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ORIGINAL REPORT

Prescription and non-prescription analgesic use among the US adult population: results from the third National Health and Nutrition Examination Survey (NHANES III)†

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SUMMARY

Purpose To estimate prescription and non-prescription analgesic use in a nationally representative sample of US adults.
Methods Data collected during the third National Health and Nutrition Examination Survey (1988–1994), for persons 17 years and older were analyzed ($n = 20\,050$). During the household interview, respondents reported use, in the last month, of prescription and non-prescription analgesics.
Results An estimated 147 million adults reported monthly analgesic use, Prescription analgesic use was 9% while non-prescription use was 76%. Females were more likely than males to use prescription (11 vs. 7%, $p < 0.001$) and non-prescription (81 vs. 71%, $p < 0.001$) analgesics. Across race–ethnicity groups, males ($\sim$8%) and females (11–13%) had similar age-adjusted prescription analgesic use. Non-prescription analgesic use was higher among non-Hispanic whites than non-Hispanic blacks and Mexican–Americans for males (76 vs. 53% ($p < 0.001$) and 59% ($p < 0.001$), respectively) and females (85 vs. 68% ($p < 0.001$) and 71% ($p < 0.001$), respectively). With increasing age, prescription analgesic use increased whereas non-prescription use decreased. Approximately 30% of adults used multiple analgesics during a 1-month period. This was more common among females (35%) than males (25%, $p < 0.001$) and among younger (17–44 years, 33%) rather than older age groups (45+ years, 26%, $p < 0.001$).
Conclusions Analgesic use among US adults is extremely high, specifically of non-prescription analgesics. Given this, health care providers and consumers should be aware of potential adverse effects and monitor use closely. Published in 2002 by John Wiley & Sons, Ltd.

KEY WORDS — analgesics; NSAIDs; opiates; aspirin; acetaminophen; ibuprofen; US prevalence estimates; NHANES III; medication use

INTRODUCTION

Worldwide, oral analgesics are among the most widely used medications with prevalences of use ranging from 7 to 35% in different countries.[1–4] The analgesic drug class includes (1) para-aminophenol derivatives (acetaminophen), (2) non-steroidal anti-inflammatory drugs (NSAIDs; salicylates (e.g. aspirin) and other organic acids (e.g. ibuprofen and piroxicam)), and (3) opiates (e.g. codeine and propoxyphene). Analgesics are most commonly used for pain relief. Certain analgesics, such as aspirin, may also provide beneficial cardiovascular and cerebrovascular effects, while others provide anti-inflammatory and antipyretic effects.

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Used appropriately, analgesics are generally safe and effective. However, there is potential for serious adverse results including gastrointestinal (GI),[5–9] renal,[10–12] hepatic,[13–15] cardiovascular,[16,17] and respiratory effects.[18–20] Older persons, a growing subgroup of the US population, are particularly susceptible to such effects.[21–23]

Analgesic use in the US has been examined in previous studies. Most of these have focused on specific populations (e.g. the elderly),[24–27] certain drug classes (e.g. NSAIDs or aspirin),[28,29] or the analysis of potential risks (e.g. GI or renal effects). However, the prevalence of prescription and non-prescription analgesic use, overall and for specific subgroups in the US has not been well defined.

Given the widespread availability of over-the-counter (OTC) analgesics, the risks associated with analgesic use, and the limited knowledge of analgesic risks by users,[30] a detailed examination of US prescription and non-prescription analgesic use is needed to provide accurate prevalence estimates for public health planning and for tracking changes in patterns of use across the population over time. Using nationally representative data (NHANES III), this study reports population-based age-, sex- and race–ethnicity-specific prevalence estimates of prescription and non-prescription analgesic use among US adults.

METHODS

Sample

The NHANES III was a cross-sectional survey conducted between October 1988 and October 1994 by the National Center for Health Statistics of the Centers for Disease Control and Prevention. A multistage, stratified probability cluster design was used to select a sample representative of the civilian, non-institutionalized population, aged 2 months and older, residing in the 50 States of the United States. Children younger than 5 years, adults aged 60 years and older, and black and Mexican–American persons were over-sampled to improve the precision of estimates for these subgroups. The NHANES III plan of operation and sample design has been described in detail elsewhere.[31]

Of those eligible to participate in NHANES III, 33 994 infants, children, adolescents and adults received the household interview (86%). Although prescription medication use was obtained on all participants, questions regarding non-prescription analgesic use were limited to those aged 17 years and older. As a result, all analyses for this study were conducted on the sample of persons who were aged 17 years and older at the time of the interview ($n = 20\,050$). Less than 1.4% of this sample had missing or unknown responses for the prescription medication ($n = 36$) or any of the four non-prescription analgesic ($n \leq 273$) use questions.

Drug use data collection

Prescription drug data. During an in-person household interview, respondents were asked: 'Have you taken or used any medicines for which a doctor's or dentist's prescription is needed, in the past month?' For each medication reported, the interviewer asked to see the medication container to record the product name. If the container was unavailable, the interviewer probed the subject for this information. Participants were also asked how long they had been taking the prescription medication. No information was collected on drug dosage or daily or monthly frequency of use of reported prescription medications.

Each prescription drug reported in the survey was subsequently identified in the Physicians' GenRx,[32] and assigned a standard generic name and 4-digit generic code for that product. In this study, we applied the American Hospital Formulary Service® (AHFS)[33] Pharmacologic Therapeutic Classification System© for categorizing all prescription analgesics. This system classifies drugs based on the drug's activity and primary indication. Based on the AHFS, each prescription analgesic was assigned to one of the following therapeutic drug categories: Non-Steroidal Anti-Inflammatory Drugs (NSAIDs; AHFS Drug Code: 28:08:04), Opiate Agonists (28:08:08), Opiate Partial Agonists (28:08:12), and Miscellaneous Analgesics and Antipyretics (28:08:92). Combination drugs were assigned to a category based on the principal analgesic ingredient in the product (i.e. an opiate agonist, NSAID, or acetaminophen). Any combination drug containing an opiate agonist plus an NSAID or acetaminophen was categorized as an opiate agonist. Due to the small number of persons reporting opiate partial agonist use, these drugs were reassigned to the opiate agonist drug category.

