlations between treatment and the patient's experience, aiding shared decision making **Constraint:** Requires additional research from a technical perspective. Scores are likely not captured in a structured format.
Alert	Consider non-opioid medication **Trigger:** opioid order (if no evidence of non-opioid med in last 3 months)	Med List	5	4	**Benefit:** May facilitate opioid avoidance **Constraint:** May disrupt workflow if the provider has already considered this treatment and discussed the risks, benefits, and options. Might also be presented as an order set with various suggestions for treating mild, moderate, severe pain, but technical order constraints would apply.
Reminder/ Order	Order follow-up appointment within 3 months for patients on long-term OT **Trigger:** Active opioid medication for > 3 months	Med List, Encounter data	4	3	**Benefit:** Facilitates reassessment of risk and benefit. **Constraint:** Very challenging to decipher "time passed" from captured EHR data. Unable to schedule an appointment via an action by the provider. Negative impact on workflow may outweigh the clinical advantage.
Reminder	Consider adding non-pharmacologic therapies when a pain medication is ordered (opioid or non-opioid) **Trigger:** Opioid order with the presence of a pain diagnosis	Problem List, Med List	2	4	**Benefit:** Follows evidence-based recommendations, may lessen the need for pain meds **Constraints**: Many non-pharmacologic therapies are defined by SNOMED-CT codes, which are not implemented in many EHRs. If this intersects with the order (i.e., recommends adjusting the order to include a non-pharmacologic therapy), the technical requirements become very challenging.

8.   Conclusion

The opioid epidemic has expanded rapidly in the U.S.; attention and focus on management strategies is also expanding rapidly, although many of the guidelines and existing CDS are fairly recent and not widely implemented. A wide range of CDS artifacts applied at several points of the patient's journey, for use by clinicians as well as patients, can and should be applied together to address pain management and opioid management concerns. Ideally, CDS that is recognizable to those who use CDS for other purposes would bring the quickest results: thus, familiar presentation types such as alerts, order sets, reminders, and smart data displays have an enhanced chance of acceptance and dissemination.

CDS Connect seeks to codify, standardize, and disseminate effective, usable, actionable CDS from a wide range of sources. Of the many guidelines and artifacts reviewed in this scan, the CDS Connect team will develop some and will also reach out to other CDS developers outside of the AHRQ and MITRE teams to edit and submit artifacts in the CDS Connect Repository. Together, these efforts should demonstrate and expand the capabilities of CDS Connect to house and disseminate a wide range of effective, shareable CDS for broad use by clinicians and patients.

9. References

[1] Murray CJ, Atkinson C, Bhalla K, et al. (2014) The state of US health, 1990-2010: Burden of diseases, injuries, and risk factors. *Jama.* Aug 14 2013;310(6):591-608.

[2] Institute for Health Metrics and Evaluation. (ND) Retrieved from http://www.healthdata.org/united-states.

[3] Institute of Medicine Committee on Advancing Pain Research, Care Education. The National Academies Collection: Reports funded by National Institutes of Health. *Relieving pain in America: A blueprint for transforming prevention, care, education, and research.* Washington (DC): National Academies Press (US); 2011

[4] American Academy of Pain Medicine. AAPM Facts and Figures on Pain. Retrieved at http://www.painmed.org/PatientCenter/Facts_on_Pain.aspx

[5] Daubresse M, Chang HY, Yu Y, et al. (2013) Ambulatory diagnosis and treatment of nonmalignant pain in the United States, 2000-2010. *Med Care.* Oct 2013;51(10):870-878.

[6] Reuben DB, Alvanzo AAH, Ashikaga T, et al. (2015) National Institutes of Health Pathways to Prevention workshop: The role of opioids in the treatment of chronic pain the role of opioids in the treatment of chronic pain. *Annals of Internal Medicine.* 2015;162(4):295-300.

[7] U.S. Department of Health and Human Services. (2016) National Pain Strategy Outlines Actions for Improving Pain Care in America. Retrieved from https://www.hhs.gov/ash/about-ash/news/2016/national-pain-strategy-outlines-actions-improving-pain-care/index.html

[8] The White House. (2017) President Donald J. Trump is Taking Action on Drug Addiction and the Opioid Crisis. Retrieved from https://www.whitehouse.gov/the-press-office/2017/10/26/president-donald-j-trump-taking-action-drug-addiction-and-opioid-crisis

[9] Department of Veterans Affairs, Department of Defense. (2017) VA/DoD Clinical Practice Guideline for Opioid Therapy for Chronic Pain Version 3.0. Retrieved from https://www.healthquality.va.gov/guidelines/Pain/cot/VADoDOTCPG022717.pdf

[10] Dowell D, Haegerich TM, Chou R. CDC Guideline for Prescribing Opioids for Chronic Pain — United States, 2016. MMWR Recomm Rep 2016;65(No. RR-1):1–49. DOI: http://dx.doi.org/10.15585/mmwr.rr6501e1.

