

Non-prescribed use of pain relievers among adolescents in the United States

Li-Tzy Wu^{a,*}, Daniel J. Pilowsky^b, Ashwin A. Patkar^a

^a Department of Psychiatry and Behavioral Sciences, School of Medicine, Duke University Medical Center, Box 17969, Durham, NC 27715, USA

^b Mailman School of Public Health, Columbia University, 722 West 168th Street, Room 1702, New York, NY 10032, USA

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Abstract

Background: We examined gender-specific prevalences, patterns, and correlates of non-prescribed use of pain relievers – mainly opioids – in a representative sample of American adolescents ($N = 18,678$).

Methods: Data were drawn from the public use data file of the 2005 U.S. National Survey on Drug Use and Health, a survey of non-institutionalized American household residents. The patterns of non-prescribed use of prescription pain relievers were examined, and logistic regression procedures were conducted to identify correlates of non-prescribed use.

Results: Approximately one in 10 adolescents aged 12–17 years reported non-prescribed use of pain relievers in their lifetime (9.3% in males and 10.3% in females). The mean age of first non-prescribed use was 13.3 years, which was similar to the mean age of first use of alcohol and marijuana but older than the age of first inhalant use. Among all non-prescribed users, 52% reported having used hydrocodone products (Vicodin, Lortab, Lorcet, and Lorcet Plus, and hydrocodone), 50% had used propoxyphene (Darvocet or Darvon) or codeine (Tylenol with codeine), and 24% had used oxycodone products (OxyContin, Percocet, Percodan, and Tylox). Approximately one quarter (26%) of all non-prescribed users had never used other non-prescribed or illicit drugs. There were gender variations in correlates of non-prescribed use.

Conclusions: Use of non-prescribed pain relievers occurs early in adolescence. Research is needed to understand whether early use of non-prescribed pain relievers is related to later drug use.

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1. Introduction

In the United States, both prescribed and non-prescribed use of prescription pain relievers, as well as rates of opioid-related mortality and admissions to emergency departments, have increased in the last few years (Gilson et al., 2004; Paulozzi et al., 2006; Zacny et al., 2003). For the purposes of this paper, the terms “non-prescribed use” and “use of non-prescribed pain relievers” refer to the use of a prescription pain reliever(s) that was not prescribed for an individual or that an individual took only for the experience or feeling that it caused (e.g., nonmedical use). Prescription pain relievers

include opioids, such as preparations containing oxycodone (Oxycontin[®], Percocet[®]), hydrocodone (Lortab[®], Vicodin[®]), codeine (Tylenol with codeine[®]), propoxyphene (Darvon[®]), methadone (Dolophine[®]), and hydromorphone (Dilaudid[®]). Data from the U.S. Drug Abuse Warning Network (DAWN) and the Treatment Episode Data Set (TEDS) show an upward trend in opioid-related admissions to emergency departments (Gilson et al., 2004; Novak et al., 2004; SAMHSA [Substance Abuse and Mental Health Services Administration], 2003) and publicly funded substance abuse treatment facilities (SAMHSA, 2004). For example, an analysis of data from the 1997 to 2002 DAWN report indicates an increase in opioid-related visits to emergency departments: 642% for fentanyl, 347% for oxycodone, and 342% for hydromorphone (Gilson et al., 2004). The rate of drug-overdose deaths associated with prescription opioid misuse has also increased, and, in 2002, it was greater

* Corresponding author. Tel.: +1 919 668 6067; fax: +1 919 668 7056.
E-mail address: litzylwu@yahoo.com (L.-T. Wu).

than the rate associated with heroin or cocaine use (Paulozzi et al., 2006).

Similarly, surveys of the general population and students have shown that non-prescribed use of prescription pain relievers is a growing public health problem in the United States (Compton and Volkow, 2006; Johnston et al., 2006). In 2005, an estimated 2.2 million Americans used pain relievers nonmedically for the first-time within the preceding year, and more than one third (36%) of these first-time or new users were adolescents aged 12–17 years (SAMHSA, 2006). The Monitoring the Future (MTF) survey has studied the extent of drug use among American 12th graders annually since 1975. The survey was expanded in 1991 to include 8th and 10th graders. The recent MTF report shows that lifetime non-prescribed use of pain relievers among 12th graders increased from about 6% in the early 1990s to close to 13% in 2005 (Johnston et al., 2006). Non-prescribed use of OxyContin[®] was not included in MTF until 2002, and only past year use was assessed. Past year prevalence of non-prescribed use of OxyContin[®] increased from 1.3% in 2002 to 1.8% in 2005 among 8th graders and from 4.0% to 5.5% among 12th graders (Johnston et al., 2006).

Despite the evident increase in prevalence rates, patterns and correlates of non-prescribed use of pain relievers (and gender-specific patterns of use in particular) have received limited research attention. To date, only a few studies have examined non-prescribed use of pain relievers among adolescents using representative population-based samples. Boyd and colleagues (2006a) examined non-prescribed use of prescription pain relievers among 1017 students in grades 5 through 10 from a Detroit-area public school district and found that 22% of females reported lifetime non-prescribed use of pain relievers compared with 10% of males (Boyd et al., 2006a). McCabe and colleagues (2007a) examined prescribed and non-prescribed medication use among 1086 students in grades 7 through 12 from a Detroit-area public school district. In their sample, 44.7% of students reported a history of prescribed use of pain relievers. They found that females generally were more likely than males to report both prescribed and non-prescribed use of prescription drugs and that both prescribed and non-prescribed use of pain relievers (14.3% of the study sample) was more common than non-prescribed use of pain relievers only (3.4% of the study sample). Non-prescribed use of pain relievers was also found to be associated with increased odds of probable drug abuse in this sample of secondary school students (McCabe et al., 2007a).