For analysis purposes dichotomous variables were created to record participants' use or non-use of a prescription analgesic within an AHFS therapeutic class. These variables were then summarized for each person to create a person-level file that identified the total number and the use of any prescription analgesics within each of the above-identified analgesic drug classes.

Due to limited sample sizes, estimates for miscellaneous analgesics are not provided separately but

miscellaneous analgesics are included in total estimates for all prescription analgesics.

Non-prescription drug data. During the household interview, respondents aged 17 years and older were asked about their use of specific non-prescription pain relief medicines commonly available during the time of the survey: 'In the past month, have you taken any (1) aspirin, Anacin, Bufferin, Ecotrin, Ascriptin or Midol, (2) ibuprofen, Advil, Nuprin or Medipren, (3) acetaminophen, Tylenol, or Anacin-3 or (4) any other non-prescription pain medication. Participants were allowed to report up to four additional non-prescription analgesics. These 'other' responses were subsequently classified into one of eight product-type categories that included several non-analgesics. In this study, only the following four analgesic categories were defined as 'other' and included in the analyses: (1) other ingested pain medication, (2) topical pain medication, (3) cold, cough, flu, sinus or allergy medication with pain reliever(s), and (4) any other cold, cough, flu, sinus or allergy medication with pain reliever(s). The other ingested pain category included aspirin- or acetaminophen-containing products not reported earlier and aspirin and acetaminophen drug combinations (e.g. Excedrin Extra Strength). Survey participants were defined as a non-prescription analgesic user if they reported the use of aspirin, ibuprofen, acetaminophen, or any other non-prescription pain medication in the past month. Participants also reported how often they had taken the non-prescription pain relief medication in the past month.

Demographic factors

Age was reported at interview as the respondent's age in years at last birthday. Gender was recorded as observed by the interviewer. Self-reported race and ethnicities were recoded to four race-ethnicity groups: non-Hispanic white, non-Hispanic black, Mexican–American, and other. Due to limited sample size, estimates for persons from other race-ethnicity groups are not provided separately but members of this group are included in total estimates.

Statistical analysis

Statistical analyses were conducted using SAS[34] and SUDAAN.[35] Survey sample weights that accounted for the complex survey design were used to produce estimates representative of the non-institutionalized civilian US population. SUDAAN, a statistical software program that incorporates the sample weights and adjusts for the complex survey design, was used to calculate variance estimates. All SUDAAN analyses used the total 6-year interview weights. All estimates provided here are 1-month period prevalences. Age-adjusted prevalence estimates were calculated using the direct method and were adjusted to the age distribution of the 2000 US Bureau of the Census population.[36]

In this study, the average design effect was used to determine the minimum sample size needed to reliably estimate means and percentiles.[31] If an estimate is based on a sample size of less than 30 times the average design effect or has a coefficient of variation that is greater than 30%, it is marked with an asterisk, which signifies that the estimate may potentially be statistically unreliable.

For statistical comparison between groups, chi-square tests were used to analyze categorical data. Student's *t*-tests were used to analyze continuous data. Differences were tested using an α level of 0.05.

RESULTS

Demographics

Demographic characteristics of persons 17 years of age and older in the US are presented in Table 1. Fifty-three percent were female, 11% were non-Hispanic black, and 5% were Mexican–American. Approximately 13% were living below the federal poverty level and 13% had no health insurance coverage. The mean years of education was 13 years (range: 0–17 years; standard error (SE): 0.13) and the mean age was 43 years (range: 17–90+; SE: 0.40).

Non-prescription analgesic use prevalence by sex and age

Approximately 76% of the US population aged 17 years and older reported non-prescription analgesic use during the month prior to the household interview (Table 2). Females were more likely to use non-prescription analgesics than males (81 vs. 71%, respectively, $p < 0.001$). This difference between females and males persisted across all age groups ($p < 0.05$) although it did not reach statistical significance for the 75+ years age group. Males tended to use more aspirin (40%) than acetaminophen (33%) whereas females had a higher prevalence of acetaminophen (45%) than aspirin (36%) use. Ibuprofen and other non-prescription analgesic use was lower for both males and females.

The relationship between age and non-prescription analgesic use differed by the type of analgesic taken.

Table 1. Sample sizes, population estimates, and sociodemographic characteristics by gender (ages ≥ 17 years): United States, 1988–1994

	Male			Female		
	Number interviewed	Percentage* (weighted)	Population estimate,† thousands	Number interviewed	Percentage* (weighted)	Population estimate,† thousands
Total	9401	100.0	89 638	10 649	100.0	98 010
Age groups (years)						
17–24	1506	16.3	14 576	1660	15.3	15 024
25–44	3275	44.8	40 128	3822	42.7	41 817
45–64	2175	24.9	22 296	2360	24.3	23 797
65–74	1237	9.2	8200	1305	10.1	9924
75 and over	1208	5.0	4438	1502	7.6	7448
Race/ethnicity group						
Non-Hispanic white	3879	76.3	68 376	4604	75.8	74 253
Non-Hispanic black	2503	10.4	9347	2983	11.9	11 650
Mexican–American	2682	5.7	5128	2624	4.8	4700
Below poverty level	1764	10.8	8974	2464	14.7	13 212
Uninsured	1649	14.4	12 465	1631	11.5	10 962
Education completed						
0–8 years	2424	11.5	10 196	2363	11.4	11 066
9–11 years	1773	16.2	14 351	1956	14.7	14 335
12 years	2519	30.7	27 302	3435	36.5	35 509
13 or more years	2568	41.6	36 975	2789	37.4	36 346

*Percentages were calculated with survey sample weights.
†Estimates based on 2000 US Bureau of Census population.

Acetaminophen and ibuprofen use appears to be greatest among younger age groups (17–44 years of age), while aspirin use was more prevalent among older age groups (45+ years), for both males ($p < 0.001$) and females $p < 0.001$).

Among non-prescription acetaminophen or ibuprofen users, the median days of use per month was approximately 3 days (interquartile range (IQR): 1–8 days). Among aspirin users, the median days of use was 4 days (IQR: 2–15 days).

