

Supplement 3.

Supplement 3: Table 1. Trend Line Analysis with Vaping-Related Deviations from Long-Term Trend, Log Form of Dependent Variable, Various Surveys, with Corrections for Autocorrelation (only for Equations w Durbin Watson Statistics in the Indeterminate Region)

Survey	Measure	Years Included	Long-term trend	P-value	Vaping trend	P-value	Adj. R-squared
MTF	10 th -grade, M & F	2004-2017	-0.043	<0.001	-0.086	0.01	0.911
MTF	12 th -grade, M & F	2004-2017	-0.03	<0.001	-0.056	0.002	0.958
MTF	Ages 22-24, M & F	2004-2016	-0.08	<0.001	-0.059	<0.001	0.970
MTF	12 th -grade, Daily, M & F	2004-2017	-0.039	<0.001	-0.08	0.03	0.962
MTF	Ages 22-24, Daily, M & F	2004-2016	-0.090	<0.001	-0.058	0.05	0.994
MTF	Ages 18-25, Half Pack, M & F	2004-2016	-0.065	<0.001	-0.048	0.05	0.989
NHIS	Current Smoker, 18-24, F	2004-2016	-0.054	<0.001	-0.078	0.02	0.945
MTF	10 th -grade, M & F	2004-2017	-0.020	<0.001	-0.025	0.05	0.922
MTF	Ages 22-24, M & F	2004-2016	-0.022	0.002	-0.012	0.17	0.888

Notes: MTF= Monitoring the Future survey, NHIS = National Health Interview Survey, M= Male, F=Female

Equations were corrected for autocorrelation by first estimating the correlation of the error term, $e_t = a + \rho e_{t-1}$, then adjusting the dependent variable y as $(y_t - \rho y_{t-1})$

Supplement 3: Table 2. Trend Line Analysis with Vaping-Related Deviations from Long-Term Trend, Various Surveys, with the Dependent Variable in Linear Form

Survey	Measure	Years Included	Long-term trend	P-value	Vaping trend	P-value	Durbin Watson Stat.	Adj. R-squared
Last 30-day Cigarette Use								
MTF	10th grade, M & F	2004-2017	-0.089	<0.001	-0.72	0.03	1.21*	0.954
MTF	12th grade, M & F	2004-2017	-0.92	<0.001	-0.86	0.002	1.28*	0.982
MTF	Ages 18-21, M & F	2004-2016	-1.09	<0.001	-0.77	0.04	1.23	0.975
MTF	Ages 22-24, M & F	2004-2016	-1.18	<0.001	-0.267	0.85	3.03*	0.970
NSDUH	Last 30 day Ages 18-25	2004-2016	-0.96	<0.001	-1.73	<0.001	2.23	0.981
Established Cigarette Use								
MTF	10th grade, Daily M & F	2004-2017	-0.43	<0.001	-0.27	0.09	1.97	0.960
MTF	12th grade, Daily, M & F	2004-2017	-0.69	<0.001	-0.45	0.03	1.19*	0.972
MTF	Ages 18-21, Daily, M & F	2004-2016	-0.85	<0.001	-0.58	0.06	1.62	0.970
MTF	Ages 22-24, Daily, M & F	2004-2016	-1.04	<0.001	-0.013	0.05	1.99	0.980
NSDUH	Ages 18-25, Daily M & F	2004-2016	-0.75	<0.001	-0.62	<0.001	2.04	0.994
NHIS	Current Smoker, 18-24, M	2004-2016	-0.79	0.002	-1.53	0.08	2.23	0.835
NHIS	Current Smoker, 18-24, F	2004-2016	-0.71	<0.001	-0.50	0.25	2.84*	0.781
Daily Use/Last 30 Day Use								
MTF	10th grade, M & F	2004-2017	-0.006	0.02	-0.005	0.48	3.11*	0.657
MTF	12th grade, M & F	2004-2017	-0.008	<0.001	-0.014	0.001	1.23*	0.953
MTF	Ages 18-21, M & F	2004-2016	-0.008	<0.001	-0.003	0.001	2.29	0.923
MTF	Ages 22-24, M & F	2004-2016	-0.010	<0.001	-0.004	-0.87	2.58*	0.888
NSDUH	Ages 18-25, M & F	2004-2016	-0.82	<0.001	-0.083	0.81	2.19	0.906

