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Past-year prevalence of prescription opioid misuse among those 11 to 30 years of age in the United States: A systematic review and meta-analysis

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ABSTRACT

Background: There are high levels of prescription and consumption of prescription opioids in the US. Misuse of prescription opioids has been shown to be highly correlated with prescription opioid-related morbidity and mortality including fatal and non-fatal overdose. We characterized the past-year prevalence of prescription opioid misuse among those 11–30 years of age in the US.
Methods: A systematic review and meta-analysis were carried out following a published protocol and PRISMA guidelines. We searched electronic databases; reports were eligible if they were published between 1/1/1990–5/30/2014, and included data on individuals 11–30 years of age from the US. Study quality was assessed using the Newcastle-Ottawa Scale.
Results: A total of 3211 abstracts were reviewed for inclusion; after discarding duplicates and identifying non-eligible reports, a total of 19 unique reports, providing 34 estimates, were included in the final systematic review and meta-analysis. The range of past-year prescription opioid misuse prevalence the reports was 0.7%–16.3%. An increase in prevalence of 0.4% was observed over the years of data collection.
Conclusions: This systematic review and meta-analysis found a high prevalence of past-year prescription opioid misuse among individuals 11–30 years of age. Importantly, we identified an increase in past-year prevalence 1990–2014. Misuse of prescription opioids has played an important role in national increases of fatal and non-fatal drug overdose, heroin use and injection, and HIV and HCV infection among young people. The observed high and increasing prevalence of prescription opioid misuse is an urgent public health issue.

1. Introduction

There are high levels of prescription and consumption of prescription opioids in the US. The US market accounts for nearly 100% of the world's hydrocodone and roughly 80% of the global consumption of oxycodone (INCB, 2008). Since 1990, prescriptions of opioids tripled globally; in the United States, prescribing of opioids has risen 350% since 1999 and the per capita dispensing of prescription opioids rose from 73.6 to 369.3 mg per person per year between the mid-1990s and mid-2000s (Fischer, Keates, Buhringer, Reimer, & Rehm, 2014; Imtiaz, Shield, Fischer, & Rehm, 2014; Katz et al., 2007; Rosenblatt & Catlin, 2012; SAMSHA, 2011). Non-medical prescription opioid consumption has been demonstrated to be highly correlated with prescription opioid-related morbidity and mortality (including substance abuse treatment admissions and fatal and non-fatal overdose) (Green et al., 2013; Imtiaz et al., 2014; Tanne, 2013). In 2013, 37% of drug overdose deaths in the US were attributed to prescription opioids in the US (He et al., 2013). Sales of prescription opioids, associated deaths, and treatment admissions have increased proportionally (CDC, 2012a; Imtiaz et al., 2014).

In the past decade, the prevalence of past-year non-medical prescription opioid use has risen to almost 5% among the general US population (Imtiaz et al., 2014). Among adolescents and young adults, the prevalence of lifetime and past-year use has also risen. From the early 1990s to the early 2000s, the rate of misuse rose from 12 to 13 per 1000 persons to 30–50 per 1000 persons among those 12 to 25 years

Abbreviations: HCV, Hepatitis c virus; HIV, Human immunodeficiency virus.

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old (Maxwell, 2005). As of 2010, 3.4 million 18 to 25 year olds were estimated to have misused prescription opioids (Fiellin, Tetrault, Becker, Fiellin, & Hoff, 2013). A recent national survey of suburban adolescents and early adults reported that one-third had misused prescription opioids by the age of 21 (Catalano, White, Fleming, & Haggerty, 2011). In response to such data, the White House announced initiatives and proposed funding to expand prescription drug monitoring and access to drug abuse treatment (The White House, 2016).

There have been no systematic reviews that have addressed past-year prescription opioid misuse among those 30 years of age and younger in the US nor have there been efforts to quantify the prevalence of misuse among this age group in meta-analysis. Use and misuse of prescription opioids at younger ages has been found to be associated with a higher likelihood of a diagnosis of opioid abuse/dependence (Edlund et al., 2010; McCabe, West and Wechsler, 2007; McCabe, West, Morales et al., 2007). Therefore, the need to synthesize and quantify the burden of misuse among this population is critical for informing public health interventions and resource allocation to address prescription opioid misuse in adolescence and young adulthood.

