Mass incarceration in the U.S. disproportionately impacts individuals of lower socioeconomic status. These populations have also experienced increased rates of suicide over the past decade. This is especially noteworthy in the context of the United States, where half of all suicides involve a firearm. We sought to examine if incarceration and release from a Washington State Prison was associated with increased risk of suicide, especially firearm suicide. We conducted a population-based cohort study of 140,281 individuals incarcerated in Washington State at least once during the study period 1990-2017. These individuals were compared to the age-, sex-, and race-matched population of Washington. Incarceration records from Department of Corrections were used to construct timelines for individuals incarcerated and released from Washington prisons. Death certificates provided data on suicide and firearm suicide. Of 25,287 suicides in Washington during 1990-2017, 484 were among previously incarcerated individuals. Suicide risk was 62% higher among former inmates compared to the general population (RR: 1.62; 95% CI:1.46–1.79) and higher among individuals convicted of firearm-involved crimes (RR:2.27; 95% CI:1.79–2.89). Compared to the general population, individuals whose first release was prior to age 18 had substantially elevated suicide risk (RR: 7.62; 95% CI:2.84–20.46) and notably higher risk for firearm suicide (RR: 15.98; 95% CI:5.95–42.91). This is one of few studies in the US to examine self-directed harm among those involved in the criminal legal system. The increased rates of suicide among previously incarcerated individuals, especially those incarcerated at a young age, highlight the need for improved access to mental health resources both during and after incarceration, as well as measures to reduce the impact of incarceration on subsequent opportunities including employment, housing, and government programs. These findings also indicate that current dispossession policies may not be sufficient in restricting access to firearms among previously incarcerated populations.