Notes: Durbin Watson Statistic (k=2, n= 13: dl=0.86, du= 1.56; k=2, n= 14, dl=0.91, du= 1.55), * = indeterminate region, MTF= Monitoring the Future survey, NSDUH =National Survey of Drug Use and Health, NHIS = National Health Interview Survey, M= Male, F=Female

Supplement 3: Table 3a. Trend Line Analysis of Last 30-day Use with Vaping-Related Deviations from Long-Term Trend, Log Form, Various Surveys, with Different Begin Dates for Vaping Trend: 2012, 2013, 2014

Survey	Measure	Years	Initial Year of Vaping trend	Long-term trend	P-value	Vaping trend	P-value	Durban-Watson Statistic	Adj R-squared
Last 30-day Use									
MTF	10th grade, M & F*	2004-2017	2014	-0.340	<.0001	-0.130	<.0001	2.44*	0.980
MTF	10th grade, M & F*	2004-2017	2013	-0.046	<.0001	-0.133	<.0001	1.87	0.975
MTF	10th grade, M & F*	2004-2017	2012	-0.058	<.0001	-0.140	<.0001	1.28*	0.954
MTF	12th grade, M & F*	2004-2017	2014	-0.046	<.0001	-0.096	<.0001	1.16*	0.985
MTF	12th grade, M & F*	2004-2017	2013	-0.040	<.0001	-0.086	<.0001	2.45*	0.990
MTF	12th grade, M & F*	2004-2017	2012	-0.034	<.0001	-0.078	<.0001	1.69	0.988
MTF	Ages 18-21, M & F	2004-2016	2014	-0.048	<.0001	-0.091	0.0005	2.28	0.973
MTF	Ages 18-21, M & F	2004-2016	2013	-0.047	<.0001	-0.061	0.01	2.02	0.951
MTF	Ages 18-21, M & F	2004-2016	2012	-0.049	0.0200	-0.045	0.0008	1.63	0.943
MTF	Ages 22-24, M & F	2004-2016	2014	-0.047	<.0001	-0.041	0.0100	3.00*	0.979
MTF	Ages 22-24, M & F	2004-2016	2013	-0.470	<.0001	-0.025	0.0800	2.74*	0.969
MTF	Ages 22-24, M & F	2004-2016	2012	-0.021	<.0001	-0.046	<.0001	2.48	0.968
NSDUH	Ages 18-25, M&F	2004-2016	2014	-0.027	<.0001	-0.075	<.0001	2.21	0.982
NSDUH	Ages 18-25, M&F	2004-2016	2013	-0.024	<.0001	-0.059	<.0001	2.09	0.976
NSDUH	Ages 18-25, M&F	2004-2016	2012	-0.021	0.0006	-0.050	0.0003	1.59	0.967

Notes: Durbin Watson Statistic (k=2, n= 13: dl=0.86, du= 1.56; k=2, n= 14, dl=0.91, du= 1.55),
 * = indeterminate region, MTF= Monitoring the Future survey, NSDUH =National Survey of Drug Use and Health,

Supplement 3: Table 3b. Trend Line Analysis of Established Use with Vaping-Related Deviations from Long-Term Trend, Log Form, Various Surveys, with Different Begin Dates for Vaping Trend: 2012, 2013, 2014