The objective of this systematic review and meta-analysis was to synthesize the data on the prevalence of prescription opioid misuse among those 11–30 years of age in the US. Drug use trends among adolescents and young adults up to age 30 – the ages when misuse is more likely to lead to abuse or dependence – foreshadows future trends in problem drug use (McCabe, West, Morales, Cranford, & Boyd, 2007; Toumbourou et al., 2007).

2. Methods

Data presented in this paper were collected as part of a series of linked systematic reviews of the HCV Synthesis Project. The aim of the HCV Synthesis Project is to synthesize burden of disease data on both key populations of incipient risk for HCV acquisition (e.g., persons who misuse prescription opioids) and populations with persistent, long-standing HCV epidemics (e.g., persons who inject drugs) in an effort to inform evidence-based policy to address preventable morbidity and mortality due to HCV infection.

Methods of data collection and extraction are presented elsewhere (Jordan, Des Jarlais, & Hagan, 2014); as such, only a summary is presented here. The study protocol was also registered with the International Register of Prospective Systematic Reviews (PROSPERO; registration number 42014008870). The methods of this study follow PRISMA guidelines (Shamseer et al., 2015).

2.1. Search strategy

A medical librarian was consulted for the development of the search strategy. Automated searches were carried out with the use of a sensitive search string with keywords including prescription opioid misuse, in the following electronic bibliographic databases and citation indices: PubMed, Ovid MEDLINE, Web of Knowledge, and PsychINFO. Manual search methods were also used and included hand-searches of public health and medical conference databases and reference lists of reviews and related articles for relevant reports, abstracts or presentations.

2.2. Inclusion criteria

Reports were considered for eligibility if they were: 1) published between 1/1/1990 and 5/30/2014; 2) were in English (no potentially eligible, non-English language reports were encountered); 3) included measures of prevalence of prescription opioid misuse or prescription opioid abuse, dependence or substance use-related disorder as defined by the DSM-IV criteria; and 4) report prevalence among adolescents and young adults aged 11–30 years. All reports were required to report data on prevalence of prescription opioid misuse in the past 12 months; reports that provided prevalence data for any other timeframe were excluded. Review of potentially eligible reports was a multi-step process; this process is depicted in the PRISMA flow diagram of Fig. 1. An abstract screening pilot was conducted where both the Project Director (PD, AEJ) and the principal investigator (PI, HH) reviewed several sets of abstracts and compared exclusion/inclusion results; pilots were carried out until consensus between reviewers was reached and there was 100% agreement. In the final abstract screening, the PD and PI each reviewed one half of the abstracts.

2.3. Data extraction

Two researchers carried out data extraction. As with abstract screening, a pilot procedure was done with the data extraction process to both refine the data extraction form and to ensure 100% agreement between data extractors with respect to which data were eligible for extraction. All data extraction was reviewed by the PD for completeness and to field questions that emerged during data extraction. Any unresolved issues were discussed to reach consensus, and when necessary, the PI was brought in to discuss issues related to methodology and study design.

Data were extracted onto coding forms that included items related to study methods and characteristics of the sample. Study years, location and description of location (e.g., population density), study design elements, and characteristics of the study sample were abstracted from each report. Prevalence, measures of variance (e.g., confidence intervals), and crude and adjusted measures of association between misuse and exposures examined in each report were extracted.

2.4. Quality ratings

Assessments for report-level quality were informed by the Newcastle-Ottawa Scale (NOS) (Wells et al., 2009). In an effort to reduce the likelihood of introducing bias with respect to misclassification of the outcome, we employed strict entry criteria requiring that studies present data prescription opioid misuse in the past one year. For this analysis, our emphasis was on assessing the risk due to selection bias due that may arise from methods to sample study participants. Thus, quality assessment was a one domain dichotomous variable where reports were either classified as being of higher quality and lower risk of selection bias if they employed probability or other non-probability weighted systematic sampling methods, and of lower quality and higher risk of selection bias if convenience sampling was employed.

