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Comorbid Chronic Pain and Opioid Misuse in Youth: Knowns, Unknowns, and Implications for Behavioral Treatment

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Chronic pain and opioid misuse occur in pediatric populations and can be associated with a range of negative adverse outcomes that may persist into adulthood. While the association between chronic pain, opioid prescribing, and opioid-related adverse consequences is reasonably well established in adults, the relation in pediatric patients is not well understood and the long-term impact of opioid exposure during childhood is yet to be fully revealed. The present review draws from the available literature on chronic and acute pediatric pain prevalence and treatment, opioid misuse, and adolescent substance use to address knowns and unknowns of comorbid pediatric chronic pain and opioid misuse. Additionally, gaps in knowledge regarding the prevalence and etiology of co-occurring chronic pain and opioid misuse in youth are identified. Hypothesized, modifiable risk factors associated with both pediatric pain and opioid misuse are considered. Due to a lack of empirically supported integrated treatments for comorbid chronic pain and opioid misuse in youth, this review examines the evidence base and best practices from both the chronic pain and opioid treatment literature to guide treatment recommendations for these comorbid conditions in youth. Recommendations are then provided to promote screening and mitigate risk of chronic pain and opioid misuse across a range of pediatric settings. Lastly, a comprehensive agenda to prevent and treat chronic pain and opioid misuse in adolescents and young adults is discussed.

Public Significance Statement
This review draws from the literature on chronic and acute pediatric pain, opioid misuse, and adolescent substance use to summarize knowns and unknowns of comorbid pediatric chronic pain and opioid misuse in order to inform prevention and intervention development for patients with chronic pain who also misuse opioids.

Keywords: opioid use disorder, opioid misuse, chronic pain, adolescents, youth

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Both chronic pain and opioid misuse are significant humanitarian and socioeconomic burdens that pose great risk to children and adolescents, including risk of comorbidity between conditions (Dash, Wilson, Morasco, & Feldstein Ewing, 2018; Ditre, Zale, & Larowe, 2019). It is estimated that 25% of young people are affected by chronic pain, defined as pain lasting 3 months or longer which persists beyond normal healing time (King et al., 2011), costing the United States approximately $19.5 billion annually in pain-related disability for adolescents (Groenewald, Essner, Wright, Fesinmeyer, & Palermo, 2014). In 2018, about 2.8% of United States adolescents aged 12 to 17 years misused opioids at least once, and a total of 108,000 adolescents (0.4%) met criteria for an opioid use disorder (Substance Abuse and Mental Health Services Administration, 2019). Disparities in access to pediatric pain management are a further complicating factor in understanding comorbidity, as relations between pain and opioid misuse are bidirectional. Acute and chronic pain are risk factors for opioid misuse and opioid misuse can precipitate increased pain sensitivity and pain-related disability via opioid induced hyperalgesia (Colvin, Bull, & Hales, 2019; Lee, Silverman, Hansen, Patel, & Manchikanti, 2011). The individual and societal impacts of chronic pain and opioid misuse in youth are substantial: when ineffectively treated or left untreated, both conditions have high likelihood of recurrence and persistence into adulthood (Brna, Dooley, Gordon, & Dewan, 2005).

The history of opioid use in the United States has been controversial and capricious since the discovery of the morphine alkaloid in the early 19th century (see Bailey & Vowles, 2015 for a historical overview of the opioid epidemic and Levy, 2019 for a pediatric-specific review). Opioid use in the United States and associated adverse consequences have become a public health crisis, perhaps one of the largest in American history. It is well documented in adults that increased opioid prescribing throughout the last three decades was a factor in the increased rates of both opioid use disorders and opioid-related adverse consequences (Scholl, Seth, Kariisa, Wilson, & Baldwin, 2019).

Opioid prescribing rates to youth in the United States are generally low at present, but pediatric prescribing trends vary across samples and trends of prescribing for pediatric chronic pain, specifically, are not well characterized. Robust national data indicate minimal increases in overall pediatric opioid prescribing rates (for both acute and chronic pain conditions) in recent decades (Groenewald et al., 2014), while other studies found increases in pediatric prescribing rates akin to adult prescribing patterns (Fortuna, Robbins, Caiola, Joynt, & Halterman, 2010; Mazer-Amirshahi, Mullins, Rasooly, van den Anker, & Pines, 2014; Pielech, Kruger, Rivers, Snow, & Vowles, 2020; Sheridan et al., 2016). It has also been shown that rates of prescription opioids to adolescents with multiple pain complaints are higher than rates in adolescents with a single pain condition (Richardson et al., 2012). Low rates of pediatric opioid prescribing may be partly driven by the dearth of available data to indicate that opioids are effective for treating chronic pain in youth with noncancer pain (Cooper et al., 2017; Paice, 2018). Opioids are used far more sparingly in the treatment of pediatric chronic pain than in adult chronic pain, even though the conditions are similarly prevalent, disabling, and economically burdensome (Groenewald et al., 2014; Wojtowicz & Banez, 2015).