[11] American Society for Addiction Medicine. (2014) The ASAM Performance Measures for the Addiction Specialist Physician. Retrieved from https://www.asam.org/docs/default-source/advocacy/performance-measures-for-the-addiction-specialist-physician.pdf?sfvrsn=5f986dc2_0

[12] Centers for Disease Control and Prevention. (2017) Opioid Prescribing Support Implementation Guide. Retrieved from http://build.fhir.org/ig/cqframework/opioid-cds/

[13] Indian Health Service. Proper Pain Assessment. Retrieved from https://www.ihs.gov/painmanagement/properpatientassessment/

[14] National Association of Attorneys General. (2017) Opioid Letter to AHIP. Retrieved from https://ag.ny.gov/sites/default/files/final_naag_opioid_letter_to_ahip.pdf

[15] Rudd RA, Seth P, David F, Scholl L. Increases in Drug and Opioid-Involved Overdose Deaths — United States, 2010–2015. *MMWR Morb Mortal Wkly Rep*. 2016;65. doi:10.15585/mmwr.mm655051e1.

[16] The Washington Post. (August 11, 2017). How to Comfort the Opioid Emergency. Retrieved from https://www.washingtonpost.com/opinions/how-to-confront-the-opioid-emergency/2017/08/11/f8ef4220-7dd5-11e7-b2b1-aeba62854dfa_story.html?utm_term=.e3c7d5575d48

[17] Florence CS, Zhou C, Luo F, Xu L. The Economic Burden of Prescription Opioid Overdose, Abuse, and Dependence in the United States, 2013. *Med Care*. 2016;54(10):901-906. doi:10.1097/MLR.0000000000000625.

[18] The White House. (2017) National Drug Control Strategy. Retrieved at https://obamawhitehouse.archives.gov/ondcp/policy-and-research/ndcs

[19] Centers for Disease Control and Prevention (2016) Morbidity and Mortality Weekly Report: Increases in Drug and opioid Overdose Deaths – United States, 2000-2014. Retrieved from: https://www.cdc.gov/mmwr/preview/mmwrhtml/mm6450a3.htm

[20] Centers for Disease Control and Prevention. (2017) Prescribing Data. Retrieved from https://www.cdc.gov/drugoverdose/data/prescribing.html

[21] Harvard Law & Policy Review. (2017) The Opioid Epidemic: Fixing a Broken Pharmaceutical Market. Retrieved from http://harvardlpr.com/wp-content/uploads/2017/07/SarpatwariSinhaKesselheim.pdf

[22] National Center for Biotechnology Information. (2013) Pain as the 5th Vital Sign: Exposing the Vital Need for Pain Education. Retrieved from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3888154/

[23] Centers for Disease Control and Prevention: Morbidity and Mortality Weekly Report. (2016) CDC Guideline for Prescribing Opioids for Chronic Pain. Retrieved from https://www.cdc.gov/mmwr/volumes/65/rr/pdfs/rr6501e1er.pdf

[24] National Center for Biotechnology Information. (2011) Management of Chronic Pain in the Rheumatic Diseases with Insights for the Clinician. Retrieved from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3382677/

[25] Centers for Disease Control and Prevention. (ND) Nonopioid Treatments for Chronic Pain. Retrieved from: https://www.cdc.gov/drugoverdose/pdf/nonopioid_treatments-a.pdf

[26] National Center for Biotechnology Information. (2008) Pain Management in Musculoskeletal Conditions. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/18519099

[27] Institute of Medicine (US) Committee on Quality of Health Care in America. Crossing the Quality Chasm: A New Health System for the 21st Century. (2001). Retrieved from https://www.ncbi.nlm.nih.gov/books/NBK222265/#ddd00039

[28] Robinson, J.H., Callister, L.C., Berry, J.A., and Daring, K.A. (2008). Patient-centered care and adherence: Definitions and applications to improve outcomes. J of the American Academy

of Nurse Practitioners 20(12) pg 600-607. Retrieved from
http://onlinelibrary.wiley.com/doi/10.1111/j.1745-7599.2008.00360.x/abstract

