



## Correspondence

### Alarming trends in the frequency of malignant hypertension among admissions with a known cannabis use disorder



In the past decade, a drastic surge in cannabis use has been witnessed in the United States (US) [1,2]. Cannabis use disorder (dependence or abuse) has been linked to the risk of acute cerebrovascular events [3]. Malignant hypertension is one of the hypertensive emergencies which could lead to acute end-organ damage like myocardial infarction, cardiac failure, and stroke, if not treated [4]. Furthermore, end-organ damage could lead to long-term comorbidities and increased health care burden. Also, it bears a significantly high risk of long-term mortality as well. However, there is a paucity of data on trends in admissions for malignant hypertension among patients with cannabis use disorder.

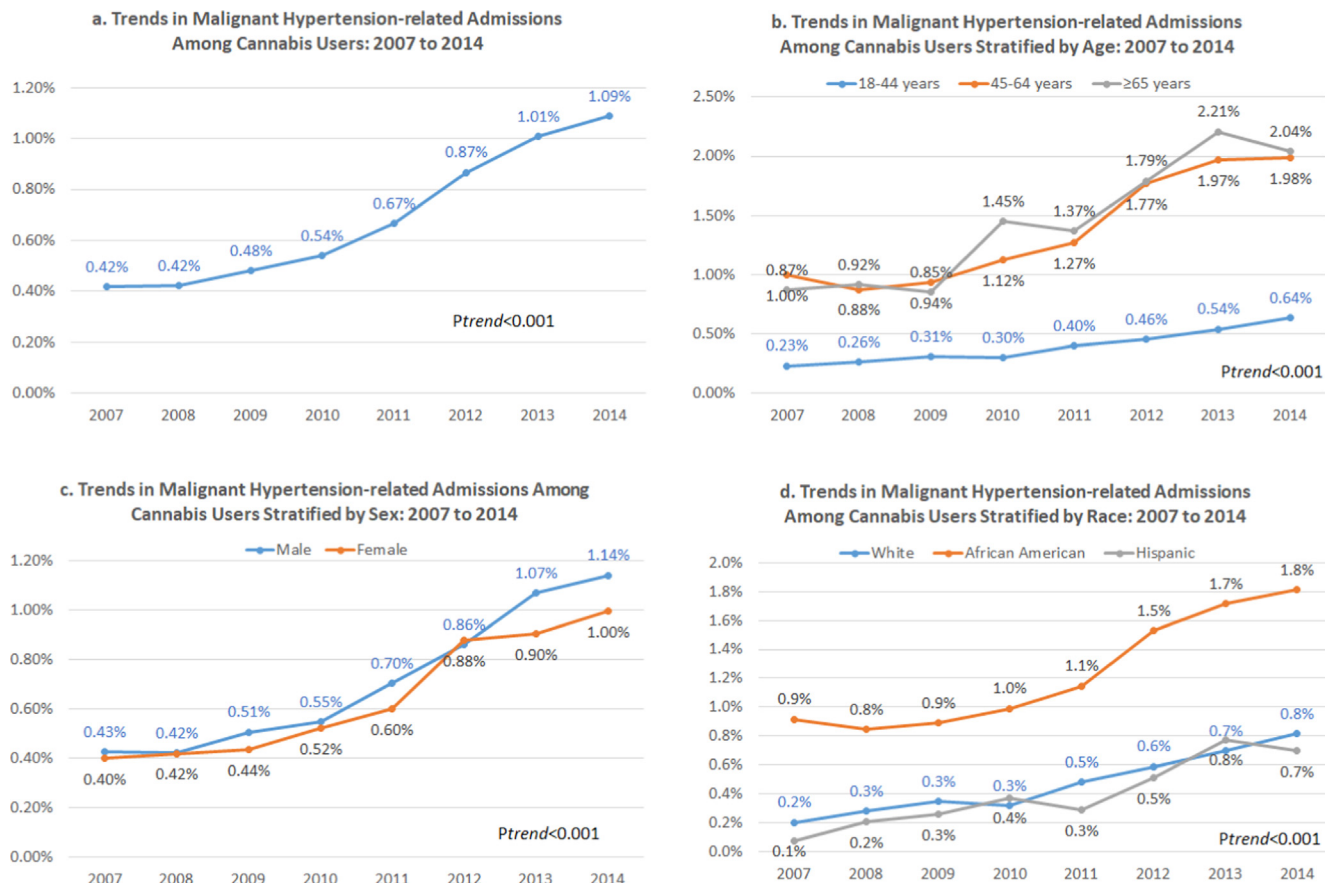
We retrospectively queried the National Inpatient Sample (NIS) datasets (2007–2014) to identify malignant hypertension-related hospitalizations among patients with known cannabis use disorder using appropriate ICD-9 CM diagnostic codes (304.30, 304.31, 304.32, 305.20, 305.21, and 305.22). The NIS datasets are provided by the Agency for Healthcare Research and Quality-sponsored Healthcare Cost and Utilization Project (<https://www.hcup-us.ahrq.gov/nisoverview.jsp>). It estimates more than 35 million hospitalizations nationally when weighted. The NIS consists of data from all states participating in HCUP, covering nearly 97 percent of the US population. The primary outcome was the frequency and trends in admissions for malignant hypertension among patients with cannabis use disorder. Furthermore, we also performed a subgroup analysis for trends in hospitalizations with malignant hypertension related to age, gender and ethnicity. SPSS v24 (IBM Corp, Armonk, NY, USA) were utilized to perform statistical analyses using defined strata/cluster designs. Trends were analyzed using a linear-by-linear association test. A  $p$ -value  $<0.05$  was considered statistically significant.