Unfortunately, differences between adult and pediatric opioid prescribing rates have not spared youth from being impacted by the opioid overdose epidemic and the long-term impact of opioid exposure during childhood is yet to be fully revealed. National data suggest that opioid misuse in youth is often precipitated by exposure to opioids for acute pain management or through diversion (e.g., using leftover prescription opioids from a friend/family member; Jones, Paulozzi, & Mack, 2014). Death by overdose is the most serious consequence of opioid misuse: over 4,000 adolescents and young adults died from opioids in 2016, totaling 230,694 years of premature life lost (Gomes, Tadrous, Mamdani, Paterson, & Juurlink, 2018). Death rates involving synthetic opioids (e.g., fentanyl and tramadol) among adolescents increased from 0.1 in 2002 to 0.7 in 2015 and between 2014 and 2016 synthetic opioids were implicated in nearly one third of all prescription and illicit opioid deaths among older teens (Curtin, Tejada-Vera, & Warner, 2017). Societal costs related to medical and nonmedical opioid use in youth are high, marked by recurrent emergency department visits and treatment admissions (Hser, Evans, Grella, Ling, & Anglin, 2015).



Claire E. Lunde

Relative to the established relations between adult chronic pain, opioid prescribing, and problematic opioid-related adverse outcomes, the relation between pediatric chronic pain and opioid misuse is less understood. This issue is significant because youth are a vulnerable population who are developmentally prone to risk-seeking behaviors, including onset of substance use. Youth also tend to underestimate the risks of using prescription opioids (Martin, Bhalla, Beltran, Veneziano, & Tobias, 2014), even though opioids are associated with the highest rates of overdose and mortality, often require long-term treatment, and have high rates of relapse (Veilleux, Colvin, Anderson, York, & Heinz, 2010). Therefore, pediatric populations represent a critical population for intervention to prevent addiction, dependency, and its consequences.

Unfortunately, at present, little is known about the optimal behavioral treatments for youth with comorbid chronic pain and opioid misuse. The current review draws on multidisciplinary theoretical perspectives from the available literature on chronic and acute pediatric pain, opioid misuse, and adolescent substance use to identify knowledge gaps regarding the prevalence, etiology, and treatment of co-occurring chronic pain and opioid misuse in youth. Hypothesized, modifiable risk factors associated with both pediatric pain and opioid misuse are considered, before reviewing the evidence base from both the chronic pain and opioid treatment literature to guide treatment recommendations. The review concludes with discussion of a comprehensive agenda to increase our understanding of these comorbid conditions in youth, promote effective treatment of comorbid pediatric chronic pain and opioid misuse as well as prevent comorbid development of opioid misuse or persistent pain. While the literature base in this area is limited, we argue that documented relations between adolescent and adult chronic pain and opioid misuse, as well as the public health need for prevention and intervention development in this domain provide sufficient rationale for this review.

Development of Pediatric Chronic Pain and Opioid Misuse

Pediatric Chronic Pain Risk Factors

Chronic nonmalignant pain, which includes nociceptive, idoiopathic, neuropathic, and postoperative pain as well as noncancer disease-related pain (e.g., sickle cell) is multidimensional in nature, with complex biological, social, and psychological factors that contribute to and exacerbate the pain experience (Gatchel, Peng, Peters, Fuchs, & Turk, 2007) and can result in tremendous disability and emotional impairment (e.g., Cohen, Vowles, & Eccleston, 2010). While the prevalence of chronic pain has remained stable in adults, the prevalence of pediatric chronic pain appears to be on the rise: an increase of 831% in the rate of pediatric chronic noncancer pain inpatient admissions was observed from 2004–2010 in one sample (Coffelt, Bauer, & Carroll, 2013). A recently published model of the intergenerational transmission of pain suggests that genetic, neurobiological, psychological, behavioral, stress, and health mechanisms are risk factors contributing to chronic pain in youth (Stone & Wilson, 2016). Interestingly, studies have shown that factors outside of the immediate family environment may play a role, or further exacerbate a child's pain or poor health (Murray, Groenewald, de la Vega, & Palermo, 2020). It has been found that adolescents who are at a lower risk for developing chronic pain are more likely to live in walkable neighborhoods, have nearby parks, and have a larger proportion of college graduates in their neighborhood (Schild, Reed, Hingston, Dennis, & Wilson, 2016). Whether these risk factors also increase the risk of developing opioid misuse in youth with chronic pain is an important area of inquiry.