Using data from the 2002 National Survey on Drug Use and Health (NSDUH), Sung and colleagues (2005) reported historical trends and correlates of past year nonmedical use of prescription opioids among adolescents aged 12–17 years. They defined “nonmedical use” using the same question from the NSDUH as we use in the present study (i.e., use of a prescription pain reliever[s] that was not prescribed for the respondent or that the respondent took only for the experience or feeling that it caused). Sung et al. (2005) reported a significant increase in the prevalence of nonmedical use of prescription opioids in the mid 1990s, continuing into 2002, when it reached a prevalence of 11%. They also noted a slightly higher preva-

lence of past year nonmedical use among females compared with males (7.8% vs. 6.9%). Low parental involvement, selling of illicit drugs, and use of alcohol and drugs were associated with increased odds of nonmedical use of prescription opioids (Sung et al., 2005). Sung et al. (2005) indicated that use of illicit drugs was the best predictor of nonmedical use of prescription opioids.

Together, the available data suggest that non-prescribed use of pain relievers is more prevalent among girls than among boys (e.g., Boyd et al., 2006a; McCabe et al., 2007a). In addition, the use of non-prescribed pain relievers may be influenced by medical exposure to pain relievers, by health conditions that could lead to non-prescribed use for self-medication purposes, and by the prior use of alcohol and other commonly used drugs (e.g., marijuana and inhalants) (Boyd et al., 2006a; McCabe et al., 2007a; Sung et al., 2005). Given that sources of prescription pain relievers and reasons for initial non-prescribed use may differ from sources of illicit drugs (medical exposures vs. illicit channels) and reasons for nonmedical use (self-treatment for pain vs. getting a high), it would be important to determine whether non-prescribed use of pain relievers occurred among adolescents who had never initiated use of common drugs, such as marijuana or inhalants (Wu et al., 2005). Such a pattern of findings would suggest that non-prescribed use of pain relievers may be related to self-medication of health-related conditions by some adolescents, which is not necessarily an antecedent of deviant behaviors (e.g., illicit drug use).

Previous studies have not examined gender-specific use of specific categories of non-prescribed pain relievers, use of alcohol and specific drug classes, age of onset of alcohol and other specific drug classes, and correlates of non-prescribed use (Boyd et al., 2006a; McCabe et al., 2007a; Sung et al., 2005). Additionally, physical health-related variables appear to be important correlates of non-prescribed use of pain relievers among adolescents (Boyd et al., 2006b; McCabe et al., 2007a) but are not examined by Sung et al. (2005). Examining both deviance-related (e.g., criminality and other drug use) and health-related variables would help determine deviant and non-deviant patterns of use of non-prescribed pain relievers.

In this study, we extend prior research suggesting an increase in non-prescribed use of pain relievers (Sung et al., 2005) by using more recent data to ascertain whether the rise in non-prescribed use has continued beyond 2002, and to study gender-specific patterns and correlates of non-prescribed use, including use of multiple pain relievers, frequency of use, and onset of first use. By using what is currently the largest available sample of American adolescents who participated in the 2005 NSDUH (SAMHSA, 2006), we were able to examine gender-specific patterns and correlates of non-prescribed use. Specifically, we investigated whether non-prescribed use of pain relievers is associated with risk factors from multiple domains, including: (1) perceived health status and health care use (e.g., related to self-medication and medical exposures); (2) general risk factors for drug use (e.g., a history of foster care placement and criminality); (3) use of mental health treatment services (e.g., related to self-medication); and (4) use of other substances (e.g., alcohol, marijuana, and inhalants) (Boyd et al., 2006a;

Khantzian, 1985; Wu et al., 2005, 2006; Pilowsky and Wu, 2006; Sung et al., 2005). We also determined the extent of alcohol and other specific drug use among users of non-prescribed pain relievers compared with never users and onset of first non-prescribed use of pain relievers compared with onset of first use of alcohol and other drugs. Findings from this study may help identify subgroups of non-prescribed users for targeting intervention and prevention efforts.

2. Methods

2.1. Data source

This study is based on data from the public use file of the 2005 NSDUH (SAMHSA, 2006). NSDUH is designed to provide population estimates of substance use and related disorders in the U.S. general population. It utilizes multistage area probability sampling methods to select a representative sample of the U.S. civilian, noninstitutionalized population aged 12 years or older for participation in the study. Participants include household residents; residents of shelters, rooming houses, and group homes; residents of Alaska and Hawaii; and civilians residing on military bases. To improve the precision of drug use estimates for subgroups, adolescents aged 12–17 years and young adults aged 18–25 years were oversampled.

NSDUH participants were interviewed in private at their places of residence. Potential participants were assured that their names would not be recorded and that their responses would be kept strictly confidential. All field interviewers signed a confidentiality agreement, and the procedures and protections were carefully explained to potential participants in the informed consent protocol. For adolescents aged 12–17 years, the field interviewer first obtained verbal consent from a parent or guardian. Once parental permission was granted, the field interviewer approached the adolescent and introduced the study using a script to obtain the adolescent's agreement to participate. Parents were then asked to leave the interview setting to ensure the confidentiality of the adolescent's responses.

The NSDUH interview utilizes a computer-assisted interviewing (CAI) methodology to increase the likelihood of valid respondent reports of illicit drug use behaviors (Turner et al., 1998). The CAI methodology includes a combination of computer-assisted personal interviewing (CAPI) and audio computer-assisted self-interviewing (ACASI) methodologies. ACASI is designed to provide the respondent with a highly private and confidential means of responding to questions and is used for questions of a sensitive nature (e.g., substance use). Respondents read questions on the computer screen or questions were read to respondents through headphones, and they entered their responses directly into the computer.

A total of 68,308 respondents aged 12 years or older completed the interview in 2005. The survey was conducted from January through December 2005. Weighted response rates for household screening and for interviewing were 91.3% and 76.2%, respectively (SAMHSA, 2006). Each independent, cross-sectional NSDUH sample was considered representative of the U.S. general population aged 12 years or older. NSDUH design and data collection procedures have been reported in detail elsewhere (SAMHSA, 2006).