Misclassification of the outcome of interest, prescription opioid misuse, was also of particular importance to this study. In order to account for variability in the defining of prescription opioid misuse in the included reports, we recorded the studies' definitions of misuse (e.g., “use of medication that was not prescribed to the individual or use only for the experience or feeling it causes”), and classified reports by their operational definitions (Katz et al., 2007). Throughout this report we use the term “misuse” to characterize all prevalence data.

2.5. Data analysis

We first sought to determine an overall pooled prevalence of prescription opioid misuse among all the included reports. We calculated 95% confidence intervals (CIs) around the pooled prevalence estimates assuming a normal distribution. Cochran's Q statistic was calculated to ascertain whether or not heterogeneity was observed across estimates and whether the heterogeneity was compatible with chance. I^2 was calculated to quantify inconsistency in the prevalence measures. Meta-regression was conducted to estimate the prevalence of prescription opioid misuse over time. Analyses were conducted using both R and SPSS (version 23.0) (Blasiole, Shinkunas, Labrecque, Arnold, & Zickmund, 2006; IBM Corp, 2013; R Development Core Team, 2008).

Data synthesis began with the search for homogeneous subsets across included reports. Examinations of study-level covariates were ultimately limited by the available information presented in each study.

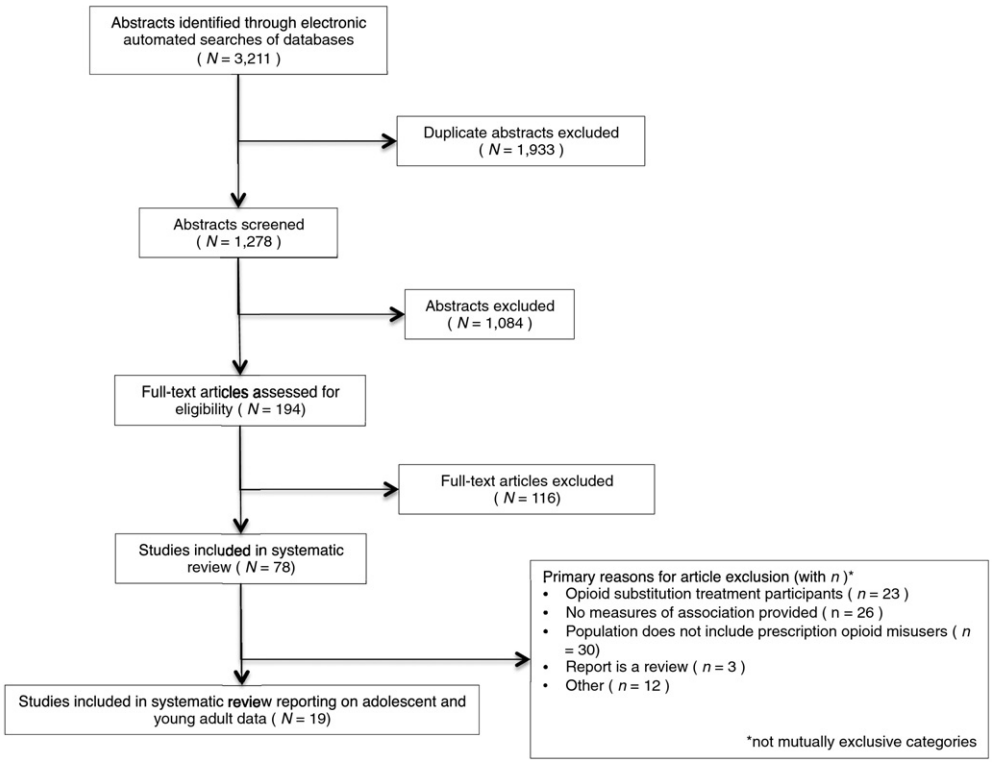

Fig. 1. PRISMA flow of information from identification to inclusion of studies.

Lack of consistency in the reporting of covariates was also a limiting factor. However, calendar time, geographic region, and selection bias could be examined as study-level moderators.