Exposure to Opioids via Receipt of a Prescription

There are several individual factors which have been shown to increase or decrease the likelihood of receiving an opioid prescription for pain management. Whether or not an adolescent receives an opioid prescription (if it is deemed medically necessary) may have short- term implications on quality and equity of pain management as well as the risk for potential long-term implications, given data linking medical use of opioids during adolescence with nonmedical use of prescription opioids in early adulthood (McCabe, Veliz, & Schulenberg, 2016). Broadly, it appears that racial and ethnic minority youth are less likely to be prescribed



Sara J. Becker

opioids for treatment of painful conditions despite reporting higher levels of pain (Goyal, Kuppermann, Cleary, Teach, & Chamberlain, 2015; Ortega, Velden, Lin, & Reid, 2013; Rasooly, Mullins, Mazer-Amirshahi, van den Anker, & Pines, 2014), and that youth who were older and of non-Hispanic White race were more likely to receive an opioid prescription (Groenewald, Rabbitts, Gebert, & Palermo, 2016). Youth from lower socioeconomic groups are also less likely to receive medical care from a specialized pain clinic (Ruhe, Wager, Hirschfeld, & Zernikow, 2016; S. Evans, Taub, Tsao, Meldrum, & Zeltzer, 2010). A recent study of a large pediatric sample ($N = 42{,}020$) found that youth who were older, White, not Hispanic/Latino, and English-speaking were also more likely to receive multiple outpatient opioid prescriptions (Pielech et al., 2020). Finally, the presence of mental health disorders, chronic pain, or a history of substance use also increases the risk of extended opioid usage or misuse by two- or threefold in youth (Richardson et al., 2012).

Exposure to Opioids via Diversion

Previously increasing trends in medical prescribing of opioid analgesics over the past 20 years increased the overall United States and global supply of prescription opioids greatly, with nonmedical diversion an unintended, but predictable, outcome (Dart et al., 2015). Leftover opioids from family and friend's prescriptions are a common source for adolescent opioid misuse and experimentation (McCabe, West, & Boyd, 2013a). In a nationally representative United States sample, Groenewald et al. (2016) found significant increases in rates of opioid prescriptions to family members of children and adolescents, fueling a hypothesis that there may be potential downstream adverse effects of adult opioid prescribing in youth.

Risk Factors for Opioid Misuse

Similar to pediatric chronic pain, pharmacological, genetic (Uhl & Grow, 2004), environmental (e.g., stress, adversity, exposure to substance use by family & peers; Webster, 2017), geographic (Monnat & Rigg, 2015), and developmental influences (Rose, Picci, & Fishbein, 2019), as well as psychiatric comorbidities (Swendsen et al., 2010) are factors which interact to influence the vulnerability, progression, and course of opioid misuse. Additionally, developmental vulnerabilities (Rose et al., 2019) and comorbid psychiatric disorders (Swendsen et al., 2010) are risk factors for all substance use disorders. Examples include problems with affective regulation, depression, anxiety, excitement seeking, extreme extroversion, impulsivity, cognitive impairment, and problems with executive control. Parental substance use history is also a relevant contextual factor, especially when considering the role of parents in administering opioid analgesics to their child for pain management. For example, maternal usage of long-term opioid therapy has been linked with repeated use of prescription opioids in their children (Log et al., 2013).

Data also indicates that inadequate pain treatment and/or persistent pain may drive patients to seek opioids or heroin for pain relief. In a sample of young adults with pain conditions (ages 16–25), nearly a quarter of patients who were denied prescription opioids went on to pursue nonmedical use of opioids or heroin in order to self-medicate pain (Fibbi, Silva, Johnson, Langer, & Lankenau, 2012). Relatedly, pediatric chronic pain is a risk factor for opioid misuse in adulthood (Groenewald, Law, Fisher, Beals-Erickson, & Palermo, 2019), with pain relief being a frequently identified motive for opioid misuse among adolescents across different samples. In a large study examining motives for medical misuse of opioids with nearly 3,000 adolescents, pain relief was cited as the primary motive by 84.2% of respondents (McCabe, West, & Boyd, 2013b). Similarly, data from the 2015–2016 National Survey on Drug Use and Health indicated that pain relief was the most commonly endorsed motive for opioid misuse among adolescents and young adults (endorsed by 56.1% and 59.6%, respectively), however, an interesting finding is that adolescents and young adults were more likely than older adults to endorse nonpain relief motives for opioid misuse (e.g., using to relax, get high) suggesting that there are age-related differences in motives for opioid misuse (Schepis, Wastila, Ammerman, McCabe, & McCabe, 2019). Within this body of research, it is unclear what kind of pain relief young people were seeking (e.g., acute, emotional, chronic pain) or their pain management history, but the findings point to a



Kevin E. Vowles

likely need for improvements in access to nonopioid and nonpharmacological pediatric pain management options, particularly given that this age group is also likely to utilize opioids for nonpain relief.