2.2. Study variables

2.2.1. Non-prescribed use of pain relievers. *Non-prescribed use of pain relievers* was defined as any self-reported use of prescription pain relievers that were not prescribed for the respondent or that the respondent took only for the experience or feeling they caused. The NSDUH assessments of alcohol and drug use included a detailed verbal description of each drug group and lists of qualifying drugs. Under the section of non-prescribed use of prescription pain relievers, respondents were read the following statement: "These questions are about the use of pain relievers. We are not interested in your use of 'over-the-counter' pain relievers such as aspirin, Tylenol, or Advil that can be bought in drug stores or grocery stores without a doctor's prescription." Interviewers also showed a Pill Card A to the respondents. Respondents were then read the following: "Card A shows pictures of some different kinds of prescription pain reliev-

ers and lists the names of some others. These pictures show only pills, but we are interested in your use of any form of prescription pain relievers that were not prescribed for you or that you took only for the experience or feeling they caused."

The following 21 categories of prescription pain relievers were listed on Pill Card A: (1) Darvocet[®], Darvon[®], or Tylenol[®] with codeine; (2) Percocet[®], Percodan[®], or Tylox[®]; (3) Vicodin[®], Lortab[®], Lorcet[®], or Lorcet Plus[®]; (4) codeine; (5) Demerol[®]; (6) Dilaudid[®]; (7) Fioricet[®]; (8) Fiorinal[®]; (9) hydrocodone; (10) methadone; (11) morphine; (12) OxyContin[®]; (13) Phenaphen[®] with codeine; (14) propoxyphene; (15) SK-65[®]; (16) Stadol[®] (no picture); (17) Talacen[®]; (18) Talwin[®]; (19) Talwin NX[®]; (20) tramadol (no picture); and (21) Ultram[®]. A series of separate questions was presented to respondents to assess respondents' non-prescribed use of pain relievers. For example, respondents were asked "Have you ever, even once, used Darvocet[®], Darvon[®], or Tylenol[®] with codeine that was not prescribed for you or that you took only for the experience or feeling it caused?"

Based on respondents' answers to the question about recency of non-prescribed use ("How long has it been since you last used any prescription pain reliever that was not prescribed for you or that you took only for the experience or feeling it caused?"), we defined *lifetime* (any use in the lifetime) and *past year* (any use in the past 12 months) non-prescribed use variables. *Age at onset of non-prescribed use* referred to age at first non-prescribed use of any prescription pain reliever. *Frequency of past year non-prescribed use* was categorized into three groups: never use, less than weekly, weekly or more (i.e., non-prescribed use on 52 or more days in the past year). Frequency of lifetime use was not assessed. *Non-prescribed use of multiple pain relievers* was defined by counting the number of 21 categories of pain relievers ever used without a prescription by the respondents and categorized into three groups (one, two, and three or more categories of pain relievers). This method of grouping identified the proportion of non-prescribed users who used (or preferred) only one category of pain relievers vs. those who used two or more, and it explored whether adolescents typically used a single category of pain relievers.

2.2.2. Past year use of alcohol and other drugs. For alcohol and drug use, respondents' lifetime use was dichotomized into any use and no use. *Use of multiple drugs* was estimated by summing the number of eight drug classes ever used by the respondents (use of inhalants, marijuana, cocaine/crack, heroin, hallucinogens, and non-prescribed use of prescription sedatives, tranquilizers, and stimulants). *Age at onset of commonly used substances*, such as alcohol, inhalants, and marijuana (Wu et al., 2005), was defined as the age of first use of the specific substance and was categorized into three groups: 12 years or younger, 13–14 years, and 15 years or older, representing early, mid, and late adolescence. Using this categorization, we sought to determine whether early substance use was associated with increased odds of non-prescribed use of pain relievers.

2.2.3. Medical health, mental health, and criminality variables. We also examined the following potential correlates of non-prescribed use of pain relievers: adolescents' self-reported perceived overall health, use of emergency room/department, inpatient hospitalizations, mental health treatment service utilization, a history of foster care placement, and criminal activity. Adolescents' *perceived overall health* was assessed by a question: "Would you say your health in general is excellent, very good, good, fair, or poor?" *Past year use of emergency room* was assessed by asking, "During the past 12 months, that is, since [DATE-FILL], how many different times have you been treated in an emergency room for any reason?" *Past year inpatient hospitalization* was defined as self-reported inpatient hospitalization (staying overnight or longer in a hospital) during the past 12 months.

Mental health treatment service utilization was defined as any use of treatment or counseling at any service location in the prior year for emotional or behavioral problems that were not caused by alcohol or drug use (Wu et al., 2004). History of foster care placement (ever being in foster care) was determined using self-reported information included in the NSDUH (Pilowsky and Wu, 2006). *Criminal activity* (being arrested or booked) was defined as respondents' self-reported past year experience of having been arrested and booked for breaking the law, not counting minor traffic violations, and it was grouped into three categories (none, once, and two or more times) (Wu et al., 2006).

2.2.4. Social and demographic variables. We examined associations of non-prescribed use of pain relievers with the following key demographic variables: respondents' age (12–13, 14–15, 16–17 years), gender, race/ethnicity (non-Hispanic white, non-Hispanic black, American Indian or Alaska Native, Asian, other Pacific Islander or Native Hawaiian, Hispanic, and persons reporting more than one race), school status (student vs. nonstudent), total annual family income (less than \$20,000, \$20,000 to \$39,999, \$40,000 to \$74,999, and \$75,000 or more), and population density where the adolescent resided. Family income was ascertained by asking respondents: "Of these income groups, which category best represents your total combined family income during the previous calendar year?" For adolescents who were unable to respond to the income question, proxy responses were accepted from a household member identified as being better able to give the correct information about family income. NSDUH classified population density into large metropolitan areas (population ≥ 1 million), small metropolitan areas (population < 1 million), and non-metropolitan areas (outside a standard metropolitan statistical area).

2.3. Data analysis

Because of the use of a complex survey design, we utilized SUDAAN software (Research Triangle Institute, 2006) to conduct weighted data analyses in order to reflect the representativeness of the NSDUH sample. All results from our statistical analyses are weighted estimates, while only the sample sizes are unweighted figures.