Survey	Measure	Years	Initial Year of Vaping trend	Long-term trend	P-value	Vaping trend	P-value	Durban - Watson Statistic	Adj R-squared
Daily Use									
MTF	Daily, 10th grade, M & F	2004-2017	2014	-0.070	<.0001	-0.15	0.0010	2.23	0.959
MTF	Daily, 10th grade, M & F	2004-2017	2013	-0.058	0.0003	-0.14	0.0003	2.81*	0.958
MTF	Daily, 10th grade, M & F	2004-2017	2012	-0.130	0.0002	-0.048	0.004	2.93*	0.959
MTF	Daily, 12th grade, M & F	2004-2017	2014	-0.061	<.0001	-0.13	<.0001	1.19*	0.986
MTF	Daily, 12th grade, M & F	2004-2017	2013	-0.053	<.0001	-0.12	<.0001	2.50*	0.989
MTF	Daily, 12th grade, M & F	2004-2017	2012	-0.061	<.0001	-0.13	<.0001	1.19*	0.986
MTF	Daily, Ages 18-21, M & F	2004-2016	2014	-0.063	<.0001	-0.15	<.0001	2.09	0.977
MTF	Daily, Ages 18-21, M & F	2004-2016	2013	-0.059	<.0001	-0.10	0.0020	1.95	0.974
MTF	Daily, Ages 18-21, M & F	2004-2016	2012	-0.055	<.0001	-0.085	0.0090	1.51*	0.940
MTF	Daily, Ages 22-24, M & F	2004-2016	2014	-0.062	<.0001	-0.050	0.0100	2.65*	0.982
MTF	Daily, Ages 22-24, M & F	2004-2016	2013	-0.062	<.0001	-0.034	0.0400	2.82*	0.977
MTF	Daily, Ages 22-24, M & F	2004-2016	2012	-0.029	<.0001	-0.020	0.0600	2.61*	0.976
NSDUH	Daily, Ages 18-25, M & F	2004-2016	2014	-0.044	<.0001	-0.083	<.0001	2.36*	0.988
NSDUH	Daily, Ages 18-25, M & F	2004-2016	2013	-0.041	<.0001	-0.065	<.0001	1.80*	0.984
NSDUH	Daily, Ages 18-25, M & F	2004-2016	2012	-0.038	<.0001	-0.054	0.0008	1.38*	0.976
NHIS	Current Smoker, Ages 18-24, M	2004-2016	2014	-0.033	0.002	-0.099	0.012	2.22	0.876
NHIS	Current Smoker, Ages 18-24, M	2004-2016	2013	-0.031	0.011	-0.073	0.028	2.27	0.857

NHIS	Current Smoker, Ages 18-24, M	2004-2016	2012	-0.038	0.0037	-0.032	0.18	2.59*	0.879
NHIS	Current Smoker, Ages 18-24, F	2004-2016	2014	-0.040	0.0002	-0.059	0.05	2.99*	0.899
NHIS	Current Smoker, Ages 18-24, F	2004-2016	2013	-0.039	0.0009	-0.039	0.14	2.78*	0.883
NHIS	Current Smoker, Ages 18-24, F	2004-2016	2012	-0.038	0.0037	-0.032	0.17	2.59*	0.879

Notes: Durbin Watson Statistic (k=2, n= 13: dl=0.86, du= 1.56; k=2, n= 14, dl=0.91, du= 1.55), * = indeterminate region, MTF= Monitoring the Future survey, NSDUH =National Survey of Drug Use and Health, NHIS = National Health Interview Study

Supplement 3: Table 3c. Trend Line Analysis of Daily/Last 30-day Use with Deviations from Long-Term Trend with Vaping, Log Form, Various Surveys, with Different Begin Dates for Vaping Trend: 2012, 2013, 2014

Survey	Measure	Years	Initial Year of Vaping trend	Long-term trend	P-value	Vaping trend	P-value	Durban-Watson Statistic	Adj R-squared
Daily Use/Last 30-day Use									
MTF	10th grade, M & F	2004-2017	2014	-0.013	0.03	-0.013	0.46	3.16*	0.954
MTF	10th grade, M & F	2004-2017	2013	-0.013	0.05	-0.008	0.55	3.10*	0.974
MTF	10th grade, M & F	2004-2017	2012	-0.006	0.65	-0.012	0.08	3.05*	0.800
MTF	12th grade, M & F	2004-2017	2014	-0.015	<.0001	-0.037	0.0002	2.01	0.963
MTF	12th grade, M & F	2004-2017	2014	-0.015	<.0001	-0.034	0.0002	1.30*	0.963
MTF	12th grade, M & F	2004-2017	2013	-0.013	<.0001	-0.029	0.0001	2.45	0.958
MTF	12th grade, M & F	2004-2017	2012	-0.011	0.0030	-0.026	0.009	1.82	0.952
MTF	Ages 18-21, M & F	2004-2016	2014	-0.013	0.0004	-0.058	0.0002	2.33	0.941
MTF	Ages 18-21, M & F	2004-2016	2013	-0.013	0.0001	-0.029	0.0010	2.35	0.965
MTF	Ages 18-21, M & F	2004-2016	2012	-0.010	0.06	-0.035	0.0065	1.93	0.890
MTF	Ages 22-24, M & F	2004-2016	2014	-0.015	<.0001	-0.008	0.39	2.62*	0.891
MTF	Ages 22-24, M & F	2004-2016	2013	-0.014	0.0003	-0.009	0.26	3.10*	0.897
MTF	Ages 22-24, M & F	2004-2016	2012	-0.014	<.0001	-0.078	0.28	3.24*	0.896
NSDUH	Ages 18-25, M & F	2004-2016	2014	-0.017	<.0001	-0.05	0.51	2.29	0.937
NSDUH	Ages 18-25, M & F	2004-2016	2013	-0.017	<.0001	-0.04	0.55	2.22	0.936
NSDUH	Ages 18-25, M & F	2004-2016	2012	-0.017	<.0001	-0.0057	0.78	2.21	0.934

