Abstract: Wildfires in Chile have become more frequent and destructive due to climate change and evolving environmental conditions. In this context, the study “Smoke Signals: Understanding Temporal Dynamics of Wildfire Exposure on Human Capital Outcomes” tackles the challenge of measuring the overall impacts of these events. Its primary objective is to examine both the direct and indirect effects of wildfire smoke pollution on health and educational outcomes, evaluating these impacts over short-, medium-, and long-term horizons.

To conduct this analysis, the researchers utilize wildfire data recorded in Chile between 2002 and 2022, supplemented by $PM_{2.5}$ concentration measurements from satellite sources and ground-based monitoring stations. On the health side, the variables considered include respiratory hospitalizations, birth outcomes (such as low birth weight and prematurity), and individual medical histories. In the educational domain, the study analyzes school enrollment rates, absenteeism levels, grade point averages (GPA), and SIMCE standardized test scores. To model smoke exposure, the study employs the NOAA’s HYSPLIT model, which traces the trajectories of smoke plumes based on the precise geographic location and timing of each wildfire.

The causal identification strategy relies on a quasi-experimental design that incorporates region and month-year fixed effects, exploiting spatial variability in wildfire locations and prevailing wind directions. This approach helps isolate the influence of wildfire smoke from other concurrent factors. In the short term, the findings reveal a significant increase in respiratory hospitalizations, with especially pronounced effects among infants under one year of age exposed to high $PM_{2.5}$ concentrations. At the medium-term horizon, prenatal smoke exposure is associated with adverse birth outcomes (such as low birth weight and respiratory problems), as well as declines in school enrollment and reductions in GPA. Over the long term, students who were exposed to smoke during early life exhibit lower SIMCE test scores.

In conclusion, the study’s results indicate that exposure to wildfire smoke during the prenatal period and early childhood produces persistent effects on both health and educational performance, establishing a concrete linkage between these two domains across multiple time horizons. These findings underscore the importance of public policies aimed at mitigating wildfire smoke pollution and protecting the most vulnerable populations, particularly pregnant women and young children.