We first examined demographic distributions of our study sample, as well as gender-specific prevalences of lifetime non-prescribed use of pain relievers among all adolescents ($N = 18,678$). Among the subsample of adolescents who reported lifetime non-prescribed use of pain relievers ($N = 1987$), we determined the prevalence of non-prescribed use of 21 categories of pain relievers, as well as the prevalence of non-prescribed use of multiple pain relievers, age of first non-prescribed use, and frequency of such use in the past year. We then examined prevalences of other substance use (alcohol and other drugs) among users of non-prescribed pain relievers and determined mean ages of onset of each substance use. Gender variations in the prevalence of non-prescribed use and other substance use were examined by χ^2 tests, and variations in the mean age of initiation were determined by t -tests. Finally, we conducted gender-specific multiple logistic regression analyses to determine the estimated associations between non-prescribed use of pain relievers and its correlates.

3. Results

3.1. Study sample

A total of 18,678 adolescents aged 12–17 years were identified from the public use data file of 2005 NSDUH. In this sample, 51% were females; 33% were young adolescents aged 12–13 years; 39% were members of nonwhite groups (non-Hispanic black, 15%; Hispanic, 17%; American Indian or Alaska Native, 0.7%; Asian, 4.2%; other Pacific Islander or Native Hawaiian, 0.7%; persons reporting more than one race, 1.5%); 98% were students; and 18% reported an annual family income of less than \$20,000.

3.2. Prevalence of lifetime non-prescribed use of pain relievers

Overall, 9.8% of adolescents aged 12–17 years reported a history of non-prescribed use of pain relievers (lifetime use: 9.3% in males vs. 10.3% in females; $\chi^2 = 4.46$, d.f. = 1, $p = 0.039$). As shown in Table 1, lifetime non-prescribed use of pain relievers was associated with each of the independent variables examined (χ^2 test, $p < 0.001$), with the exception of family income.

Table 1

Lifetime prevalence of non-prescribed use of pain relievers among adolescents aged 12–17 years (unweighted $N = 18,678$)

Characteristics	Overall	Males	Females
Overall	9.8	9.3	10.3
Age group (years)			
12–13	4.9***	4.4***	5.4***
14–15	8.0	6.7	9.4
16–17	16.4	16.7	16.2
Race/ethnicity			
Non-Hispanic white	10.5***	9.9***	11.0
Non-Hispanic black	8.9	8.0	9.9
American Indian, Alaska Native	14.3	19.1	9.5
Pacific Islander, Native Hawaiian	8.2	4.1	12.0
Asian	3.9	1.9	5.9
More than one race	11.7	8.9	14.6
Hispanic	9.4	9.8	9.1
Student status			
Yes	9.5***	9.0***	10.0***
No	29.8	25.5	36.4
Family income			
\$0–\$19,999	11.5	10.5	12.6***
\$20,000–\$39,999	9.9	8.1	11.5
\$40,000–\$74,999	10.0	9.1	10.9
\$75,000 or more	8.6	9.6	7.5
Population density			
Large metro areas	8.6***	8.5	8.8
Small metro areas	11.0	10.3	11.9
Nonmetro areas	11.0	9.6	12.4
Perceived overall health			
Very good or excellent	6.1***	6.7***	5.6***
Good	10.6	9.1	11.4
Fair	13.6	12.8	14.4
Poor	15.3	14.1	16.7
Emergency room use, past year			
None	8.0***	8.1***	8.0***
1–2 times	13.7	11.8	15.8
3 or more times	16.8	14.0	19.8
Inpatient hospitalization, past year			
None	9.3***	8.9***	9.8***
1–2 days	16.5	18.3	14.5
3–4 days	24.8	20.5	28.9
5 or more days	24.4	17.7	28.3
Mental health service use, past year			
No	8.2***	8.4***	8.0***
Yes	16.0	13.3	18.1
History of foster care placement			
No	9.6***	9.2	10.1***
Yes	16.5	12.3	20.9
Booked or arrested in the past year			
None	8.9***	8.2***	9.6***
One	28.5	25.6	33.7
Two or more	39.9	38.9	41.9
Age of first alcohol use (years)			
12 or younger	24.0***	21.7***	27.0***
13–14	20.1	18.6	21.3
15 or older	13.1	14.4	12.0
No use	3.2	3.1	3.4
Age of first inhalant use (years)			
12 or younger	24.1***	22.6***	25.9***
13–14	37.0	32.7	40.2

Table 1 Continued

Characteristics	Overall	Males	Females
15 or older	46.8	42.7	51.3
No use	7.2	7.0	7.3
Age of first marijuana use (years)			
12 or younger	41.1***	39.9***	43.0***
13–14	33.7	27.3	40.0
15 or older	26.1	26.8	25.4
No use	5.0	4.7	5.3

*** $p \leq 0.001$ from the χ^2 test for non-prescribed use of pain relievers and the corresponding variable in the first column.

Approximately 5% of adolescents aged 12–13 years reported lifetime non-prescribed use compared with 16% of older adolescents aged 16–17 years. American Indians or Alaska Natives (14%) had a relatively high prevalence of non-prescribed use, whereas Asians (4%) had a low prevalence.

Non-prescribed use of pain relievers was prevalent among nonstudents (30%), those who perceived their overall health as

poor (15%), adolescents with three or more emergency room admissions (17%) or hospitalized for three or more nights in the past year (25%), past year users of mental health services for psychological problems (16%), adolescents with a history of foster care placement (17%), and those who were booked or arrested for criminal activities (29–40%) in the past year. Early onset of use of alcohol, marijuana, or inhalants was associated with non-prescribed use (e.g., 41% among those who initiated marijuana use before age 13). Few gender variations in the patterns of non-prescribed use were evident. A low family income and a history of foster care placement were associated with non-prescribed use of pain relievers among females but not among males.