When reports presented data collected across a number of years, spans of 4 years or less were assigned a temporal midpoint for the period of data collection in analyses of changes in prevalence over time. The assignment of a temporal midpoint to reports that presented data over multiple year periods permitted us to include these estimates, along with estimates reported in individual years, in moderator analyses.

3. Results

3.1. General findings

After conducting both an automated and manual search, a total of 3211 abstracts were reviewed for duplicates; and after removing 1933 duplicate abstracts, 1278 were screened for initial eligibility. Fig. 1 depicts the process of abstract and full-text review. A total of 19 reports, including 34 independent non-overlapping estimates of prevalence, reflecting 503,845 unique participants, met the inclusion criteria and were included in this review. In total, the 19 reports provided 34 separate estimates of prescription opioid misuse. 18 estimates presented data for a single year. 17 estimates presented data over a range of years; there estimates were assigned a midpoint in calendar time analysis.

Of the 34 estimates, 21 estimates were derived from probability samples. Eight reports presented data using probability survey methods, and the remaining 11 reports presented data using other methods such as convenience or systematic sampling in observational research. Table 1 depicts the included estimates by sampling method.

3.2. Prevalence of past-year prescription opioid misuse

The range of past-year prescription opioid misuse prevalence among the 19 reports was 0.7%–16.3%. Fig. 2 presents a Forest Plot of the reports ordered by prevalence (with 95% confidence intervals). Reports presenting data from probability-based surveys presented a range of prevalence estimates from 3.9–12.7% and non-probability samples presented a range of prevalence estimates from 0.7–16.3%. There was significant heterogeneity ($I^2 = 99.61\%$; Q-statistic = 7619.34, p-value <0.0001) in the data; efforts were made to address heterogeneity separating the data based on similar sampling method ($I^2 = 99.48\%$; Q-statistic = 2505.65, p-value <0.0001, for probability samples, and $I^2 = 99.63\%$; Q-statistic = 1666.05, p-value <0.0001 for non-probability samples). We attempted to address high heterogeneity by examining studies by study location. There were 13 estimates that provided misuse data from education settings (e.g., high school, college); these estimates had a pooled prevalence of 7.39% (95% CI 5.84–8.94). Again, high heterogeneity was present ($I^2 = 99.13\%$; Q-statistic = 950.16, p-value <0.0001) which reflects the high variability as shown by the wide confidence intervals (Table 1). Given high heterogeneity, we were not able to pool prevalence estimates; therefore we present the range of prevalence estimates from probability and non-probability samples.

Individual reports using probability sampling generally had narrower confidence intervals for their estimates of prevalence than non-probability based reports due to larger sample sizes (n range 236–11,521). The probability-based samples were predominately national household surveys; in contrast, the reports employing non-probability sampling were typically smaller (n range 20–543), recruited from community settings and these had higher variability in estimates.

Eleven different definitions of prescription opioid misuse were used in 19 reports; however, these definitions differed only slightly. The National Survey on Drug Use and Health (NSDUH) definition ("Have you ever, even once, used a prescription pain reliever that was not prescribed for you or that you took only for the experience or feeling it caused?") was the most frequently used definition ($n = 8$ estimates in 5 reports) (Table 1). Given the variability in misuse definition there was no meaningful way to statistically examine the extent to which misclassification bias may or may not have affected the prevalence estimates as a function of definition of prescription opioid misuse.

Table 1
Prevalence of past-year prescription opioid misuse among those 11–30 years of age in the United States.

