Assessing prescription stimulant use, misuse, and diversion among youth 10–18 years of age

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Purpose of review
Assessing the medical and nonmedical use (NMU) of stimulants and diversion is a challenge, especially among youth, with different methods for recruitment and definitions of NMU. The field needs inexpensive, yet effective and reliable, methods of data collection to understand the prescription drug use problem. Most studies of youth are school or web-based, and conducted with teens.

Recent findings
The National Monitoring of Adolescent Prescription Stimulants Study recruited 11 048 youth 10–18 years of age from urban, rural, and suburban areas in 10 US cities using an entertainment venue intercept study. This review discusses the effectiveness of the method and results from four cross-sections as well as the representativeness of the sample. Lifetime prevalence of any stimulant use was 14.8%, with rates highest among rural 16–18 year olds. The rate of last 30-day use was 7.3%, with over half (3.9%) NMU. Nearly 12% of all youth (whether a user or not) reported lifetime incoming/outgoing diversion of prescription stimulants.

Summary
Because no study has focused on stimulant use among youth as young as 10 and 11, this study is a landmark for future comparisons and offers a unique strategy for sampling and data collection.

Keywords
diversion, drug use, intercept venue study, nonmedical use, prescription stimulant use

INTRODUCTION

Many methodological challenges exist in the assessment of nonmedical use (NMU) of prescription medications among adults. This begins with substantial variation in the definition and questions used to assess it [1–3]. NMU is defined as 'misuse' or 'abuse', and is often referred to as use that deviates from the prescribed dose, route, or frequency of administration, or use without a prescription. Medical use is typically defined as use according to the labeled route, frequency, and dose of drugs obtained with one's own prescription. Any use includes both medical and NMU. Because of the definitional challenges, and because NMU with a prescription is often neglected as a definition of misuse, comparisons among studies are difficult. This article examines two areas of emerging concern: surveillance of young adults, and misuse and diversion of specific stimulant drugs, by illustrating these issues with data from a recent US national survey.

Engaging youth in research

Challenges exist in assessing youth, who are often thought to be questionable sources of information on their own use and NMU. Thus, many researchers use parents as proxy reporters because children may not be aware of the name or indication of their own prescription(s), often dispensed by parents at home or by teachers at school. Also, parental consent is usually required to obtain data from youth themselves and parents may decline to allow their children to participate in research.

Despite the earlier mentioned limitations, two United States national sources of data on prescription drug use among youth exist: the National Survey on Drug Use and Health (NSDUH) and Monitoring the Future (MTF). NSDUH conducts computer-assisted personal interviews with respondents 12 years of age and older in their homes [4,5,6▪▪]; MTF relies on self-administered questionnaires from

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KEY POINTS

- The first US national study that monitored preteen and teenage use, nonmedical use, and diversion of prescription stimulants with significant details for each topic.
- This study showed effectiveness of an entertainment venue intercept method in recruiting a nationally representative sample for the survey.
- This study found lifetime rates of stimulant use to be nearly 15%.
- The last 30-day rate of prescription stimulant use was 7.3%, with NMU reported to be more than half that rate (3.9%).

8th (13–14 year olds), 10th (15–16 year olds), and 12th (17–18 year olds) graders completed in their classrooms [7▪▪]. NMU of prescription drugs is assessed in NSDUH by the question: 'Have you ever, even once, used (DRUG), that was not prescribed for you or that you took only for the experience or feeling it caused?' In MTF, it is assessed with 'On how many occasions (if any) have you used (DRUG) on your own – that is, without a doctor telling you to take them?' Both studies require parental consent.

Emerging problem of prescribed stimulant use and diversion

Sweeney *et al.* [8] reported lifetime NSDUH prevalence of stimulant misuse to be 3.5% among respondents 12+ years of age. MTF estimated stimulant misuse in the last 1 year (including methamphetamine) to be 4.5% among 8th graders and 12% among 12th graders [7▪▪]. Definitional and other methodological issues affect the reported prevalence of substance use as well. Absent students and nonenrolled youth are excluded from the MTF sample, which could lead to biased rates [9]. Hispanics, who have higher school dropout rates [10], would be underrepresented in school-based surveys – this is especially problematic in that nonwhites have higher medication diversion rates compared with whites [11]. Additionally, a child could be taking prescribed stimulants fraudulently obtained by faking symptoms with the physician.