3.3. Patterns of pain relievers used among users of non-prescribed pain relievers

We then examined gender differences in patterns of pain reliever use among adolescents with a history of non-prescribed use of pain relievers ($N=1987$). As shown in Table 2, the two categories of pain relievers most often used by these ado-

Table 2

Characteristics of non-prescribed use of pain relievers among lifetime users of non-prescribed pain relievers aged 12–17 years (unweighted $N=1987$)

Prevalence of non-prescribed use (%)	Total $N=1987$	Male $N=915$	Female $N=1072^a$
Darvocet [®] , Darvon [®] , or Tylenol [®] with codeine	49.8	50.6	49.0
Vicodin [®] , Lortab [®] , Lorcet [®] , or Lorcet Plus [®]	46.8	47.1	46.5
Codeine	18.7	18.7	18.7
Percocet [®] , Percodan [®] , or Tylox [®]	18.0	17.4	18.5
Hydrocodone	17.0	16.8	17.1
OxyContin [®]	11.3	11.4	11.3
Morphine	7.1	6.9	7.3
Methadone	5.6	4.3	6.7
Demerol [®]	4.2	3.9	4.4
Ultram [®]	1.5	1.3	1.8
Phenaphen [®] with codeine	1.4	1.6	1.3
Tramadol	1.2	0.7	1.7
Dilaudid [®]	0.5	0.5	0.4
Fioricet [®]	0.5	0.2	0.7
Fiorinal [®]	0.9	0.3	1.4
Propoxyphene	0.8	0.9	0.7
SK-65 [®]	0.2	0.3	0.1
Stadol [®]	0.1	–	0.1
Talacen [®]	0.4	0.4	0.3
Talwin [®]	0.3	0.2	0.4
Talwin NX [®]	0.2	0.01	0.4
Hydrocodone products: Vicodin [®] , Lortab [®] , Lorcet [®] , Lorcet Plus [®] , or hydrocodone	52.3	51.4	53.3
Oxycodone products: Percocet [®] , Percodan [®] , Tylox [®] , OxyContin [®]	23.8	23.6	23.9
Codeine products: codeine or Phenaphen [®] with codeine	18.9	18.8	19.0
Number of 21 categories of pain relievers used			
1	56.9	59.8	54.1
2	17.5	16.4	18.6
3 or more categories	25.6	23.9	27.3
Age of first pain reliever non-prescribed use (years)			
12 or younger	30.1	31.6	28.7
13–14	30.5	29.0	31.9
15 or older	39.4	39.4	39.5
Frequency of non-prescribed pain reliever use in the past year			
Less than weekly	52.2	49.4	54.9
Weekly or more	17.7	18.9	16.6
None	30.1	31.7	28.5

All percentages are weighted estimates.

^a χ^2 tests for each category of pain reliever use by gender are *not* significant for each of the comparisons (p -value > 0.05).

Table 3
Characteristics of lifetime use of alcohol and other illicit drugs among lifetime users and non-users of non-prescribed pain relievers aged 12–17 years (unweighted $N = 18,678$)

Prevalence of use (%)	Lifetime users of non-prescribed pain relievers (unweighted $N = 1987$)				Lifetime non-users of non-prescribed pain relievers (unweighted $N = 16,691$)			
	Total	Male	Female	χ^2 (d.f.) p -value for gender	Total ^b	Male	Female	χ^2 (d.f.) p -value for gender
Alcohol	80.6	80.3	80.8	NS	36.6	36.1	37.1	NS
Marijuana	58.2	58.9	57.7	NS	13.0	13.8	12.2	5.29 (1) 0.02
Inhalants	34.5	32.4	36.4	NS	7.8	8.0	7.5	NS
Hallucinogens	25.3	26.8	23.9	NS	1.5	1.5	1.6	NS
Tranquilizers ^a	24.9	22.1	27.5	4.72 (1) 0.03	0.7	0.6	0.7	NS
Stimulants ^a	21.9	18.8	24.9	6.31 (1) 0.01	1.3	1.0	1.6	5.41 (1) 0.02
Cocaine/crack	15.8	16.1	16.4	NS	0.8	0.8	0.9	NS
Sedatives ^a	6.4	6.2	6.6	NS	0.3	0.3	0.3	NS
Heroin	1.7	1.8	1.5	NS	0.08	0.09	0.08	NS
Number of other 8 illicit drug classes ever used, excluding pain relievers								
None	26.3	26.8	25.9	NS	80.4	79.4	81.6	21.69 (3)
1	25.0	25.0	25.0		15.2	16.6	13.8	<0.001
2	18.2	19.2	17.3		3.1	2.9	3.3	
3 or more	30.5	28.9	31.9		1.2	1.1	1.4	

NS: $p > 0.05$. All percentages are weighted estimates.

^a Non-prescribed use of prescription drugs.

^b χ^2 tests for substance use between lifetime users and non-users of non-prescribed pain relievers are significant for each substance use (p -value < 0.001).

lescent users were “Darvocet[®], Darvon[®], or Tylenol[®] with codeine” (50%) and “Vicodin[®], Lortab[®], Lorcet[®], or Lorcet Plus[®]” (47%). Other commonly used categories of pain relievers were codeine (19%), Percocet[®]/Percodan[®] Tylox[®] (18%), and hydrocodone (17%). When we combined brand name and generic products together, hydrocodone products (Vicodin[®], Lortab[®], Lorcet[®], Lorcet Plus[®], and hydrocodone) were used by 52% of all users of non-prescribed pain relievers, and oxycodone products (Percocet[®], Percodan[®], Tylox[®], and OxyContin[®]) were used by 24% of all users of non-prescribed pain relievers. There were no significant gender differences in each of these pain relievers used.

Of all users of non-prescribed pain relievers, more than one half (57%) reported non-prescribed use of only one category of pain relievers, and about one quarter (26%) used three or more categories of pain relievers. Non-prescribed use of pain relievers

occurred early: about 61% reported their first non-prescribed use before age 15. Of all users of non-prescribed pain relievers, 18% reported approximately weekly non-prescribed use in the past year.

3.4. Patterns of alcohol and other drug use among users of non-prescribed pain relievers

We then examined gender differences in the prevalence and patterns of alcohol and other drug use among all users of non-prescribed pain relievers (Table 3). For comparison purposes, we also report the prevalence of alcohol and other drug use among adolescents without a history of non-prescribed use of pain relievers.

Close to one fifth (19%) of all users of non-prescribed pain relievers reported no history of alcohol use in their lifetime.