A total of 3,307,310 hospitalizations were noted with cannabis use disorder, of these 0.7% ( $n = 24,148$ ) had malignant hypertension. The mean age during the hospitalization was  $36.54 \pm 13.09$  years. Of all admissions with cannabis use disorder, the all-cause in-hospital mortality among patients with malignant hypertension was found to be 1.6% compared to 0.5% among patients without malignant hypertension. During the study period, we found an increase from 0.42% to 1.09% (1.6 fold increase) in malignant hypertension among individuals with cannabis use disorder (Fig. 1a). Overall, there were rising trends in malignant hypertension-related hospitalizations across all subgroups. We noted the highest frequency in malignant hypertension-related hospitalizations among geriatric patients, however, there was a more pronounced rising trend in the frequency of admissions

among young patients (18–44 yrs: 1.8 fold vs  $\geq 65$  years: 1.3 fold) with cannabis use disorder as compared to elderly patients. (Fig. 1b). Male patients with cannabis use disorder witnessed a higher increase in malignant hypertension-related hospitalizations as compared to females (1.7 fold vs. 1.5 fold increase) (Fig. 1c). The burden of malignant hypertension was highest among African American individuals with cannabis use disorder over the study period compared to both white and Hispanic patients. (Fig. 1d). In this study, we found a nearly 1.5-fold increase in malignant hypertension among cannabis use disorder related hospitalization from 2007 to 2014. We noticed nearly two-fold higher mortality among individuals hospitalized with cannabis use disorder and malignant hypertension compared to those without malignant hypertension. A rising trend of malignant hypertension-related hospitalization with improved survival has been reported in various studies in the United States [5,6]. However, there are limited data or guidelines in the Europe and United States regarding the shifting landscape of cannabis use and its impact on hypertension and related complications in recent years. Amidst improving outlook of survival data, increased mortality in our study among cannabis users with malignant hypertension shows a worrisome trend and warrants future studies to explore further. In addition, we also reported age and racial disparity in the frequency of malignant hypertension, with a higher burden in the younger population compared to the elderly and African America compared to the White and Hispanics. An increase in cannabis use disorder-related hospitalizations and associated complications among the young population in the US has been reported in recent years [7].

Being an administrative database, the NIS inherits some limitations which needs to be considered while interpreting the results. There always remain a chance of coding errors which could lead to a selection bias. Besides, non-availability of data on type of antihypertensive medication makes it a challenging task to derive any association between their use in the study population and outcome. Furthermore, inability to determine the dose and duration of substance abuse could influence the outcome. However, a large sample size representative of nationwide inpatient hospitalizations makes these data robust to provide useful preliminary insights into this understudied subject so far.

In conclusion, a rising trend with age, gender and racial disparity in malignant hypertension among individuals with cannabis use disorder related hospitalization has been reported in the present study. With a rising trend of malignant hypertension in patients with cannabis use disorders, there remains a concern of the rise in cardiovascular events with increased morbidity and mortality in this population, especially with an expected increase in cannabis utilization soon. Our findings warrant further studies to look into the racial differences and targeting population to explore the factors influencing the present trend while simultaneously developing an intervention to raise awareness regarding the



**Fig. 1.** Frequency trend of malignant hypertension in cannabis related hospitalizations in the United States over a period of 2007–2014.

deleterious effect of cannabis use and curtail additional healthcare costs.

**Declaration of Competing Interest**

The authors report no relationships that could be construed as a conflict of interest.

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