Report	Year of data collection	Sampling method	Survey name (if applicable)	Recruitment location	Definition of prescription opioid "misuse"	Age category	Sample size	Prevalence N, %	95% Cis
Becker, Sullivan, Tetrault, Desai, and Fiellin (2008)	2002–2004	Probability	NSDUH[a]	Households	NSDUH definition[g]	21–25 year olds	21,826	2186 (10.0%)	9.6–10.4%
Berenson and Rahman (2011)	2008–2010	Convenience	..	Health clinic	"Have you ever, even once, used a prescription pain reliever that was not prescribed for you or that you took only for the experience or feeling it caused?" [NSDUH informed question]	16–24 year olds	2976	20 (0.7%)	0.4–1.0%
Boyd, Young, Grey, and McCabe (2009)	2007	Convenience	…	Educational setting	Nonmedical use was measured with the question: "On how many occasions in the past 12 months have you used the following types of drugs not prescribed to you?"	13–15 year olds	912	91 (10.0%)	8.1–12.1%
Boyd, McCabe, Cranford, and Young (2007)	2005	Convenience	..	Educational setting	Use of prescription medication to "get high", to create an altered states, or for reasons (or by routes) other than what the prescribing clinician intended.	11–13 year olds	290	20 (6.9%)	4.3–10.5%
						14–16 year olds	580	74 (12.8%)	10.2–15.8%
						17–19 year olds	214	32 (15.0%)	10.5–20.4%
Cerda et al. (2014)	2010	Convenience	GUTS[b]	Multi-site	"Have you ever used pain killers (e.g., Percocet, Percodan, Oxycontin, Oxycodone, codeine, morphine) without a doctor's prescription?"	23–30 year olds	7646	543 (7.1%)	6.5–7.7%
Fiellin et al. (2013)	2006–2008	Probability	NSDUH[a]	Households	NSDUH definition	18–19 year olds	15,079	1916 (12.7%)	12.2–13.2%
						20–21 year olds	13,602	1696 (12.5%)	11.9–13.0%
						22–23 year olds	13,363	1534 (11.5%)	10.9–12.0%
						24–25 year olds	13,171	1350 (10.3%)	9.7–10.8%
Jones (2013)	2002–2004	Probability	NSDUH[a]	Households	NSDUH definition	12–17 year olds	24,987	1860 (7.4%)	7.1–7.8%
						18–25 year olds	31,648	3679 (11.6%)	11.3–12.0%
	2008–2010	Probability	NSDUH[a]	Households	NSDUH definition	12–17 year olds	24,617	1553 (6.3%)	6.0–6.6%
						18–25 year olds	33,531	3758 (11.2%)	10.1–11.6%
Lord, Brevard, & Budman (2011)	2005	Convenience	..	Social network website	"Which of the following prescription pain medications have you ever used for nonmedical reasons? Nonmedical means use of a prescription drug without a prescription or for reasons other than those indicated by a prescription"	18–25 year olds	527	86 (16.3%)	13.3–19.8%
Martins et al. (2012)	2004–2005	Probability	NESARC[d]	Households	NESARC definition[h]	18–29 year olds	6719	261 (3.9%)	3.4–4.4%
McCabe, Teter, Boyd, Knight, and Wechsler (2005)	2001	Systematic	CAS[c]	Educational setting	"How often, if ever, have you used any of the drugs listed below? Do now include anything you used under a doctor's orders." [list of pain killers]	<21 years old	5444	387 (7.1%)	6.4–7.8%
						21–23 year olds	3959	281 (7.1%)	6.3–7.9%
McCabe et al. (2005)	2000–2002	Probability	NESARC[d]	Households	NESARC definition	17–24 year olds	5198	236 (4.5%)	4.0–5.1%
McCabe, West, Morales et al. (2007), McCabe, West and Wechsler, (2007)	1993	Systematic	CAS[c]	Educational setting	"How often, if ever, have you used any of the drugs listed below? Do now include anything you used under a doctor's orders." [list of pain killers]	18–24 year olds	15,282	474 (3.1%)	2.8–3.4%
	1997	Systematic	CAS[c]	Educational setting		18–24 year olds	14,428	544 (3.8%)	3.5–4.1%
	1999	Systematic	CAS[c]	Educational setting		18–24 year olds	13,953	629 (4.5%)	4.2–4.9%
	2001	Systematic	CAS[c]	Educational setting		18–24 year olds	10,904	800 (7.3%)	6.9–7.8%
McCabe, West, Teter, and Boyd (2012)	2002–2006	Probability	MTF[e]	Educational setting	"Used prescription opioids on their own-that is, without a doctor telling them to take the medicine (e.g., Vicodin, Percodan)"	17–18 year olds	11,274	843 (7.5%)	7.0–8.0%
McCabe, West, and Boyd (2013a, 2013b)	2007–2010	Probability	MTF[e]	Educational setting	"Used prescription opioids on their own-that is, without a doctor telling them to take the medicine (e.g., Vicodin, Percodan)"	17–18 year olds	8888	647 (7.3%)	6.7–7.8%
Nakawaki and Crano (2012)	2003–2009	Probability	NSDUH[a]	Households	NSDUH definition	12–17 year olds	126,764	11,521 (12.0%)	11.8–12.2%
Sung et al., 2005	2005	Probability	NSDUH[a]	Households	NSDUH definition	14–15 year olds	6000	450 (7.5%)	6.8–8.2%
						16–17 year olds	5554	661 (11.9%)	11.1–12.7%
Tetrault et al. (2008)	2003	Probability	NSDUH[a]	Households	NSDUH definition	19–23 year olds	11,371	1341 (11.8%)	11.2–12.4%
						24–34 year olds	5228	749 (14.3%)	13.4–15.3%