Use of non-prescription analgesics for less than half the month (1–14 days/month) was more common than use for 15 days or more, for acetaminophen (Table 3; 34 vs. 5%), aspirin (27 vs. 10%) and ibuprofen (21 vs. 3%). Acetaminophen and ibuprofen use for more than half the month was more common among females

Table 2. Prevalence of non-prescription analgesic use in the past month by sex and age: United States, 1988–1994*

Sex	Any analgesic		Acetaminophen		Aspirin		Ibuprofen		Other analgesic†	
Age (years)	%	(95% CI)‡	%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)
Total	76.2	(75.2–77.2)	39.2	(37.6–40.8)	37.6	(35.8–39.4)	24.2	(22.8–25.6)	6.4	(5.8–7.0)
Males										
Total	71.4	(69.8–73.0)	33.1	(31.5–34.7)	39.7	(37.3–42.1)	19.0	(17.4–20.6)	5.8	(5.0–6.6)
17–24	65.2	(60.5–69.9)	33.8	(29.5–38.1)	36.1	(31.6–40.6)	20.1	(16.2–24.0)	6.5	(4.0–9.0)
25–44	74.0	(71.8–76.2)	38.9	(36.4–41.4)	36.5	(33.0–40.0)	22.4	(20.0–24.8)	7.1	(5.7–8.5)
45–64	72.0	(69.5–74.5)	26.6	(23.9–29.3)	43.7	(40.6–46.8)	17.5	(14.8–20.2)	4.5	(3.1–5.9)
65–74	70.2	(66.9–73.5)	23.3	(20.2–26.4)	49.1	(45.4–52.8)	11.5	(9.0–14.0)	3.8	(2.6–5.0)
75+	66.1	(62.0–70.2)	28.2	(24.1–32.3)	43.9	(39.8–48.0)	6.9	(4.9–8.9)	3.3	(1.9–4.7)
Females										
Total	80.7	(79.5–81.9)	44.8	(42.6–47.0)	35.6	(33.4–37.8)	28.9	(27.3–30.5)	7.0	(6.2–7.8)
17–24	78.9	(75.8–82.0)	50.5	(45.4–55.6)	34.6	(30.7–38.5)	36.3	(33.8–38.8)	6.9	(5.1–8.7)
25–44	84.1	(82.3–85.9)	48.9	(46.5–51.3)	32.8	(29.9–35.7)	35.1	(32.2–38.0)	7.6	(6.2–9.0)
45–64	80.4	(78.8–82.0)	42.3	(39.0–45.6)	36.4	(33.1–39.7)	24.8	(22.4–27.2)	7.7	(6.3–9.1)
65–74	76.6	(73.1–80.1)	32.3	(29.0–35.6)	42.4	(39.3–45.5)	15.9	(13.4–18.4)	5.2	(3.6–6.8)
75+	71.5	(68.6–74.4)	34.0	(30.7–37.3)	41.4	(37.9–44.9)	9.8	(7.4–12.2)	3.7	(2.1–5.3)

*Totals, percentages and standard errors based on survey sample weights.
†Use of any of the following in the past month: cold/flu medicine with pain reliever, other ingested pain medicine or, topical pain medicine.
‡Confidence interval.

Table 3. Prevalence of non-prescription analgesic use by the number of days of use in the past month, by gender and age group: United States, 1988–1994*

	Acetaminophen				Aspirin				Ibuprofen			
	1–14 days		15–30 days		1–14 days		15–30 days		1–14 days		15–30 days	
Sex Age (years)	%	(95% CI)†	%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)
Total	33.5	(31.9–35.1)	5.3	(4.7–5.9)	27.4	(25.6–29.2)	9.8	(9.0–10.6)	20.9	(19.7–22.1)	3.1	(2.5–3.7)
Male												
Total	29.2	(27.6–30.8)	3.6	(3.0–4.2)	28.4	(26.3–30.6)	10.8	(9.6–12.0)	16.6	(15.2–18.0)	2.3	(1.7–2.9)
17–24	32.6	(28.5–36.7)	1.2‡	(0.4–2.0)	34.5	(29.8–39.2)	1.5	(0.7–2.2)	19.0	(15.1–22.9)	1.1‡	(0.1–2.1)
25–44	35.5	(33.1–37.8)	3.1	(2.3–3.9)	30.4	(27.2–33.5)	5.9	(4.3–7.5)	20.0	(17.6–22.3)	2.3	(1.3–3.3)
45–64	22.1	(19.2–25.0)	4.2	(2.9–5.6)	26.3	(23.1–29.4)	16.7	(14.6–18.9)	14.6	(11.9–17.4)	2.7	(1.7–3.7)
65+	17.7	(15.5–19.8)	6.8	(5.0–8.6)	19.0	(16.7–21.4)	26.5	(24.0–29.1)	6.7	(5.1–8.3)	3.2	(2.2–4.2)
Female												
Total	37.5	(35.6–39.5)	6.8	(6.3–7.4)	26.4	(24.5–28.4)	8.9	(7.9–9.8)	24.9	(23.5–26.2)	3.8	(3.2–4.3)
17–24	47.6	(43.1–52.1)	2.2	(0.8–3.6)	32.1	(28.2–36.0)	2.3	(1.4–3.3)	35.3	(32.5–38.0)	1.1	(0.5–1.6)
25–44	42.7	(40.6–44.9)	6.1	(4.7–7.5)	28.1	(25.0–31.3)	4.6	(3.6–5.6)	30.8	(28.1–33.6)	3.7	(2.8–4.7)
45–64	33.0	(29.6–36.3)	9.0	(7.6–10.4)	24.9	(22.6–27.3)	11.1	(8.9–13.2)	19.5	(17.1–21.8)	5.2	(4.2–6.2)
65+	22.6	(20.0–25.1)	9.7	(8.5–10.9)	19.5	(17.1–21.8)	21.7	(19.5–23.8)	8.8	(7.2–10.4)	4.2	(3.2–5.2)

*Percentages and standard errors are based on survey sample design and weights.
†Confidence interval.
‡Estimate is potentially unreliable due to large coefficient of variation.

(7 and 4%, respectively) than males (4% ($p < 0.001$) and 2% ($p < 0.001$), respectively). However, the opposite was true for more frequent aspirin use (females 9% vs. males 11%, $p < 0.01$). With increasing age acetaminophen and aspirin tended to be used for more than half the month. Among persons aged 65 years and older, about one out of four males and one out of five females reported aspirin use for more than half of the days in a month.

