Tenth International Conference on Managing Fatigue: Abstract for Review

High School Start Times and Teenage Driver Crashes

Robert D. Foss, University of North Carolina, rob.foss@unc.edu (corresponding author)

Email your file to papers@fatigueconference2017.com.

Problem [100 words]

There is substantial evidence that lack of adequate sleep is a significant factor in motor vehicle crashes experienced by teenage drivers. Adolescent sleep needs differ from those of both adults and younger children. Due to a biological shift that leads adolescents to fall asleep later at night, early high school start times throughout the U.S. interfere with adolescent sleep needs, potentially contributing to the drowsy/fatigued crash problem. Shifting start times to a later hour has been found to improve academic performance and reduces behavior problems. The present study takes advantage of a natural experiment—created when one moderately large North Carolina County pushed back the school start time by 75 minutes—to examine whether delaying the high school daily start time reduces crashes among affected teens.

Method [250 words]

We examined the effect of changing the high school start time, beginning August 2003, from 7:30 to 8:45 am for all public high schools in one moderately large North Carolina county (Fall 2003 enrollment ≈ 12,500). We conducted ARIMA interrupted time-series analyses to examine motor vehicle crash rates of high school age drivers in four large urban/suburban counties (the study county and 3 similar comparison counties with comparable urban-rural population distribution (combined Fall 2003 enrollment ≈ 74,000). In addition to using ARIMA analysis to control for seasonal fluctuations and long-term trends, we focused more clearly on crashes most likely to be affected by the policy change, to improve upon a previous study of this issue. Specifically, we limited analysis to high school age teens (16- & 17-year-olds) and examined crashes only on days when school was in session, excluding summer months, weekends, scheduled school vacations and cancellations due to inclement weather.

Several time-series of crashes per day in school were created. These included 10 pseudo-months each year from 2000 through mid-2007, providing 75 periods for analysis. These pseudo-months correspond roughly to calendar months, excluding June & July, but they do not include weekends or other days school was not in session. The best fitting time-series model used in all analyses reported here included an adjustment for seasonality; none was needed for trend. Analyses were conducted separately for each of the four counties, looking for a downward shift after August 2003 in overall crash rates, as well as crashes during specific times of day.

Results [250 words]

In the intervention county, there was a 14% decrease (downward shift in the time-series) in the 16-17-year-old driver crash rate per day in school after the 75 minute delay in school start times. This change was marginally significant (p=.076). There was no significant change in any of the other three counties.

Further analysis indicated marked, statistically significant shifts in hourly crash rates in the intervention county, reflecting effects of the change in school start time on young driver exposure. Crashes from 7-7:59 am decreased sharply (-25%, p=.008), but increased similarly from 8-8:59 am (21%, p=.004). In the afternoon, crashes from 2-2:59 pm declined dramatically (-48%, p=.000), then increased to a lesser degree from 3-3:59 pm (32%, p=.024) and non-significantly from 4-4:59 (19%, p=.102). These changes clearly reflect the difference in time when students were driving to school before and after the change in start time. There was no meaningful change in crashes from 9 – 11:59 pm, when fatigue-induced crashes might have been expected to be most common.

Discussion [250 words]

The decrease in motor vehicle crashes among high school age drivers following a 75-minute shift in school start time is generally consistent with the findings of other studies of teen driver crashes and school start times (Danner & Phillips, 2008; Vorona et al., 2011; Vorona et al., 2014). All these studies, including the present one have limitations, but the similar findings suggest that crashes and school start times are indeed related, with earlier start times equating to more crashes. The studies by Vorona et al. demonstrated differences in crash rates between counties with different start times, leaving open the possibility that driving conditions or patterns simply differ between the counties compared and are not due to the different start times. Danner & Phillips included drivers too old (18) to be affected by school start times and included weekends and summer months in their analyses, rendering the findings difficult to interpret as due solely to a county-wide change in school start time.

A detailed analysis of crashes by single hour of the day indicate that a delay in school start shifts the morning peak in crashes accordingly and alters the early afternoon, post-school crash peak as well. It appears that a substantial proportion of the 14% decrease in crashes results from compressing the after-school time available for driving. That is, driving exposure during the peak crash time for high school age teens—the after school hours—is reduced by a shift in the school day. As with previous studies it was not possible in the present case to determine whether drowsy-driving crashes in particular were affected by the change in the daily school schedule.

Summary [150 words]

It appears that a 75 minute shift in school start time produced a decrease in motor vehicle crashes among high school students. It is not possible to attribute this effect specifically to decreased drowsiness, which has been the motivation for a number of school systems around

the U.S. to delay high school start times. Nonetheless—especially when these results are combined with those from other studies in Kentucky and Virginia—the effect appears to be real, whether it results from reducing discretionary driving or drowsy driving by young drivers. Additional research remains needed, however, to clearly establish the existence of a cause-effect relationship between delaying school start times and teen driver crashes.