Table 1 (*continued*)

Report	Year of data collection	Sampling method	Survey name (if applicable)	Recruitment location	Definition of prescription opioid "misuse"	Age category	Sample size	Prevalence N, %	95% Cis
Wu et al., (2008)	2005–2008	Probability	NSDUH[a]	Households	NSDUH definition	14–15 year olds	12,682	799 (6.3%)	5.9–6.7%
						16–17 year olds	12,445	1394 (11.2%)	10.7–11.8%
Zullig and Divin (2012)	2008	Probability	NCHA[f]	Educational setting	"Have you taken any of the following prescription drugs that were not prescribed to you?" [list of painkillers (e.g., OxyCotin, Vicodin)]	≤25 year olds	22,783	1913 (8.4%)	8.0–8.9%

[a] National Survey on Drug Use and Health (NSDUH).
[b] Growing Up Today Study (GUTS).
[c] College Alcohol Survey (CAS).
[d] National Epidemiologic Survey on Alcohol and Related Conditions (NESARC).
[e] Monitoring the Future (MTF).
[f] National College Health Assessment (NCHA).
[g] NSDUH definition: "Have you ever, even once, used a prescription pain reliever that was not prescribed for you or that you took only for the experience or feeling it caused?"
[h] NESARC definition: "Now I'd like to ask you about your experiences with medicines and other kinds of drugs that you may have used on your own-that is, either without a doctor's prescription (pause); in greater amounts, more often, or longer than prescribed (pause); or for a reason other than a doctor said you should use them. People use these medicines and drugs on their own to feel more alert, to relax, or quiet their nerves, to feel better, to enjoy themselves, or to get high, or just to see how they would work."

3.3. Prevalence of prescription opioid misuse over time

Among the 34 estimates contributing to the analysis of the change in prevalence of prescription opioid misuse over time, the majority (31 of 34) present data from 2001 to 2010. For the data characterizing prescription opioid misuse prevalence (all sampling methods), prevalence over the years of data collection (from 1993 through to 2010) was shown to increase by 0.40% (p-value <0.001) each year. Similar statistically significant increases in prevalence over time were also observed among those reports using probability and non-probability sampling methods (0.25% and 0.05%, respectively; p-values <0.000).

4. Discussion

The results of this systematic review and meta-analysis which included 34 independent estimates from 503,845 unique persons aged 11–30 years in the US, demonstrate a high and rising prevalence of past-year prescription opioid misuse. Reports presenting data from probability-based surveys identified a more narrow range of prevalence (range interval spanned 8.8 units) than did reports relying on non-probability samples (range interval spanned 15.6). That the probability samples presented a narrower prevalence estimates was likely due to the large sample sizes compared to the non-probability samples.