Another national study, the National Survey of Adolescents-Replication (NSA-R), which is telephone based, reported a 2.7% prevalence of last year stimulant NMU among youth 12–17 years [12]. For that study, youth were asked: Have you ever taken 'on your own' or nonmedically stimulants like Ritalin, speed, Adderall, diet pills? These questions differ from those previously mentioned, further illustrating variability that exists in the assessment of nonmedical prescription stimulant use.

Regional studies have also been conducted; they have assessed stimulant misuse through a web survey with middle and high school students and found lifetime NMU of attention deficit hyperactivity disorder (ADHD) stimulants to be 4.5% [9]. Kroutil *et al.* [13] identified lifetime prevalence of misuse of stimulants to be 2.6% among 12–17 year olds. Another found NMU of prescription stimulants to be 2.4% among youth in Mississippi schools [14▪]. These are the only studies of stimulant misuse that can be found among youth. Others assess 'use of prescription drugs to get high', without looking specifically at rates of each type.

The national monitoring of adolescent prescription stimulants study

To resolve these methodological issues to detect current levels of NMU of prescription stimulants among preteens and adolescents, the National Monitoring of Adolescent Prescription Stimulants Study (N-MAPSS) was launched with an innovative method to detect signals of use and misuse. An entertainment venue intercept method – used previously to recruit people in popular venues where they congregate or visit – allowed us to economically reach a large and diverse sample of over 11 000 youth [15–19,20▪▪]. This method and rate comparisons with other more traditional sources of recruitment are the focus of this review.

METHODS

Our methods are described below.

Research site selection

To begin, standard federal regions of the United States (Office of Management and Budget) Circular A-105 used by the National Survey of Children's Health were selected. Then, the IMS Health database – which identifies prescriptions dispensed in the USA at retail pharmacies, using the ZIP code of each prescriber – was used to identify the states with the highest volume of stimulant prescriptions and the city within each with the highest volume.

The regions, states, cities, and their 2008 rankings are shown in Table 1: four cities represented eastern USA (Boston, New York, Philadelphia, and Tampa); three represented central USA (St Louis, Cincinnati, and Houston); and three represented western USA (Denver, Los Angeles, and Seattle).

ZIP code enumeration

Areas were characterized as urban, suburban, and rural, determined by city limits, proximity to city

Table 1. N-MAPSS cities

OMB circular A-105 region	State	State volume rank in nation[a]	City	City volume rank in nation[b]
Eastern USA				
Region I	Massachusetts	13	Boston	43
Region II	New York	9	New York City	2
Region III	Pennsylvania	7	Philadelphia	17
Region IV	Florida	2	Tampa	22
Central USA				
Region V	Ohio	3	Cincinnati	6
Region VI	Texas	1	Houston	1
Region VII	Missouri	16	Saint Louis	4
Western USA				
Region VIII	Colorado	31	Denver	49
Region IX	California	4	Los Angeles	50
Region X	Washington	24	Seattle	45

N-MAPSS, National Monitoring of Adolescent Prescription Stimulants Study.
[a]States ranked #5–6, 8, 10–12, 14–15, 17–23, 25–30 are within already selected federal regions and, therefore, were not selected.
[b]Cities ranked 3, 5, 7–16, 18–21, 23–42, 44, 46–48 are within already selected regions.

limits, and population density. All five-digit ZIP codes contained in the selected city boundary were defined 'urban'. Those contiguous to the urban ZIP codes were defined suburban and included if a population density was less than urban, but more than rural (the US Census does not define suburban). ZIP codes contiguous to suburban areas with fewer than 1000 persons per square mile were considered rural.

Eligibility criteria and participant recruitment

Youth 10–18 years of age residing in an urban, suburban, or rural ZIP code from one of the ten cities were eligible. Youth unaware of their ZIP code, non-English readers, cognitively impaired, or in college were excluded. N-MAPSS utilized the entertainment venue intercept method to comprehensively and inclusively reach youth where they were likely to be, to achieve representativeness. This was accomplished by sending recruiter interviewers to carefully selected venues (shopping malls, movie theaters, sports and recreation centers, libraries, arcades, skate parks, and parks) to locate a diverse and representative sample of youth in each region. Criteria for venue selection included being inside the designated ZIP code boundary, being youth friendly, having a large customer base, being age appropriate, and allowing study recruitment. Home-schooled and truant youth were included. The most common venue visited was malls (69%), followed by parks and other shopping areas (13%). Libraries, skate parks, recreation centers, movie theaters, and restaurants or food courts accounted for 11% of venues.