More recent research has shown an association between both medical and nonmedical use of opioids in adolescence and later nonmedical use of prescription opioids in early adulthood (McCabe et al., 2016), suggesting that any exposure to opioids during childhood and adolescence carries with it potential long-term risks. This is supported by neurobiological findings that substance use can have long-lasting adverse effects on the developing brain (Casey et al., 2018). Additionally, differential tolerance to opioids puts some patients at significant risk for opioid misuse and hyperalgesia, as opioid tolerance can develop even as quickly as in the perioperative period (Hayhurst & Durieux, 2016). Lastly, significantly increased risk of adverse outcomes (e.g., overdose, death) has been observed in pediatric patients receiving multiple outpatient opioid prescriptions, and in youth who were older, of minority race, received their first prescription in an outpatient clinic, and were publicly insured or uninsured (Pielech et al., 2020).

Comorbid Pain and Opioid Misuse

Prevalence rates of comorbid chronic pain and opioid misuse in adolescents are unknown, but it is clear that there is high potential for co-occurrence (see Dash et al., 2018 for a review of shared risk factors among children and adolescents). Of note, the legal accessibility of prescription opioids is a confounding factor when trying to apply traditional adolescent health risk and addiction models to opioid misuse, as nearly all other substances are illegal to youth and require rule-violating behavior to obtain (Dash et al., 2018). Miech, Johnston, O'Malley, Keyes, and Heard (2015) posit that ease of access of opioids via prescription from a medical provider increases opportunities for drug experimentation in youth. Indeed, evidence has shown that adolescents tend to underestimate the potential risk of using prescription opioids with up to 41% of teenagers endorsing that prescription drugs are safer than illegal drugs and 29% speculating that prescription pain relievers were not addictive (Martin et al., 2014). In response to identified nuances of prescription opioid misuse versus other substance use, Dash et al. (2018) proposed a developmentally tailored theoretical model of potential mechanisms driving the intersection between pain and opioid misuse in adolescents. In brief, the model incorporates both preexisting contextual risk factors (including those in child, family, and peers) as well as postprescription risk and protective factors, underscoring the dynamic complexity between these conditions.

Several questions remain regarding the intersection of the etiology of pediatric and adult chronic pain, as well as opioid misuse, the answers to which would inform treatment development in this area. First, what is the long-term trajectory for youth with chronic noncancer pain, particularly in relation to opioid use? Second, what are the underlying mechanisms by which pediatric chronic pain is a risk factor for opioid misuse in adulthood? Third, are disparities in access to pediatric pain management related to increased risk for opioid misuse? Finally, does receipt of evidence-based pain management for pediatric chronic pain mitigate risk for persistence of chronic pain and/or opioid misuse/disorder in adulthood?

Relatedly, pain disease characteristics (e.g., chronicity, pain location), pain management needs, and pain-related functioning (e.g., pain interference, functional disability, pain-related fear), of youth who endorse pain relief as a motive for opioid misuse are largely unknown and uncharacterized. This information would help elucidate the suitability of empirically supported treatments for pediatric chronic pain (e.g., Cognitive Behavior Therapy [CBT], Acceptance and Commitment Therapy [ACT], interdisciplinary pain rehabilitation) and optimal delivery format to meet the needs of youth with co-occurring chronic pain and opioid misuse. It is also unknown if there may be a potential response bias in the data on youth-reported motives for opioid misuse, such that social desirability drives individuals to identify pain management as a motive for nonprescribed opioid use. It should be noted that this hypothesis is proposed carefully, as minimization or dismissing pain is not the goal.

Treatment Considerations for Comorbid Chronic Pain and Opioid Use Disorders

Empirically supported integrated treatments for comorbid chronic pain and opioid use disorders in youth are lacking.



Christine B. Sieberg

However, examination of the evidence and best practices from both the chronic pain and opioid misuse treatment literature provides insight into potential intervention options, particularly when paired with Dash et al.'s (2018) theoretical model. Pertinent considerations and subsequent recommendations for intervention with this population are discussed below (see Table 1 for a summary of considerations as well as recommendations for clinical practice and research).

Consideration 1: Opioid Misuse in Youth is Often Underidentified and Untreated

National data indicates that only 8.5% of adolescents who need substance use treatment actually receive it (Center for Behavioral Health Statistics and Quality, 2017). For adolescents over the age of 16, the frontline, evidence-based treatment for symptoms of opioid dependency is medication for opioid use disorder (MOUD), such as buprenorphine/naloxone or methadone (Chang, Klimas, Wood, & Fairbairn, 2018). The American Academy of Pediatrics further recommends that MOUD should be augmented with developmentally appropriate behavioral interventions in community settings (Committee on Substance Use and Prevention, 2016). Subsequently, recommended best practice for MOUD is a minimum of 52 weeks of buprenorphine with psychosocial interventions as an adjunct to enhance adherence and retention (Chang et al., 2018). In adults, the addition of behavioral treatment to MOUD, specifically contingency management (CM), has demonstrated incremental value in abstinence rates beyond MOUD alone (Griffith, Rowan-Szal, Roark, & Simpson, 2000), but the uptake of MOUD in treatment programs has been limited due to the financial and time investment associated with providing incentives (Kirby, Benishek, Dugosh, & Kerwin, 2006). Additionally, there is a dearth of research on the additive effects of psychosocial interventions on MOUD for adolescents (Pecoraro, Fishman, Ma, Piralishvili, & Woody, 2013). A further complicating factor is that adolescents' access to MOUD is severely limited: of the 38,000 physicians who are trained and waivered to prescribe buprenorphine in the United States, only about 1% are pediatricians (Hadland et al., 2017). It is therefore not surprising that less than 2% of adolescents identified as having an opioid use disorder receive MOUD (Levy, 2019). Adolescents and young adult patients who do access treatment for opioid misuse struggle with treatment retention, more so than older adults (Pecoraro et al., 2013).