Prescription analgesic use prevalence by sex and age

Prescription analgesic use was less prevalent than non-prescription analgesic use with approximately a 9% monthly prevalence of use among the adult US population (Table 4). Females had a slightly higher prevalence of use (11%) compared to males (7%; $p < 0.001$). Prescription NSAID use was more common than opiate use for both males (5 vs. 3%, respectively) and females (8 vs. 4%, respectively).

Increasing age was positively related to prescription analgesic use for both males and females for prescription NSAIDs and opiates (Table 4). The prevalence of opiate use was however, generally similar across age groups for males and females (2 to 4%). The exception was women aged 75 years and older who had the greatest prevalence of opiate use (7%), with more than twice the frequency of the 65, 74 year age group (3%; $p < 0.001$) and three times that of the youngest age group (2%; $p < 0.001$).

Among prescription NSAID users, ibuprofen (30%) and naproxen (25%) were the most commonly reported prescription NSAIDs (Table 5). Among opiate users, drug products containing codeine and acetaminophen (28%) and propoxyphene and acetaminophen (24%) were most frequently used.

The median number of days of prescription NSAID use reported by prescription NSAID users was approximately 1 year (340 days, 95% CI: 293–387 days). Twenty-five percent reported use for more than almost 3 years (1039 days, 95% CI: 888–1190 days) and 10% for greater than 6 years (2379 days, 95% CI: 1428–3330 days). Duration of use was similar across the top four most frequently used NSAIDs.

The median number of days of use of codeine or codeine derivatives (e.g. hydrocodone and oxycodone) was about 1 month (27 days, 95% CI: 9–45 days). However, 25% of codeine users reported use for more than approximately 1 year (348 days, 95% CI: 121–575 days) and 10% for greater than 5 years (1668 days, 95% CI: 1043–2293 days). The median days of use of propoxyphene or propoxyphene-containing drugs was approximately 5 months (150 days, 95% CI: 9–291 days), with 25% of propoxyphene users reporting use for more than about 2 years (672 days, 95% CI: 296–1048 days) and

Table 4. Prevalence of prescription analgesic use in the past month by sex and age: United States, 1988–1994*

Sex	Any analgesic†		NSAID‡		Opiate analgesic§	
Age (years)	%	(95% CI)‖	%	(95% CI)	%	(95% CI)
Total	9.3	(8.5–10.1)	6.4	(5.8–7.0)	3.4	(3.0–3.8)
Males						
Total	7.1	(6.3–7.9)	4.7	(4.1–5.3)	3.0	(2.4–3.6)
17–24	3.6	(2.4–4.8)	1.6	(1.0–2.2)	1.9	(0.7–3.1)
25–44	5.9	(4.5–7.3)	3.6	(2.6–4.6)	3.0	(2.2–3.8)
45–64	9.3	(7.7–10.9)	6.4	(5.2–7.6)	3.4	(2.2–4.6)
65–74	10.4	(8.2–12.6)	8.1	(6.3–9.9)	2.8	(1.6–4.0)
75+	12.5	(9.8–15.2)	9.1	(7.1–11.1)	4.2	(2.2–6.2)
Females						
Total	11.3	(10.3–12.3)	8.0	(7.0–9.0)	3.7	(3.3–4.1)
17–24	5.9	(4.3–7.5)	3.8	(2.6–5.0)	2.1	(1.3–2.9)
25–44	10.0	(8.2–11.8)	6.1	(4.5–7.7)	4.0	(3.2–4.8)
45–64	13.9	(11.9–15.9)	10.8	(9.0–12.6)	3.6	(2.4–4.8)
65–74	14.4	(12.2–16.6)	13.0	(10.8–15.2)	2.9	(1.7–4.1)
75+	16.5	(14.0–19.0)	12.2	(9.8–14.6)	6.6	(5.0–8.2)

*Totals, percentages and standard errors based on survey sample weights.
†Includes data for miscellaneous analgesic drug class not shown separately.
‡Non-steroid anti-inflammatory drugs. Includes non-aspirin NSAIDs, aspirin, and drug combinations containing aspirin.
§Includes opiate agonists, drug combinations containing opiate agonists, opiate partials agonists, and drug combinations containing opiate partial agonists.
‖ Confidence interval.

Table 5. Top four most frequently used prescription NSAIDs and opiate analgesics in the past month: United States, 1988–1994*

Drug Class Generic Drug Name	Percentage of sample (weighted) (95% CI†)	Percentage of drug class users (95% CI)
NSAIDs	**6.4 (5.8–7.1)**	
Ibuprofen	1.9 (1.5–2.3)	29.7 (25.1–34.3)
Naproxen‡	1.6 (1.4–1.9)	25.4 (22.2–28.6)
Diclofenac sodium	0.56 (0.40–0.72)	8.7 (6.6–10.8)
Piroxicam	0.47 (0.31–0.63)	7.3 (5.1–9.6)
Opiate agonists§	**3.34 (2.95–3.73)**	
Codeine phosphate w/acetaminophen	0.95 (0.73–1.17)	28.4 (22.6–34.2)
Propoxyphene‖ w/acetaminophen	0.79 (0.61–0.97)	23.7 (19.5–28.0)
Hydrocodone bitartrate w/acetaminophen	0.54 (0.36–0.72)	16.2 (11.7–20.8)
Propoxyphene‖	0.32 (0.20–0.44)	9.5 (6.2–12.9)

*Percentages and standard errors are based on survey sample design and weights.
†Confidence interval.
‡Includes naproxen and naproxen sodium.
§Includes opiate partial agonists.
‖Includes propoxyphene hydrochloride and propoxyphene napsylate.

10% for more than 7 years (2528 days, 95% CI: 786–4270).

Analgesic use prevalence by sex and race–ethnicity

After adjusting for age, race–ethnicity was found to be significantly associated with non-prescription but not with prescription analgesic use. Non-prescription analgesic use was more prevalent among non-Hispanic whites than non-Hispanic blacks and Mexican–Americans, for males (Table 6; 76 vs. 53% ($p < 0.001$) and 59% ($p < 0.001$), respectively) and females (85 vs. 68% ($p < 0.001$) and 71% ($p < 0.001$), respectively). Across all race–ethnicity groups, males had a lower prevalence of use compared to females for non-prescription and prescription analgesics ($p < 0.001$).