Recruiter interviewers approached the potential respondents in venues based on the time and day youth most likely attend each venue, similar to the MacKellar *et al.* [19] and Zhao *et al.* [16] studies. Recruiter interviewers documented the city, date, time, sex, race/ethnicity and number of eligible youth in the approached group and age, grade, and ZIP code for each person contacted. Youth were coded as complete, refused, or ineligible (because of college, age, language, out of ZIP code, or over quota). Demographics of noncompleters were used to calculate a response rate.

Recruiter interviewers answered the respondents' questions about the study and obtained implied assent, indicated by survey completion. Parental permission was not solicited per Washington University and University of Florida Human Protection Research Offices because all survey data were anonymous.

Sampling goals

The target sample size was based on a power calculation assuming a 4% rate of stimulant use; 270 youth per site was adequate (80% power) to detect a 3% difference in rates across sites. With four data collection periods, 1080 youth per site would be adequate to show even small differences.

Recruitment goals ensured representation of all ages and urban, suburban, and rural status. Our goal was to include 20% 10–12 year olds, 40% 13–15 year

olds, and 40% 16–18 year olds as well as 50% urban youth, 30% suburban, and 20% rural from each city. When adolescents at the venues were in small groups (clusters), recruiter interviewers surveyed one 10–12 year old, two 13–15 year olds, and three 16–18 year olds per cluster. Recruiter interviewers were notified when urbanicity or age quotas were met for their city.

Assessment

The cost and logistics of supplying computers to 30–40 interviewers in 10 cities motivated us to use a full-color paper assessment, which was familiar to youth, easy to use, and eliminated technical complications of computer malfunctions.

The N-MAPSS research team adapted survey questions from the Substance Abuse Module (SAM) [21] and the Washington University Risk Behavior Assessment (RBA) [22] on quantity and frequency, route of administration, reasons, and source of use. The 20-min assessment, conducted in private, was divided into two (Table 2). After Part I was completed, mostly on demographics and dosage and form recognition, respondents completed Part II, in which information on lifetime and last 30-day use of Adderall, Concerta, Daytrana, Ritalin, and Vyvanse was assessed with photos of each. (All formulations were queried, including immediate release and extended release.) NMU was assessed by use other than by mouth (except for Daytrana), use of someone else's medications, more than prescribed, or use 'to get high', 'out of curiosity' or 'just because'. After completion, participants were given a $10 electronics store gift card.

Test–retest substudy

Before the study, a Pre-Test Reliability Feasibility study was conducted with a sample of 10 each of 10–12 year olds, 13–14 year olds, 15–16 year olds, and 17–18 year olds to ensure the assessment was appropriate for all. Participants were recruited via flyers in St Louis; to be enrolled youth had to have used any Adderall, Concerta, Daytrana, Ritalin, or Vyvanse.

Interviewers guided 10–12 year olds through the written survey, but were present in the room with 13–18 year olds to answer any questions during survey self-administration (Time 1). Respondents returned 7 days later for the Time 2 survey with a different interviewer. As locating information was needed for the Time 2 interview, parental and youth informed consent was needed. All participants received a $40 gift certificate to an area department store.

The data showed good-to-excellent agreement between Time 1 and Time 2 interviews (kappas = 0.6–1.0); use of drugs and an attention deficit disorder (ADD) diagnosis were in nearly perfect agreement (0.95–1.0).

After Time 2, the project coordinator conducted a Discrepancy Interview Protocol (DIP) and Debriefing Interview to identify the questions needing modification [23]. The DIP compares answers from Time 1 to Time 2 to assess whether inconsistent responses were because of misunderstanding questions, inability to remember answers, change in situation since the first interview, or if the youth was not paying attention. A debriefing interview was then conducted with 50 10–18 year olds to evaluate their understanding of the intent of the questions. Participants received a $10 gift card for these interviews. Responses indicated that youth had no difficulty understanding the questions; no other inconsistencies were found, confirming that the survey was feasible.