Table 4
Mean age of first non-prescribed use of pain relievers and of first use of other substances among adolescents aged 12–17 years who used that specific substance (unweighted $N = 18,678$)

Mean age of initiation in years (95% CI) among users of each substance	Unweighted sample size	All	Male	Female	t -Test p -value
Pain relievers ^a	1987	13.3 (13.07–13.47)	13.2 (12.91–13.51)	13.3 (13.08–13.58)	NS
Inhalants	2134	12.4 (12.25–12.51)	12.1 (11.84–12.28)	12.7 (12.55–12.86)	<0.05
Alcohol	7925	13.1 (13.04–13.20)	12.9 (1.78–13.03)	13.3 (13.25–13.41)	<0.05
Sedatives ^a	182	13.2 (12.76–13.72)	13.0 (12.20–13.82)	13.5 (12.95–13.98)	NS
Marijuana	3485	13.6 (13.49–13.72)	13.5 (13.38–13.62)	13.7 (13.50–13.94)	NS
Stimulants ^a	673	13.7 (13.42–13.88)	13.3 (12.88–13.68)	13.9 (13.66–14.16)	<0.05
Heroin	53	13.9 (13.17–14.72)	13.9 (13.00–14.83)	14.0 (13.01–14.94)	NS
Tranquilizers ^a	593	14.4 (14.16–14.54)	14.3 (13.99–14.65)	14.4 (14.15–14.60)	NS
Hallucinogens	797	14.4 (14.26–14.53)	14.5 (14.25–14.67)	14.3 (14.09–14.55)	NS
Cocaine/crack	438	15.1 (14.88–15.23)	15.2 (14.84–15.47)	15.0 (14.77–15.15)	NS

95% CI: 95% confidence interval. NS: $p > 0.05$. All mean ages are weighted estimates.

^a Non-prescribed use of prescription drugs.

Among all users of non-prescribed pain relievers, use of marijuana (58%) and inhalants (35%) were more prevalent than use of other drugs. The use of multiple drug classes was not uncommon. Close to one half (49%) of all users of non-prescribed

pain relievers reported having ever used two or more other drug classes. Female non-prescribed users were more likely than their male counterparts to use prescription stimulants (25% vs. 19%) and tranquilizers (28% vs. 22%) nonmedically. It is also

Table 5

Adjusted odds ratios and 95% confidence intervals of lifetime non-prescribed use of pain relievers among adolescents aged 12–17 years (unweighted $N = 18,678$)

Adjusted logistic regression model ^a	Males ($n = 9425$)	Females ($n = 9253$)
Age group (ref = 12–13 years)		
14–15 years	0.90 (0.63–1.28)	0.94 (0.70–1.27)
16–17 years	2.20 (1.54–3.15)***	1.62 (1.12–2.35)**
Race/ethnicity (ref = black)		
Non-Hispanic white	1.15 (0.83–1.58)	1.00 (0.68–1.48)
American Indian, Alaska Native	1.78 (0.62–5.13)	0.41 (0.17–1.00)*
Pacific Islander, Native Hawaiian	0.41 (0.05–3.27)	0.86 (0.30–2.45)
Asian	0.40 (0.15–1.02)	1.28 (0.59–2.79)
More than one race	1.11 (0.55–2.20)	1.27 (0.64–2.51)
Hispanic	1.19 (0.75–1.88)	0.84 (0.50–1.39)
Student status (ref = students)		
Non-students	0.93 (0.58–1.49)	1.62 (0.94–2.81)
Family income (ref = \$75,000 or more)		
\$0–\$19,999	0.91 (0.61–1.36)	1.43 (1.01–2.01)*
\$20,000–\$39,999	0.75 (0.53–1.07)	1.52 (1.17–1.97)**
\$40,000–\$74,999	0.86 (0.63–1.17)	1.25 (0.98–1.59)
Population density (ref = nonmetro areas)		
Large metro areas	0.91 (0.66–1.26)	0.84 (0.55–1.28)
Small metro areas	1.09 (0.79–1.51)	1.05 (0.71–1.55)
Perceived overall health (ref = excellent)		
Good	1.23 (0.94–1.60)	1.73 (1.33–2.27)***
Fair	1.62 (1.22–2.14)***	1.73 (1.28–2.35)***
Poor	1.40 (0.87–2.25)	1.42 (0.96–2.11)
Emergency room use, past year (ref = none)		
1–2 times	1.20 (0.97–1.48)	1.57 (1.25–1.96)***
3 or more times	1.46 (1.03–2.08)*	1.72 (1.16–2.55)**
Inpatient hospitalization, past year (ref = none)		
1–2 days	2.24 (1.41–3.56)***	0.85 (0.54–1.33)
3–4 days	2.73 (1.41–5.28)**	1.39 (0.85–2.27)
5 or more days	1.40 (0.35–5.55)	1.28 (0.66–2.47)
Mental health service use (ref = no)		
Yes	1.24 (0.92–1.66)	1.53 (1.27–1.84)***
History of foster care placement (ref = no)		
Yes	0.65 (0.38–1.10)	0.99 (0.60–1.63)
Booked or arrested, past year (ref = none)		
Once	1.24 (0.85–1.80)	1.20 (0.77–1.86)
Twice or more	2.19 (1.33–3.61)**	1.03 (0.52–2.03)
Age of first alcohol use, years (ref = no use)		
12 or younger	2.95 (2.15–4.06)***	3.31 (2.35–4.64)***
13–14	2.77 (2.10–3.64)***	2.51 (1.85–3.40)***
15 or older	1.83 (1.22–2.72)**	1.50 (1.09–2.05)**
Age of first inhalant use, years (ref = no use)		
12 or younger	3.32 (2.15–5.12)***	2.83 (2.00–4.01)***
13–14	3.58 (2.66–4.82)***	3.48 (2.47–4.90)***
15 or older	2.51 (1.61–3.92)***	4.17 (2.61–6.66)***
Age of first marijuana use, years (ref = no use)		
12 or younger	5.00 (3.46–7.23)***	3.71 (2.41–5.71)***
13–14	3.05 (2.20–4.23)***	4.05 (2.89–5.66)***
15 or older	3.08 (2.16–4.39)***	2.57 (1.80–3.66)***

* $p \leq 0.05$; ** $p \leq 0.01$; *** $p \leq 0.001$.

