US Census Bureau (USCB) has implemented a new privacy-preserving disclosure avoidance system (DAS), which includes application of differential privacy (DP), on the public-release 2020 decennial census data. There are increasing concerns among social scientists, epidemiologists, and public health practitioners that DP may bias small-area and demographically-stratified population counts serving as denominators in the estimation of disease/mortality rates. USCB published several DAS demonstration products, with different DAS apply to public-release 2010 decennial census data, to allow researchers to evaluate impacts of the proposed DAS. However, few studies have investigated the effects of DAS-protected population counts on public health studies and fewer have done so in the context of small-area studies of patterns and inequities in disease/mortality rates. In this study, we employ three different DAS demonstration products, representing successive refinements of the DAS over time, to quantify errors attributable to reliance on DAS-protected denominators in standard small-area disease mapping models for characterizing health inequities across social groups. We conduct pseudo-simulation study and real data analysis of racialized and socioeconomic inequities in premature mortality at the census tract level in Massachusetts in 2010. Our results show that overall patterns of inequity by racialized group and economic deprivation level are preserved when using each of the three DAS-protected denominators. However, early versions of DAS induce errors in mortality rate estimation that are considerably larger for Black than for NHW populations. In particular, we observe over-estimation of premature mortality rates for Black populations, and over-estimation of Black vs. NHW inequities. These issues appear to have been ameliorated in newer DAS refinements.