Hiring and training of recruiter interviewers

Craigslist was used to find recruiter interviewers, along with university listservs and career centers. Once hired, recruiter interviewers received a Training Manual with ZIP codes, Question-by-Question Specifications, Screeners, Logs, Adverse Event Forms, surveys, and Code of Conduct material. A 2-h training via Skype was held which covered a practice interview and editing session. Additional time was needed to review the details before recruiter interviewers entered the field. The project coordinator was available every day and evening via text messaging to address issues that arose; she also gave immediate feedback and guidance on the surveys. Booster training continued throughout field periods to reinforce protocol adherence. For subsequent cross-sections, recruiter interviewers were chosen from among the excellent performers. St Louis project staff and investigators also collected surveys for first-hand experience (L.B. Cottler and C. Striley).

Quality control

Quality control from St Louis included a check of handwriting on all self-administered surveys; analyses were conducted to identify variable outliers, suspicious patterns, and potentially fabricated data [24]. Questionable surveys were reviewed by the team resulting in 164 surveys being excluded.

Surveys were also checked with the Statistical Analysis System random number generator for duplication both within and across field periods.

Table 2. Data collected by topic

Topic – Part 1	Specifics
Demographics	Sex, age, race, and ZIP code
Family	Who Respondent lived with (in the last 7 days, no. of siblings, birth order, no. of times ate meals with family (in last 7 days)
Education	Grade in school, grades
Income	Employment, no. of hours worked, cash on hand, debit card
Activity level	Number of sports teams, no. of hours watching TV, number of hours playing video games, bedtime, waking time
Health	Perceived health
Conduct	Number of tickets, arrests, suspensions
Behavioral problems	Selected conduct disorder, anxiety, depression, anorexia symptoms
ADD/ADHD	Did a doctor diagnose ADD/ADHD, five symptoms
Brand level data	Number of youth able to identify drugs by name, source of information
Topic – Part 2	**Specifics**
Prescription stimulants	Use, misuse, abuse, and diversion, use of more than one prescription stimulant, route of administration, source, reasons for use, likelihood of taking Rx stimulant in 1 and 5 years, dependence symptoms, perception of how big a problem prescription stimulants are with kids, respondents' age
Prescription sedatives	Use and misuse
Prescription opioids	Use and misuse
Illegal drugs	Use of marijuana, cocaine, crack, heroin, club drugs (like ecstasy), hallucinogens (like LSD or mushrooms), anabolic steroids, cough syrup/'purple drank' to get high, methamphetamine, inhalants (like gasoline or paint)
Energy drink	Use in last 7 days
Tobacco	Use, onset, no. of cigarettes smoked on days when Respondent smokes
Alcohol	Use, onset, no. of drinks in last 7 days, no. of days drank in last 30 days, binge drinking, source
Gambling	Internet, poker games and sports bets, ever played Second Life
Friends	Number of close friends, no. of close friends Respondent thinks has tried Adderall, even once
Poly drugs	Within and between prescription drugs and illicit drugs
Truthfulness	How truthful Respondents were in answering questions on the survey (not at all, somewhat or completely)
Qualitative data	How should kids your age be told about prescriptions drugs and their effects? If you ran the world, how would you stop kids from taking other people's prescription medicines? Why do people use prescription stimulants without a prescription?
Height and weight	Self-reported
Accompanied by parent	Yes or no

ADD, attention deficit disorder; ADHD, attention deficit hyperactivity disorder.

Suspicious cases were matched on ZIP code, sex, age, ethnicity, birth order, and grade in school. In five replications, the pool of potential repeaters was found to be 1.0–2.5%. We examined seven pairs that matched on all six criteria and agreed on cigarette, alcohol, marijuana, and prescription stimulant use, and history of ADD/ADHD. Three of these also had similar family compositions and handwriting; they were excluded from further analysis.

RESULTS

The study was carried out in four cross-sections of data collection with fall and spring selected. In fall of 2008, in 52 days, 2820 adolescents were surveyed. In spring 2009, in 74 days, 2878 youth were surveyed. The third period, fall 2010, took 82 days to yield 2839 surveys. The final period, in spring 2011, concluded 84 days later with 2931 surveys collected.