Table 6. Age-adjusted prevalence of non-presription and prescription analgesic use by race–ethnicity: United States, 1988–1994*

Sex	Non-prescription analgesic use		Prescription analgesic use	
Race–ethnicity	%	(95% CI)†	%	(95% CI)
Total	76.2	(75.2–77.2)	9.3	(8.5–10.1)
Male				
All races	71.4	(69.8–73.0)	7.1	(6.3–7.9)
Non-Hispanic white	75.7	(73.9–77.5)	7.6	(6.6–8.6)
Non-Hispanic black	52.5	(49.8–55.2)	7.9	(6.9–8.9)
Mexican–American	59.3	(56.4–62.2)	7.9	(6.3–9.5)
Female				
All races	80.7	(79.5–81.9)	11.3	(10.3–12.3)
Non-Hispanic white	84.5	(83.1–85.9)	11.6	(10.4–12.8)
Non-Hispanic black	68.1	(65.6–70.6)	13.5	(11.7–15.3)
Mexican–American	71.1	(68.7–73.5)	11.2	(9.4–13.0)

*All percentages and standard errors are based on survey sample design and weights.
†Confidence interval.

Multiple analgesic use by age and sex

Almost half of the US adult population, males and females alike, used a single analgesic (prescription or non-prescription) during a 1-month period (Table 7). However, an additional 22% reported using two and 8% used three or more. Multiple analgesic users were more likely to use two non-prescription analgesics, such as aspirin and ibuprofen (26%), aspirin and acetaminophen (24%), or acetaminophen and ibuprofen (16%). One out of six multiple analgesic users were using non-prescription analgesics for 15 days or more per month (95% CI: 16–18%). Multiple analgesic use was more prevalent among females (35%) than males (25%, $p < 0.001$) and among persons 17–44 years of age (33%) rather than persons 45 years and older (26%, $p < 0.001$). The greatest use of multiple analgesics was observed among young women aged 17 to 24 years (41%), followed by women aged 25 to 44 years (37%).

COMMENTS

US national data on analgesic use

To our knowledge, this is the first published data on prescription and non-prescription analgesic use, overall and for specific subgroups, in a nationally representative sample of the US population. These data indicate that a substantial number of American adults use oral analgesics on a monthly basis.

Table 7. Prevalence of non-prescription and prescription analgesic use combined during the past month by age, sex and number used: United States, 1988–1994*

Sex	No analgesic use		One analgesic		Two analgesics		Three+ analgesics	
Age (years)	%	(95% CI)†	%	(95% CI)	%	(95% CI)	%	(95% CI)
Total	21.7	(20.9–22.5)	48.2	(47.1–49.3)	22.0	(21.2–22.8)	8.1	(7.4–8.8)
Males								
Total	26.9	(25.5–28.3)	48.0	(46.5–49.5)	18.7	(17.4–20.0)	6.4	(5.3–7.5)
17–24	34.2	(29.5–38.9)	39.7	(34.7–44.7)	18.3	(14.8–21.8)	7.7	(3.9–11.5)
25–44	24.8	(22.5–27.1)	47.5	(44.9–50.1)	20.1	(18.0–22.2)	7.6	(6.0–9.2)
45–64	25.3	(23.0–27.6)	52.7	(49.5–55.9)	17.0	(14.7–19.3)	5.0	(3.4–6.6)
65–74	27.2	(23.8–30.6)	51.8	(48.6–55.0)	17.3	(14.7–19.9)	3.8	(2.7–4.9)
75+	29.8	(26.0–33.6)	49.9	(45.6–54.2)	17.3	(13.2–21.4)	3.1	(1.6–4.6)
Females								
Total	16.9	(15.7–18.1)	48.4	(46.9–49.9)	25.0	(23.7–26.3)	9.7	(8.7–10.7)
17–24	20.4	(17.4–23.4)	39.0	(36.1–41.9)	27.1	(23.7–30.5)	13.5	(10.6–16.4)
25–44	14.5	(12.9–16.1)	48.1	(45.7–50.5)	25.9	(23.9–27.9)	11.5	(10.0–13.0)
45–64	15.9	(14.3–17.5)	51.0	(48.2–53.8)	25.3	(23.1–27.5)	7.7	(6.1–9.3)
65–74	19.0	(16.0–22.0)	55.6	(51.7–59.5)	21.1	(17.8–24.4)	4.3	(3.1–5.5)
75+	23.8	(20.9–26.7)	51.4	(48.2–54.6)	19.5	(17.0–22.0)	5.3	(3.9–6.7)

*Percentages are based on survey sample design and weights.
†95% Confidence interval.

Moreover, the majority of use is of non-prescription analgesics. Increased non-prescription analgesic use may be explained by the wide availability of effective analgesics on a non-prescription basis, by increased marketing, and by the frequent inclusion of analgesic drugs in cough and cold preparations. Currently there are over 170 non-prescription products containing analgesics either alone or in combination with other medications that are available for purchase by the US public.[37] A recently conducted Slone study (1998–1999) that used a telephone survey to examine all medications used in the prior week on a random sample of Americans aged 18 years and older identified acetaminophen, ibuprofen, and aspirin as the top three most commonly used prescription or over-the-counter drugs with a weekly prevalence of use of 23, 17 and 17%, respectively.[38]

This study showed that the majority of American adults who use non-prescription analgesics take them infrequently (for less than half the days in a month). Longer daily use of aspirin was more common than that of acetaminophen or ibuprofen. The 1996 Behavioral Risk Factors Surveillance Survey showed that approximately 25% of Americans aged 35 years and older reported taking aspirin daily or every other day.[39] This study found similar prevalences of use among older persons. Approximately one in four older men and one in five older women used aspirin for more than half the days in a month. In 1988 the Physician's Health Study suggested that aspirin had a cardio-protective effect in healthy people.[28] This factor may explain the more frequent monthly use of aspirin among middle and older age groups. This study could not directly estimate the proportion of aspirin users who were using aspirin for its cardio-protective effects, however we note that 13% of aspirin users and 27% of frequent aspirin users had self-reported cardiovascular disease (self-reported heart attack, stroke, or angina).[40]

Multiple studies have identified an increased risk of acetaminophen-related renal or hepatic toxicity with the ingestion of large or repeated doses of acetaminophen, after recent fasting, or with concurrent alcohol intake.[15,13,10] Although dosage information was not collected in NHANES III, this study showed that approximately 2 million Americans adults (95% CI, 1.5–2.4 million) reported the use of acetaminophen plus an opiate drug combination with acetaminophen within a 1-month period. Additionally, about 17% of these multiple acetaminophen users reported non-prescription acetaminophen use for nearly every day of the month (i.e. 29 or 30 days; SE 3.0). The increased availability of OTC drug combination products containing acetaminophen, of which the public may be unaware, creates a greater potential for the ingestion of larger acetaminophen doses and possible long-term adverse effects.