Consideration 2: Specialty, Emergency, and Routine Care Visits are Ideal Opportunities to Screen for Substance Use and Pain

According to the National Institute on Drug Abuse and the American Academy of Pediatrics, increased screening in pediatric medical settings offers a key way to increase identification of risky substance use and persistent pain (National Institute on Drug Abuse, n.d.). Screening using validated tools (e.g. Screening to Brief Intervention [S2BI; Levy et al., 2014], Brief Screener for Tobacco, Alcohol, and Other Drugs [BSTAD; Kelly et al., 2014], CRAFFT v2.0 [Knight, 2016]) is recommended in primary care settings, emergency departments, as well as specialty care clinics (e.g., pain and substance use treatment facilities). To minimize provider bias in screening and decrease the risk of missing patients who are engaging in risky substance use, screening is recommended during well-child visits as well as when there is a concern for comorbidities, risky use behavior, or recent exposure to opioids. In clinical populations, such as frequent contact with medical providers yields an opportunity for frequent screening and monitoring of mental health and substance using behaviors, as well as opportunities to collect unused prescription medications. Youth with chronic pain, for example, are quite likely to utilize specialty care and emergency care (Tumin et al., 2018). Further, youth with opioid use disorders who are receiving MOUD are in frequent contact with providers for treatment which similarly provides many opportunities to screen for pain symptoms, substance use, and mental health functioning as part of routine care.

Consideration 3: Acute Pain is a Risk Factor for Opioid Misuse and Chronic Pain

Opioids are still viewed as a front line, evidenced-based treatment for pediatric acute pain (e.g., postsurgical). Thus,

Table 1
Summary of Key Clinical Practice and Research Considerations and Recommendations for Youth With Chronic Pain and Opioid Misuse

Considerations	Clinical recommendations and calls for action	Future directions for research
1. Opioid misuse in youth is often underidentified and untreated.	Implement recurrent evidence-based screening and treatment for substance use (including opioid misuse) in pediatric settings. Medication for opioid use disorder (MOUD) is the frontline treatment for opioid misuse, but access is severely limited for adolescents. Use implementation strategies to increase access to MOUD for adolescents; this also requires increasing training in substance use disorder assessment and treatment for pediatric providers.	Measurement of the long-term effects and safety of MOUD for adolescents, particularly neurodevelopmental. Evaluation of training, implementation, and delivery models to increase MOUD access.
2. Specialty, emergency, and routine care visits are ideal opportunities to screen for substance use and pain.	Early detection of substance use and chronic pain, followed by referral for appropriate assessment and treatment (pharmacological and non-pharmacological) are essential to facilitating rehabilitation, recovery, and preventing long term disability in youth with pain and/or opioid misuse. Screening is recommended during well-child visits as well as when there is a concern for comorbidities, risky use behavior, or recent exposure to opioids to minimize provider bias in screening.	Ongoing evaluation of the predictive validity of substance use screening tools in youth as well as validation of screening tools with specific populations across clinical settings.
3. Acute pain is a risk factor for opioid misuse and chronic pain.	Use psychosocial screening and assessments for pain-related functioning and substance use to inform decision making and mitigate risks for opioid misuse prior to prescribing an opioid. If risk factors for opioid misuse are identified, do not restrict youth from adequate pain management. Instead, utilize patient and family education as well as nonopioid pain management strategies to bolster resilience and recovery, prevent opioid misuse, and prevent ongoing pain. Increase provider education about the complex, biopsychosocial nature of pain and evidence-based treatments for pediatric pain.	Longitudinal examination of outcomes of youth exposed to opioids (e.g. psychosocial and physical functioning, substance use), as well as youth diagnosed with chronic pain. Evaluation of effectiveness of opioid misuse and chronic pain risk mitigation strategies.
4. Opioid prescribing guidelines for pediatric chronic pain do not exist.	Until pediatric-specific guidelines exist, opioid therapy should remain a treatment of last resort for youth with chronic non-cancer pain.	Conduct placebo-controlled, randomized clinical trials to inform development of pediatric specific opioid use guidelines.
5. Interdisciplinary treatment works for pediatric chronic pain but is not readily accessible.	Apply implementation strategies to increase access to interdisciplinary pain treatment and address disparities in pediatric pain care. Increased access to multi and interdisciplinary evidence-based pediatric pain management is vital to enable physicians to stop relying primarily on pharmacological treatments to manage pain.	Identification of barriers and facilitators to providing interdisciplinary pain treatment. Development and evaluation of more accessible delivery models (e.g. mhealth). Track outcomes of pediatric interdisciplinary pain rehabilitation into adulthood.
6. Integrated treatment of comorbid chronic pain and opioid misuse does not exist.	Integrated treatment of comorbid pediatric chronic pain and opioid misuse should be interdisciplinary, family-based and draw from evidence-based principles of treatment of both conditions (e.g. MOUD and interdisciplinary pain rehabilitation) while accounting for unique complexities of how the comorbidity may interfere with treatment engagement.	Systematic evaluation of pain-related functioning in youth with comorbid chronic pain and opioid misuse to understand pain treatment needs, pain sensitivity, and mechanisms of opioid-induced hyperalgesia. Measure the feasibility, acceptability, and efficacy of treatments for comorbid pain and opioid misuse.