Among the 21 444 youth approached (Fig. 1), 25% did not stop to hear the recruiter interviewer's introduction. Additionally, 21% were ineligible mostly (84%) because of their age or an ineligible ZIP code. Another 10% who stopped to hear about the survey refused participation. Among the 11 468 youth who participated, 420 were eliminated as shown in the figure. The remaining 11 048 youth represented an 86.7% participation rate and a 68% overall response rate (11 048/16 143). Among these, 48, 37, and 15% were urban, suburban, and rural, respectively, in line with the goal.

As shown in Table 3, data are stratified by urbanicity and age, with 55.6% of youth living with both parents and 43.7% reporting excellent health. Other

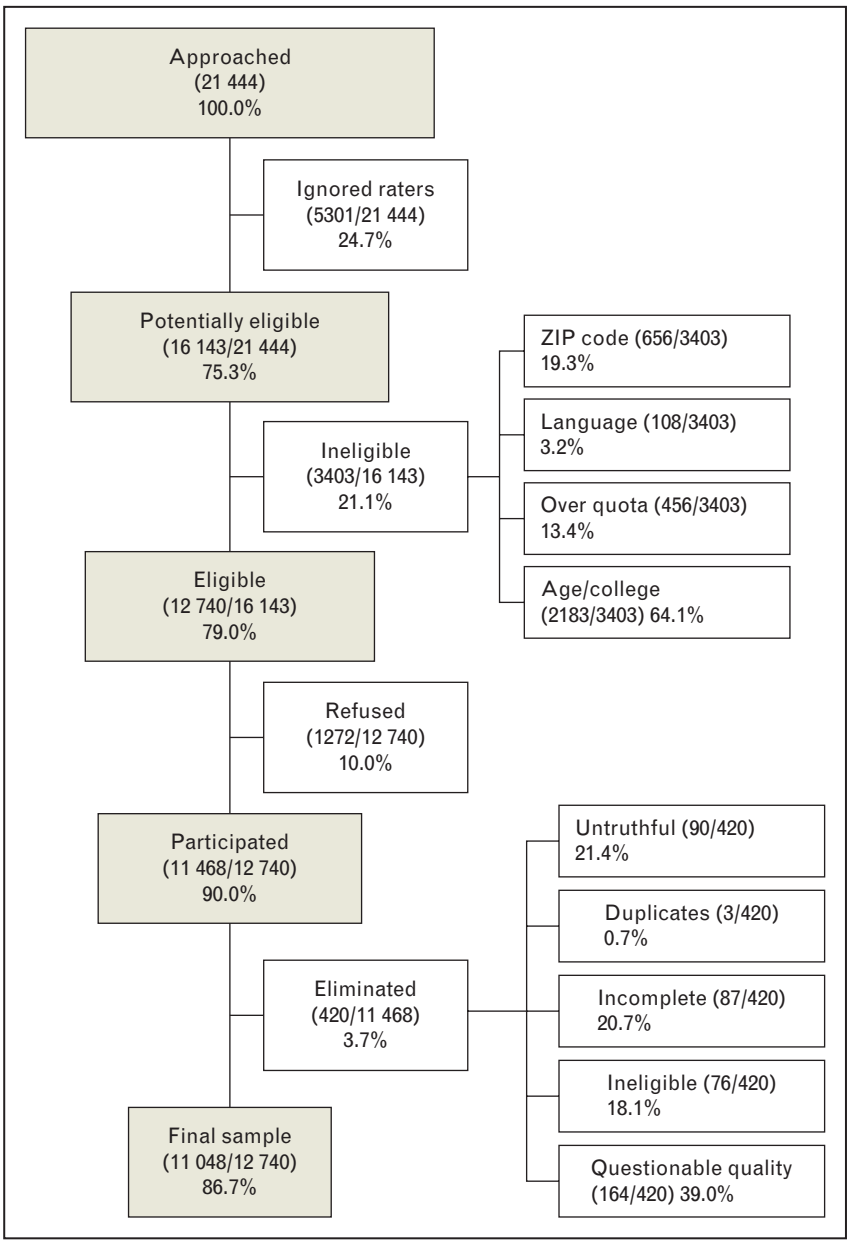

FIGURE 1. Accrual of the N-MAPSS sample from 21 444 approached to 11 048 completed. N-MAPSS, National Monitoring of Adolescent Prescription Stimulants Study.