Prescription analgesic use

While the prevalence of prescription analgesic use was lower than non-prescription analgesic use, a large number of Americans, over 17 million, reported prescription analgesic use during a 1-month period

(95% CI, 16–19 million). The top four most commonly used prescription NSAIDs were the same as those reported in a Dutch population-based study that analyzed pharmacy records.[3] It is not surprising that ibuprofen was the most commonly prescribed prescription NSAID since among non-aspirin NSAIDs (excluding new generation cyclooxygenase-2 (COX-2) inhibitors), it has consistently been shown to have the lowest risk of GI toxicity.[6,7,41–43]

Prevalence of use of specific drugs may change with time and the introduction of newer analgesics to the drug market. The release of low-dose ibuprofen as an OTC product (e.g. Advil, Nuprin, and Medipren) a few years prior to and during the time of the survey may have affected prevalence estimates for prescription and non-prescription ibuprofen. We might also expect changes in naproxen use since its introduction into the US drug market as an OTC medication in 1997. The Slone Survey found that non-prescription naproxen was one of the 40 most commonly used medications with a 1-week prevalence of 3.5%.[38] New COX-2 inhibitors, which were approved by the Food and Drug Administration after 1998, will also affect future prescription and non-prescription NSAID prevalences.

The most frequently used opiates were mild analgesics that are generally used in the relief of mild to moderate pain (codeine and propoxyphene derivatives) and moderate to moderately severe pain (hydrocodone derivatives). Approximately 9% (SE 1.5) of opiate users reported the use of a 'strong opiate' such as morphine, oxycodone, methadone and hydromorphone. The majority of these users were taking the product for less than 3 months (73%, SE 7.3). It is important to recognize that the greatest prevalence of opiate use was among American women aged 75 years and older. Older persons are more sensitive to the analgesic effects of opiates due to physiologic changes that occur with aging. One study has suggested an increased risk of hip fractures in older persons using codeine and propoxyphene.[44] Analgesic use in general also has been associated with falling in elderly women.[45]

According to NSAID product labeling, GI toxicity such as bleeding, ulceration and perforation can occur at any time with chronic NSAID use. Although the assessment of risk associated with long-term use may be limited in the current study due to the lack of information on dose or monthly frequency of use and the identification of continuous long-term users, this study did show that approximately 50% of prescription NSAID users reported some use for more than 1 year and 25% for more than 3 years. It is likely, therefore, that sizeable numbers of NSAID-using American adults are at risk for GI side-effects.

Additionally, the continuous use of codeine or codeine derivatives (hydrocodone and oxycodone) produces tolerance and may lead to physical dependence and abuse.[18,20] Although the median days of use of codeine and codeine derivatives was less than 1 month, this study found high rates of long-term use. Approximately 25% of codeine users were taking these products for more than 1 year and approximately 10% were using for more than 5 years. Long-term use of propoxyphene was also observed, however, its potency is about half that of codeine and it does not have much abuse potential, although some cases of drug dependence have been reported.[46]

Demographic subgroups and analgesic use

Females, as a group, had a higher prevalence of non-prescription and prescription analgesic use than males across all age groups. This gender difference has been reported in several other studies[1,2,25,47,48] and may be explained by the higher prevalence of arthritis among elderly women and analgesic use during menstruation. Increased use of health care services and reporting of pain to physicians by women may also result in increased analgesic prescribing to women.

With increasing age, prescription analgesic use prevalence increased whereas non-prescription analgesic use decreased. Some studies reported similar age effects with prescription analgesic use[1] however, others found no age effect with analgesic use after 20 years of age.[48] Increasing age appears to be directly related to chronic pain and inversely related to acute pain.[27,49] As a result, we might expect to see increased prescription analgesic use and decreased non-prescription analgesic use among the elderly, as observed in the present study. The cross-sectional design of the survey however, precluded an examination of age effects versus cohort effects.

Prescription analgesic use prevalence was similar across race–ethnicity groups. However, non-prescription analgesic use was greater among non-Hispanic whites than non-Hispanic blacks and Mexican–Americans. Race–ethnicity differences with non-prescription analgesic use have been identified in other studies[50,51] and may indicate other differences between race–ethnicity groups such as income and educational levels that need to be further examined.

Study strengths and limitations

Several strengths and limitations of this study should be noted. A major strength of this study

was the use of the NHANES III data, which provided a large, nationally representative sample of the non-institutionalized US population. Further, oversampling of key demographic subsamples such as older persons, non-Hispanic blacks, and Mexican–Americans, which are often underrepresented, increased the precision of estimates for these groups. Additionally, data were collected by trained interviewers, using an in-person, household interview protocol, with verification of reported analgesics with medication containers which eliminates known biases with self-report of medication use. Specific survey questions also allowed the collection of all reported prescription and non-prescription analgesics.

Given the large sample size, it is important to note that even small differences may become statistically significant. Therefore, when considering the clinical importance of these data, it is necessary to consider the effect size. However, since the data are nationally representative even small differences, when extrapolated to the entire US adult population, can represent a large number of adults.

Study limitations include the lack of data on daily analgesic drug dose and daily/monthly frequency of prescription analgesics, which limited any detailed risk assessment associated with analgesic use and specifically with length of prescription analgesic use. Additionally, this study could not differentiate between cardio-prophylactic dose and analgesic dose for non-prescription aspirin users. An understanding of symptomatology or treatment patterns was also not possible due to lack of information on the drug's indication for use.

