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Effects of Using Different Death Rate Metrics on the Analysis of Drug-Overdose Death Rates and Socioeconomical Factors

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Background:

Age-adjusted death rate (AADR) and raw death rate (RDD) used in drug-overdose studies typically involves death-record data and population-survey data. Difference can exist between the two data sources, leading to the so-called dual data-source error. Proportionate mortality avoids the error; however, no studies have been done comparing the conclusions drawn using the different metrics. The objective of this study is to evaluate the differences and merits of using different death-rate metrics in overdose analysis.

Drug overdose deaths in the US from 2010 to 2019 were analyzed using the mortality multiple cause files published yearly by the Center for Disease Control and Prevention. RDD and AADR were calculated using the standard method. Proportionate mortality due to drug overdose (PMOD) is defined as the number of drug-overdose deaths divided by the number of all deaths in the subject group, with percentage as the unit.

Results and Discussion:

- Variation with age and sex: RDD were similar among 25 to 64 years old adults, and RDD for males were much higher than for females (Fig. 1a). PMOD highlighted that the 25 – 34 years old group had much higher PMOD than other age groups; nearly 30% of all deaths in this group were related to drug overdose. Additionally, while RDD were lower for females than males, PMOD for females were similar to males. PMOD for 15 – 24 years old females were even higher than their male counterparts, highlighting the vulnerability of young females to drug overdose.
- Variation with race: RDD were higher among American Indian males than White American males across all age groups (Fig. 2a). However, PMOD were higher among White Americans than American Indians. For the age 25 – 34 group, PMOD among White American males was nearly twice of that for American Indian males.

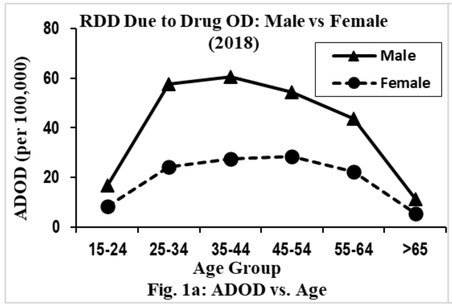

Fig. 1a: ADOD vs. Age

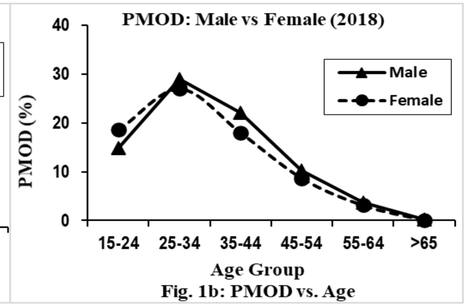

Fig. 1b: PMOD vs. Age

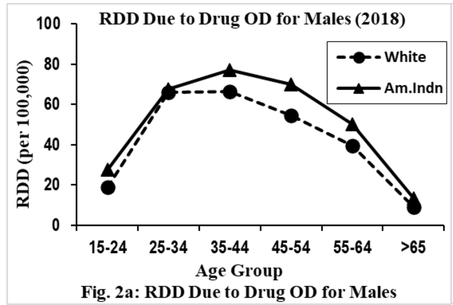

Fig. 2a: RDD Due to Drug OD for Males

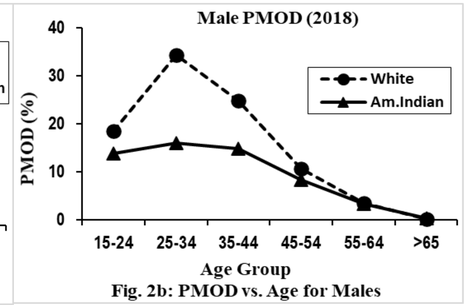

Fig. 2b: PMOD vs. Age for Males

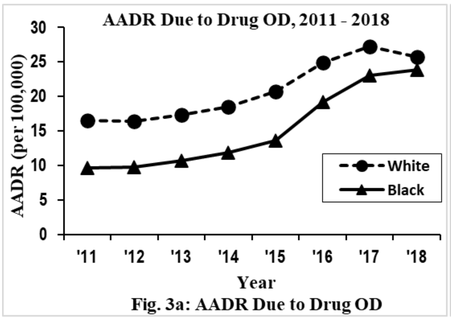

Fig. 3a: AADR Due to Drug OD

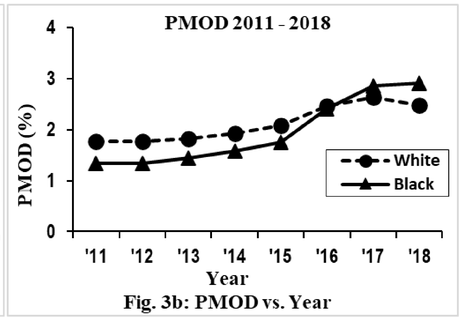

Fig. 3b: PMOD vs. Year

- Change from 2010 to 2019: ADOD increased for both the Black and White populations, with higher ADOD among White populations. However, PMOD indicated a much faster increase among the Black population from 2013 to 2019, their PMOD surpassing the White population since 2017.
- Variations of ADOD and PMOD with educational attainment also had different characteristics: PMOD decreased steadily with increasing education, while the trend of ADOD vs education was not as consistent.

Conclusions:

Analysis of drug overdose deaths can reveal and emphasize different messages depending on whether the standard metrics or the PMOD metric is used to characterize overdose deaths. The commonly used standard metrics, raw death rate or age-adjusted death rate, reflect the absolute number of deaths as a percentage of the population count. However, they do not directly reflect the severity of drug overdose deaths relative to the total deaths in a population group. In contrast, PMOD directly reflect the severity of overdose deaths relative to all deaths. The high percentage of deaths among young adults related to drug-overdose was clearly revealed by PMOD.

The PMOD metric is limited by several factors. First, deaths from different causes affect the percentage related to the cause of interest. This becomes an issue when other causes of death are attributable to the group in question. Furthermore, PMOD does not reflect the absolute number of deaths in a subject group.

For more complete understanding of the drug overdose epidemic, the PMOD metric should also be considered in addition to the standard AADR metric.