^a Each model includes all variables listed in the first column.

noteworthy that approximately one fourth (26%) of all users of non-prescribed pain relievers reported having *never* used other drugs (including non-prescribed use of other prescription drugs).

As shown in [Table 3](#), lifetime prevalence of alcohol and other drug use was comparatively lower among adolescents without a history of non-prescribed use of pain relievers: alcohol use, 37%; marijuana use, 13%; and inhalant use, 8%. Overall, 80% of adolescents without a history of non-prescribed use of pain relievers had never used a drug assessed by NSDUH; and 4% had ever used two or more drug classes compared with 49% of adolescents with a history of non-prescribed use of pain relievers.

3.5. Mean ages of onset of non-prescribed use of pain relievers and of other substance use

[Table 4](#) summarizes mean ages of onset of non-prescribed use of pain relievers and of other substance use. Inhalants on average were most likely to be the first substance used by adolescents, with a mean onset age of 12.4 years. First-time non-prescribed use of pain relievers (13.3 years) on average occurred at about the same age as the first-time use of alcohol (13.1 years), sedatives (13.2 years), marijuana (13.6 years), stimulants (13.7 years), and heroin (13.9 years).

3.6. Odds ratios of non-prescribed use of pain relievers

We conducted multiple logistic regression analyses to identify correlates of lifetime non-prescribed use of pain relievers for males and females ([Table 5](#)).

Regardless of gender, older age (16–17 years), perceived fair health (relative to perceived excellent health), three or more emergency department admissions in the past year (relative to no admissions), and use of alcohol, inhalants, or marijuana were each associated with increased odds of non-prescribed use of pain relievers. Race/ethnicity, total family income, and past year use of mental health treatment services were significant correlates among females only. Female American Indians/Alaska Natives were less likely than female blacks to use pain relievers, and the latter group was as likely as the other racial/ethnic groups to do so. Among female adolescents, increased odds of non-prescribed use of pain relievers were significantly associated with low family income and with receiving treatment services for psychological problems. Among male adolescents, past year inpatient hospitalization and having been arrested at least twice in the past year were associated with increased odds of non-prescribed use of pain relievers.

4. Discussion

Approximately one in 10 (9.8%) non-institutionalized American adolescents aged 12–17 years reported a history of non-prescribed use of prescription pain relievers in 2005, compared with a slightly higher lifetime prevalence (11.2%) in the 2002 survey ([Sung et al., 2005](#)), suggesting that non-prescribed use of these substances may have stabilized. In this sample, first-time use of non-prescribed pain relievers occurred in early

adolescence, with 60.6% reporting their first non-prescribed use before age 15 years (mean = 13.3 years). Inhalants are the only substance showing an earlier mean age of first use than non-prescribed use of pain relievers. Non-prescribed use of pain relievers on average begins as early as first-time use of alcohol, marijuana, sedatives, and stimulants, while the mean age of first-time use of tranquilizers, hallucinogens, and cocaine is older than that of first-time use of non-prescribed pain relievers. The causal relation between use of non-prescribed pain relievers and future drug use is beyond the scope of this study. Longitudinal data would be required to address this important question.

Our findings suggest that there might be at least two subsets of users of non-prescribed pain relievers: those who did and those who did not use other substances. In this sample, about one fifth (19%) of users of non-prescribed pain relievers had never used alcohol, and 26% had never used other drugs, including non-prescribed use of other prescription drugs (sedatives, tranquilizers, and stimulants). Some adolescent users of non-prescribed pain relievers might have used pain relievers primarily for the purpose of self-treating health-related conditions (e.g., reducing pain or discomfort). This putative association, between use of non-prescribed pain relievers and health status, was observed by our findings: adolescents perceiving their health as excellent had low odds of non-prescribed use of pain relievers, and health care utilization (emergency visits and inpatient hospitalizations) was associated with increased odds of non-prescribed use of pain relievers. In a sample of 1086 7th through 12th graders from a school district in southeastern Michigan, [Boyd and colleagues \(2006b\)](#) found that “relieving pain” was the most frequently reported reason for non-prescribed pain reliever use (endorsed by 79% of all users of non-prescribed pain relievers), and “helping with sleep” was the second most common reason (endorsed by about 20% of all users of non-prescribed pain relievers). Other reasons for non-prescribed use of pain relievers (e.g., to get high, for experimentation, or associated with drug dependence) were endorsed by far less than 20% of users of non-prescribed pain relievers ([Boyd et al., 2006b](#)). Thus, some adolescents may use pain relievers without a prescription mainly as a form of self-treatment for relieving pain, reducing anxiety or depression, coping with stress, or helping with sleep ([Boyd et al., 2006b](#); [Madianos et al., 1995](#); [McCabe et al., 2007b](#)).

As suggested in previous studies ([Boyd et al., 2006a](#); [McCabe et al., 2007a](#); [Sung et al., 2005](#)), a second subset of users of non-prescribed pain relievers participating in this survey used multiple substances. About half (49%) of all users of non-prescribed pain relievers reported the use of two or more other drugs (e.g., marijuana and inhalants). A prior study of youth indicates that non-prescribed use of pain relievers may be associated with polydrug use ([Inciardi et al., 2004](#)). Studies of adults suggest a link between non-prescribed use of pain relievers and heroin use ([Brands et al., 2004](#); [Siegal et al., 2003](#)). The association between non-prescribed use of pain relievers and heroin use was not found in this sample of community adolescents. In this sample, only 1.7% of users of non-prescribed pain relievers used heroin, which does not depart from an estimate of 1.5% among Americans aged 12 years or older

nationally (SAMHSA, 2006). Longitudinal studies are needed to ascertain whether there is continuity between adolescent non-prescribed use of pain relievers and heroin use in adulthood.