demographic characteristics are shown in the table. The sample, overall, mimicked population rates for race. Reports of drinking increased with age. Regarding stimulant use, 14.8% reported any lifetime use; rates increased with age, with highest rates among rural 16–18 year olds. Among 10–12 year olds, 7.6–10.1% reported use. Additionally, 63.2% of youth reported thinking that prescription stimulant use was a moderate-to-large problem among youth.

Past 30-day use of stimulants was reported by 7.3% of youth (Table 4), with over half (53%) being NMU (3.9%). Diversion was stratified by having received (incoming) or given (outgoing) pills. Older youth were more likely than younger to report being approached to divert medications, or diverting and receiving prescription stimulants. In fact, 2.4–4.9% of 10–12 year olds reported incoming diversion. About 12% of youth reported lifetime diversion of prescription stimulants; 4.3% reported both incoming and outgoing diversion, with rates increasing with age. The highest rate of any lifetime diversion ($6.6 + 3.1 + 7.6\% = 17.4\%$) was among 16–18 year old rural youth.

DISCUSSION

Assessing the stimulant use from teens and preteens presents challenges around definitions, sampling, and validity. This is the first US national study that

Table 3. Descriptive characteristics of N-MAPSS sample residential area and age ($n = 11\,048$)

	Rural						Suburban						Urban							
	10–12 ($n = 211$)		13–15 ($n = 622$)		16–18 ($n = 836$)		10–12 ($n = 553$)		13–15 ($n = 1635$)		16–18 ($n = 1935$)		10–12 ($n = 642$)		13–15 ($n = 2126$)		16–18 ($n = 2488$)		Total ($n = 11\,048$)	
	n	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%
Sex (male)	110	52.1	265	42.6	410	49.0	238	43.0	730	44.7	980	50.7	313	48.8	977	46.0	1260	50.6	5283	47.8
Race/ethnicity																				
Caucasian	120	57.7	441	71.2	603	72.6	234	42.8	805	49.4	885	45.8	185	29.0	662	31.4	780	31.5	4715	42.9
African-American	25	12.0	44	7.1	69	8.3	102	18.6	207	12.7	292	15.1	228	35.7	478	22.7	741	30.0	2186	19.9
Asian	7	3.4	29	4.7	21	2.5	57	10.4	130	8.0	183	9.5	41	6.4	195	9.2	192	7.8	855	7.8
Hispanic/Latino	25	12.0	52	8.4	72	8.7	101	18.5	292	17.9	357	18.5	125	19.6	502	23.8	500	20.2	2026	18.4
Other	31	14.9	53	8.6	66	7.9	53	9.7	195	12.0	214	11.1	60	9.4	273	12.9	260	10.5	1205	11.0
Live w mom and dad	145	68.7	411	66.1	514	61.6	345	62.4	951	58.2	1068	55.2	341	53.1	1167	54.9	1194	48.0	6136	55.6
Level of general health																				
Excellent	109	51.7	286	46.1	378	45.2	259	46.9	736	45.2	782	40.5	322	50.2	953	44.9	991	39.9	4816	43.7
Good	84	39.8	281	45.3	375	44.9	251	45.5	718	44.1	924	47.8	283	44.1	951	44.8	1140	45.9	5007	45.4
Fair/poor	18	8.5	53	8.5	83	9.9	42	7.6	174	10.7	226	11.7	37	5.8	219	10.3	353	14.2	1205	10.9
Has a job	6	2.8	84	13.5	427	51.1	36	6.5	229	14.0	810	41.9	38	5.9	320	15.1	950	38.3	2900	26.3
Has a debit card	7	3.3	68	11.0	376	45.0	20	3.6	182	11.2	765	39.6	26	4.1	262	12.4	943	38.1	2649	24.1
Think Rx stimulants are moderate-to-large problem	93	44.7	399	64.8	582	70.4	245	44.7	984	60.7	1341	70.0	320	50.6	1319	62.9	1617	65.7	6900	63.2
Ever drank alcohol	7	3.3	242	39.2	549	66.4	40	7.3	624	38.5	1236	64.3	37	5.8	770	36.6	1461	59.2	4966	45.3
Lifetime Rx stimulant use	16	7.6	94	15.1	206	24.8	56	10.1	202	12.4	374	19.5	55	8.6	230	10.9	399	16.1	1632	14.8