it is important to note that acute and postsurgical pain are risk factors for development of chronic pain and exposure to opioids during adolescence is a risk factor for development of an opioid use disorder in adulthood. To protect pediatric patients from adverse outcomes, prior to prescribing opioids to youth, it is recommended that providers screen both the patient and caregiver for identified risk factors for chronic pain and substance use. Additionally, emerging data shows promise for the effects of behavioral parenting interventions to promote the disposal of leftover opioids (Voepel-Lewis et al., 2020), representing another potential risk mitigation strategy to implement.

Consideration 4: Opioid Prescribing Guidelines for Pediatric Chronic Pain do not Exist

There is not a specific consensus on guidelines for prescribing opioids to pediatric and adolescent patients (<18 years) with chronic noncancer pain (Dash et al., 2018; Schechter & Walco, 2016). Several sets of published guidelines exist for administration of opioids for chronic noncancer pain treatment in adults (American Academy of Pain Medicine, American Pain Society, & American Society of Addiction Medicine 2004; Chou et al., 2009; Dowell, Haegerich, & Chou, 2016), however, clinical decision making in this domain for youth is often based on adult literature and practice, which is problematic due to developmental differences between youth and adults (L. E. Kelly et al., 2018).

Consideration 5: Interdisciplinary Treatment Works for Pediatric Chronic Pain but is not Readily Accessible

Clinically effective (Simons, Sieberg, Pielech, Conroy, & Logan, 2013) and cost-effective (J. R. Evans, Benore, & Banez, 2016) alternatives to long-term opioid therapy include behaviorally based therapies such as ACT (Pielech, Vowles, & Wicksell, 2017) and CBT (Palermo, 2012), physical therapy, nonopioid medications (e.g., NSAIDs, anticonvulsants, antidepressants; Mathew, Kim, & Goldschneider, 2014), as well as outpatient multidisciplinary treatment (comprised of at least outpatient physical or occupational therapy and behavioral treatment) and the highest level of care: interdisciplinary pediatric pain rehabilitation which includes integrated care across at least three disciplines; for example, physical therapy, behavioral treatment, occupational therapy, medical; delivered in a day hospital or inpatient setting for an average of 8 hr per day over the course of multiple weeks (Hechler et al., 2015). Rehabilitative approaches, whether multidisciplinary or interdisciplinary, prioritize targeting improvements in functioning and engagement with valued activities (e.g., school, work, sports), rather than pain reduction, as increasing functioning and quality of life may be more feasible outcomes than pain reduction among individuals with chronic pain. Interdisciplinary rehabilitation treatment for pediatric chronic pain is typically based on learning theory, cognitive–behavioral models, and the biopsychosocial model of pain, which accounts for the complex interplay of the biological, psychological, social, and environmental factors that contribute to and maintain pain symptoms and disability.

Multidisciplinary pain management treatment is recommended early in the process of caring for youth experiencing acute and chronic pain (Tighe et al., 2015) and has been shown to be successful, marked by significant decreases in disability, depressive symptoms, pain catastrophizing, and discontinuing opioid use (Bruce, Weiss, Ale, Harrison, & Fischer, 2017). Interdisciplinary pain rehabilitation programs, the gold standard of treatment for complex, disabling chronic pain in youth (Hechler et al., 2014), have demonstrated effectiveness for improving pain-related functioning, including pain intensity, disability, and school absence (Hechler et al., 2010), as well as improving psychological functioning by reducing anxiety, depression, and pain catastrophizing (Bruce et al., 2017; Hechler et al., 2009, 2015). Evidence demonstrates maintenance of gains up to 1 year postdischarge, and in one sample, interdisciplinary pain rehabilitations outcomes were maintained 4 years after treatment ended (Dobe, Hechler, Behlert, Kosfelder, & Zernikow, 2011). Improvements from involvement in a pediatric interdisciplinary program may also be associated with decreased health care use and indirect costs (Hechler et al., 2009). More research is greatly needed to determine the long-term success and durability of intensive interdisciplinary treatment for youth, particularly through the developmental transition into adulthood, and if receipt of intensive interdisciplinary pain rehabilitation minimizes disease persistence and levels of disability into adulthood.