[29] Rathert, C., Wyrwich, M.D., & Born, S.A. (2012). Patient-Centered Care and Outcomes: A
Systematic Review of the Literature. Retrieved from
http://journals.sagepub.com/doi/abs/10.1177/1077558712465774?journalCode=mcrd

[30] Stewart M., Brown J.B., Donner A, McWhinney JR, Oates J, Weston WW & Jordan J.
(2000). The impact of patient-centered care on outcomes. Journal of Family Practice. 49(9):796-
804. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/11032203

[31] Centers for Medicare and Medicaid Services: Innovation Center New Direction. Request for
Information (September 20, 2017). Retrieved from
https://innovation.cms.gov/initiatives/direction/

[32] Greene SM, Tuzzio L, & Cherkin, D. (2012) A Framework for Making Patient-Centered
Care Front and Center. The Permanente Journal. 16(3) 49–53. Retrieved from
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3442762/

[33] Inflexxion. (N.D.) PainCAS: A Scientifically Developed Tool for Pain and Opioid Risk
Assessment. Retrieved from https://www.inflexxion.com/paincas/

[34] National Institute of Drug Abuse. (2016) Clinical decision support for Opioid use disorders
in Medical settings: Pilot Usability Testing in an EMR (COMPUTE). Retrieved from
https://www.drugabuse.gov/about-nida/organization/cctn/ctn/research-studies/clinical-decision-
support-opioid-use-disorders-in-medical-settings-pilot-usability-testing-in-emr

[35] Clinical Pain Advisor. (2015). CHOIR Integrates Clinical Decision Support into EHRs for
Chronic Pain. Retrieved from http://www.clinicalpainadvisor.com/aps-2015/choir-integrates-
clinical-decision-support-into-ehrs-for-chronic-pain/article/415113/

[36] Cedars-Sinai (N.D.) Patient Voices in Chronic Pain. Retrieved from https://www.cedars-
sinai.edu/Research/Research-Areas/CORE/Patient-Voices-in-Chronic-Pain.aspx

[37] Centers for Disease Control and Prevention. (2015) Common Elements in Guidelines for
Prescribing Opioids. Retrieved from http://pcss-o.org/wp-
content/uploads/2015/12/Common_Elements_in_Guidelines_for_Prescribing_Opioids-a.pdf

[38] Graham R, Mancher M, Wolman DM, Greenfield S, Steinberg, E (Eds). (2011) Clinical
Practice Guidelines We Can Trust. National Academies Press.

[40] Manchikanti L et. al. Responsible, Safe, and Effective Prescription of Opioids for Chronic
Non-Cancer Pain: American Society of Interventional Pain Physicians (ASIPP) Guidelines. Pain
Physician. 2017 Feb;20(2S):S3-S92.

[41] Institute for Clinical Systems Improvement. (2012) Adult Acute and Subacute Low Back
Pain. Retrieved from
https://www.icsi.org/guidelines__more/catalog_guidelines_and_more/catalog_guidelines/catalog
_musculoskeletal_guidelines/low_back_pain/

[42] Institute for Clinical Systems Improvement. (2016) Pain: Assessment, Non-opioid
Approaches and Opioid Management. Retrieved from

https://www.icsi.org/guidelines__more/catalog_guidelines_and_more/catalog_guidelines/catalog_neurological_guidelines/pain/

[43] Qaseem, A., et al. (2017). "Noninvasive Treatments for Acute, Subacute, and Chronic Low Back Pain: A Clinical Practice Guideline From the American College of Physicians." Ann Intern Med 166(7): 514-530.

[44] Clinical Pharmacogenetics Implementation Consortium. (2014) Clinical Pharmacogenetics Implementation Consortium guidelines for cytochrome P450 2D6 genotype and codeine therapy: 2014 update. Retrieved from https://www.guidelines.gov/summaries/summary/47993/clinical-pharmacogenetics-implementation-consortium-guidelines-for-cytochrome-p450-2d6-genotype-and-codeine-therapy-2014-update?q=opioid

[45] Department of Veterans Affairs/Department of Defense. (2015) VA/DoD Clinical Practice Guideline for the Management of Substance Use Disorders. Retrieved from https://www.healthquality.va.gov/guidelines/MH/sud/VADoDSUDCPGFinal1.pdf

[46] Kampman, K. and M. Jarvis (2015). "American Society of Addiction Medicine (ASAM) National Practice Guideline for the Use of Medications in the Treatment of Addiction Involving Opioid Use." J Addict Med 9(5): 358-367.

