Myocarditis Risk 17 Times Higher for Unvaccinated Patients Ages 12-30 Who Get COVID-19 Than COVID-Vaccinated Patients

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Last updated 24 January 2022 • Check for updates at EHRN.org

Abstract: Risk of myocarditis after a COVID-19 diagnosis in patients ages 12-30 is much higher than the risks associated with the COVID vaccine.

Recent reports have indicated that adolescents and young adults, particularly males ages 12-29, who receive an mRNA COVID-19 vaccine have an increased risk of myocarditis, an inflammation of the heart muscle.[1,2] In October 2021, the FDA delayed its decision on the authorization of the Moderna vaccine for adolescents due to these concerns.[3] We previously studied the risk of myocarditis across 15 million patients of all ages and found that the incidence of myocarditis following the COVID-19 vaccine was not substantively different from the incidence in pre-pandemic years.[4]

In this study, we estimated the risk of myocarditis among patients ages 12-30 to identify trends across age, sex, and vaccine type. To determine the risk of myocarditis in this population, we looked at the following data:

1. **Historical incidence.** The annual incidence of myocarditis in patients ages 12-30 who had an interaction with the health system in 2019. This historical incidence is provided for reference to help put the risk after vaccination and risk after COVID-19 diagnosis into perspective. However, it should not be directly compared to the 30-day risks outlined below.

2. **Risk after vaccination.** The 30-day incidence of a new myocarditis diagnosis following the first or second vaccination dose against COVID-19 among all patients ages 12-30 who received at least one vaccination dose between December 11, 2020, and December 20, 2021.

3. **Risk after COVID-19 diagnosis.** The 30-day incidence of a new diagnosis of myocarditis following a diagnosis of COVID-19 among all patients ages 12-30 who had not yet received a COVID-19 vaccine between January 20, 2020, and November 21, 2021.

The data show that the risk of myocarditis following a COVID-19 diagnosis is much higher than the risk of myocarditis following a COVID-19 vaccination for all ages and sexes studied. Overall, the 30-day incidence of myocarditis following a COVID-19 diagnosis was nearly 17 times higher than the incidence among patients receiving the COVID-19 vaccine. This is consistent with CDC data.[5]

Figure 1: Risk of Myocarditis in Patients Ages 12-30

"Risk of Myocarditis in Patients Ages 12-30" 2022. Epic Research (Epic Research.org)

Figure 1. The 30-day risk of myocarditis in patients ages 12-30 after a COVID-19 diagnosis is much higher than either historical (pre-pandemic) incidence or risk after receiving a COVID-19 vaccine. This risk is measured as the number of patients diagnosed with myocarditis per 100,000 patients. The historical incidence shows the one-year risk of myocarditis for active patients over calendar year 2019.

We also looked at the breakdown of myocarditis by sex. Consistent with what others have reported, adolescent and young adult males have a higher risk of myocarditis than females.

Additionally, we analyzed the risk based on the vaccine manufacturer. The Pfizer-BioNtech vaccine was the only vaccine authorized for use in the 12-17 age group during the study period, so it was the only one we considered for that age group in this analysis. For the 18-30 age group, which had all three vaccines authorized for use, incidents of myocarditis were similar across vaccine manufacturers.