A key finding of this meta-analysis was the statistically significant increase in the prevalence of prescription opioid misuse among those 11–30 years of age from 1993 through 2010. The rise in prevalence we observed is consistent with a National Institute of Drug Abuse report documenting a rise in the incidence of prescription opioid misuse over the period 1994–2001 (CEWG, 2005). These rates rose from approximately 12–13 per 1000 persons for those aged 12–17 years and 18–25 years to nearly 50 per 1000 among 12–17 year olds and to over 30 for those in the 18–25 age group in 2001 (CEWG, 2005). In 2014, national estimates for past 30-day prescription opioid misuse among those in the age groups 12–17 and 18–25 were lower than estimates from the time period 2002–2012; however, similar to the 2013 estimates (NSDUH, 2014).

There have been several efforts to address the prescription opioid misuse epidemic in the US. These efforts have included strategies to increase the use of tamper-resistant pill containers to avoid diversion to adolescents and others, and interventions at the provider level (Gilson, Fishman, Wilsey, Casamalhuapa, & Baxi, 2012; Griggs &

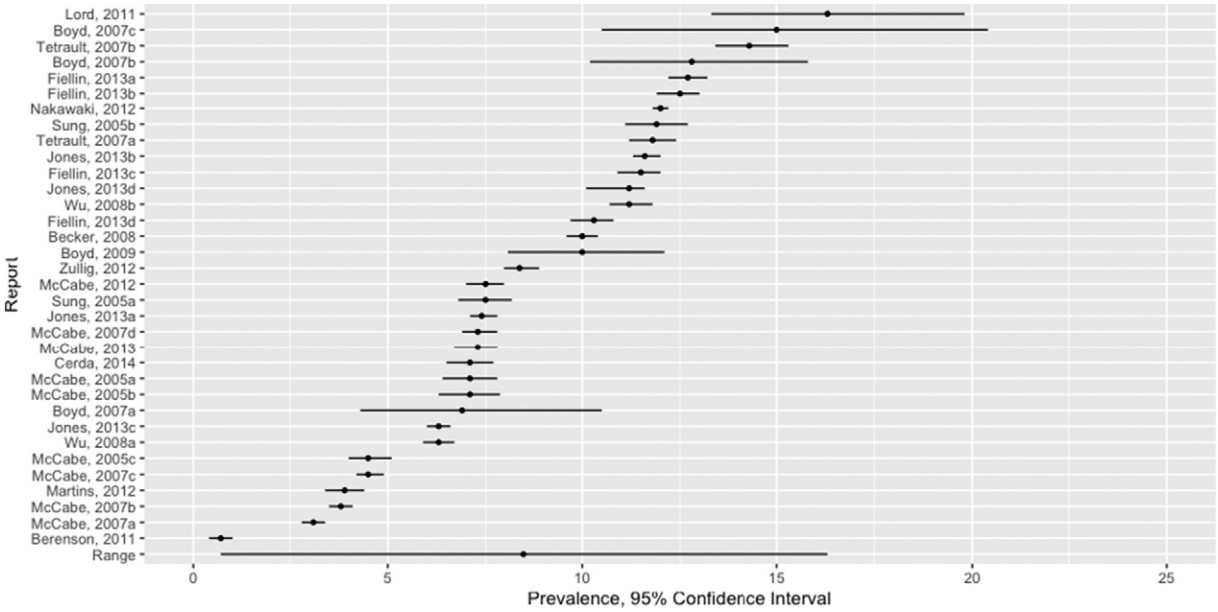

Fig. 2. Prevalence of past-year prescription opioid misuse among those 11–30 years of age.

Weiner, 2011; Miller, Miller, & Franger, 2009) such as prescription monitoring systems (Brady et al., 2014) and improved guidelines for the use of prescription opioids (Manchikanti et al., 2012). There have also been efforts to develop prescription opioids that resist being rendered into a form that is easily inhaled or injected (Romach, Schoedel, & Sellers, 2013). Regulating prescription opioids more tightly, and making formulations less readily injectable, in the absence of easy access to drug treatment, may unintentionally accelerate the transition to heroin injection drug use among already dependent persons (Cicero, Ellis, & Surratt, 2012; Mars, Bourgois, Karandinos, Montero, & Ciccarone, 2014).