Lastly, it is important to note that integrative nonpharmacological treatments often require significant commitment, time, and effort from both children and families (Gatchel, McGeary, McGeary, & Lippe, 2014). Some barriers to utilizing interdisciplinary approaches include self-efficacy of both the patient and family for the proposed treatment; work, family, and scheduling demands; financial challenges; and limited availability of specialized pain programs (Caes, Fisher, Clinch, & Eccleston, 2018; Palermo & Chambers, 2005). Pediatric pain specialty programs are only available in about half of states, with 23 states offering at least one outpatient program and only 14 states offering at least an inpatient or day hospital program (American Pain Society, 2015). Additionally, while the majority of youth report improvements in functioning and pain after interdisciplinary pain rehabilitation, a subset of pediatric patients (up to one third) are treatment nonresponders (Simons et al., 2018). Patients who were older, had more complex pain, higher baseline anxiety levels, and lower levels of patient

readiness to self-manage pain were more likely to have poor treatment response, underscoring the need for early intervention with youth.

Consideration 6: There is a Need for Integrated Treatments of Comorbid Chronic Pain and Opioid Misuse

Comorbid chronic pain and opioid misuse presents significant clinical management difficulties, as few trials exist that incorporate treatment of pain-related interference and substance misuse, and all of the extant trials have been conducted with adults (Witkiewitz & Vowles, 2018). Therefore, an important health care objective is to develop and test coordinated treatments for pediatric patients with both chronic pain and evidence of opioid misuse and dependency. Such treatments will need to simultaneously reduce both the problematic interference of chronic pain on functioning and problematic opioid use. At present, there are only a handful of interventions that have done so (Wachholtz, Ziedonis, & Gonzalez, 2011). Two recent studies incorporating CBT for substance use with MOUD for opioid-treated chronic pain failed to have a significant effect on pain interference (Barry et al., 2019; Guarino et al., 2018). Garland and colleagues developed mindfulness-oriented recovery enhancement and found evidence for reduced pain interference and risk of opioid misuse in comparison to a support group control (Garland et al., 2014, 2019), although the more recent study specifically excluded individuals with evidence of current opioid misuse or opioid use disorder. A recent clinical pilot study in veterans with chronic pain and documented opioid misuse found that a combined behavioral intervention involving ACT and mindfulness-based relapse prevention was feasible and associated with reductions in both pain interference and opioid misuse at a 6-month follow up in comparison to usual care (Vowles et al., 2019).

Recommended Next Steps and Future Directions

As previously mentioned, an essential addition to the national agenda to combat the opioid overdose epidemic is implementing recurrent evidence-based screening and treatment for both pediatric chronic pain and opioid misuse in pediatric treatment facilities. Youth presenting for pain treatment should be screened with developmentally appropriate, validated tools (detailed below) to assess substance use at every clinical encounter to increase chances of early detection of opioid misuse behaviors. At the same time, youth presenting for treatment of opioid misuse should be screened regularly for pain interference, pain catastrophizing, pain intensity, and other pain-related risk factors related to opioid misuse. Pain sensitivity and pain-related functioning may evolve throughout withdrawal and MOUD induction, secondary to opioid induced hyperalgesia, signaling a need to augment MOUD with nonopioid pain management, such as behavioral approaches. For any screening measures and processes to be effective, patient's disclosures of pain and/or substance use behavior must be met with compassion, empathy, and curiosity rather than judgment or labeling the patient as "difficult" or "attention seeking" (Lumley et al., 2011), as there is a long history of stigmatizing patient's needs and symptoms related to both pain and substance use, which can interfere with self-report, treatment engagement, and recovery.

The screening, brief intervention, and referral to treatment (SBIRT) model is recommended for use in pediatric primary care settings and is being increasingly utilized in pediatric emergency departments (Mello et al., 2018; Sterling et al., 2015). SBIRT would also be an ideal candidate for implementation in pediatric pain management settings, as it is unknown how many pediatric pain clinics do any form of screening of substance use. In a recent survey of pediatric chronic pain programs, 82% ($N = 65$) utilized opioids as part of treatment, but the survey did not include assessment of screening for substance use (Miró, McGrath, Finley, & Walco, 2017). In pediatric populations, screening for substance use should be done with a developmentally appropriate, validated tool that assesses recent frequency of use such as the S2BI (Levy et al., 2014), BSTAD (S. M. Kelly et al., 2014) or the CRAFFT v2.0 (Knight, 2016). The CRAFFT was successfully applied in one study to identify subgroups of nonmedical opioid users at high risk for substance use disorders and in need of pain management (McCabe, West, Teter, Cranford, et al., 2012). To assess pediatric pain, measures like the Pediatric Pain Screening tool (Simons et al., 2015) have shown strong evidence of predictive validity, although need to be validated in youth with opioid misuse.