Figure 2: Risk of Myocarditis by Sex, Age, and Vaccine Manufacturer

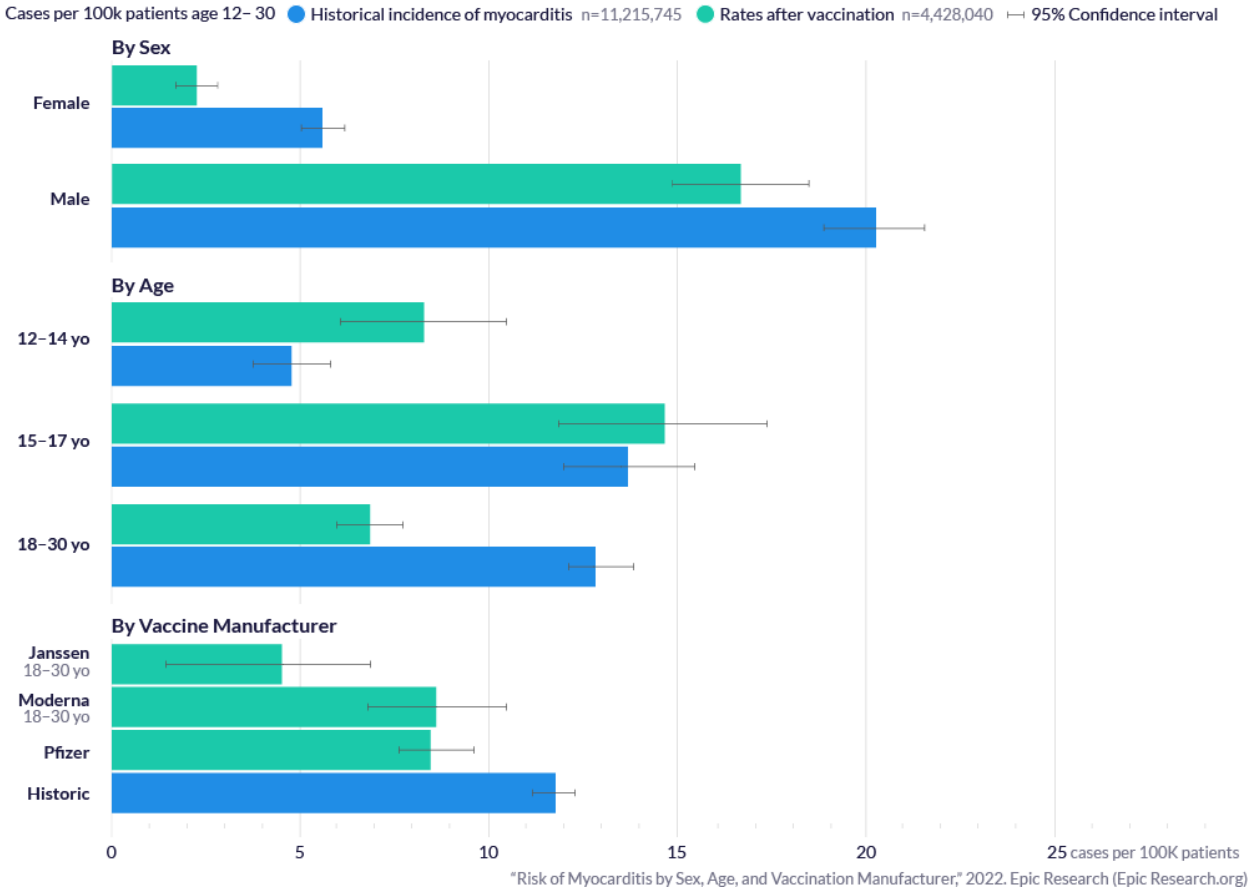

Figure 2. Risk of myocarditis among males and females ages 12-14, 15-17, and 18-30 per 100,000 patients. This is defined by a new incidence of myocarditis within 30 days following the first or second vaccination dose against COVID-19. The historical risk shows the one-year risk of myocarditis for active patients over calendar year 2019.

We found the 30-day risk of myocarditis was less than the one-year historical incidence across all three vaccine manufacturers when considering all ages and sexes. When evaluating different combinations of sex, age, and manufacturer, out of the 364,249 male patients aged 18-30 who received Moderna, 73 had myocarditis, which is approximately 20 cases per 100,000. This is significantly higher than other combinations of sex, manufacturer, and age and corroborates the Danish finding of increased risk in this group.[6] However, the risk of myocarditis after vaccination remains significantly less than the risk of myocarditis after a COVID infection.

These data come from Cosmos, a HIPAA-defined Limited Data Set of more than 126 million patients from 156 Epic organizations including 889 hospitals and 19,420 clinics, serving patients in all 50 states. This study was completed by two teams, each composed of a clinician and research scientists who worked independently. The two teams came to similar conclusions.

References

1. Gargano JW et al. Use of mRNA COVID-19 Vaccine After Reports of Myocarditis Among Vaccine Recipients: Update from the Advisory Committee on Immunization Practices — United States, June 2021. *MMWR Morb Mortal Wkly Rep*. 2021;70. doi:10.15585/mmwr.mm7027e2
2. Witberg G, Barda N, Hoss S, et al. Myocarditis after Covid-19 Vaccination in a Large Health Care Organization. *New England Journal of Medicine*. 2021;385(23):2132-2139. doi:10.1056/NEJMoa2110737
3. Schwartz F. Moderna Confirms FDA Delayed Covid-19 Vaccine in Adolescents to Review Myocarditis Risk. *Wall Street Journal*. https://www.wsj.com/articles/moderna-confirms-fda-delayed-covid-19-vaccine-in-adolescents-to-review-myocarditis-risk-11635698082. Published October 31, 2021. Accessed December 2, 2021.
4. Bregman H, Barkley E, Alban C, Posner X, Deckert J. New Heart Disease Diagnosis After COVID-19 Vaccination Very Rare. Epic Health Research Network. Published October 8, 2021. Accessed December 2, 2021. https://ehrn.org/articles/new-heart-disease-diagnosis-after-covid-19-vaccination-very-rare
5. Boehmer TK. Association Between COVID-19 and Myocarditis Using Hospital-Based Administrative Data — United States, March 2020–January 2021. *MMWR Morb Mortal Wkly Rep*. 2021;70. doi:10.15585/mmwr.mm7035e5
6. Husby A, Hansen J V, FosbÃ¸l E, Thiesson E M, Madsen M, Thomsen R W et al. SARS-CoV-2 vaccination and myocarditis or myopericarditis: population based cohort study BMJ 2021; 375:e068665 doi:10.1136/bmj-2021-068665

Data Definitions

Term	Definition
Covid-19 Diagnosis	The earliest date between January 20, 2020, and March 31, 2020, on which a diagnosis mapped to ICD-10 code B97.29 was documented on a patient as an encounter diagnosis, final billing diagnosis, or problem list problem, or the earliest date after Mar. 31, 2020, on which a diagnosis mapped to ICD-10 code U07.1 was documented on a patient as an encounter diagnosis, final billing diagnosis, or problem list problem.
Myocarditis Diagnoses	The earliest date on which a diagnosis mapped to ICD-10 code I40.0, I40.1, I40.8, I40.9, or I51.4 was documented on a patient as an encounter diagnosis, final billing diagnosis, or problem list problem. Myocarditis diagnoses are included if they occurred within 30 days of a diagnosis of COVID-19 or a COVID-19 vaccination.
Covid-19 Vaccination	Documentation of a completed COVID-19 vaccination on or after December 11, 2020. Patients are included in the analysis if they had one dose of the Janssen, Pfizer, or Moderna vaccine; two doses of the Pfizer vaccine; or two doses of the Moderna vaccine. Patients ages 12-17 are included only if they received one or two doses of the Pfizer vaccine.