The critical importance of addressing drug dependence in adolescents and young adulthood cannot be understated. Use and misuse of prescription opioids at younger ages has been found to be associated with a higher likelihood of a diagnosis of opioid abuse/dependence. Edlund et al. demonstrated a strong inverse relationship between age and post-misuse opioid abuse/dependence, where a particularly high likelihood of opioid abuse/dependence diagnoses were found among those aged 18–30 compared to those over 65 years (OR = 9.08, 95% CI 3.38–24.1) (Edlund et al., 2010). A national sample reported that 36% of adolescents 12–17 years misusing prescription drugs (including opiates, stimulants and tranquilizers/sedatives) exhibited one or more signs of dependence including tolerance, spending a great deal of time acquiring, using or recovering from the drug, and experiencing withdrawal (Schepis & Krishnan-Sarin, 2008).

Early intervention is key to preventing the development of dependence and abuse among all misusers, but there is greater urgency for prioritizing early intervention among young people. Public health policy must effectively and systematically address the availability and accessibility of evidence-based treatment of opioid abuse and dependence (e.g., methadone and buprenorphine) to respond to the current opioid epidemic (Maremmani & Gerra, 2010; Perlman et al., 2015). Programs to prevent fatal overdoses, such as naloxone distribution programs, are critical in addressing preventable drug use-related deaths (CDC, 2012b). Transition to heroin is an additional and key concern related particularly to misuse of prescription opioids; heroin use has increased in the US by 145% since 2007, and fatal overdoses due to heroin have increased 5-fold during the same time period (NSDUH, 2014).

4.1. Limitations

Several important limitations to our study are worth mentioning. First, both the generalizability and validity of our pooled estimate are dependent on the quality of the data provided in each individual report, thus, we were only able to present prevalence ranges. In order to account for the varying quality of individual estimates we employed an NOS-informed quality rating scale to assess study-level quality and explored the effect of study quality on prevalence in moderator analysis. We found that prevalence did not vary meaningfully in relation to quality assessment scores.

While we were able to document an ongoing increase in prevalence among those aged 11–30 from the 1990s to 2010, we were not able to examine trends in specific age groups across reports because of inconsistencies in the way age groups were constructed in the included reports. However, Sung, et al. demonstrated both an increase in lifetime misuse prevalence and in the number of new misusers among youth aged 12–17 from 1968 to 2002 (Sung, Richter, Vaughan, Johnson, & Thom, 2005).

In moderator analysis we were able to explore the role of year of data collection on prevalence. One limitation regarding categorizing calendar year was that it relied on interpolation for half of the estimates and thus, may have introduced error in the observed trends in prevalence of past-year prescription opioid misuse over time. However, as already discussed, the observed increase in prevalence over time is consistent with other published data not included in this report (CEWG, 2005; Imtiaz et al., 2014). Another potential limitation is that the included reports used a variety of different definitions of prescription opioid misuse (based on slightly different questions of those surveyed); because of inconsistencies in definitions we were unable to formally examine the potential contribution of differential classification to heterogeneity in prevalence estimates. This highlights the need for consistency in definitions in future studies to ensure that estimates are reliable and valid (DeVellis, 2012). In addition, we were not able to prevalence over time either among specific age strata or geographic region or urban, suburban, or rural classification because data available in the reports were not provided in formats allowing these analyses. These would be important areas for future research and public health monitoring.

Lastly, the estimates used in our meta-analysis are only as reliable as the estimates provided in the included studies. However, effort was undertaken both through rigorously applied inclusion criteria and quality ratings assessments to ensure that the estimates ultimately used in analyses were of the highest quality and as reliable as possible.

5. Conclusion

Our data confirm both a high and a rising prevalence of past-year prescription opioid misuse among those 11–30 years of age in the United States. This rising prevalence is an urgent public health problem the response to which requires effort to expand access to and engagement in evidence-based prevention and treatment interventions such as opioid agonist treatment of drug dependence, sterile syringe and injection equipment access, and efforts to reduce misuse and diversion of prescription opioids.

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Disclosures

The authors declare that they have no competing interests or disclosures to make.

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