monitored preteen and teenage use, NMU, and diversion of prescription stimulants, using photo cards with and without brand names, and multiple questions to assess NMU and medical use. N-MAPSS employed an innovative sampling technique of recruiting respondents and conducting surveys in popular youth-oriented entertainment venues that helped overcome the limitations of school-based sampling, such as home-schooled adolescents, school drop-outs, and other selective absenteeism [25]. By conducting a recruiter interviewer's paper-based survey, and not a web-based one, there was the ability to validate the approximate age of our participants, unlike other studies recently completed [9,26,27].

Also, unlike other surveys, N-MAPSS focused primarily on prescription stimulants and collected brand-level information with photos of each drug. Specifically, five stimulants were focused on and eight questions were asked per drug which allowed the assessment of medical as well as the NMU of each stimulant along with subtypes of diversion and other risk factors. This enabled N-MAPSS to be uniquely comprehensive as well as exhaustive in assessing prescription stimulant use. Other information, not the focus of this review, such as qualitative data on what teens think could be done to reduce the NMU of prescription drugs, adds to the study.

The lifetime prevalence of use of prescription stimulants assessed in the N-MAPSS is 14.8%. Learning from the past experience in substance use measurement and prior, albeit limited, prescription stimulant research, and as reported earlier, the N-MAPPS survey asked specific questions for each of five stimulants that allow a distinction to be made between medical use and NMU exclusively. Using this distinction, the rate of last 30-day NMU only was found to be 2.7%. A last month prevalence rate of 3.9% (both medical and nonmedical) was found; most other studies have reported a last 12-month prevalence of under 5% [12,28–30].

The entertainment venue methodology was found to be highly successful as measured in several ways. First, only 10% of eligible youth declined participation – a mark of success at a time when household surveys are experiencing record low response rates [31]. N-MAPSS has a large database of 1406 10–12 year olds, which other studies lack. Second, the rates of self-reported ADD/ADHD, stimulant use, NMU, medical use, school suspension history, and other indicators were consistent across

Table 4. N-MAPSS prevalence of use, misuse, and diversion of Rx stimulants by residential area and age