CQM Section:

[47] National Committee for Quality Assurance. (2017) Retrieved from http://blog.ncqa.org/wp-content/uploads/HEDIS-HPA-2018-Google-Hangout-All-Slides-Final.pdf

[48] American Society for Addiction Medicine. (2014) The ASAM Performance Measures for the Addiction Specialist Physician. Retrieved from https://www.asam.org/docs/default-source/advocacy/performance-measures-for-the-addiction-specialist-physician.pdf?sfvrsn=5f986dc2_0

[68] Goertz M, Thorson D, Bonsell J, Bonte B, Campbell R, Haake B, Johnson K, Kramer C, Mueller B, Peterson S, Setterlund L, Timming R. (2012) Adult acute and subacute low back pain. Bloomington (MN): Institute for Clinical Systems Improvement (ICSI); Nov. 91 p.

[69] Hooten WM, Timming R, Belgrade M, Gaul J, Goertz M, Haake B, Myers C, Noonan MP, Owens J, Saeger L, Schweim K, Shteyman G, Walker N. (2013) Assessment and management of chronic pain. Bloomington (MN): Institute for Clinical Systems Improvement (ICSI); Nov. 105 p.

[70] American Medical Directors Association (AMDA). (2014) Implementing AMDA's clinical practice guidelines in the long term care setting -- CPG implementation series: pain management manual. Columbia (MD): American Medical Directors Association; 113 p.

[71] Pharmacy Quality Alliance (PQA). (2015) Technical specifications for PQA approved measures. Springfield (VA): Pharmacy Quality Alliance (PQA); Jul. 66 p.

[72] American Society of Addiction Medicine. (2014) The ASAM Performance Measures for the Addiction Specialist Physician. Retrieved from https://www.asam.org/docs/default-source/advocacy/performance-measures-for-the-addiction-specialist-physician.pdf?sfvrsn=5f986dc2_0

[73] National Committee for Quality Assurance. (2017) HEDIS 2018 Volume 2: Technical Update. Retrieved from

http://www.ncqa.org/Portals/0/HEDISQM/HEDIS2018/HEDIS%202018%20Volume%202%20Technical%20Update.pdf?ver=2017-10-01-234940-073

[49] Ballantyne JC, Fishman SM, Rathmell JP. (2009) Bonica's management of pain. Philadelphia, PA: Lippincott Williams & Wilkins.

[50] Gatchel RJ, Peng YB, Peters ML, Fuchs PN, Turk DC. (2007) The biopsychosocial approach to chronic pain: Scientific advances and future directions. *Psychol Bull.* Jul 2007;133(4):581-624.

[51] Department of Defense/Veterans Health Administration. Pain Management for Primary Care: Clinical Assessment of Pain/Assessment Tools. Module 3-2.

[52] Inflexxion. (2017) PainAction. Retrieved from https://www.painaction.com/

[53] Consumer Reports. (2016) Pain Management: Which Treatment is Right for You? Retrieved from https://www.consumerreports.org/pain-relief/pain-management-treatment-right-for-you/

[54] Inflexxion. (2017) PainEDU. Retrieved from https://www.painedu.org/

[55] Centers for Disease Control and Prevention. (ND) Nonopioid Treatments for Chronic Pain. Retrieved from https://www.cdc.gov/drugoverdose/pdf/nonopioid_treatments-a.pdf

[56] Department of Veterans Affairs. (2013) Mental Health Innovations Template – Pain. Accessed at:
https://www.va.gov/PAINMANAGEMENT/docs/CIM_CAM_MH_INNOVATIONS_Pain_4_23_13.pdf

[57] Kahan, M., Srivastava, A., Wilson, L., Gourlay, D., & Midmer, D. (2006). Misuse of and dependence on opioids: Study of chronic pain patients. *Canadian Family Physician*, *52*(9), 1081.

[58] Studies Identify Riskiest Patients for Opioids. (2017) Retrieved from https://www.painnewsnetwork.org/stories/2017/4/14/studies-identify-riskiest-patients-for-opioids

[59] Walker MJ, Webster LR. Risk factors for drug diversion in a pain clinic patient population. (2012) *Journal of Opioid Management.* 2012; 8(6): 351-62. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/23264313 Accessed on: 2015-07-07.