Notes: Durbin Watson Statistic (k=2, n= 13: dl=0.86, du= 1.56; k=2, n= 14, dl=0.91, du= 1.55), * = indeterminate region, MTF= Monitoring the Future survey, NSDUH =National Survey of Drug Use and Health, NHIS = National Health Interview Study

Pace of US smoking rate decline mirrors rapid rise in popularity of vaping

Little evidence that e-cigs prompting young people to start smoking, say researchers

The pace of the fall in smoking prevalence among teens and young adults in the US has mirrored the rapid rise in popularity of e-cigarettes, suggesting that the two may be linked, finds research published online in the journal **Tobacco Control**.

While trying e-cigarettes may prompt some young people to take up smoking at the individual level, there is little evidence that this is the case at the population level, conclude the researchers. And these findings are consistent over several years, they emphasise.

Earlier this year, the National Academies of Sciences, Engineering and Medicine published a report which concluded there was “substantial evidence” that vaping among young people is strongly associated with progression to smoking.

But the report also noted that recent increases in the popularity of e-cigarettes have been associated with falling smoking rates among this age group.

To try and explore these trends in more depth and settle the question of whether vaping might act as a gateway to smoking, the researchers carried out a time trend analysis, using publicly available data up to and including 2017.

They first drew on nationally representative surveys on vaping and tobacco use for 15-25 year olds, as this is the age group most likely to start and/or progress to regular smoking.

They then looked at smoking patterns among teens and young adults, going back as far as 2004, to gauge smoking trends before e-cigarette use became popular.

They used responses to five different national surveys. Where information was available, they included any cigarette use during the preceding 30 days as well as established use—defined as daily/half a pack a day/100 cigarettes smoked to date and currently smoking some days.

The responses revealed that vaping prevalence was low between 2011 and 2013, but reached much higher levels by 2014, so this was identified as the tipping point when vaping became popular among teens and young adults.

The choice of this date is backed up by retail sales data, which recorded a more than doubling in sales in 2014, and by the percentage of adults switching from cigarettes to e-cigarettes, which also doubled between 2012-13 and 2013-14.

The analysis showed that the downward trend in smoking prevalence among young people in the US sped up after 2013, just as vaping was becoming more widespread, and that this was particularly evident among 18-21 year olds.

The analysis also showed that the decline in more established smoking sped up sharply when vaping prevalence increased. And the proportion of those who said they had smoked within the past 30 days, which had fallen slowly throughout 2012, fell more steeply (two to four times) once vaping became popular.

The findings were consistent across different surveys, suggesting that the results were reliable despite different methods of data collection, and after correcting for data input anomalies.

The researchers suggest that the increase in smoking prevalence in tandem with vaping prevalence, found by other researchers, may nevertheless be consistent with their findings.

“It is possible that trying e-cigarettes is causally related to smoking for some youth, but the aggregate effect of this relationship at the population level may be small enough that its effects are swamped by other factors that influence smoking behaviour,” they suggest.

These factors could include media campaigns and tobacco control policies: further research would be needed to distinguish between their potential role and the rise in popularity of vaping, they add.

This is an observational study, and as such, can't establish cause. And as the analyses were all done using US data, the findings may not be applicable elsewhere, caution the researchers.

"While caution is warranted in interpreting our findings, they paint a consistent picture of accelerated reductions in youth and young adult smoking prevalence as vaping became more widespread," they write.

And referring to the National Academies report, they add: "In our view, it is premature to conclude that the observed increased rate of decline in smoking is due to vaping diverting youth from smoking, although it is a plausible explanation."

They conclude: "If our primary concern is population level trends in youth and young adult smoking, which we believe is appropriate, then vaping has not shown to be a serious cause for concern...and may be playing a contributing role to the recent steep declines in youth and young adult smoking."