	Rural						Suburban						Urban							
	10–12 (*n* = 211)		13–15 (*n* = 622)		16–18 (*n* = 836)		10–12 (*n* = 553)		13–15 (*n* = 1635)		16–18 (*n* = 1935)		10–12 (*n* = 642)		13–15 (*n* = 2126)		16–18 (*n* = 2488)		Total (*n* = 11 048)	
	n	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%
Rx stimulant use in the last 30 days																				
No Rx stimulant use	194	94.6	527	92.0	626	87.2	497	94.1	1425	93.4	1548	90.2	582	94.3	1884	95.6	2080	92.6	9363	92.7
Nonmedical use only	0	0.0	17	3.0	38	5.3	3	0.6	22	1.4	77	4.5	9	1.5	27	1.4	81	3.6	274	2.7
Medical use only	10	4.9	24	4.2	41	5.7	27	5.1	69	4.5	57	3.3	23	3.7	45	2.3	50	2.2	346	3.4
Both	1	0.5	5	0.9	13	1.8	1	0.2	10	0.7	35	2.0	3	0.5	14	0.7	36	1.6	118	1.2
Approached to divert[a]	2	1.0	66	10.7	152	18.4	42	7.6	153	9.4	324	16.9	24	3.8	172	8.2	348	14.1	1283	11.7
Asked to sell Rx stimulant	1	0.5	39	6.3	85	10.3	31	5.6	79	4.9	204	10.6	16	2.5	100	4.7	181	7.3	736	6.7
Asked to give Rx stimulant	2	1.0	53	8.6	120	14.5	29	5.3	109	6.7	241	12.6	20	3.2	112	5.3	273	11.1	959	8.8
Asked to trade Rx stimulant	2	1.0	28	4.5	63	7.6	22	4.0	45	2.8	131	6.8	10	1.6	54	2.6	153	6.2	508	4.6
Outgoing diversion[a]	2	1.0	40	6.5	89	10.8	22	4.0	70	4.3	184	9.6	15	2.4	90	4.3	201	8.1	713	6.5
Sold Rx stimulant	0	0.0	16	2.6	49	5.9	5	0.9	26	1.6	94	4.9	4	0.6	32	1.5	102	4.1	328	3.0
Gave Rx stimulant	1	0.5	25	4.1	61	7.4	15	2.7	42	2.6	137	7.1	10	1.6	61	2.9	147	6.0	499	4.6
Trade Rx stimulant	0	0.0	14	2.3	45	5.4	6	1.1	21	1.3	78	4.1	2	0.3	20	0.9	77	3.1	263	2.4
Had Rx stimulant stolen	1	0.5	17	2.8	24	2.9	11	2.0	18	1.1	39	2.0	5	0.8	22	1.0	43	1.7	180	1.6
Incoming diversion[a]	5	2.4	48	7.8	118	14.2	27	4.9	101	6.2	266	13.8	15	2.4	140	6.6	287	11.6	1007	9.2
Stolen Rx stimulant	0	0.0	14	2.3	29	3.5	5	0.9	25	1.5	62	3.2	4	0.6	22	1.0	69	2.8	230	2.1
Got Rx stimulant for free	2	1.0	27	4.4	99	12.0	24	4.3	65	4.0	217	11.3	10	1.6	90	4.3	235	9.5	769	7.0
Borrowed Rx stimulant	3	1.4	27	4.4	47	5.7	10	1.8	48	3.0	115	6.0	11	1.7	80	3.8	123	5.0	464	4.2
Lifetime diversion[b]																				
None	203	97.1	552	89.5	684	82.6	512	92.8	1492	92.0	1601	83.3	604	96.2	1932	91.7	2120	85.9	9700	88.6
Incoming diversion only	4	1.9	25	4.1	55	6.6	18	3.3	59	3.6	136	7.1	9	1.4	85	4.0	148	6.0	539	4.9
Outgoing diversion only	1	0.5	17	2.8	26	3.1	13	2.4	28	1.7	54	2.8	9	1.4	35	1.7	62	2.5	245	2.2
Both incoming and outgoing diversion	1	0.5	23	3.7	63	7.6	9	1.6	42	2.6	130	6.8	6	1.0	55	2.6	139	5.6	468	4.3

N-MAPSS, National Monitoring of Adolescent Prescription Stimulants Study.
[a]Any type.
[b]Incoming or outgoing.

four cross-sections. Third, when the age, sex, race, and urban/rural composition of the 11 048 youth in the 10 N-MAPSS cities were compared with that of the 2010 US Census for each of the cities, the sample was found to be highly representative, though there were slightly fewer men, Hispanics, and African-Americans in several cities. Fourth, this method, modeled on the venue–time sampling method, allowed us to recruit a large number of youth in a relatively short period without the need for parental approval [15,19].

CONCLUSION

The N-MAPSS survey was launched in view of the limitations imposed by variable methodology, definition, and measurement in the understanding

of prescription stimulant use and misuse. The utilization of innovative methods to best recruit and survey youth based on ZIP codes across ten cities in the USA led to the comprehensive assessment of a nationally representative sample of youth. Additionally, inclusion of youth not reachable through conventional methods of school based or telephone surveys was possible. The last 30-day prevalence rate for NMU as assessed in the N-MAPSS was 3.9% overall (1.2 plus 2.7%).

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None.

Editor's note

This article explores a rapidly emerging subject of concern in the substance-use field, namely the use of prescribed medications wherein there is no appropriate medical indication. There has been worldwide concern about the increase in prescriptions for various opioid-analgesics and sedative-hypnotics. This article examines the misuse of prescription stimulant use and includes some original data from recent surveys to complement the literature review undertaken by the authors. We hope this rather novel combination will be of interest and value to our readers.

Conflicts of interest

N-MAPSS was implemented by Washington University in St Louis and University of Florida under contract from Pinney Associates, Inc., with funding provided by Shire Development LLC and Noven Therapeutics.

REFERENCES AND RECOMMENDED READING

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