[60] Harry, E; Patel, R; Mlaver, E; Espares, J; Schnipper, JL. Building a Dashboard to Identify Patients at High Risk for Adverse Drug Events Related to Opioids [abstract]. *Journal of Hospital Medicine.* 2017; 12 (suppl 2). Retrieved from http://www.shmabstracts.com/abstract/building-a-dashboard-to-identify-patients-at-high-risk-for-adverse-drug-events-related-to-opioids/.

[61] Venebio Opioid Advisor. (2016) Retrieved from http://venebio.com/wp-content/uploads/2016/10/VOA-product-sheet.pdf

[62] CDC Opioid Guideline app, viewed on the iTunes app store 10/25/2017. Also retrieved from https://www.cdc.gov/drugoverdose/training/index.html

[63] Centers for Disease Control and Prevention. (2017) Checklist for Prescribing Opioids for Chronic Pain, modified June 21, 2017. Retrieved from https://www.cdc.gov/drugoverdose/pdf/PDO_Checklist-a.pdf

[64] Veterans Health Administration. (2000) Pain as the 5th Vital Sign Toolkit. Retrieved from https://www.healthquality.va.gov/guidelines/Pain/cot/

[65] World Health Organization, Guidelines for the psychosocially assisted pharmacological treatment of opioid dependence, 2009. (ISBN 978 92 4 154754 3). Retrived from http://www.who.int/substance_abuse/activities/treatment_opioid_dependence/en/

[66] Gaskin DJ, Richard P. (2012) The economic costs of pain in the United States. *J Pain.* Aug 2012;13(8):715-724. [67] AHRQ (2015), Implementing Medication-Assisted Treatment for Opioid Use Disorder in Rural Primary Care: Environmental Scan: Volume 2, Tools and Resources. https://integrationacademy.ahrq.gov/sites/default/files/MAT_for_OUD_Environmental_Scan_Volume_2.pdf

[74] Ezenwa MO, Suarez ML, et. al. Implementing the PAINRelieveIt Randomized Controlled Trial in Hospice Care: Mechanisms for Success and Meeting PCORI Methodology Standards. West J Nurs Res. 2017 Jul; 39(7) 924-941. Web information at https://www.pcori.org/research-results/2013/computerized-painrelieveit-protocol-cancer-pain-control-hospice

[75] American Society of Anesthesiologists – Pain Medicine. (2014) Choosing Wisely. Retrieved from http://www.choosingwisely.org/clinician-lists/american-society-anesthesiologists-opioid-analgesics-as-long-term-therapy-for-non-cancer-pain/

[76] Cedars-Sinai. (ND) Patient Voinces in Chronic Pain. Retrieved from https://www.cedars-sinai.edu/Research/Research-Areas/CORE/Patient-Voices-in-Chronic-Pain.aspx

[77] Zedler, B., et al. (2015). "Development of a Risk Index for Serious Prescription Opioid-Induced Respiratory Depression or Overdose in Veterans' Health Administration Patients." Pain Med 16(8): 1566-1579.

[78] Netherton, S. J., et al. (2014). "Computerized physician order entry and decision support improves ED analgesic ordering for renal colic." Am J Emerg Med 32(9): 958-961.

[79] Akce, M., et al. (2014). "A multifactorial intervention for hospital opioid management." J Opioid Manag 10(5): 337-344.

[80] Trafton, J., et al. (2010). "Evaluation of the acceptability and usability of a decision support system to encourage safe and effective use of opioid therapy for chronic, noncancer pain by primary care providers." Pain Med 11(4): 575-585.

[81] (J. Tripathi, personal communication, November 2, 2017)

[82] (K. Kawamato, personal communication, October 3, 2017)

[83] Caraballo, P. J., et al. (2015). "Clinical Decision Support to Implement CYP2D6 Drug-Gene Interaction." Stud Health Technol Inform 216: 946.