Of the many pain relievers used, non-prescribed use of OxyContin[®] perhaps has received the most media attention (Anon., 2007 (<http://www.oxyabusekills.com/>); Regan and Alderson, 2003; Suleman et al., 2002). Nationally, the number of users of non-prescribed OxyContin[®] rose from 1.9 million in 2002 to 3.5 million in 2005 (SAMHSA, 2006). Our analyses showed that OxyContin[®] was used by 11% of adolescent users of non-prescribed pain relievers. It is possible that OxyContin[®] is more likely to be used nonmedically by adults than by adolescents (SAMHSA, 2003). Data from the DAWN report suggest significant increases in misuse or abuse of fentanyl, morphine, oxycodone, methadone, and hydrocodone (Novak et al., 2004; SAMHSA, 2003). Our data suggest that American adolescents may be most likely to use hydrocodone products (Vicodin[®], Lortab[®], Lorcet[®], Lorcet Plus[®], and hydrocodone), which were used by 52% of all users of non-prescribed pain relievers. The use of oxycodone products (OxyContin[®], Percocet[®], Percodan[®], and Tylox[®]: 24% of all non-prescribed users), the category of “Darvocet[®], Darvon[®], or Tylenol[®] with codeine” (50% of all non-prescribed users), and codeine (19% of all non-prescribed users) were also not uncommon. However, the 2005 NSDUH survey combined propoxyphene (Darvocet[®], Darvon[®]) and codeine (Tylenol[®] with codeine) products into one broad category, and this precluded an analysis of specific prevalences for propoxyphene and codeine. Recently, propoxyphene products were identified as a major concern by Public Citizen’s Health Research Group (Wolfe et al., 2006). Propoxyphene is a relatively weak painkiller and could induce drug dependence (Wolfe et al., 2006).

Further, we found no gender differences in the types of pain relievers used, onset of use, or frequency of past year use. However, among all users of non-prescribed pain relievers, females were more likely than males to have used prescription stimulants and tranquilizers nonmedically, which is consistent with a recent study of the nonmedical use of prescription stimulants among youth (Wu et al., 2007) and a study of nonmedical use of prescription tranquilizers among persons aged 12 years or older (Simoni-Wastila et al., 2004). Treatment for psychological problems was associated with use of non-prescribed pain relievers among females, whereas being booked for criminal activities was associated with such use among males. Our previous studies among youth also show that the use of drugs other than marijuana is associated with internalizing syndromes (depression and anxiety) among females only (Wu et al., 2003), and that nonmedical use of prescription stimulants is associated with delinquency among males only (Wu et al., 2007). These findings could be explained in part by gender-related differences in sources of psychotropic drugs and reasons for non-prescribed use. Females tend to obtain such drugs from prescriptions or family members, whereas males are more likely than females to obtain them from non-family members and to use them for purposes of getting high or experimentation (McCabe et al., 2007a,b). Considered jointly,

these findings suggest that, among subsets of youth, the use of non-prescribed medications (i.e., pain relievers and stimulants) is associated with deviant behavior (e.g., being booked or arrested) among males and with emotional problems among females.

4.1. Limitations and strengths

These findings should be interpreted with caution. First, because NSDUH uses a cross-sectional design, our findings represent estimates of non-prescribed use of pain relievers and patterns of associations of such use. These associations should not be construed as causal pathways. Second, the NSDUH relies on respondents’ self-reports of their substance use behaviors. These results may be influenced by biases associated with reporting, such as memory errors. Third, a small but high-risk group of drug users (incarcerated, institutionalized, and homeless individuals) was not included in the NSDUH. These findings do not apply to them. Fourth, non-prescribed use of pain relievers is defined broadly in NSDUH. This broad definition may have led to the inclusion of users of pain relievers who have a legitimate medical condition but lack a prescription for various reasons, as well as including the deliberate misuse of these drugs (Colliver et al., 2006). The extent to which this broad definition affects the prevalence estimate of non-prescribed use of pain relievers among adolescents is not known, but it is possible that the wording of the question might have led to the inclusion of very few infrequent users who received the medication from a friend or family member to self-medicate their health-related conditions. Concerns about the possible overestimation of the prevalence of non-prescribed use of pain relievers are mitigated, however, by evidence of a recent increase in opioid-related admissions to emergency rooms (Gilson et al., 2004; Zacny et al., 2003). Last, specific prevalence of non-prescribed use of codeine and of propoxyphene cannot be determined by this study because the NSDUH lists Tylenol[®] with codeine in a category that includes Darvocet[®] and Darvon[®] (propoxyphene).

Nevertheless, the data from NSDUH has several noteworthy strengths that are not found in other surveys. The sample is a probability sample of the U.S. population aged 12 years and older and therefore is representative of the non-institutionalized American population. It includes both students and non-students and has more respondents than other ongoing surveys of drug use among American adolescents. The large sample size facilitates comparisons of prescription pain relievers by gender. Additionally, the survey uses “pill cards” displaying the names and color photographs of pain relievers and other prescription drugs to aid respondents in identification and recall of prescription drugs used. Last, the use of computer-assisted interviewing is likely to increase respondents’ reporting of socially stigmatized or sensitive drug use behaviors (Turner et al., 1998).

4.2. Conclusion and implications

The very early onset of non-prescribed use of pain relievers in this representative adolescent community sample is noteworthy, given the potential risk of opioids’ adverse interactions with

other central nervous system depressants, overdose, and addiction (National Institute on Drug Abuse, 2006; Paulozzi et al., 2006; Schulteis and Koob, 1996). Of all users of non-prescribed pain relievers, close to one fifth (18%) reported non-prescribed use approximately weekly in the past year, and lifetime use of multiple substances was common. Parents should be aware of potential non-prescribed use of commonly prescribed pain relievers by their children and monitor their frequency and dosing of medical use as needed. Epidemiological evidence indicates that adolescents manifesting early drug use are likely to need clinical attention, especially in the presence of other risk factors, such as psychiatric problems, genetic predisposition, or adverse environments (Anthony and Petronis, 1995; Brook et al., 2000; Costello, 2007; Tsuang et al., 1998). To what extent early use of non-prescribed pain relievers is related to subsequent drug use and factors modifying the risk for adverse outcomes deserves investigation.

Conflict of interest

Dr. Patkar has received grant support from Pfizer, Forest Laboratories, Cephalon and Titan Pharmaceuticals and is on the speakers bureau of Cephalon and Reckitt-Benckiser. The other authors declare that they have no conflicts of interest.

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