In order to effectively respond to a pediatric patient's pain and/or opioid related treatment needs, efforts are needed to equip providers with the behavioral and interpersonal skills to effectively and empathically work with complex patients and their families. Values and expectations for effective pain management can appear as discordant between the youth and care provider (Esquibel & Borkan, 2014) highlighting the need for a developmentally appropriate approach that involves the family. Along with increasing education to providers about the complex, biopsychosocial nature of chronic pain, shared decision making, and collaborative, goal-directed health care are recommended approaches for clinical care that psychologists can model and teach other disciplines, particularly in regard to opioid misuse and pain management.

Early detection of chronic pain etiology and referral to appropriate assessment and treatment is optimal for patient improvement. It is important for all pediatric health professionals to be educated on both pharmacological pain man-

agement and nonpharmacological pain management options for children and adolescents, including behavioral pain management and nonopioid prescriptions. Additionally, pediatric-specific opioid prescribing guidelines are needed to help providers discern if opioids are clinically indicated for chronic pain management, and, if so, what dosing is appropriate, as current guidelines are intended for adults. Well-constructed, placebo-controlled, randomized clinical trials are needed as the foundation for development of pediatric specific guidelines (Lathyris, Panagiotou, Baltogianni, Ioannidis, & Contopoulos-Ioannidis, 2014). These trials should include longitudinal follow up to evaluate the impact of childhood opioid use on development and neurocognitive functioning, as well as rates of risky use or substance use disorders, particularly for youth receiving chronic opioid therapy. Until these data have been published, long-term opioid therapy should be a treatment of last resort for youth with chronic noncancer pain.

If opioids are deemed as the optimal treatment option, efforts should be taken to optimize benefits and mitigate risks. Care is needed to ensure that mitigation of risk associated with opioids does not equate to inadequate pain control for youth or further perpetuate racial and ethnic disparities in pediatric pain management. Relevant risk factors to assess for in the patient as well as their caregivers and family include past and current substance use prenatal drug exposure (particularly opioid use), comorbid mental health diagnoses (especially depression, posttraumatic stress disorder, and anxiety), role as an athlete, pain history, particularly multiple pain complaints, adverse childhood events/traumatic experiences, and levels of health literacy (e.g., Log et al., 2013; Monnat & Rigg, 2015; Richardson et al., 2012; Veliz et al., 2014). It is also best practice for prescribers to log in the Prescription Drug Monitoring Program and notify the youth's other providers about the indication and timeframe for the opioid prescription.

Ongoing multidimensional assessment in both patient and parent is encouraged via urine drug toxicology screening and clinical interview. For example, Saroyan and colleagues (2016) provide a stellar model of this kind of ongoing assessment in a pediatric pain setting. Providing education to both families and children about the risks and benefits of opioids, signs of tolerance, dependency, and adverse events, safe storage of pills, use of rescue medications (i.e., naloxone), and dosing is also essential (Matthias, Krebs, Bergman, Coffing, & Bair, 2014). It is further recommended that psychologists and behavioral health providers check in with patients and their families regarding their opioid use and pain management needs following an acute injury or procedure and regularly monitor for signs of opioid misuse and development of persistent pain. As appropriate, psychologists are also uniquely skilled to provide current patients with pain education, behavioral pain coping, and distress tolerance skills prior to an anticipated painful procedure, to protect youth with preexisting mental health disorders who are more vulnerable to opioid misuse and chronic pain development.

A final aspect of a comprehensive agenda to address and prevent pediatric chronic pain and opioid misuse is the application of implementation strategies to increase access to interdisciplinary treatment programs and address disparities in pediatric pain care. Increased access is vital to enable physicians to stop relying primarily on pharmacological treatments to manage pain. Youth with comorbid chronic pain and opioid use disorders will likely require more than pharmacotherapy to treat their pain and substance use. Systematic reviews of the adolescent substance use literature suggest that adolescents would benefit from developmentally tailored interventions that incorporate family members to facilitate treatment engagement and recovery (Hogue, Henderson, Becker, & Knight, 2018). Paired with what is known from the pediatric chronic pain literature, a family based, interdisciplinary rehabilitation model may be ideal. Mobile health and other technology-assisted interventions for pain self-management in adolescents (e.g., Palermo et al., 2016) represent a promising potential direction for increasing access to evidence-based pain management. Other promising directions to bridge the gap between youth in need of effective intervention for chronic pain and those who receive it include patient-directed dissemination strategies (e.g., direct-to-consumer marketing, patient education campaigns) and provider-directed implementation strategies (e.g., training of front-line counselors, organizational change interventions). Expanding access to effective treatment options for chronic pain and opioid misuse provides potential to help address the opioid overdose epidemic and prevent further transmission across the life span.

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