[84] Elfvengren K, Clinical Decision Support System for Opioid Substitution Therapy, IEEE HICSS Conference Proceedings 2015. http://ieeexplore.ieee.org/document/7070184/

[85] Clinical Decision Support for Opioid Use Disorders in Medical Settings: Pilot Usability Testing in an EMR (COMPUTE). (ND) Retrieved from https://www.drugabuse.gov/about-nida/organization/cctn/ctn/research-studies/clinical-decision-support-opioid-use-disorders-in-medical-settings-pilot-usability-testing-in-emr

[86] National Conference of State Legislatures. (ND) Prescription Drug Monitoring Programs. Retrieved from http://www.ncsl.org/research/health/prescription-drug-monitoring-programs-postcard.aspx

[87] The New Yorker Magazine. (2017) The Family That Built and Empire of Pain. Retrieved from https://www.newyorker.com/magazine/2017/10/30/the-family-that-built-an-empire-of-pain

[88] Losby JL, Hyatt JD, Kanter MH, Baldwin G, Matsuoka D. Safer and more appropriate opioid prescribing: a large healthcare system's comprehensive approach. J Eval Clin Pract. 2017;1–7. https//doi.org/10.1111/jep.12756

[89] PROMIS (2017) Retrieved from http://www.healthmeasures.net/explore-measurement-systems/promis

[90] Northwestern Leads Consortioum to Integrate Patient-Reported Outcomes into Electron Health Records. (2016) Retrieved from http://www.healthmeasures.net/images/applications/EASIPRO_PressRelease_102016.pdf

[91] Labkoff, S., Bond ,C., Kallenbach, L., Nguyen, N., Gangadhar, S., O'Brien, D. (2017) Reach and Impact of an HER Pain Care Clinical Decision Support Program. (Poster #82 at 2017 AMIA Conference)

[92] McNeely, Jennifer. (2017) Usability Testing to Guide Development of a Clinical Decision Support System for Substance Use Screening and Interventions in Primary Care. (2017 AMIA Conference presentation on November 8, 2017).

10. Acronyms

AAN	American Academy of Neurology
ACT	Behavioral activation and Acceptance and Commitment Therapy
AHRQ	Agency for Healthcare Research and Quality
ARCOS	Automation of Reports and Consolidated Orders System
AMIA	American Medical Informatics Association
ASAM	American Society of Addiction Medicine
BPI	Brief Pain Inventory
CAMH	Centers for Medicare and Medicaid Services Alliance to Modernize Healthcare
CBT	Cognitive Behavioral Therapy
CDC	Centers for Disease Control and Prevention
CDS	Clinical Decision Support
CHOIR	Collaborative Health Outcomes Information Registry
COMM	Current Opioid Misuse Measure
COPD	Chronic Obstructive Pulmonary Disease
COX-2	Cyclooxygenase-2
CPG	Clinical Practice Guideline
CPT	Current Procedural Terminology
CQL	Clinical Quality Language
CQM	Clinical Quality Measure
DoD	Department of Defense
DVPRS	Defense Veteran Pain Rating Scale
eCQM	Electronic Clinical Quality Measure
FFRDC	Federally Funded Research and Development Center
FHIR	Fast Healthcare Interoperability Resources
GAD	General Anxiety Disorder
HER	Electronic Health Record
HHS	U.S. Department of Health and Human Services
ICD	International Classification of Diseases
IOM	Institute of Medicine
MAT	Medication-Assisted Therapy
MIPS	Merit-based Incentive Payment System
MME	Morphine Milligram Equivalent
NIDA	National Institute on Drug Abuse
NIH	National Institutes of Health
NQF	National Quality Forum
NQMC	National Quality Measures Clearinghouse
NRS	Numeric Rating Scale
ONC	Office of the National Coordinator for Health Information Technology
ORT	Opioid Risk Tool
OUD	Opioid Use Disorder
OUD	Opioids at High Dosage
PCC	Patient-Centered Care

PCOR	Patient-Centered Outcomes Research
PCOR CDS-LN	Patient-Centered Outcomes Research Clinical Decision Support-Learning Network
PCORI	Patient-Centered Outcomes Research Institute
PDMP	Prescription Drug Monitoring Program
PEAT	Patient Education and Activation Tool
PEG	Pain, Enjoyment, and General Activity
PHQ	Patient Health Questionnaire
PQRS	Physician Quality Reporting System
QoL	Quality of Life
RIOSORD	Risk of Overdose or Serious Opioid-Induced Respiratory Depression
SAMHSA	Substance Abuse and Mental Health Services Administration
SME	Subject Matter Expert
SOAPP-R	Screener and Opioid Assessment for Patients with Pain
UDT	Urine Drug Test
UOP	Opioids from Multiple Providers
USHIK	United States Health Information Knowledgebase
VA	Department of Veterans Affairs
VA/DoD	Department of Veterans Affairs/Department of Defense
VHA	Veteran Health Administration
VRS	Verbal Rating Scale
VSAC	Value Set Authority Center