Direct comparison between the results of this survey and those of other studies is also difficult due to variations in the criteria used to define analgesics, the different types of analgesics included within a drug category and different time frames (past 2 weeks, past month, or past year). It is important to remember that our classification scheme for prescription analgesics counted drug combinations containing aspirin or acetaminophen plus an opiate as an opiate analgesic. Therefore, the prescription NSAID category somewhat underreports the true prevalence of prescription NSAID use in the US. Additionally, differences in non-prescription prevalence estimates between studies may be due to our inclusion of all non-prescription drug products containing analgesic ingredients, such as cold, cough, flu, sinus and allergy medicines, into our computed estimates for non-prescription analgesics. It is also important to note that this study analyzed data collected between 1988 and 1994. Therefore, prevalence estimates are based on drugs available to the US public during this time period. As stated earlier, the introduction of new analgesics into the US drug market and the approval of certain prescription analgesics as OTC products will affect current prevalence estimates of specific drugs and drug classes. These limitations not withstanding, the NHANES III data provide national baseline information on the pattern of prescription and non-prescription analgesic use in the US adult population by analgesic drug classes and sociodemographic factors.

CONCLUSION

In conclusion, this study found a very high prevalence of analgesic use among the US adult population, specifically of non-prescription analgesics. Health care providers may need to be aware of this high OTC analgesic use and question patients regarding prescription and non-prescription analgesic use before prescribing new medications, especially since more analgesics currently exist as OTC products. Many consumers assume OTC products are safe, but without physician supervision, improper use of these drugs could potentially present a serious health risk. Future studies may need to examine the effect of newly approved analgesics on prevalence of use. Further research utilizing drug dosage and frequency of use may also be helpful in identifying persons at high risk for the adverse reactions associated with analgesic use.

KEY POINTS

- Very high prevalence of analgesic use in the US adult population, specifically of non-prescription analgesics
- Prevalence of analgesic use in the US varies by several socio-demographic factors
- High rates of multiple analgesic drug use by females and younger age groups

REFERENCES

1. Antonov KIM, Isacson DGL. Prescription and nonprescription analgesic use in Sweden. *Ann Pharmacother* 1998; **32**: 485–494.
2. Antonov K, Isacson D. Use of analgesics in Sweden—the importance of sociodemographic factors, physical fitness, health and health-related factors, and working conditions. *Soc Sci Med* 1996; **42**: 1473–1481.
3. Leufkens GH, Ameling CB, Hekster YA, Bakker A. Utilization patterns of non-steroidal anti-inflammatory drugs in an open Dutch population. *Pharmaceut Week Sci Ed* 1990; **12**: 97–103.

