Confidence Interval Estimation in R-DAS: State-Level Estimates for Extra-Medical Use of Prescription Pain Relievers

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State-by-State Variation in Incidence Estimates

Data Preparation
- Combined survey data from 2002 to 2009 were used to examine the patterns of incidence estimates, with due attention to male-female differences by geographical location (state) and age. We also wrote a python script to extract relative information from the R-DAS tables.

Males & Females
- Combined 8-year R-DAS incidence estimates for extra-medical prescription pain reliever (EMPRR) use, estimated for males and for females separately, in each of 49 state-level jurisdictions (hereinafter, “state”) are summarized in Figures 1 and 2.
- Utah has strikingly high incidence estimates for males (1.5% 95% CI: 1.1, 2.2) as well as for females (1.8% 95% CI: 1.3, 2.5).
- To see whether females or males are at higher risk of becoming newly incident users at the state level, we conducted a statistical test based on Eq. (2). Fig. 3 shows states with statistically significant findings (p<0.05) highlighted in color. Additionally, in Fig. 3, we provide 95% confidence intervals for the differences that have been calculated by inverting the test statistic in Eq. (2).

Age-Specific Estimates
- There is a widespread impression that newly incident EMPRR use almost exclusively arises before middle-late life.
- To shed light on this situation, we sought to compare state-specific estimated incidence of EMPRR use for 12-44-year-olds relative to older adults in the same states. However, when we attempted to estimate the “older adult” values within R-DAS, the output was suppressed due to the “small numbers” confidentiality issue.
- We used Eq. (3) to derive the estimates for older adults and their standard errors.
- Figures 4 and 5 illustrate estimated incidence for the 12-44-year-olds and for the older adults. Among 12-44-year-olds, incidence estimates are noticeably higher than among older adults, but in many states there are non-zero estimated values for older adults.
- To assess an aspect of potential bias of Eq. (3) estimators, we compared our results to R-DAS output available for large states that did not require Eq (3).

Discussion
- During recent years, there has been a substantial attempt of the epidemiological and clinical research community to alert the public of the new emerging problems attributable to EMPRR use (e.g., [2], [7], [3]).
- Our estimates from the combined 2002-2009 NSDUH data disclosed Utah has top rank empirical estimates of becoming a newly incident EMPRR user. In rank order and as compared to other states, Utah was in the top rank (92) for EMPRR incidence among males (1.5%) and was the 31 state for EMPRR incidence among females. Furthermore, in 2007, Utah had more deaths due to opioids overdose than it had motor vehicle crash deaths.
- One study aimed to quantify the degree to which incidence of extra-medical prescription pain reliever use might differ across the sexes and by state. Previously published research suggests that women might be over-represented among newly incident users of these compounds (e.g., [8], [6]). To verify this claim, we employed the classical Fisher test [5], by combining the one-sided p-values (i.e., H0: πr > πm) over 51 states. The resulting p-value for the overall over-representation of females was significant (p-value = 3.49 x 10^-10). Thus, we found that women are over-represented among newly incident EMPRR users.

In the most recent epidemiological data, there is narrowing of the gap in estimates of EMPRR prevalence rates between the adolescent (ages 12-17) and the adult populations [4]. Collier and colleagues [1] report that the projected EMPRR use among users aged 50 and older is expected to double by 2020. These prior findings are in the background of our decision to contrast the adult population to older adults (age 45-106 years) and our discovery that there are some older adults who are becoming EMPRR users in later life, even though original R-DAS tabular output would suggest that the numbers are too small for estimation at the state level. Accordingly, these estimates offer an epidemiological rationale to think through prevention of EMPRR use in each state’s older adult population, although the incidence estimates for these older adults do tend to be smaller than incidence estimates for 12-44 year olds.

Limitations
- The NSDUH estimates are based on self-report data. However, when the goal is to study newly incident EMPRR use in national-scale surveys, there seems to be no logically feasible alternative to the self-report.

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References