4. McManus P, Primrose JG, Henry DA, Birkett DJ, Lindner J, Day OR. Pattern of non-steroidal anti-inflammatory drug use in Australia 1990–1994. A report from the Durg Utilization Sub-Committee of the Pharmaceutical Benefits Advisory Committee. *Med J Aust* 1996; **164**: 589–592.
5. Carson JL, Strom BL, Soper KA, West SL, Morse ML. The association of non-steroidal anti-inflammatory drugs with upper gastrointestinal tract bleeding. *Archiv Intern Med* 1987; **147**: 85–88.
6. Griffin MR, Piper JM, Daugherty JR, Snowden M, Ray WA. Nonsteroidal anti-inflammatory drug use and increased risk of peptic ulcer disease in elderly persons. *Ann Intern Med* 1991; **114**: 257–263.
7. Garcia Rodriguez LA, Jick H. Risk of upper gastrointestinal bleeding and perforation associated with individual non-steroidal anti-inflammatory drugs. *Lancet* 1994; **343**: 769–772.
8. Wilcox CM, Shalek KA, Cotsonis G. Striking prevalence of over-the-counter nonsteroidal anti-inflammatory drug use in patients with upper gastrointestinal hemorrhage. *Arch Intern Med* 1994; **154**: 42–46.
9. Kelly JP, Kaufman DW, Jurgelon JM, Sheehan J, Koff RS, Shapiro S. Risk of aspirin-associated major upper-gastrointestinal bleeding with enteric-coated or buffered product. *Lancet* 1996; **348**: 1413–1416.
10. Perneger TV, Whelton PK, Klag MJ. Risk of kidney failure associated with the use of acetaminophen, aspirin, and nonsteroidal antiinflammatory drugs. *New Engl J Med* 1994; **331**: 1675–1679.
11. Segasothy M, Samad SA, Zulfigar JM, Bennett WM. Chronic renal disease and papillary necrosis associated with long-term use of nonsteroidal anti-inflammatory drugs as the sole or predominant analgesic. *Am J Kid Dis* 1994; **24**: 17–24.
12. Perez Gutthann S, Garcia Rodriguez LA, Raiford DS, Duque Oliart A, Ris Romeu J. Nonsteroidal anti-inflammatory drugs and the risk of hospitalization for acute renal failure. *Arch Intern Med* 1996; **156**: 2433–2439.
13. Whitcomb DC, Block GD. Association of acetaminophen hepatotoxicity with fasting and ethanol use. *JAMA* 1994; **272**: 1845–1850.
14. Lee WM. Drug-induced hepatotoxicity. *New Engl J Med* 1995; **333**: 1116–1127.
15. Schiødt FV, Rochling FA, Casey DL, Lee WM. Acetaminophen toxicity in an urban county hospital. *New Engl J Med* 1997; **337**: 1112–1117.
16. Johnson AG, Nguyen TV, Day RO. Do nonsteroidal anti-inflammatory drugs affect blood pressure? A meta-analysis. *Ann Intern Med* 1994; **121**: 289–300.
17. Matzke GR. Nonrenal toxcities of acetaminophen, aspirin, and nonsteriodal anti-inflammatory agents. *Am J Kid Dis* 1996; **28**: S63–S70.
18. Reisine T, Pasternak G. Opiod analgesics and antagonists. In *Goodman and Gilman's the Pharmacological Basis of Therapeutics* (9th edn), Hardman JG, Limbird LE (eds). McGraw-Hill: New York, 1996; 521–555.
19. Insel PA. Analgesic-antipyretic and anti-inflammatory agents and drugs employed in the treatment of gout. In *Goodman and Gilman's the Pharmacological Basis of Therapeutics* (9th edn), Hardman JG, Limbird LE (eds). McGraw-Hill: New York, 1996; 617–657.
20. Aronson MD. Nonsteroidal anti-inflammatory drugs, traditional opioids, and tramadol: contrasting therapies for the treatment of chronic pain. *Clin Ther* 1997; **19**: 422–432.
21. Amadio P, Jr, Cummings DM, Amadio P. Nonsteroidal anti-inflammatory drugs—tailoring therapy to achieve results and avoid toxicity. *Postgrad Med* 1993; **93**: 73–97.
22. American Society of Health-System Pharmacists. Therapeutic position statement on the safe use of oral non-prescription analgesics. *Am J Health-Syst Pharm* 1999; **56**: 1126–1131.
23. Abrahm JL. Advances in pain management for older adult patients. *Clin Geriatr Med* 2000; **16**: 269–311.
24. Chrischilles EA, Lemke JH, Wallace RB, Drube GA. Prevalence and characteristics of multiple analgesic drug use in an elderly study group. *J Am Geriatr Soc* 1990; **38**: 979–984.
25. Hanlon JT, Fillenbaum GG, Studenski SA, Ziqubu-Page T, Wall WE, Jr. Factors associated with suboptimal analgesic use in community-dwelling elderly. *Ann Pharmacother* 1996; **30**: 739–744.
26. Pahor M, Guralnik JM, Wan JY, *et al.* Lower body osteoarticular pain and dose of analgesic medications in older disabled women: the Women's Health and Aging Study. *Am J Public Health* 1999; **89**: 930–934.
27. Cramer GW, Galer BS, Mendelson MA, Thompson GD. A drug use evaluation of selected opioid and nonopioid analgesics in the nursing facility setting. *J Am Geriatr Soc* 2000; **48**: 398–404.
28. Steering Committee of the Physicians' Health Study Research Group. Final report on the aspirin component of the ongoing Physician's Health Study. *New Engl J Med* 1989; **321**: 129–135.
29. Shahar E, Folsom AR, Romm FJ, *et al.* Patterns of aspirin use in middle-aged adults: the Atherosclerosis Risk in Communities (ARIC) Study. *Am Heart J* 1996; **131**: 915–922.
30. Roach JA, Stacey B. Acetaminophen toxicity. *Orthopaed Nursing* 1997; **16**: 49–54.
31. National Center for Health Statistics. Plan and operation of the Third National Health and Nutrition Examination Survey, 1988–94. *Vital Health Stat 1* 1994; **32**: 1–407.
32. Denniston PL, Jr, Epner JA (eds). *Physicians GenRx, 1994: The Official Drug Reference.* Data Pharmaceutica Inc.: Smithtown, NY, 1993.
33. *American Hospital Formulary Service Drug Information 96.* American Society of Health-System Pharmacists, Inc.: Bethesda, MD, 1996.
34. SAS Institute Inc. *SAS Procedure Guide, Version 6* (3rd edn). SAS Institute Inc.: Cary, NC, 1990.
35. Shah BV, Barnwell BG, Bieler GS. *SUDAAN User's Manual, Release 7.0.* Research Triangle Institute: Research Triangle Park, NC, 1996.
36. Klein RJ, Schoenborn CA. *Age Adjustment Using the 2000 Projected U.S. Population. Healthy People Statistical Notes, No. 20.* National Center for Health Statistics: Hyattsville, MD, January 2001.
37. *Physicians' Desk Reference for Nonprescription Drugs and Dietary Supplements* (22nd edn). Medical Economics Company Inc.: Montvale, NJ, 2001.
38. Kaufman DW, Kelly JP, Rosenberg L, Anderson TE, and Mitchell AA. Recent patterns of medication use in the ambulatory adult population of the United States: The Slone Survey. *JAMA* 2002; **287**: 337–344.
39. Centers for Disease Control and Prevention. *Tracking Major Health Risks among Americans: The Behavioral Risk Factors Surveillance System.* U.S. Department of Health and Human Services, CDC: Atlanta, GA, 2000.
40. Simon JA, Hudes ES. Serum ascorbic acid and cardiovascular disease prevalence in U.S. adults: the third national health and

nutrition examination survey (NHANES III). *Ann Epidemiol* 1999; **9**: 358–365.
41. Langman MJS, Weil J, Wainright P, *et al.* Risks of bleeding peptic ulcer associated with individual non-steroidal anti-inflammatory drugs. *Lancet* 1994; **343**: 1075–1078.
42. Henry D, Lim LLY, Garcia Rodriguez LA, *et al.* Variability in risk of gastrointestinal complications with individual non-steroidal anti-inflammatory drugs: results of a collaborative meta-analysis. *BMJ* 1996; **312**: 1563–1566.
43. McMahon AD, Evans JMM, White G, *et al.* A cohort study (with re-sampled comparator groups) to measure the association between new NSAID prescribing and upper gastrointestinal hemorrhage and perforation. *J Clin Epidemiol* 1997; **50**: 351–356.
44. Shorr RI, Griffin MR, Daugherty JR, Ray WA. Opioid analgesics and the risk of hip fracture in the elderly: codeine and propoxyphene. *J Gerontol: Med Sci* 1992; **47**: M111–M115.
45. Ryynänen OP, Kivelä SL, Honkanen R, Laippala P, Saano V. Medications and chronic diseases as risk factors for falling injuries in the elderly. *Scand J Soc Med* 1993; **21**: 264–271.
46. Julien RM. *A Primer of Drug Action* (6th edn). WH Freeman and Co.: New York, 1992.
47. Svarstad BL, Cleary PD, Mechanic D, Robers PA. Gender differences in the acquisition of prescribed drugs: an epidemiological study. *Med Care* 1987; **25**: 1089–1098.
48. Eggen AE. The Tomsø Study: frequency and predicting factors of analgesic drug use in a free-living population (12–56 years). *J Clin Epidemiol* 1993; **46**: 1297–1304.
49. Harkins SW. Geriatric pain: pain perceptions in the old. *Clin Geriatr Med* 1996; **12**: 435–459.
50. Hanlon JT, Fillenbaum GG, Burchett B, *et al.* Drug-use patterns among black and nonblack community-dwelling elderly. *Ann Pharmacother* 1992; **26**: 679–685.
51. Fillenbaum GG, Hanlon JT, Corder EH, Ziqubu-Page T, Wall WE, Brock D. Prescription and nonprescription drug use among black and white community-residing elderly. *Am J Public Health* 1993; **83**: 1577–1582.